UNITS
1–4

Simply Good and Beautiful

PRE-ALGEBRA

ANSWERS & SOLUTIONS

MATH
8

The Good and the Beautiful
CURRICULUM

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Note to Parents

This *Pre-Algebra Answers & Solutions Manual* includes detailed solutions for all problems in the course book. Final answers are highlighted for easy reference. Solutions are not included for the Video Practice section. Parents do not need to check this section. Students try problems on their own that are then explained in the video. Student answers may not be correct in this section, and that is OK. Mastery is not expected in the Video Practice section.

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Place Value and Estimation

WARM-UP

a. 60 b. 24 c. 51

PRACTICE

1. The digit to the right of the hundreds place (7) is greater than 5, so round up.
   1400

2. $6.3\overline{81} = 6.3818181...$
   The digit to the right of the hundred thousandths place (8) is greater than 5, so round up.
   6.38182

3. 3

4. $(3 \bullet 100{,}000) + (2 \bullet 1000) + (4 \bullet 100)$
   $= 300{,}000 + 2000 + 400$
   $= 302{,}400$

5. 12,000.006

6. 405,213

7. 18,324 rounds to 18,000.
   $18{,}000 \div 9 = 2000$

8. Numbers with a whole number part of 1 are smallest. Compare the tenths place in these numbers: 1.23 1.203 1.03

   1.03 is the smallest. Then compare the hundredths place in the other two numbers. 1.203 is smaller than 1.23.

   2.31 is greater than numbers with a whole number part of 1 but less than numbers with a whole number part of 12.

   For numbers with a whole number part of 12, look at the tenths place. 12 12.3

   12 has a 0 in the tenths place, so it is smaller than 12.3.

   Least to greatest:

   1.03, 1.203, 1.23, 2.31, 12, 12.3

   Riddle answer: OWL-GEBRA

REVIEW

More than one answer is possible for each problem. A possible solution is given.

1. $6 \bullet 4 - 2$
$= 24 - 2$
$= 22$

2. $\frac{7+5}{4}$
$= \frac{12}{4}$
$= 3$

3. $5 + 5$
$= 10$

4. $7 + 3 + 1$
$= 10 + 1$
$= 11$

5. $\frac{8 \bullet 2 - 6}{5}$
$= \frac{16 - 6}{5}$
$= \frac{10}{5}$
$= 2$

6. $\frac{8-1}{7} \bullet 7 \bullet 2$
$= \frac{7}{7} \bullet 7 \bullet 2$
$= 1 \bullet 7 \bullet 2$
$= 7 \bullet 2$
$= 14$

7. $8 \div 2 + 2$
$= 4 + 2$
$= 6$

Decimals and Fractions

WARM-UP

a. $22 \bullet 4 = 88$

$21.843 \bullet 3.93 \approx 88$

b. $56 \div 8 = 7$

$55.5 \div 8.24 \approx 7$

c. $11 \bullet 5 = 55$

$11.058 \bullet 5.321 \approx 55$

PRACTICE

1. a. $0.65 = \frac{65}{100} = \frac{13}{20}$

   b. $12.32 = 12\frac{32}{100} = 12\frac{8}{25}$

   c. $10.98 = 10\frac{98}{100} = 10\frac{49}{50}$

   d. $6.4 = 6\frac{4}{10} = 6\frac{2}{5}$

2. a. $5\overline{)3.0}$ = 0.6; -30; 0

   $\frac{3}{5} = 0.6$

   b. $15\overline{)7.000...}$ = 0.466...; -60; 100; -90; 100; -90; 10

   $\frac{7}{15} = 0.4\overline{6}$

3. a. same denominator, $5 > 2$

   $\frac{5}{3} > \frac{2}{3}$

   b. same numerator, $7 > 6$

   $\frac{5}{7} < \frac{5}{6}$

   c. Half of 9 is 4.5.

   $\frac{5}{9} > \frac{1}{2}$

   Half of 13 is 6.5.

   $\frac{6}{13} < \frac{1}{2}$

   $\frac{5}{9} > \frac{6}{13}$

   d. Half of 22 is 11.

   $\frac{11}{22} = \frac{1}{2}$

   Half of 16 is 8.

   $\frac{5}{16} < \frac{1}{2}$

   $\frac{11}{22} > \frac{5}{16}$

4. a. Half of 4 is 2.

$\frac{3}{4} > \frac{1}{2}$

Half of 5 is 2.5.

$\frac{2}{5} < \frac{1}{2}$

$\frac{4}{3} = 1\frac{1}{3}$

Greatest to least:

$\frac{4}{3}, \frac{3}{4}, \frac{1}{2}, \frac{2}{5}$

b. same numerator (smaller denominators mean larger fractions)

Greatest to least:

$\frac{7}{9}, \frac{7}{11}, \frac{7}{12}, \frac{7}{13}$

5.

$\frac{2}{5}$	A 1.375	B $2\frac{4}{9}$
C 0.476	D 1.45	$\frac{119}{250}$
$2.\overline{4}$	$1\frac{9}{20}$	$1\frac{3}{8}$
E $1\frac{3}{11}$	$1.\overline{27}$	0.4

Detailed work is shown below. Work may vary. Students may have converted decimal values to fractions or fractions to decimals to find equivalent numbers.

A $1.375 = 1\frac{375}{1000} = 1\frac{15}{40} = 1\frac{3}{8}$

B
$$\begin{array}{r} 0.44... \\ 9\overline{)4.00...} \\ -\ 36 \\ \hline 40 \\ -\ 36 \\ \hline 4 \end{array}$$

C $0.476 = \frac{476}{1000} = \frac{119}{250}$

D $1.45 = 1\frac{45}{100} = 1\frac{9}{20}$

E
$$\begin{array}{r} 0.2727... \\ 11\overline{)3.0000...} \\ -\ 22 \\ \hline 80 \\ -\ 77 \\ \hline 30 \\ -\ 22 \\ \hline 80 \\ -\ 77 \\ \hline 30 \end{array}$$

REVIEW

1.
$$\begin{array}{r} 83 \\ 13\overline{)1079} \\ -104 \\ \hline 39 \\ -39 \\ \hline 0 \end{array}$$

83 packages

2. a. Minutes practiced each week:

$$\begin{array}{r} {\scriptstyle 2} \\ 45 \\ \times\ \ 5 \\ \hline 225 \end{array}$$

225 minutes

Minutes practiced in a year:

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ {\scriptstyle 2\ 1} \\ 225 \\ \times\ \ 52 \\ \hline 450 \\ +11250 \\ \hline 11700 \end{array}$$

11,700 minutes

b.
$$\begin{array}{r} 195 \\ 60\overline{)11700} \\ -60 \\ \hline 570 \\ -540 \\ \hline 300 \\ -300 \\ \hline 0 \end{array}$$

195 hours

3. a. 75,300

b. 75,300

c. 80,000

4.
$$\begin{array}{r} {\scriptstyle 1} \\ 24 \\ \times\ 30 \\ \hline 720 \end{array}$$

720 hours

Addition and Subtraction with Integers

WARM-UP

a.
$$\begin{array}{r} 0.466\ldots \\ 15\overline{)7.000\ldots} \\ -\ 60 \\ \hline 100 \\ -\ 90 \\ \hline 100 \\ -\ 90 \\ \hline 10 \end{array}$$

$\frac{7}{15} = 0.4\overline{6}$

b.
$$\begin{array}{r} 0.4375 \\ 16\overline{)7.0000} \\ -\ 64 \\ \hline 60 \\ -\ 48 \\ \hline 120 \\ -\ 112 \\ \hline 80 \\ -\ 80 \\ \hline 0 \end{array}$$

$\frac{7}{16} = 0.4375$

PRACTICE

1. a. -3
   b. -17
   c. 2
   d. 51
   e. 0

2. a. $|13 - 81| = |-68| = 68$
   b. $|13 - (-42)| = |13 + 42| = |55| = 55$
   c. $|-15 - (-22)| = |-15 + 22| = |7| = 7$
   d. $|-17 - 85| = |-102| = 102$

3. **ACROSS**

   a. different signs, greater absolute value is negative
   $-96 + 65$
   $= -31$

   b. different signs, greater absolute value is positive
   $-13 - (-116)$
   $= -13 + 116$
   $= 103$

   c. different signs, greater absolute value is positive
   $-2 + 222 = 220$

   d. $53 - (-69)$
   $= 53 + 69$
   $= 122$

   e. different signs, greater absolute value is negative
   $-272 + 100 = -172$

   DOWN

   a. different signs, greater absolute value is negative
   $35 + (-58)$
   $= -23$

   b. $69 - 58$
   $= 11$

e. same sign, answer is negative

$-152 - 68$

$= -152 + (-68)$

$= -220$

f. $34 - (-200)$

$= 34 + 200$

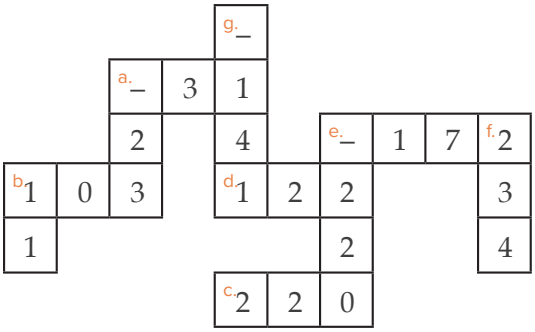
$= 234$

g. different signs, greater absolute value is negative

$-146 - (-5)$

$= -146 + 5$

$= -141$



REVIEW

1. a. $12.43 \approx 12$ $9.26 \approx 9$

b. $12 \cdot 9 = 108$

$12.43 \cdot 9.26 \approx 108$

c. greater than

Note: Both numbers were rounded down, so the estimate is an underestimate.

2.
$$
\begin{array}{r}
0.925 \\
40\overline{)37.000} \\
-360 \\
\hline
100 \\
-80 \\
\hline
200 \\
-200 \\
\hline
0
\end{array}
$$

0.925

3. 9.088, 9.115, 9.12, 9.2, 9.21

4. 125,502,000 rounds to 126,000,000.

36,991,981 rounds to 37,000,000.

126,000,000 – 37,000,000 = 89,000,000

89,000,000 people

5. 15 hours before 3:00 PM is midnight. Two hours before that is the previous day at 10:00 PM.

Date: September 1 Time: 10:00 PM

Addition and Subtraction with Fractions and Decimals

WARM-UP

a. different signs, greater absolute value is negative

$89 - 44 = 45$

$-89 + 44 = -45$

b. $53 - 100 = 53 + (-100)$

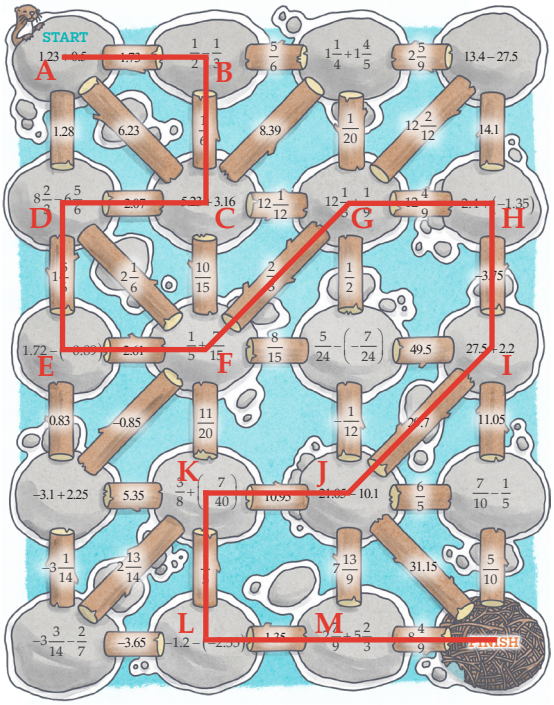
different signs, greater absolute value is negative

$100 - 53 = 47$

$53 - 100 = -47$

c. $65 - (-24) = 65 + 24 = 89$

PRACTICE



Detailed work for problems on the correct pathway is shown at right.

A

$$\begin{array}{r} 1.23 \\ +\ 0.50 \\ \hline 1.73 \end{array}$$

B

$$\frac{1}{2} - \frac{1}{3}$$
$$= \frac{3}{6} - \frac{2}{6}$$
$$= \frac{1}{6}$$

C

$$\begin{array}{r} 5.\overset{1}{\cancel{2}}\overset{1}{3} \\ -\ 3.1\ 6 \\ \hline 2.0\ 7 \end{array}$$

different signs, greater absolute value is negative

-2.07

D $8\frac{2}{3}-6\frac{5}{6}$

$=\frac{26}{3}-\frac{41}{6}$

$=\frac{52}{6}-\frac{41}{6}$

$=\frac{11}{6}$

$=1\frac{5}{6}$

E $1.72-\left(-0.89\right)=1.72+0.89$

$$\begin{array}{r} {\scriptstyle 1\ 1}\\ 1.72\\ +\ 0.89\\ \hline 2.61 \end{array}$$

F $\frac{1}{5}+\frac{7}{15}$

$=\frac{3}{15}+\frac{7}{15}$

$=\frac{10}{15}$

$=\frac{2}{3}$

G $12\frac{1}{3}+\frac{1}{9}$

$=12\frac{3}{9}+\frac{1}{9}$

$=12\frac{4}{9}$

H

$$\begin{array}{r} 2.40\\ +\ 1.35\\ \hline 3.75 \end{array}$$

same sign, answer is negative

–3.75

I

$$\begin{array}{r} 27.5\\ +\ 2.2\\ \hline 29.7 \end{array}$$

J

$$\begin{array}{r} {\scriptstyle 0\ 1}\\ 2\not{1}.05\\ -\ 10.10\\ \hline 10.95 \end{array}$$

K $\frac{3}{8}+\left(-\frac{7}{40}\right)$

$=\frac{15}{40}+\left(-\frac{7}{40}\right)$

$=\frac{8}{40}$

$=\frac{1}{5}$

L $-1.2-\left(-2.55\right)=-1.2+2.55$

$$\begin{array}{r} 2.55\\ -\ 1.20\\ \hline 1.35 \end{array}$$

different signs, greater absolute value is positive

1.35

M $2\frac{7}{9}+5\frac{2}{3}$

$=2\frac{7}{9}+5\frac{6}{9}$

$=7\frac{13}{9}$

$=8\frac{4}{9}$

REVIEW

1. $\frac{5}{8} = \frac{15}{24}$

$\frac{2}{3} = \frac{16}{24}$

$\frac{16}{24} > \frac{15}{24}$

$\frac{2}{3} > \frac{5}{8}$

Maria

2. a. different signs, greater absolute value is positive

$29 - 16 = 13$

$-16 + 29 = 13$

b. $57 - 88 = 57 + (-88)$

different signs, greater absolute value is negative

$88 - 57 = 31$

$57 - 88 = -31$

c. same sign, answer is negative

$43 + 43 = 86$

$-43 + (-43) = -86$

d. $-74 - (-74)$

$= -74 + 74$

$= 0$

3. Answers may vary depending on rounding but should be between 15 and 22. An example solution is given.

32 rounded to the nearest 10 is 30.

$30 \div 1.5 = 20$

about 20 servings

4. a. $90 \bullet 2 = 180$

180

$18

b. $76{,}000 \bullet 2 = 152{,}000$

152000

15,200 seats

c. $325 \bullet 2 = 650$

650

$65

Multiplication with Integers, Fractions, and Decimals

WARM-UP

a. $\frac{4}{5}+\frac{3}{10}=\frac{8}{10}+\frac{3}{10}=\frac{11}{10}=1\frac{1}{10}$

b. $5.23-4.12=1.11$

PRACTICE

1. a. different signs, answer is negative

-132

b. different signs, answer is negative

-75

c.
$$\begin{array}{r} 21.03 \\ \times\ \ 5.1 \\ \hline 2103 \\ +\ 105150 \\ \hline 107253 \end{array}$$

different signs, answer is negative

-107.253

d. same sign, answer is positive

96

e. $-3\bullet(5)\bullet(-4)=-15\bullet(-4)=60$

f.
$$\begin{array}{r} \overset{1}{\not 3}\ \overset{1}{\not 4}.72 \\ \times\ 1.25 \\ \hline 2360 \\ 9440 \\ +\ 47200 \\ \hline 59000 \end{array}$$

same sign, answer is positive

5.9

–	1	0	.	7	2	9	3
1	3	.	6	–	8	.	4
0	.	7	4	1	.	2	–
7	–	2	.	3	–	7	5
.	6	0	4	2	–	3	.
2	–	5	1	–	.	9	1
5	.	2	.	.	3	1	6
3	1	–	4	9	9	2	5

2. a. multiplication

b. $\frac{2}{3}\bullet 20$

$=\frac{2}{3}\bullet\frac{20}{1}$

$=\frac{40}{3}$

$=13\frac{1}{3}$

c. $1\frac{3}{4}\bullet 6\frac{2}{21}$

$=\frac{\overset{1}{\cancel{7}}}{\underset{1}{\cancel{4}}}\bullet\frac{\overset{32}{\cancel{128}}}{\underset{3}{\cancel{21}}}$

$=\frac{32}{3}$

$=10\frac{2}{3}$

3. a. different signs, answer is negative

$$-\frac{7}{15}\cdot 1\frac{7}{8}$$
$$=-\frac{7}{\cancel{15}}\cdot\frac{\cancel{15}}{8}$$
$$=-\frac{7}{8}$$

b. same sign, answer is positive

$$-2\frac{2}{3}\cdot\left(-2\frac{1}{4}\right)$$
$$=-\frac{\overset{2}{\cancel{8}}}{\underset{1}{\cancel{3}}}\cdot\left(-\frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{4}}}\right)$$
$$=6$$

REVIEW

1. $5\frac{1}{8}+2\frac{3}{4}$

$=5\frac{1}{8}+2\frac{6}{8}$

$=7\frac{7}{8}$

$7\frac{7}{8}$ cups of flour

2. $\begin{array}{r} \overset{4}{\cancel{5}}\,\overset{1}{\cancel{3}}\overset{2}{\cancel{.}}\overset{9}{\cancel{0}}\overset{1}{0} \\ -\,1\;4\;.\;8\;2 \\ \hline 3\;8\;.\;1\;8 \end{array}$

$38.18

3. $7\frac{325}{1000}=7\frac{13}{40}$

4. $72-76$ — negative

$33-(-9)$ — positive

$-15+(-22)$ — negative

$-16+8$ — negative

Detailed work for each problem is shown below.

$72-76$

$=72+(-76)$

different signs, larger absolute value is negative, negative answer

$33-(-9)$

$=33+9$

both positive, positive answer

$-15+(-22)$

both negative, negative answer

$-16+8$

different signs, larger absolute value is negative, negative answer

5. Fractions that add to one whole are circled.

a. $4\frac{7}{8}+3\frac{1}{16}+1\frac{1}{8}$

$=4\frac{7}{8}+1\frac{1}{8}+3\frac{1}{16}$

$=4+1+1+3\frac{1}{16}$

$=9\frac{1}{16}$

b. $2\frac{2}{5}+2\frac{3}{5}+5\frac{1}{7}$

$=2+2+1+5\frac{1}{7}$

$=10\frac{1}{7}$

c. $1\frac{1}{3}+5\frac{3}{10}+3\frac{2}{3}+4\frac{7}{10}$

$=1+3+5+4+1+1$

$=15$

Division with Integers, Fractions, and Decimals

WARM-UP

a. $-5\frac{5}{6} \bullet \left(-2\frac{3}{5}\right)$

$= -\frac{35}{6} \bullet \left(-\frac{13}{5}\right)$

$= -\frac{\overset{7}{\cancel{35}}}{6} \bullet \left(-\frac{13}{\cancel{5}_{1}}\right)$

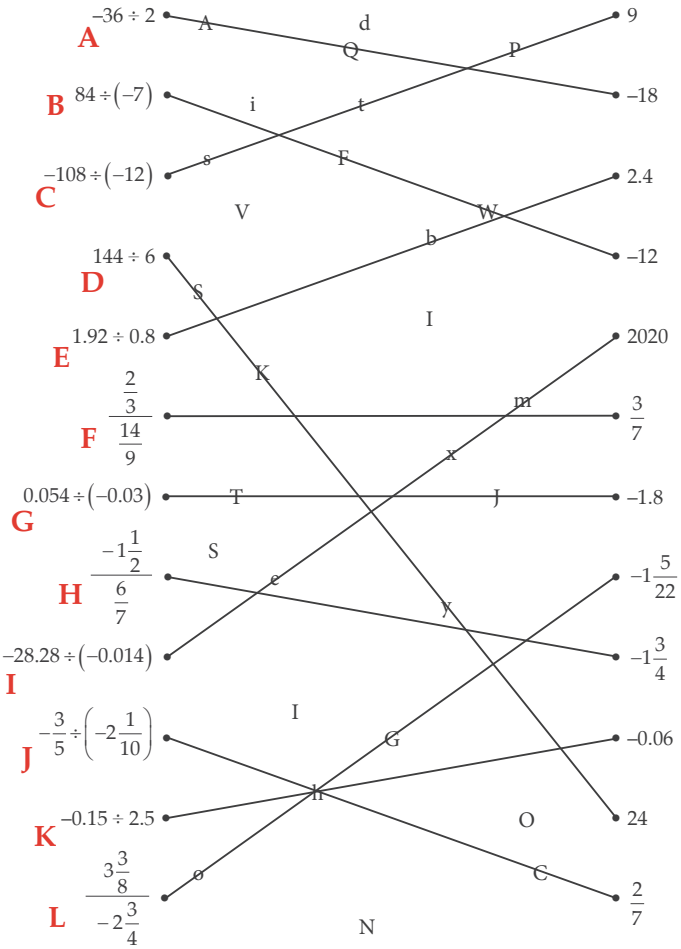
$= \frac{91}{6} = 15\frac{1}{6}$

b.

$$\begin{array}{r} 101 \\ \times\ 5.5 \\ \hline 505 \\ +\ 5050 \\ \hline 5555 \end{array}$$

$-5.5 \bullet 101 = -555.5$

PRACTICE



Detailed work for the problems is shown at right.

A different signs, answer is negative
-18

B different signs, answer is negative
-12

C same sign, answer is positive
9

D same sign, answer is positive

$$\begin{array}{r} 24 \\ 6\overline{)144} \\ -12 \\ \hline 24 \\ -24 \\ \hline 0 \end{array}$$

E same sign, answer is positive

$$\begin{array}{r} 2.4 \\ 8\overline{)19.2} \\ -16 \\ \hline 32 \\ -32 \\ \hline 0 \end{array}$$

F same sign, answer is positive

$$\frac{\frac{2}{3}}{\frac{14}{9}}$$

$$= \frac{2}{3} \div \frac{14}{9}$$

$$= \frac{\cancel{2}^{1}}{\cancel{3}_{1}} \bullet \frac{\cancel{9}^{3}}{\cancel{14}_{7}}$$

$$= \frac{3}{7}$$

G different signs, answer is negative

$$3\overline{)5.4}\quad 1.8$$

$$\underline{-3}$$

$$24$$

$$\underline{-24}$$

$$0$$

$$-1.8$$

H different signs, answer is negative

$$\frac{-1\frac{1}{2}}{\frac{6}{7}}$$

$$= -1\frac{1}{2} \div \frac{6}{7}$$

$$= -\frac{\cancel{3}^{1}}{2} \bullet \frac{7}{\cancel{6}_{2}}$$

$$= -\frac{7}{4}$$

$$= -1\frac{3}{4}$$

I same sign, answer is positive

$$14\overline{)28280}\quad 2020$$

$$\underline{-28}$$

$$02$$

$$\underline{-0}$$

$$28$$

$$\underline{-28}$$

$$00$$

$$\underline{-0}$$

$$0$$

J same sign, answer is positive

$$-\frac{3}{5} \div \left(-2\frac{1}{10}\right)$$

$$= -\frac{3}{5} \div \left(-\frac{21}{10}\right)$$

$$= -\frac{\cancel{3}^{1}}{\cancel{5}_{1}} \bullet \left(-\frac{\cancel{10}^{2}}{\cancel{21}_{7}}\right)$$

$$= \frac{2}{7}$$

K different signs, answer is negative

$$25\overline{)1.50}\quad 0.06$$

$$\underline{-150}$$

$$0$$

$$-0.06$$

L different signs, answer is negative

$$\frac{3\frac{3}{8}}{-2\frac{3}{4}}$$

$$= 3\frac{3}{8} \div \left(-2\frac{3}{4}\right)$$

$$= \frac{27}{8} \div \left(-\frac{11}{4}\right)$$

$$= \frac{27}{\cancel{8}_{2}} \bullet \left(-\frac{\overset{1}{\cancel{4}}}{11}\right)$$

$$= -\frac{27}{22}$$

$$= -1\frac{5}{22}$$

It improved her di-VISION!

REVIEW

1. $-3\frac{1}{8} \bullet \left(-2\frac{2}{3}\right)$

$$= -\frac{25}{\cancel{8}} \bullet \left(-\frac{\cancel{8}}{3}\right)$$

$$= \frac{25}{3} = 8\frac{1}{3}$$

2. Four days after August 27 is August 31.
Add 10 more days to make two weeks.

September 10

3.
$$\begin{array}{r} \overset{5}{\cancel{5}}\,\overset{2}{\cancel{2}}6.31 \\ \times \quad 8.8 \\ \hline 21048 \\ +\ 210480 \\ \hline 231528 \end{array}$$

$-26.31 \bullet 8.8 = -231.528$

4.
$$\begin{array}{r} \overset{1}{5}\overset{1}{4}.620 \\ +\ 79.448 \\ \hline 134.068 \end{array}$$

$54.62 + 79.448 = 134.068$

5. a. $120 \div 4 = 30$

b. $72 \div 6 = 12$

c. $60 \div 20 = 3$

d. $500 \div 5 = 100$

Properties of Real Numbers: Part 1

WARM-UP

a. $\dfrac{\frac{4}{5}}{-2\frac{4}{10}}$

$= \dfrac{4}{5} \div \left(-2\dfrac{4}{10}\right)$

$= \dfrac{4}{5} \div \left(-\dfrac{24}{10}\right)$

$= \dfrac{4}{5} \bullet \left(-\dfrac{10}{24}\right)$

$= \dfrac{\cancel{4}^{1}}{\cancel{5}_{1}} \bullet \left(-\dfrac{\cancel{10}^{2}}{\cancel{24}_{6}}\right)$

$= -\dfrac{2}{6} = -\dfrac{1}{3}$

b.
$$\begin{array}{r} 56.89 \\ 25\overline{)1422.25} \\ -\ 125 \\ \hline 172 \\ -\ 150 \\ \hline 222 \\ -\ 200 \\ \hline 225 \\ -\ 225 \\ \hline 0 \end{array}$$

$142.225 \div 2.5 = 56.89$

PRACTICE

1.

$3 \bullet 2 = 2 \bullet 3$	Commutative Property of Multiplication
$1.75r + 0 = 1.75r$	Identity Property of Addition
$-p + q = q + (-p)$	Commutative Property of Addition
$2 \bullet (a \bullet 3) = (2 \bullet a) \bullet 3$	Associative Property of Multiplication
$-3 \bullet \left(-\dfrac{1}{3}\right) = 1$	Inverse Property of Multiplication
$\left(-\dfrac{2}{5}\right) \bullet 0 = 0$	Zero Property of Multiplication
$ab = ab$	Reflexive Property
$1\dfrac{1}{2} + \left(-1\dfrac{1}{2}\right) = 0$	Inverse Property of Addition
$-6 \bullet 1 = -6$	Identity Property of Multiplication
$\left(\dfrac{1}{e} + \dfrac{1}{f}\right) + \dfrac{1}{g} = \dfrac{1}{e} + \left(\dfrac{1}{f} + \dfrac{1}{g}\right)$	Associative Property of Addition

$x + (1 + y) = (x + 1) + y$	Associative Property of Addition
$-5 + 5 = 0$	Inverse Property of Addition
$\dfrac{t}{2} \bullet 1 = \dfrac{t}{2}$	Identity Property of Multiplication
$0 \bullet 17.5 = 0$	Zero Property of Multiplication
$6 + 27 = 27 + 6$	Commutative Property of Addition
$104.5 = 104.5$	Reflexive Property
$-6 + 0 = -6$	Identity Property of Addition
$\dfrac{17w}{4} \bullet \dfrac{4}{17w} = 1$	Inverse Property of Multiplication
$\dfrac{4}{5} \bullet 1.23 = 1.23 \bullet \dfrac{4}{5}$	Commutative Property of Multiplication
$\left(5.42 \bullet \dfrac{1}{2}\right) \bullet 17 = 5.42 \bullet \left(\dfrac{1}{2} \bullet 17\right)$	Associative Property of Multiplication

2. a. $17 = m + n$

b. $uv = s$

3. a. $23 + 15$

b. $(17z)y$

4. a. 1

b. -7.45

5. a. $a = \frac{1}{5}$

b. $j = 0$

c. $k = 21.5$

d. $t = 1$

REVIEW

1. a. 12.3 57.81

$$123\overline{)578.1} \quad 4.7$$
$$-492$$
$$861$$
$$-861$$
$$0$$

$57.81 \div 12.3 = 4.7$

b. $-5\frac{2}{3} \div 4$

$= -\frac{17}{3} \div 4$

$= -\frac{17}{3} \bullet \frac{1}{4}$

$= -\frac{17}{12}$

$= -1\frac{5}{12}$

2. a. *Answers may vary. An example is given.* 49.47 rounds to 50, and 11.58 rounds to 10. Since $50 \bullet 10 = 500$, the actual answer should be around 500, not 5 million.

b. 572.8626

3. a. greater than

b. $6 \div \frac{3}{4}$

$= \frac{\cancel{6}^{2}}{1} \bullet \frac{4}{\cancel{3}_{1}}$

$= \frac{8}{1}$

$= 8$

8 strips

c. greater than

4. a. less than

b. $6 \bullet \frac{3}{4}$

$= \frac{\cancel{6}^{3}}{1} \bullet \frac{3}{\cancel{4}_{2}}$

$= \frac{9}{2}$

$= 4\frac{1}{2}$

$4\frac{1}{2}$ feet

c. less than

Properties of Real Numbers: Part 2

WARM-UP

a. $k = 2.7$

b. $t = \frac{1}{479}$

PRACTICE

1. a. $62 + 54 = 116$

$116 - 62 = 54$

$116 - 54 = 62$

b. $27 \cdot 36 = 972$

$972 \div 36 = 27$

$972 \div 27 = 36$

2. a. $z = 58 - 17 = 41$

b. $y = -279 \div 31 = -9$

c. $x = -23 + 81 = 58$

d. $w = 11 \cdot 17 = 187$

e. $v = -161 \div 7 = -23$

3. a. $5(p + 2)$

$= 5 \cdot p + 5 \cdot 2$

$= 5p + 10$

b. $3(-3 + a - b)$

$= 3 \cdot (-3) + 3 \cdot a - 3 \cdot b$

$= -9 + 3a - 3b$

c. $-12(3g - h - 4)$

$= -12 \cdot 3g - (-12) \cdot h - (-12) \cdot 4$

$= -36g - (-12h) - (-48)$

$= -36g + 12h + 48$

4. a. $2(\_\_ + 3) = 10 + 6$

$2 \cdot \_\_ + 2 \cdot 3 = 10 + 6$

$2 \cdot \_\_ + 6 = 10 + 6$

$2 \cdot \_\_ = 10$

$2 \cdot \underline{5} = 10$

b. $7(2 - \_\_ + 1) = 14 - 21 + 7$

$7 \cdot 2 - 7 \cdot \_\_ + 7 \cdot 1 = 14 - 21 + 7$

$14 - 7 \cdot \_\_ + 7 = 14 - 21 + 7$

$-7 \cdot \_\_ = -21$

$-7 \cdot \underline{3} = -21$

5. a. $12 \cdot 101$

$= 12(100 + 1)$

$= 12 \cdot 100 + 12 \cdot 1$

$= 1200 + 12$

$= 1212$

b. $8 \cdot 302$

$= 8(300 + 2)$

$= 8 \cdot 300 + 8 \cdot 2$

$= 2400 + 16$

$= 2416$

c. $21 \cdot 104$

$= 21(100 + 4)$

$= 21 \cdot 100 + 21 \cdot 4$

$= 2100 + 84$

$= 2184$

d. $9 \bullet 304$

$= 9(300 + 4)$

$= 9 \bullet 300 + 9 \bullet 4$

$= 2700 + 36$

$= 2736$

1	2	1	2
	1		7
	8		3
2	4	1	6

REVIEW

1. $\begin{array}{r} {\scriptstyle 1\,1\,5} \\ 121.9 \\ \times\ 66.4 \\ \hline 4876 \\ 7314\,0 \\ +7314\,0\,0 \\ \hline 8094\,1\,6 \end{array}$

$8094.16\ \text{m}^2$

2. $\dfrac{-\frac{16}{3}}{-\frac{5}{9}}$

$= -\dfrac{16}{3} \div \left(-\dfrac{5}{9}\right)$

$= -\dfrac{16}{3} \bullet \left(-\dfrac{3}{5}\right)$

$= \dfrac{48}{5}$

$= 9\dfrac{3}{5}$

3. a. -31

b. $-\dfrac{1}{8}$

c. x

d. $(29.04 \bullet 5) \bullet 2 = 29.04 \bullet (5 \bullet 2)$

$= 29.04 \bullet (10) = 290.4$

4. a. October is the 10th month. Go back 3 months to the 7th month.

July

b. April is the 4th month. Go back 3 months to the 1st month.

January

5. a. Go back 3 hours and change PM to AM.

2:35 AM

b. Go back 3 hours and change AM to PM.

5:20 PM

c. Go forward 9 hours.

11:50 PM

Exponents

WARM-UP

a. $-3(a+4b-17)$

$=-3\bullet a+(-3)\bullet 4b-(-3)\bullet 17$

$=-3a+(-12b)-(-51)$

$=-3a-12b+51$

b. $j(k+km-5n)$

$=j\bullet k+j\bullet km-j\bullet 5n$

$=jk+jkm-5jn$

PRACTICE

1. Students can choose different problems to complete. The total of the answers must be enough to get to FINISH (179 moves). Answers and work for all problems are shown below.

$-3^4=-(3\bullet 3\bullet 3\bullet 3)=-81$

$(-3)^4=(-3)(-3)(-3)(-3)=81$

$(-4)^3=(-4)(-4)(-4)=-64$

$4^3=4\bullet 4\bullet 4=64$

$145^0=1$

$2^6=2\bullet 2\bullet 2\bullet 2\bullet 2\bullet 2=64$

$6^2=6\bullet 6=36$

$10^2=10\bullet 10=100$

$(-2)^6=(-2)(-2)(-2)(-2)(-2)(-2)=64$

$(-2)^5=(-2)(-2)(-2)(-2)(-2)=-32$

$-2^4=-(2\bullet 2\bullet 2\bullet 2)=-16$

$2^7=2\bullet 2\bullet 2\bullet 2\bullet 2\bullet 2\bullet 2=128$

$7^2=7\bullet 7=49$

$5^3=5\bullet 5\bullet 5=125$

$3^5=3\bullet 3\bullet 3\bullet 3\bullet 3=243$

$37^1=37$

Optional: 1

3^5 is greater than 179, so the maze can be finished by completing one problem.

2. c

3. d

4. a

5. c

$\left(\frac{2}{3}\right)^4$

$=\frac{2}{3}\bullet\frac{2}{3}\bullet\frac{2}{3}\bullet\frac{2}{3}$

$=\frac{16}{81}$

6. a. $3^2\bullet 5\bullet 7^3$

b. xy^2z^3

7. a. $\left(\frac{3}{5}\right)^3$

$=\frac{3}{5}\bullet\frac{3}{5}\bullet\frac{3}{5}$

$=\frac{27}{125}$

b. $\frac{3^3}{5}$

$= \frac{3 \bullet 3 \bullet 3}{5}$

$= \frac{27}{5}$

$= 5\frac{2}{5}$

c. 1

8. a. 1,000,000

b. 4320

9. $(7 \bullet 10^5) + (5 \bullet 10^4) + (2 \bullet 10^0)$

REVIEW

1. $7 \bullet 545 = 7(500 + 40 + 5)$

$= 7 \bullet 500 + 7 \bullet 40 + 7 \bullet 5$

$= 3500 + 280 + 35$

$= 3815$

2. a. $g - 135 = 45$

$45 + 135 = g$

$45 + 135 = 180$

$g = 180$

b. $10 \bullet d = 125$

$125 \div 10 = d$

$125 \div 10 = 12.5$

$d = 12.5$

3. a. $154 - 30 = 124$

$124 + 1 = 125$

b. $87 - 40 = 47$

$47 + 2 = 49$

c. $295 - 70 = 225$

$225 + 1 = 226$

d. $351 - 100 = 251$

$251 + 1 = 252$

4. a. A

b. S

c. S

d. N

e. A

5. Answers will vary, but all three numbers should be greater than or equal to 6.45 and less than 6.55.

Factors and Multiples

WARM-UP

a. $5^3 = 5 \cdot 5 \cdot 5 = 125$

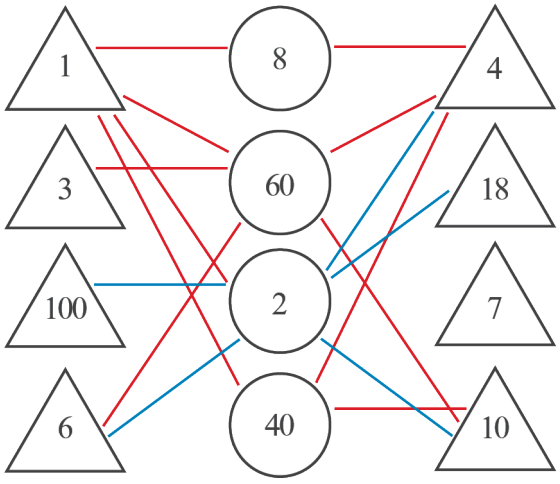
b. $7^2 = 7 \cdot 7 = 49$

c. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

d. $11^2 = 11 \cdot 11 = 121$

PRACTICE

1.



2. a. $3|345$
$5|115$
23

$3 \cdot 5 \cdot 23$
composite

b. 71
prime

c. $3|2511$
$3|837$
$3|279$
$3|93$
31

$3^4 \cdot 31$
composite

d. $2|6930$
$3|3465$
$3|1155$
$5|385$
$7|77$
11

$2 \cdot 3^2 \cdot 5 \cdot 7 \cdot 11$
composite

3. Specific numbers rolled and chosen will vary. The prime factorization for each number is shown below. Then the GCF and LCM for all possible pairs are shown.

Prime factorizations:

$5|25$
5

$25 = 5^2$

$2|156$
$2|78$
$3|39$
13

$156 = 2^2 \cdot 3 \cdot 13$

$2|476$
$2|238$
$7|119$
17

$476 = 2^2 \cdot 7 \cdot 17$

$3|279$
$3|93$
31

$279 = 3^2 \cdot 31$

$2|882$
$3|441$
$3|147$
$7|49$
7

$882 = 2 \cdot 3^2 \cdot 7^2$

$2|1456$
$2|728$
$2|364$
$2|182$
$7|91$
13

$1456 = 2^4 \cdot 7 \cdot 13$

Possible pairs of numbers:

Numbers: 25 and 279
GCF: 1
LCM: $3^2 \cdot 5^2 \cdot 31$

Numbers: 25 and 882
GCF: 1
LCM: $2 \cdot 3^2 \cdot 5^2 \cdot 7^2$

Numbers: 25 and 1456
GCF: 1
LCM: $2^4 \cdot 5^2 \cdot 7 \cdot 13$

Numbers: 156 and 279
GCF: 3
LCM: $2^2 \cdot 3^2 \cdot 13 \cdot 31$

Numbers: 156 and 882
GCF: $2 \cdot 3$
LCM: $2^2 \cdot 3^2 \cdot 7^2 \cdot 13$

Numbers: 156 and 1456
GCF: $2^2 \cdot 13$
LCM: $2^4 \cdot 3 \cdot 7 \cdot 13$

Numbers: 476 and 279
GCF: 1
LCM: $2^2 \cdot 3^2 \cdot 7 \cdot 17 \cdot 31$

Numbers: 476 and 882
GCF: $2 \cdot 7$
LCM: $2^2 \cdot 3^2 \cdot 7^2 \cdot 17$

Numbers: 476 and 1456
GCF: $2^2 \cdot 7$
LCM: $2^4 \cdot 7 \cdot 13 \cdot 17$

REVIEW

1. a. =
   b. =
   c. ≠
   d. ≠
   e. =
   f. =
   g. =

2. $3 \div \frac{1}{3}$
   $= 3 \cdot 3$
   $= 9$

   9 activity stations

3. $537.2 \div 13.6 = 5372 \div 136$

$$\begin{array}{r} 39.5 \\ 136\overline{)5372.0} \\ -408 \\ \hline 1292 \\ -1224 \\ \hline 680 \\ -680 \\ \hline 0 \end{array}$$

39.5 miles per gallon

4. a. $|-8-27|$ or $|27-(-8)|$

b. $|27-(-8)|$

$=|27+8|$

$=|35|$

$=35$

35 feet

5. $(1\bullet 10{,}000)+(2\bullet 100)+(1\bullet 10)$

Order of Operations

WARM-UP

a. $2\overline{)480}$
$2\overline{)240}$
$2\overline{)120}$
$2\overline{)60}$
$2\overline{)30}$
$3\overline{)15}$
5

$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5$

b. $2\overline{)390}$
$3\overline{)195}$
$5\overline{)65}$
13

$2 \cdot 3 \cdot 5 \cdot 13$

c. $2\overline{)200}$
$2\overline{)100}$
$2\overline{)50}$
$5\overline{)25}$
5

$2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$

PRACTICE

1. a. She added first. She should have multiplied first.

   b. She added before subtracting in the numerator. Addition and subtraction are done from left to right.

   c. She divided first. She should have evaluated the numerator and denominator separately before dividing.

   d. She evaluated the exponent first. She should have simplified in the parentheses first.

2. YELLOW
$$\begin{aligned} &1+3 \cdot 4-2 \\ &=1+12-2 \\ &=13-2 \\ &=11 \end{aligned}$$

LIGHT GREEN
$$\begin{aligned} &10 \div 5-2(1+3) \\ &=10 \div 5-2(4) \\ &=2-2(4) \\ &=2-8 \\ &=-6 \end{aligned}$$

DARK GREEN
$$\begin{aligned} &\frac{5-|3-2 \cdot 6|}{2} \\ &=\frac{5-|3-12|}{2} \\ &=\frac{5-|-9|}{2} \\ &=\frac{5-9}{2} \\ &=\frac{-4}{2} \\ &=-2 \end{aligned}$$

LIGHT BLUE

$$\frac{4 \bullet 3^2 \div 6}{|32-38|}$$
$$= \frac{4 \bullet 9 \div 6}{|-6|}$$
$$= \frac{36 \div 6}{6}$$
$$= \frac{6}{6}$$
$$= 1$$

DARK BLUE

$$(3 \bullet 5 \bullet (7-3)) \div (24 \div 2)$$
$$= (3 \bullet 5 \bullet 4) \div 12$$
$$= (15 \bullet 4) \div 12$$
$$= 60 \div 12$$
$$= 5$$

BROWN

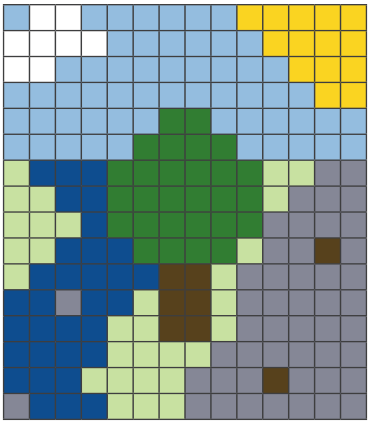
$$42 \div 3 - |2 - (3 - 4^2)|$$
$$= 42 \div 3 - |2 - (3 - 16)|$$
$$= 42 \div 3 - |2 - (-13)|$$
$$= 42 \div 3 - |15|$$
$$= 42 \div 3 - 15$$
$$= 14 - 15$$
$$= -1$$

GRAY

$$(7^2 - 25) \div 6 \bullet 4$$
$$= (49 - 25) \div 6 \bullet 4$$
$$= 24 \div 6 \bullet 4$$
$$= 4 \bullet 4$$
$$= 16$$

WHITE

$$\frac{35 \div (2 - (-5)) \bullet 3}{2 + |5 - 8|}$$
$$= \frac{35 \div (2+5) \bullet 3}{2 + |-3|}$$
$$= \frac{35 \div 7 \bullet 3}{2+3}$$
$$= \frac{15}{5}$$
$$= 3$$



REVIEW

1. a. 158, 426, 381, 972, 564, 771

   b. 426, 972, 564

2. a. $10 = 2 \bullet 5$

   $12 = 2 \bullet 2 \bullet 3$

   LCM of 10 and 12: $2 \bullet 2 \bullet 3 \bullet 5 = 60$

$$\frac{7}{10} + \frac{5}{12}$$
$$= \frac{42}{60} + \frac{25}{60}$$
$$= \frac{67}{60}$$
$$= 1\frac{7}{60}$$

b. $15 = 3 \bullet 5$

$6 = 2 \bullet 3$

LCM of 15 and 6: $2 \bullet 3 \bullet 5 = 30$

$$\frac{4}{15} + \frac{5}{6}$$
$$= \frac{8}{30} + \frac{25}{30}$$
$$= \frac{33}{30}$$
$$= 1\frac{3}{30}$$
$$= 1\frac{1}{10}$$

3. a. $\left(\frac{1}{2}\right)^5 = \frac{1}{2} \bullet \frac{1}{2} \bullet \frac{1}{2} \bullet \frac{1}{2} \bullet \frac{1}{2} = \frac{1}{32}$

b. 780,000

c. 831

d. $(-3)^3 = -3 \bullet (-3) \bullet (-3) = -27$

e. 300,000

f. 1

4. $2 \overline{)4950}$
$3 \overline{)2475}$
$3 \overline{)825}$
$5 \overline{)275}$
$5 \overline{)55}$
11

$2 \bullet 3 \bullet 3 \bullet 5 \bullet 5 \bullet 11$

Combining Like Terms

WARM-UP

$$\frac{\left(10+\left(7-12\right)^3\right)}{\left|45-53\right|\bullet 5}$$
$$=\frac{\left(10+\left(-5\right)^3\right)}{\left|-8\right|\bullet 5}$$
$$=\frac{\left(10+\left(-125\right)\right)}{8\bullet 5}$$
$$=\frac{-115}{40}=-\frac{23}{8}=-2\frac{7}{8}$$

PRACTICE

1. $3x+5-4x$
$=3x-4x+5$
$=-x+5$

2. $2ab-ab+3a+2a$
$=ab+5a$

3. $4c^2+3c-7c^2-c$
$=4c^2-7c^2+3c-c$
$=-3c^2+2c$

4. $-2.5p-q+1.3p-1.1q$
$=-2.5p+1.3p-q-1.1q$
$=-1.2p-2.1q$

5. $\frac{1}{2}u^2v-\frac{2}{3}u+u-\frac{1}{6}u^2v$
$=\frac{1}{2}u^2v-\frac{1}{6}u^2v-\frac{2}{3}u+u$
$=\frac{3}{6}u^2v-\frac{1}{6}u^2v-\frac{2}{3}u+\frac{3}{3}u$
$=\frac{2}{6}u^2v+\frac{1}{3}u$
$=\frac{1}{3}u^2v+\frac{1}{3}u$

6. $j^2l-\left(-5j\right)-2j^2l+j$
$=j^2l+5j-2j^2l+j$
$=j^2l-2j^2l+5j+j$
$=-j^2l+6j$

7. $t+2s-1$
$3+2\left(1\right)-1$
$=3+2-1$
$=5-1$
$=4$

8. $ab+b^2$

$(2)(-1)+(-1)^2$

$=(2)(-1)+1$

$=-2+1$

$=-1$

9. $3e+4f-1.5g^3$

$3(1.5)+4(2.5)-1.5(-2)^3$

$=3(1.5)+4(2.5)-1.5(-8)$

$=4.5+10-(-12)$

$=14.5+12$

$=26.5$

10. $\dfrac{nm-m}{n^2+m^2}$

$\dfrac{(2)(4)-4}{2^2+4^2}$

$=\dfrac{8-4}{4+16}$

$=\dfrac{4}{20}$

$=\dfrac{1}{5}$

11. $\dfrac{-w-(-2x)}{w}$

$\dfrac{-3-\left(-2\bullet\dfrac{1}{2}\right)}{3}$

$=\dfrac{-3-(-1)}{3}$

$=\dfrac{-3+1}{3}$

$=\dfrac{-2}{3}$

$=-\dfrac{2}{3}$

12. $\dfrac{q+1.4p}{-r}$

$\dfrac{6+1.4(2)}{-(-1)}$

$=\dfrac{6+2.8}{1}$

$=\dfrac{8.8}{1}$

$=8.8$

Fact: Although only about 3% of the earth's water is fresh water, more than 100,000 species of plants and animals have their homes in freshwater habitats.

REVIEW

1. $5\bullet1\dfrac{1}{2}$

$=\dfrac{5}{1}\bullet\dfrac{3}{2}$

$=\dfrac{15}{2}=7\dfrac{1}{2}$

$7\dfrac{1}{2}$ pounds tomatoes

$1\bullet1\dfrac{1}{2}=1\dfrac{1}{2}$

$1\dfrac{1}{2}$ pounds Anaheim peppers

$3\bullet1\dfrac{1}{2}$

$=\dfrac{3}{1}\bullet\dfrac{3}{2}$

$=\dfrac{9}{2}=4\dfrac{1}{2}$

$4\dfrac{1}{2}$ jalapeño peppers

$1\frac{1}{2} \bullet 1\frac{1}{2}$

$= \frac{3}{2} \bullet \frac{3}{2}$

$= \frac{9}{4} = 2\frac{1}{4}$

$2\frac{1}{4}$ cups chopped onion

$\frac{3}{4} \bullet 1\frac{1}{2}$

$= \frac{3}{4} \bullet \frac{3}{2}$

$= \frac{9}{8} = 1\frac{1}{8}$

$1\frac{1}{8}$ cups vinegar

$\frac{1}{2} \bullet 1\frac{1}{2}$

$= \frac{1}{2} \bullet \frac{3}{2}$

$= \frac{3}{4}$

$\frac{3}{4}$ cup chopped cilantro

$2 \bullet 1\frac{1}{2}$

$= \frac{2}{1} \bullet \frac{3}{2}$

$= \frac{6}{2} = 3$

3 teaspoons salt

2. a.

$2\overline{)150}$	$2\overline{)210}$
$3\overline{)75}$	$3\overline{)105}$
$5\overline{)25}$	$5\overline{)35}$
5	7

$150 = 2 \bullet 3 \bullet 5 \bullet 5$

$210 = 2 \bullet 3 \bullet 5 \bullet 7$

GCF of 150 and 210: $2 \bullet 3 \bullet 5 = 30$

Simplified fraction: $\frac{150}{210} = \frac{5}{7}$

b.

$2\overline{)48}$	$2\overline{)256}$
$2\overline{)24}$	$2\overline{)128}$
$2\overline{)12}$	$2\overline{)64}$
$2\overline{)6}$	$2\overline{)32}$
3	$2\overline{)16}$
	$2\overline{)8}$
	$2\overline{)4}$
	2

$48 = 2 \bullet 2 \bullet 2 \bullet 2 \bullet 3$

$256 = 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2$

GCF of 48 and 256: $2 \bullet 2 \bullet 2 \bullet 2 = 16$

Simplified fraction: $\frac{48}{256} = \frac{3}{16}$

3. $27 + 33 \div 3 - 4^3$

$= 27 + 33 \div 3 - 64$

$= 27 + 11 - 64$

$= 38 - 64$

$= -26$

Exponent Rules: Part 1

WARM-UP

a. $43 + 5x + 8x - 14$

$= 5x + 8x + 43 - 14$

$= 13x + 29$

b. $3qr - 7qr + 16r^3 - 4q^3$

$= -4qr + 16r^3 - 4q^3$

c. $18z^3 - 3z^2 + 2z^3 + 16z^2$

$= 18z^3 + 2z^3 + 16z^2 - 3z^2$

$= 20z^3 + 13z^2$

PRACTICE

1. $2^5 \bullet 2^2 = 2^{5+2} = 2^7$

2. $8^{13} \div 8^7 = 8^{13-7} = 8^6$

3. $p^{14} \div p^7 = p^{14-7} = p^7$

4. $\left(\frac{4}{7}\right)^5 \bullet \left(\frac{4}{7}\right)^6 = \left(\frac{4}{7}\right)^{5+6} = \left(\frac{4}{7}\right)^{11}$

5. $g^{11} \bullet g^2 = g^{11+2} = g^{13}$

6. $(st)^{15} \div (st)^{14} = (st)^{15-14} = (st)^1 = st$

7. $t^7 \div t^5 = t^{7-5} = t^2$

8. $8^{11} \bullet 8^4 = 8^{11+4} = 8^{15}$

9. $p^5 \bullet 3^4 \bullet p^2 \bullet 3^3 = 3^{4+3} p^{5+2} = 3^7 p^7$

10. $t^7 \bullet t^{12} = t^{7+12} = t^{19}$

11. $\left(-\frac{4}{7}\right)^{25} \div \left(-\frac{4}{7}\right)^{19} = \left(-\frac{4}{7}\right)^{25-19} = \left(-\frac{4}{7}\right)^6$

12. $g^{13} \div g = g^{13-1} = g^{12}$

13. $2^{19} \div 2^{13} = 2^{19-13} = 2^6$

REVIEW

1. $15\left(-4a - \frac{2}{3}w + 0.1e\right)$

$= 15 \bullet (-4a) + 15 \bullet \left(-\frac{2}{3}w\right) + 15 \bullet 0.1e$

$= -60a + (-10w) + 1.5e$

$= -60a - 10w + 1.5e$

2. a. T

b. F

c. T

d. F

e. F

f. T

$$\frac{24 \div 3 \bullet 2 + (58 - 26)}{2^3 - (-2)}$$
$$= \frac{24 \div 3 \bullet 2 + 32}{2^3 - (-2)}$$
$$= \frac{24 \div 3 \bullet 2 + 32}{8 - (-2)}$$
$$= \frac{8 \bullet 2 + 32}{8 - (-2)}$$
$$= \frac{16 + 32}{8 + 2}$$
$$= \frac{48}{10}$$
$$= 4.8$$

3. $365 \bullet 6 + 366 \bullet 2 = 2922$

2922 days

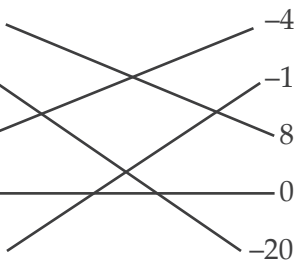
4. **A** $-5q - 21t$

B $8q + 12t$

C $\frac{1}{3}q - 9t$

D $q + 9t$

E $-4q - 39t$



Detailed work for evaluating each expression is shown below.

A $-5q - 21t$

$$-5(-3) - 21\left(\frac{1}{3}\right)$$
$$= 15 - 7$$
$$= 8$$

B $8q + 12t$

$$8(-3) + 12\left(\frac{1}{3}\right)$$
$$= -24 + 4$$
$$= -20$$

C $\frac{1}{3}q - 9t$

$$\frac{1}{3}(-3) - 9\left(\frac{1}{3}\right)$$
$$= -1 - 3$$
$$= -4$$

D $q + 9t$

$$-3 + 9\left(\frac{1}{3}\right)$$
$$= -3 + 3$$
$$= 0$$

E $-4q - 39t$

$$-4(-3) - 39\left(\frac{1}{3}\right)$$
$$= 12 - 13$$
$$= -1$$

Exponent Rules: Part 2

WARM-UP

a. $a^3 \bullet a^{12}$

$= a^{3+12}$

$= a^{15}$

b. $x^{17} \div x^9$

$= x^{17-9}$

$= x^8$

PRACTICE

Students do not need to complete every problem. Problems are to be completed until five in a row (vertically, horizontally, or diagonally) are crossed off in the chart. Work for every problem is shown below.

1. $(ab)^5 = a^5b^5$

2. $\left(\frac{a}{b}\right)^{11} = \frac{a^{11}}{b^{11}}$

3. $(3^2 \bullet 2)^2 = (3^2)^2 \bullet 2^2 = 3^4 \bullet 2^2 = 81 \bullet 4 = 324$

4. $(2a^{11})^4 = 2^4(a^{11})^4 = 16a^{44}$

5. $(a^9b^4)^5 = (a^9)^5(b^4)^5 = a^{45}b^{20}$

6. $\left(\frac{2}{-3}\right)^4 = \frac{2^4}{(-3)^4} = \frac{16}{81}$

7. $\left(\frac{b^9}{f^2}\right)^6 = \frac{(b^9)^6}{(f^2)^6} = \frac{b^{54}}{f^{12}}$

8. $(bf)^3 = b^3f^3$

9. $\left(\frac{3}{2^3}\right)^4 = \frac{3^4}{(2^3)^4} = \frac{3^4}{2^{12}} = \frac{81}{4096}$

10. $(4^3 \bullet 3)^2 = (4^3)^2 \bullet 3^2 = 4^6 \bullet 3^2 = 4096 \bullet 9 = 36{,}864$

11. $(f^6)^7 = f^{42}$

12. $\left(\frac{f^5}{b^3}\right)^4 = \frac{(f^5)^4}{(b^3)^4} = \frac{f^{20}}{b^{12}}$

13. $(2^2f^3b^5)^7 = (2^2)^7(f^3)^7(b^5)^7 = 2^{14}f^{21}b^{35} = 16{,}384f^{21}b^{35}$

14. $(2^4)^5 = 2^{20} = 1{,}048{,}576$

15. $\left(\frac{a^9b^3}{f^4}\right)^5 = \frac{(a^9)^5(b^3)^5}{(f^4)^5} = \frac{a^{45}b^{15}}{f^{20}}$

16. $(a^3)^5 = a^{15}$

17. $\left(\frac{2^3}{3^2}\right)^2 = \frac{(2^3)^2}{(3^2)^2} = \frac{2^6}{3^4} = \frac{64}{81}$

18. $(6^2 \bullet 4^2)^2 = (6^2)^2 \bullet (4^2)^2 = 6^4 \bullet 4^4 = 1296 \bullet 256 = 331{,}776$

19. $\left(\frac{4a}{-5}\right)^3 = \frac{4^3a^3}{(-5)^3} = \frac{64a^3}{-125} = -\frac{64a^3}{125}$

20. $\left(\frac{b^5 f^2}{a^7}\right)^7 = \frac{\left(b^5\right)^7 \left(f^2\right)^7}{\left(a^7\right)^7} = \frac{b^{35} f^{14}}{a^{49}}$

21. $\left(b^5 a^4\right)^3 = \left(b^5\right)^3 \left(a^4\right)^3 = b^{15} a^{12}$

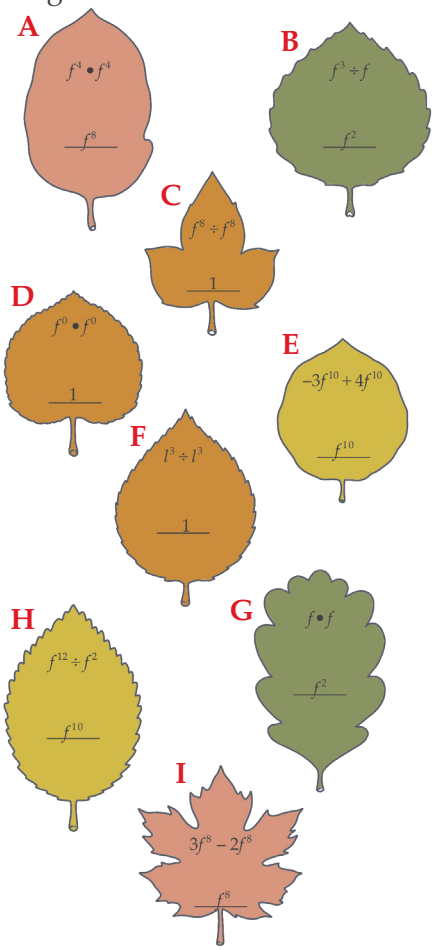
22. $\left(a^5\right)^8 = a^{40}$

23. $\left(\frac{6}{2^4}\right)^2 = \frac{6^2}{\left(2^4\right)^2} = \frac{6^2}{2^8} = \frac{36}{256} = \frac{9}{64}$

24. $\left(2^2 \bullet 3^2\right)^3 = \left(2^2\right)^3 \bullet \left(3^2\right)^3 = 2^6 \bullet 3^6 = 64 \bullet 729 = 46{,}656$

REVIEW

1. Colors will vary. Matching leaves should be in matching colors.



Detailed work for each leaf is shown below.

A $f^4 \bullet f^4 = f^{4+4} = f^8$

B $f^3 \div f = f^{3-1} = f^2$

C $f^8 \div f^8 = f^{8-8} = f^0 = 1$

D $f^0 \bullet f^0 = 1 \bullet 1 = 1$

E $-3f^{10} + 4f^{10} = 1f^{10} = f^{10}$

F $l^3 \div l^3 = l^{3-3} = l^0 = 1$

G $f \bullet f = f^{1+1} = f^2$

H $f^{12} \div f^2 = f^{12-2} = f^{10}$

I $3f^8 - 2f^8 = 1f^8 = f^8$

2. a. $-8^2 = -(8 \bullet 8) = -64$

b. $0.7^2 = 0.7 \bullet 0.7 = 0.49$

c. -1

3.
$$\begin{array}{r} 0.375 \\ 8\overline{)3.000} \\ -24 \\ \hline 60 \\ -56 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

$3\frac{3}{8} = 3.375$

4. a. \$10

b. $\$4.287 \approx \$4.29$

c. \$2.82

d. \$6.10

Logic Lesson 1

Logic puzzles can be approached in many different ways. The solutions here may not represent all possible methods or answers.

Pie Partners

Amount of leftover pie:

$\frac{1}{4}+\frac{1}{3}+\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+1=3\frac{1}{2}$ pies

$3\frac{1}{2}\div 2=1\frac{3}{4}$

Each person should get a total of $1\frac{3}{4}$ pies.

More than one solution is possible.
One solution is shown below.
The total pies for each person should be $1\frac{3}{4}$ pies.

Blake: chocolate, blueberry, and apple

Nellie: pumpkin, cherry, and banana cream

Kettle Corn

More than one solution is possible. One solution is shown below.

40 pennies: 40 cents
8 nickels: 40 cents
2 dimes: 20 cents

40 cents + 40 cents + 20 cents = $1

40 pennies, 8 nickels, and 2 dimes

Helpful Hint

The size doubles every 10 minutes, so if it was 100% complete in 50 minutes, it was half the size, or 50% complete, 10 minutes before that (after 40 minutes). It was then half the size, or 25% complete, 10 minutes before that (after 30 minutes).

30 minutes

Humdinger Hayrides

If adding 5 passengers to the smaller amount and taking 5 passengers from the larger amount makes them equal, then the difference between the two amounts is 10. Taking 5 from 25 and adding it to 35 results in 20 passengers and 40 passengers. Forty is twice 20.

Ree: 35 passengers

Piper: 25 passengers

Day Debate

Since only one of the statements is true, list all of the possible days for each statement. The answer is the day of the week that is on only one list because if it appeared on more than one list, both statements would be true. The possible days for each person's statement are listed below:

Hank: Thursday, Friday, Saturday

Joe: Tuesday

Cathy: Wednesday

Olive: Monday, Tuesday, Wednesday, Friday, Saturday

Max: Monday

Monday, Tuesday, Wednesday, Friday, and Saturday are each listed twice, but Thursday is only listed once.

Thursday

Speedy Shucking

For the first 3 minutes, Dan is the only one shucking corn. At 4 ears per minute, he shucks $4 \bullet 3 = 12$ ears of corn in 3 minutes. The two shucked 75 ears. $75 - 12 = 63$, so there are 63 ears of corn left when Delaney starts shucking. Delaney shucks 5 ears per minute, so together, Dan and Delaney shuck $5 + 4 = 9$ ears per minute. That means they'll finish shucking in $63 \div 9 = 7$ minutes. Dan will have shucked for a total of 10 minutes, so he will have shucked $10 \bullet 4 = 40$ ears of corn. Delaney will have shucked $7 \bullet 5 = 35$ ears of corn.

Dan: 40 ears of corn

Delaney: 35 ears of corn

Family Farm Assignments

Logic puzzles can be completed in different ways. Information that can be gathered from each clue is shown below.

1. Hank, Joe, and Olive do not give hayrides.

2. Joe is not assigned to the petting zoo.

3. Olive and Cathy do not close on Mondays, Wednesdays, or Fridays. That means one girl closes on Tuesdays and one on Thursdays, so none of the boys close on Tuesdays or Thursdays.

4. Since Olive and Cathy do not close on Fridays, they are not assigned to the pumpkin patch. Olive doesn't give hayrides, so she doesn't close on Thursdays. The only day left for Olive to close is Tuesdays. That means Cathy closes on Thursdays.

5. Since boys were assigned to the petting zoo and the maze, Olive was not assigned to either of those. That leaves concession stands as Olive's assignment and means that concession stands and closing on Tuesday go together.

6. If Joe doesn't close on Fridays, then he isn't assigned to the pumpkin patch. That leaves the maze as the only possible assignment for Joe.

7. The only person left who could be assigned to the pumpkin patch is Hank, and the only assignment left for Max is the petting zoo. That means Hank closes on Fridays, Max closes on Wednesdays, and Joe closes on Mondays.

		Assigned Area					Closing Day				
		Maze	Pumpkin Patch	Concession Stands	Hayrides	Petting Zoo	Monday	Tuesday	Wednesday	Thursday	Friday
Children	Hank	X	✓	X	X	X	X	X	X	X	✓
	Joe	✓	X	X	X	X	✓	X	X	X	X
	Cathy	X	X	X	✓	X	X	X	X	✓	X
	Olive	X	X	✓	X	X	X	✓	X	X	X
	Max	X	X	X	X	✓	X	X	✓	X	X
Closing Day	Monday	✓	X	X	X	X					
	Tuesday	X	X	✓	X	X					
	Wednesday	X	X	X	X	✓					
	Thursday	X	X	X	✓	X					
	Friday	X	✓	X	X	X					

a. Hank is assigned to the pumpkin patch and closes on Fridays.

b. Joe is assigned to the maze and closes on Mondays.

c. Cathy is assigned to the hayrides and closes on Thursdays.

d. Olive is assigned to the concession stands and closes on Tuesdays.

e. Max is assigned to the petting zoo and closes on Wednesdays.

Square and Cube Roots

WARM-UP

$$\left(ab^3c^7\right)^2$$
$$= a^2\left(b^3\right)^2\left(c^7\right)^2$$
$$= a^2b^6c^{14}$$

PRACTICE

1.

Number	Perfect Square?	Perfect Cube?
144	YES $12 \cdot 12 = 144$	NO
–64	NO	YES $-4 \cdot (-4) \cdot (-4) = -64$
100	YES $10 \cdot 10 = 100$	NO
55	NO	NO
64	YES $8 \cdot 8 = 64$	YES $4 \cdot 4 \cdot 4 = 64$
–27	NO	YES $-3 \cdot (-3) \cdot (-3) = -27$

2. a. $\sqrt{\frac{225}{169}} = \frac{\sqrt{225}}{\sqrt{169}} = \frac{15}{13} = 1\frac{2}{13}$

b. $\frac{\sqrt[3]{-216}}{\sqrt{81}} = \frac{-6}{9} = -\frac{2}{3}$

c. $8\sqrt[3]{64} - 3\sqrt{196}$
$= 8 \cdot 4 - 3 \cdot 14$
$= 32 - 42$
$= -10$

d. $\frac{2\sqrt{121}}{\sqrt{9} + \sqrt{64}} = \frac{2 \cdot 11}{3 + 8} = \frac{22}{11} = 2$

e. $5\sqrt[3]{-512} \div \sqrt{100}$
$= 5 \cdot (-8) \div 10$
$= -40 \div 10$
$= -4$

f. $\sqrt{\frac{225}{100}} \div \sqrt[3]{125}$
$= \frac{\sqrt{225}}{\sqrt{100}} \div \sqrt[3]{125}$
$= \frac{15}{10} \div 5$
$= \frac{\cancel{15}^{3}}{10} \cdot \frac{1}{\cancel{5}_{1}}$
$= \frac{3}{10}$

g. $\frac{\sqrt{81} - \sqrt[3]{-729}}{3\sqrt{4} + 3\sqrt{16}}$
$= \frac{9 - (-9)}{3 \cdot 2 + 3 \cdot 4}$
$= \frac{9 + 9}{6 + 12}$
$= \frac{18}{18}$
$= 1$

REVIEW

1. a. $\left(g^3\right)^3 = g^9$

   b. $\left(\frac{e^7}{d^8}\right)^6 = \frac{\left(e^7\right)^6}{\left(d^8\right)^6} = \frac{e^{42}}{d^{48}}$

   c. $\left(\frac{2}{9}\right)^3 = \frac{2^3}{9^3} = \frac{8}{729}$

2. a. 36 and –36

   b. $\left|36-\left(-36\right)\right| = \left|36+36\right| = \left|72\right| = 72$

   72 units

3. $\begin{array}{r} {}^{8}\not{2}{}^{1}\not{9}3.{}^{8}\not{9}{}^{9}\not{0}{}^{1}0 \\ -148.775 \\ \hline 145.125 \end{array}$

   $148.775 - 293.9 = -145.125$

4. $20 = 2 \bullet 2 \bullet 5$

   $55 = 5 \bullet 11$

   GCF: 5

   LCM: $2 \bullet 2 \bullet 5 \bullet 11 = 220$

5. a. $55 \div 5 = 11$

   $11 \bullet 3 = 33$

   b. $60 \div 5 = 12$

   $12 \bullet 3 = 36$

   c. $150 \div 5 = 30$

   $30 \bullet 3 = 90$

Estimating Roots

WARM-UP

a. $\sqrt{64} - \sqrt[3]{125}$

$= 8 - 5$

$= 3$

b. $\dfrac{\sqrt{144}}{\sqrt[3]{729}}$

$= \dfrac{12}{9}$

$= \dfrac{4}{3} = 1\dfrac{1}{3}$

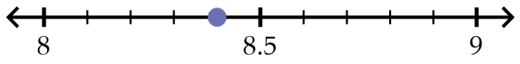
PRACTICE

1. a. $64 < 71 < 81$

b. $8 < \sqrt{71} < 9$

c. $\sqrt{71} \approx 8.4$

d.

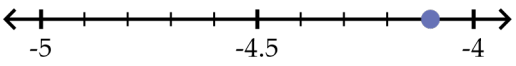


2. a. $-125 < -71 < -64$

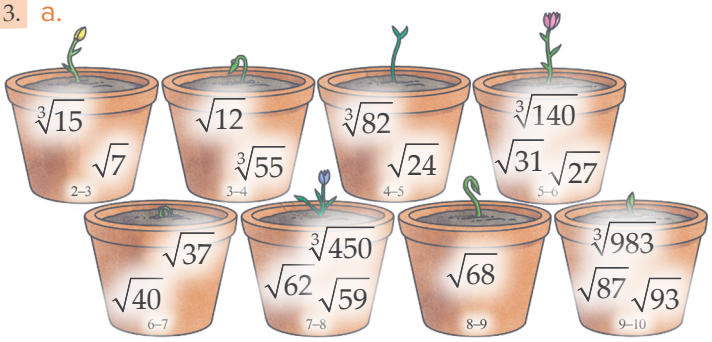
b. $-5 < \sqrt[3]{-71} < -4$

c. $\sqrt[3]{-71} \approx -4.1$

d.



3. a.



b. $\sqrt{31} \approx 5.6$ $\sqrt{87} \approx 9.3$ $\sqrt[3]{450} \approx 7.7$ $\sqrt[3]{55} \approx 3.8$

$\sqrt[3]{15} \approx 2.5$ $\sqrt{68} \approx 8.2$ $\sqrt{12} \approx 3.5$ $\sqrt{62} \approx 7.9$

$\sqrt{37} \approx 6.1$ $\sqrt[3]{82} \approx 4.3$ $\sqrt[3]{983} \approx 9.9$ $\sqrt{40} \approx 6.3$

$\sqrt[3]{140} \approx 5.2$ $\sqrt{93} \approx 9.6$ $\sqrt{27} \approx 5.2$ $\sqrt{24} \approx 4.9$

$\sqrt{59} \approx 7.7$ $\sqrt{7} \approx 2.6$

REVIEW

1. a. $\left(\frac{6}{7}\right)^9 \div \left(\frac{6}{7}\right)^7$

$= \left(\frac{6}{7}\right)^{9-7}$

$= \left(\frac{6}{7}\right)^2$

$= \frac{6^2}{7^2}$

$= \frac{36}{49}$

b. $\frac{c^4 \bullet c^8}{c^3}$

$= \frac{c^{4+8}}{c^3}$

$= \frac{c^{12}}{c^3}$

$= c^{12-3}$

$= c^9$

c. $\left(\frac{4}{t}\right)^3$

$= \frac{4^3}{t^3}$

$= \frac{64}{t^3}$

d. $\left(b^4 e^{10}\right)^3$

$= \left(b^4\right)^3 \left(e^{10}\right)^3$

$= b^{12} e^{30}$

2. a. $7\sqrt[3]{-512} + 6\sqrt{225}$

$= 7(-8) + 6(15)$

$= -56 + 90$

$= 34$

b. $3 \bullet \sqrt{\frac{49}{100}}$

$= 3 \bullet \frac{\sqrt{49}}{\sqrt{100}}$

$= 3 \bullet \frac{7}{10}$

$= \frac{3}{1} \bullet \frac{7}{10}$

$= \frac{21}{10}$

$= 2\frac{1}{10}$

3. a. 20 nickels per dollar • 150 dollars = 3000 nickels

b.
$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 0.176 \\ \times\ 3000 \\ \hline 528.000 \end{array}$$

528 ounces

c.
$$\begin{array}{r} 33 \\ 16\overline{)528} \\ -48 \\ \hline 48 \\ -48 \\ \hline 0 \end{array}$$

33 pounds

4. a. $u + 0 = u$

b. $u \bullet 1 = u$

c. $-9u + (-4u) = -4u + (-9u)$

d. $u \bullet \frac{1}{u} = 1$

Number Sets

WARM-UP

a. $81 < 92 < 100$

b. $64 < 92 < 125$

PRACTICE

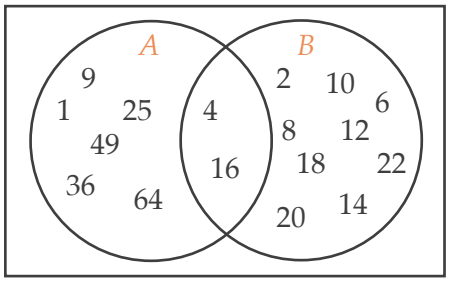
1. a. F

   b. G

   c. H

   d. E

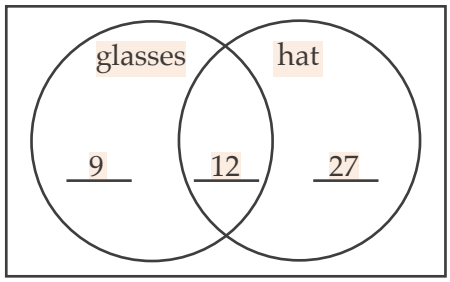
2. a.



   b. $\{4, 16\}$

3. a. Glasses only: $21 - 12 = 9$

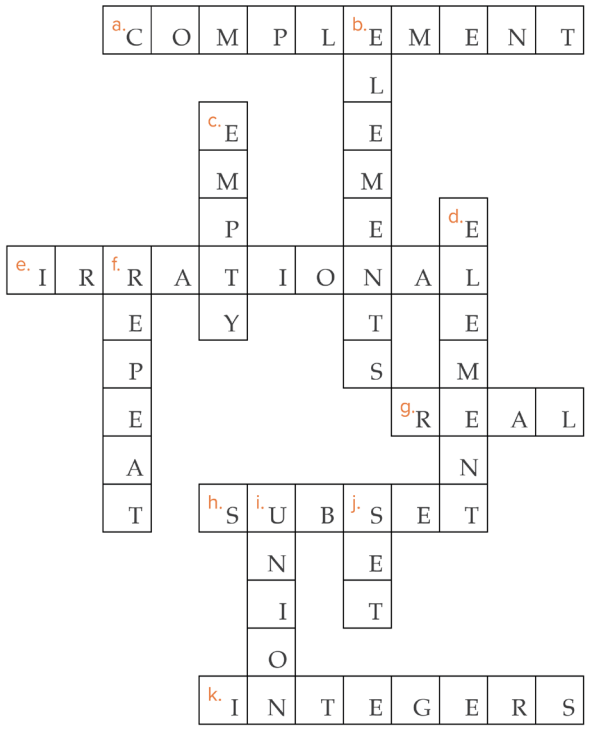
   Hat only: $39 - 12 = 27$



   b. $9 + 27 = 36$

4. $\{-1, 5, 3, -17\}$ $\left\{\frac{1}{2}, -3, -4.125, 7\frac{2}{3}\right\}$ $\{0\}$ $\{\pi, 35, -6.7, \sqrt{7}\}$ $\{\sqrt{5}, -\pi, \sqrt[3]{-17}\}$ $\{1823, 98, 4, 771\}$ $\{-10, 0, 10\}$

5.



REVIEW

1. a. 141 is between the perfect squares 121 and 144, so $\sqrt{141}$ is between 11 and 12 but is closer to 12.

   b. 11.87

   c. 100 is between the perfect cubes 64 and 125, so $\sqrt[3]{100}$ is between 4 and 5 but is closer to 5.

   d. 4.64

2. $$-\frac{2}{5}pq^3-\frac{4}{3}pq^3+8pq$$
$$=-\frac{6}{15}pq^3+\left(-\frac{20}{15}pq^3\right)+8pq$$
$$=-\frac{26}{15}pq^3+8pq$$
$$=-1\frac{11}{15}pq^3+8pq$$

3. a. $$\left(\frac{2.57-8.23\bullet 6.11}{0.09}\right)^0-(-8)$$
$$=1-(-8)$$
$$=1+8$$
$$=9$$

   b. $$\left\{-3+\left[5\bullet 2-8\div(4-8)\right]\right\}^2$$
$$=\left\{-3+\left[5\bullet 2-8\div(-4)\right]\right\}^2$$
$$=\left\{-3+\left[10-8\div(-4)\right]\right\}^2$$
$$=\left\{-3+\left[10-(-2)\right]\right\}^2$$
$$=\left\{-3+\left[10+2\right]\right\}^2$$
$$=\left\{-3+12\right\}^2$$
$$=\left\{9\right\}^2$$
$$=81$$

4. a. $$2\frac{1}{2}\bullet\frac{1}{6}$$
$$=\frac{5}{2}\bullet\frac{1}{6}$$
$$=\frac{5}{12}$$
   $\frac{5}{12}$ lb

   b. $$15\bullet\frac{1}{6}$$
$$=\frac{15}{1}\bullet\frac{1}{6}$$
$$=\frac{5}{2}$$
$$=2\frac{1}{2}$$
   $2\frac{1}{2}$ lb

   c. $$300\bullet\frac{1}{6}$$
$$=\frac{300}{6}$$
$$=50$$
   50 lb

5. 4 weeks = 28 days

   October has 31 days, and October 31 is 20 days after October 11. Add 8 more days to get November 8.

Negative Exponents

WARM-UP

$28 + 14 + 36 = 78$ children

PRACTICE

1.

Power	Fraction with Exponent	Decimal
10^{-7}	$\frac{1}{10^7}$	0.0000001
10^{-3}	$\frac{1}{10^3}$	0.001
10^{-11}	$\frac{1}{10^{11}}$	0.00000000001

2. a. 2^{-7}

$= \frac{1}{2^7}$

$= \frac{1}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$

$= \frac{1}{128}$

b. 4^{-4}

$= \frac{1}{4^4}$

$= \frac{1}{4 \cdot 4 \cdot 4 \cdot 4}$

$= \frac{1}{256}$

c. 3^{-5}

$= \frac{1}{3^5}$

$= \frac{1}{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}$

$= \frac{1}{243}$

d. $(-6)^{-3}$

$= \frac{1}{(-6)^3}$

$= \frac{1}{(-6) \cdot (-6) \cdot (-6)}$

$= -\frac{1}{216}$

e. $\frac{1}{5^{-3}}$

$= 5^3$

$= 125$

f. $\frac{1}{(-2)^{-6}}$

$= (-2)^6$

$= 64$

3.

A $a^4 \bullet a^{-2}$	B $\frac{1}{b^{-3}}$	C $\frac{b^3}{b^3}$	a^7
1	D $a^{12} \bullet a^{-5}$	b^3	E $\frac{b^2}{b^5}$
F $b^8 \bullet b^{-5}$	G $\frac{a^8}{a^6}$	H $b \bullet b^{-4}$	I $\frac{b^{12}}{b^9}$
J $\frac{a^4}{a^{-3}}$	K a^0	L $\frac{1}{a^{-7}}$	a^2
M b^{-3}	N $\frac{1}{a^{-2}}$	O $\frac{b^{-5}}{b^{-2}}$	P $a^4 \bullet a^{-4}$

Detailed work is shown below.

A $a^4 \bullet a^{-2}$
$= a^{4+(-2)}$
$= a^2$

B $\frac{1}{b^{-3}}$
$= b^3$

C $\frac{b^3}{b^3}$
$= b^{3-3}$
$= b^0$
$= 1$

D $a^{12} \bullet a^{-5}$
$= a^{12+(-5)}$
$= a^7$

E $\frac{b^2}{b^5}$
$= b^{2-5}$
$= b^{-3}$
$= \frac{1}{b^3}$

F $b^8 \bullet b^{-5}$
$= b^{8+(-5)}$
$= b^3$

G $\frac{a^8}{a^6}$
$= a^{8-6}$
$= a^2$

H $b \bullet b^{-4}$
$= b^{1+(-4)}$
$= b^{-3}$
$= \frac{1}{b^3}$

I $\frac{b^{12}}{b^9}$
$= b^{12-9}$
$= b^3$

J $\frac{a^4}{a^{-3}}$
$= a^{4-(-3)}$
$= a^{4+3}$
$= a^7$

K $a^0 = 1$

L $\frac{1}{a^{-7}}$
$= a^7$

M b^{-3}
$= \frac{1}{b^3}$

N $\frac{1}{a^{-2}}$
$= a^2$

O $\frac{b^{-5}}{b^{-2}}$
$= b^{-5-(-2)}$
$= b^{-5+2}$
$= b^{-3}$
$= \frac{1}{b^3}$

P $a^4 \bullet a^{-4}$
$= a^{4+(-4)}$
$= a^0$
$= 1$

REVIEW

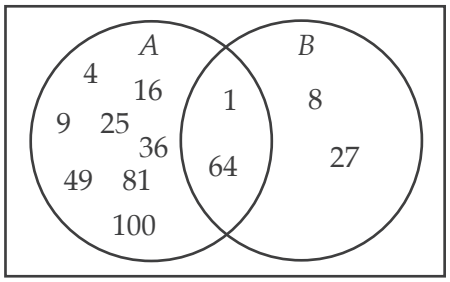
1. a. $\sqrt[3]{64} = 4$

$s = 4$ cm

b. $\sqrt[3]{1000} = 10$

$s = 10$ mm

2.



a. $\{1, 64\}$

b. $\{1, 4, 8, 9, 16, 25, 27, 36, 49, 64, 81, 100\}$

c. $\{8, 27\}$

3.
$$\begin{array}{r} {\scriptstyle 2}\,\not{2}\,0\,4 \\ \times\ 0.75 \\ \hline 10\,20 \\ +14\,2\,80 \\ \hline 153.00 \end{array}$$

153 beats per minute

4. a. $\sqrt[3]{\frac{1}{27}} - \frac{4}{3}$

$= \frac{\sqrt[3]{1}}{\sqrt[3]{27}} - \frac{4}{3}$

$= \frac{1}{3} - \frac{4}{3}$

$= \frac{1}{3} + \left(-\frac{4}{3}\right)$

$= -\frac{3}{3}$

$= -1$

b. $12\left(15 - \sqrt{\frac{8^2 - 2^5}{2}}\right)$

$= 12\left(15 - \sqrt{\frac{64 - 32}{2}}\right)$

$= 12\left(15 - \sqrt{\frac{32}{2}}\right)$

$= 12\left(15 - \sqrt{16}\right)$

$= 12(15 - 4)$

$= 12(11)$

$= 132$

Operations with Roots

WARM-UP

$$
\begin{aligned}
&4 \bullet 732 \\
&= 4(700 + 30 + 2) \\
&= 2800 + 120 + 8 \\
&= 2928
\end{aligned}
$$

PRACTICE

1. $34\sqrt{5}$

2. $-2\sqrt{6}$

3. $12\sqrt{3} + 7\sqrt{4} - 5\sqrt{3}$
$= 7\sqrt{3} + 7\sqrt{4}$
$= 7\sqrt{3} + 7 \bullet 2$
$= 7\sqrt{3} + 14$

4. $\sqrt{6} \bullet \sqrt{5}$
$= \sqrt{6 \bullet 5}$
$= \sqrt{30}$

5. $\sqrt{13} \bullet \sqrt{13}$
$= \sqrt{13^2}$
$= 13$

6. $3\sqrt{24} - \sqrt{8} \bullet \sqrt{3}$
$= 3\sqrt{24} - \sqrt{8 \bullet 3}$
$= 3\sqrt{24} - \sqrt{24}$
$= 2\sqrt{24}$

7. $47 - \sqrt{3} \bullet \sqrt{27}$
$= 47 - \sqrt{3 \bullet 27}$
$= 47 - \sqrt{81}$
$= 47 - 9$
$= 38$

8. $\sqrt{30} \bullet \sqrt{90} \bullet \sqrt{3}$
$= \sqrt{30} \bullet \sqrt{3} \bullet \sqrt{90}$
$= \sqrt{30 \bullet 3 \bullet 90}$
$= \sqrt{90 \bullet 90}$
$= \sqrt{90^2}$
$= 90$

9. $\sqrt{23^2} + 12$
$= 23 + 12$
$= 35$

10. $3\sqrt{5}\left(4\sqrt{2} + 5\sqrt{5}\right)$
$= 3\sqrt{5} \bullet 4\sqrt{2} + 3\sqrt{5} \bullet 5\sqrt{5}$
$= 12\sqrt{5 \bullet 2} + 15\sqrt{5 \bullet 5}$
$= 12\sqrt{10} + 15\sqrt{5^2}$
$= 12\sqrt{10} + 15 \bullet 5$
$= 12\sqrt{10} + 75$

REVIEW

1. $\left(\frac{5}{3}\right)^{-3}$

$=\left(\frac{3}{5}\right)^{3}$

$=\frac{3^3}{5^3}$

$=\frac{27}{125}$

2.

$\frac{4}{3}$	**A** $\sqrt[3]{-8}$	0	**B** $\frac{40}{4}$	$\sqrt{10}$
C 10^2	0.87	π	**D** 15.0	-69
-22.5	**E** $\frac{4}{4}$	**F** $\sqrt{49}$	$0.7\overline{}$	$\frac{1}{8}$

Detailed work for problems requiring simplification are shown below.

A $\sqrt[3]{-8}=-2$

B $\frac{40}{4}=10$

C $10^2=100$

D $15.0=15$

E $\frac{4}{4}=1$

F $\sqrt{49}=7$

3. **A** $-8c^2+33c^2$

B $-\left(\frac{c}{2}\right)^4$

C $\frac{2c^{20}}{18c^8}$

D $2c^5c^6+7c^3c$

E $14b^3-\frac{c^9}{c^9}+\left(-14b^3\right)$

-1

$\frac{1}{9}c^{12}$

$25c^2$

$2c^{11}+7c^4$

$-\frac{1}{16}c^4$

Detailed work for matching expressions is shown below.

A $-8c^2+33c^2$

$=25c^2$

B $-\left(\frac{c}{2}\right)^4$

$=-\frac{c^4}{2^4}$

$=-\frac{c^4}{16}$

$=-\frac{1}{16}c^4$

C $\frac{2c^{20}}{18c^8}$

$=\frac{2}{18}\bullet c^{20-8}$

$=\frac{1}{9}c^{12}$

D $2c^5c^6+7c^3c$

$=2c^{5+6}+7c^{3+1}$

$=2c^{11}+7c^4$

E $14b^3-\frac{c^9}{c^9}+\left(-14b^3\right)$

$=14b^3-1+\left(-14b^3\right)$

$=14b^3-14b^3-1$

$=0-1$

$=-1$

4. $1.5\bullet 9+14\bullet 4+5\bullet 4$

$=13.5+56+20$

$=89.5$

90 calories

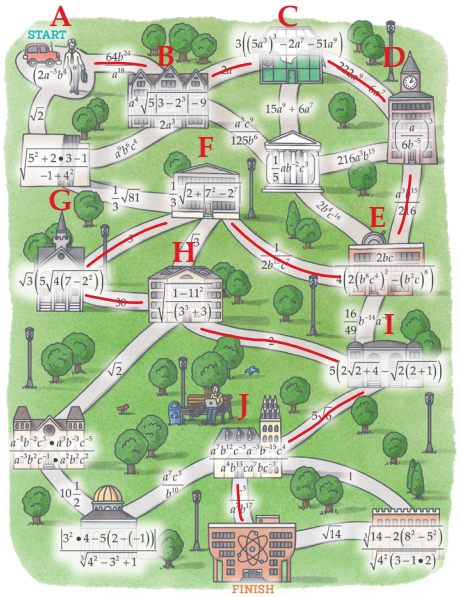
Simplifying Complex Expressions

WARM-UP

$$3\sqrt{2} \bullet \sqrt{\frac{64}{4}} + \sqrt{2}$$
$$= 3\sqrt{2} \bullet \frac{\sqrt{64}}{\sqrt{4}} + \sqrt{2}$$
$$= 3\sqrt{2} \bullet \frac{8}{2} + \sqrt{2}$$
$$= 3\sqrt{2} \bullet 4 + \sqrt{2}$$
$$= 12\sqrt{2} + \sqrt{2}$$
$$= 13\sqrt{2}$$

PRACTICE

1.



Detailed work for each expression on the correct path is shown below.

A $\left(2a^{-3}b^4\right)^6$
$$= 64a^{-18}b^{24}$$
$$= 64 \bullet \frac{1}{a^{18}} \bullet b^{24}$$
$$= \frac{64b^{24}}{a^{18}}$$

B $\dfrac{a^4\sqrt{5\left|3-2^3\right|-9}}{2a^3}$
$$= \frac{a^4\sqrt{5\left|3-8\right|-9}}{2a^3}$$
$$= \frac{a^4\sqrt{5\left|-5\right|-9}}{2a^3}$$
$$= \frac{a^4\sqrt{5 \bullet 5-9}}{2a^3}$$
$$= \frac{a^4\sqrt{25-9}}{2a^3}$$
$$= \frac{a^4\sqrt{16}}{2a^3}$$
$$= \frac{4a^4}{2a^3}$$
$$= \frac{4}{2} \bullet \frac{a^4}{a^3}$$
$$= 2a^{4-3}$$
$$= 2a$$

C $3\left(\left(5a^3\right)^3 - 2a^7 - 51a^9\right)$
$$= 3\left(125a^9 - 2a^7 - 51a^9\right)$$
$$= 3\left(74a^9 - 2a^7\right)$$
$$= 222a^9 - 6a^7$$

D $\left(\frac{a}{6b^{-5}}\right)^3$

$= \frac{a^3}{216b^{-15}}$

$= \frac{a^3b^{15}}{216}$

E $\frac{2bc}{4\left(2\left(b^8c^4\right)^2-\left(b^2c\right)^8\right)}$

$= \frac{2bc}{4\left(2b^{16}c^8-b^{16}c^8\right)}$

$= \frac{2bc}{4\left(b^{16}c^8\right)}$

$= \frac{2bc}{4b^{16}c^8}$

$= \frac{1}{2}b^{1-16}c^{1-8}$

$= \frac{1}{2}b^{-15}c^{-7}$

$= \frac{1}{2}\bullet\frac{1}{b^{15}}\bullet\frac{1}{c^7}$

$= \frac{1}{2b^{15}c^7}$

F $\frac{1}{3}\sqrt{2+\left|7^2-2^7\right|}$

$= \frac{1}{3}\sqrt{2+\left|49-128\right|}$

$= \frac{1}{3}\sqrt{2+\left|-79\right|}$

$= \frac{1}{3}\sqrt{2+79}$

$= \frac{1}{3}\sqrt{81}$

$= \frac{1}{3}\bullet 9$

$= 3$

G $\sqrt{3}\left(5\sqrt{4\left(7-2^2\right)}\right)$

$= \sqrt{3}\left(5\sqrt{4\left(7-4\right)}\right)$

$= \sqrt{3}\left(5\sqrt{4\left(3\right)}\right)$

$= \sqrt{3}\left(5\sqrt{12}\right)$

$= 5\sqrt{3\bullet 12}$

$= 5\sqrt{36}$

$= 5\bullet 6$

$= 30$

H $\sqrt{\frac{1-11^2}{-\left(3^3+3\right)}}$

$= \sqrt{\frac{1-121}{-\left(27+3\right)}}$

$= \sqrt{\frac{-120}{-30}}$

$= \sqrt{4}$

$= 2$

I $5\left(2\sqrt{2+4}-\sqrt{2\left(2+1\right)}\right)$

$= 5\left(2\sqrt{6}-\sqrt{2\left(3\right)}\right)$

$= 5\left(2\sqrt{6}-\sqrt{6}\right)$

$= 5\left(\sqrt{6}\right)$

$= 5\sqrt{6}$

J $\frac{a^7b^{12}c^{-3}a^{-3}b^{-15}c^4}{a^4b^{13}ca^7bc^{-3}}$

$= \frac{a^{7+(-3)}b^{12+(-15)}c^{-3+4}}{a^{4+7}b^{13+1}c^{1+(-3)}}$

$= \frac{a^4b^{-3}c}{a^{11}b^{14}c^{-2}}$

$= a^{4-11}b^{-3-14}c^{1-(-2)}$

$= a^{-7}b^{-17}c^3$

$= \frac{1}{a^7}\bullet\frac{1}{b^{17}}\bullet c^3$

$= \frac{c^3}{a^7b^{17}}$

REVIEW

1. $\dfrac{b^{12}}{b^{23}}$

$= b^{12-23}$

$= b^{-11}$

$= \dfrac{1}{b^{11}}$

2. a. $60 \div \left(\left|-3-14 \bullet 3\right| \div 3\right) + 2^7$

$= 60 \div \left(\left|-3-42\right| \div 3\right) + 2^7$

$= 60 \div \left(\left|-45\right| \div 3\right) + 2^7$

$= 60 \div \left(45 \div 3\right) + 2^7$

$= 60 \div 15 + 2^7$

$= 60 \div 15 + 128$

$= 4 + 128$

$= 132$

b. $\dfrac{22 \bullet 3}{6^2 - 5^2}$

$= \dfrac{22 \bullet 3}{36 - 25}$

$= \dfrac{66}{11}$

$= 6$

3.

$2 \mid \underline{182}$	$2 \mid \underline{728}$	$5 \mid \underline{455}$
$7 \mid \underline{91}$	$2 \mid \underline{364}$	$7 \mid \underline{91}$
13	$2 \mid \underline{182}$	13
	$7 \mid \underline{91}$	
	13	

$182 = 2 \bullet 7 \bullet 13$

$728 = 2 \bullet 2 \bullet 2 \bullet 7 \bullet 13$

$455 = 5 \bullet 7 \bullet 13$

GCF: $7 \bullet 13 = 91$

4. a. $18 \bullet 3 = 9 \bullet 6 = 54$

b. $16 \bullet 15 = 8 \bullet 30 = 240$

c. $6 \bullet 24 = 12 \bullet 12 = 144$

d. $5 \bullet 36 = 10 \bullet 18 = 180$

Introduction to Scientific Notation

WARM-UP

$$\frac{\sqrt{100-19}\bullet 3}{\sqrt[3]{27}+3\bullet 2^3}$$
$$=\frac{\sqrt{81}\bullet 3}{3+3\bullet 8}$$
$$=\frac{9\bullet 3}{3+24}$$
$$=\frac{27}{27}=1$$

PRACTICE

1. 2.5×10^{12} 8.135×10^{9} 4.23×10^{-5} 9.5×10^{17} 1.39×10^{6} 9.98×10^{-8} 3.5×10^{-13} 6.67×10^{5}

2. 3.12×10^{-4} 2.3×10^{6} ~~0.58×10^{3}~~ 1.734×10^{12} ~~3.57×10^{-6}~~ 5.1×10^{5} ~~3.6×8^{7}~~ ~~10.3×10^{7}~~ 4.3×10^{-23}

3. a. 36,000,000.
   3.6×10^{7}
   b. 4,500,000,000.
   4.5×10^{9}
   c. 0.00000000000000299
   2.99×10^{-14}
   d. 0.00000053
   5.3×10^{-7}

4. a. 7.24
   72,400
   b. 2.1
   210,000,000,000
   c. 9.9
   0.000000000099
   d. 1.48
   0.000148

5. a. $10^{3}<10^{6}$
   $4.5\times10^{3}<2.1\times10^{6}$
   b. $10^{-3}>10^{-4}$
   $3.1\times10^{-3}>2.1\times10^{-4}$
   c. $10^{7}=10^{7}$
   $6.21<7.5$
   $6.21\times10^{7}<7.5\times10^{7}$

REVIEW

1. $\left(\dfrac{s^{-7}u^{6}}{n^{-4}}\right)^{3}$

$$=\frac{\left(s^{-7}\right)^{3}\left(u^{6}\right)^{3}}{\left(n^{-4}\right)^{3}}$$

$$=\frac{s^{-21}u^{18}}{n^{-12}}$$

$$=\frac{1}{s^{21}}\bullet u^{18}\bullet n^{12}$$

$$=\frac{n^{12}u^{18}}{s^{21}}$$

2. a. $1\div\dfrac{2}{3}$

$$=1\bullet\frac{3}{2}$$

$$=\frac{3}{2}$$

b. $30\div 0.5$

$$=300\div 5=60$$

c. $-84\div(-2)\div(-3)$

$$=42\div(-3)$$

$$=-14$$

3. 1542 984 222 540 2181 454 680

4. a. $100^{2}=100\bullet 100=10{,}000$

b. 100

c. $1000^{2}=1000\bullet 1000=1{,}000{,}000$

d. 1000

5. $-4k^{2}\left(-3k^{3}+12i-9kn^{4}\right)$

$$=-4k^{2}\bullet\left(-3k^{3}\right)+\left(-4k^{2}\right)\bullet 12i-\left(-4k^{2}\right)\bullet 9kn^{4}$$

$$=12k^{2+3}+\left(-48ik^{2}\right)-\left(-36k^{2+1}n^{4}\right)$$

$$=12k^{5}-48ik^{2}+36k^{3}n^{4}$$

Adding and Subtracting in Scientific Notation

WARM-UP

1. 3.25×10^9

2. a. 0.0000000000048

   b. 160,000,000

PRACTICE

1. $3.2 + 5.1 = 8.3$
   $(3.2 \times 10^6) + (5.1 \times 10^6) = 8.3 \times 10^6$

2. $9.72 - 8.25 = 1.47$
   $(9.72 \times 10^{11}) - (8.25 \times 10^{11}) = 1.47 \times 10^{11}$

3. $1.02 \times 10^{-10} = 0.102 \times 10^{-9}$
   $8.72 - 0.102 = 8.618$
   $(8.72 \times 10^{-9}) - (1.02 \times 10^{-10}) = 8.618 \times 10^{-9}$

4. $5.4 - 2.1 = 3.3$
   $(5.4 \times 10^{-9}) - (2.1 \times 10^{-9}) = 3.3 \times 10^{-9}$

5. $1.25 + 9.87 = 11.12$
   $(1.25 \times 10^{17}) + (9.87 \times 10^{17})$
   $= 11.12 \times 10^{17}$
   $= 1.112 \times 10^{18}$

6. $6.1 - 5.51 = 0.59$
   $(6.1 \times 10^4) - (5.51 \times 10^4)$
   $= 0.59 \times 10^4$
   $= 5.9 \times 10^3$

7. $5.3 \times 10^4 = 53 \times 10^3$
   $4.1 + 53 = 57.1$
   $(4.1 \times 10^3) + (5.3 \times 10^4)$
   $= 57.1 \times 10^3$
   $= 5.71 \times 10^4$

8. $3.21 - 2.9 = 0.31$
   $(3.21 \times 10^{-8}) - (2.9 \times 10^{-8})$
   $= 0.31 \times 10^{-8}$
   $= 3.1 \times 10^{-9}$

9. $8.42 + 7.62 = 16.04$
   $(8.42 \times 10^{-15}) + (7.62 \times 10^{-15})$
   $= 16.04 \times 10^{-15}$
   $= 1.604 \times 10^{-14}$

10. $7.25 + 1.5 = 8.75$
    $(7.25 \times 10^{-6}) + (1.5 \times 10^{-6}) = 8.75 \times 10^{-6}$

11. $9.1 \times 10^{-12} = 0.091 \times 10^{-10}$
    $5.05 + 0.091 = 5.141$
    $(5.05 \times 10^{-10}) + (9.1 \times 10^{-12}) = 5.141 \times 10^{-10}$

12. $9.999 \times 10^{11} = 999.9 \times 10^9$
    $999.9 + 3.4 = 1003.3$
    $(9.999 \times 10^{11}) + (3.4 \times 10^9)$
    $= 1003.3 \times 10^9$
    $= 1.0033 \times 10^{12}$

Riddle answer: It had too many problems.

REVIEW

1. a. $\sqrt{15} \bullet \sqrt{15}$

$= \sqrt{15^2}$

$= 15$

b. $6\sqrt{5} - 6\sqrt{4} + 3\sqrt{5}$

$= 6\sqrt{5} + 3\sqrt{5} - 6 \bullet 2$

$= 9\sqrt{5} - 12$

2. $\sqrt{200}$ is between the whole numbers 14 and 15 but is closer to 14.

3. a. 7.0514×10^{8}

b. 8.203×10^{-6}

4. $\sqrt[3]{-64} - \left(11^2 - \left|-15 - 9 \bullet 6\right|\right) \div 4$

$= \sqrt[3]{-64} - \left(11^2 - \left|-15 - 54\right|\right) \div 4$

$= \sqrt[3]{-64} - \left(11^2 - \left|-69\right|\right) \div 4$

$= \sqrt[3]{-64} - \left(11^2 - 69\right) \div 4$

$= \sqrt[3]{-64} - \left(121 - 69\right) \div 4$

$= \sqrt[3]{-64} - 52 \div 4$

$= -4 - 52 \div 4$

$= -4 - 13$

$= -17$

5. a. 15:15

b. 23:40

c. 20:30

Multiplying and Dividing in Scientific Notation

WARM-UP

a. $5.6 - 3.2 = 2.4$

$(5.6 \times 10^{17}) - (3.2 \times 10^{17}) = 2.4 \times 10^{17}$

b. $3.8 \times 10^{-6} = 0.38 \times 10^{-5}$

$0.38 + 6.7 = 7.08$

$(3.8 \times 10^{-6}) + (6.7 \times 10^{-5}) = 7.08 \times 10^{-5}$

PRACTICE

1. a. $(1.2 \times 10^{3}) \bullet (6.7 \times 10^{5})$

$= (1.2 \bullet 6.7) \times (10^{3} \bullet 10^{5})$

$= 8.04 \times 10^{3+5}$

$= 8.04 \times 10^{8}$

b. $(7.95 \times 10^{11}) \div (1.5 \times 10^{5})$

$= \dfrac{7.95 \times 10^{11}}{1.5 \times 10^{5}}$

$= \dfrac{7.95}{1.5} \times \dfrac{10^{11}}{10^{5}}$

$= 5.3 \times 10^{11-5}$

$= 5.3 \times 10^{6}$

c. $(7.2 \times 10^{-17}) \bullet (8.4 \times 10^{14})$

$= (7.2 \bullet 8.4) \times (10^{-17} \bullet 10^{14})$

$= 60.48 \times 10^{-17+14}$

$= 60.48 \times 10^{-3}$

$= 6.048 \times 10^{-2}$

d. $(2.275 \times 10^{3}) \div (9.1 \times 10^{-6})$

$= \dfrac{2.275 \times 10^{3}}{9.1 \times 10^{-6}}$

$= \dfrac{2.275}{9.1} \times \dfrac{10^{3}}{10^{-6}}$

$= 0.25 \times 10^{3-(-6)}$

$= 0.25 \times 10^{9}$

$= 2.5 \times 10^{8}$

2. $(2.4 \times 10^{67}) \bullet (1.9 \times 10^{11})$

$= (2.4 \bullet 1.9) \times (10^{67} \bullet 10^{11})$

$= 4.56 \times 10^{67+11}$

$= 4.56 \times 10^{78}$

3. $(2.75 \times 10^{9}) \div (6.25 \times 10^{4})$

$= \dfrac{2.75 \times 10^{9}}{6.25 \times 10^{4}}$

$= \dfrac{2.75}{6.25} \times \dfrac{10^{9}}{10^{4}}$

$= 0.44 \times 10^{9-4}$

$= 0.44 \times 10^{5}$

$= 4.4 \times 10^{4}$

4. $(8.2 \times 10^{-3}) \bullet (2.9 \times 10^{4})$

$= (8.2 \bullet 2.9) \times (10^{-3} \bullet 10^{4})$

$= 23.78 \times 10^{-3+4}$

$= 23.78 \times 10^{1}$

$= 2.378 \times 10^{2}$

5. $(1.4 \times 10^{9}) \div (2.5 \times 10^{-6})$

$= \dfrac{1.4 \times 10^{9}}{2.5 \times 10^{-6}}$

$= \dfrac{1.4}{2.5} \times \dfrac{10^{9}}{10^{-6}}$

$= 0.56 \times 10^{9-(-6)}$

$= 0.56 \times 10^{15}$

$= 5.6 \times 10^{14}$

REVIEW

1. a. $6.25 \times 10^7 = 0.625 \times 10^8$

$5.63 + 0.625 = 6.255$

$\left(5.63 \times 10^8\right) + \left(6.25 \times 10^7\right) = 6.255 \times 10^8$

b. $7.49 - 6.91 = 0.58$

$\left(7.49 \times 10^9\right) - \left(6.91 \times 10^9\right)$

$= 0.58 \times 10^9$

$= 5.8 \times 10^8$

2. a. $3{,}680{,}400$

b. 0.0000000001008

3. $r^4 \bullet r^{-12}$

$= r^{4+(-12)}$

$= r^{-8}$

$= \frac{1}{r^8}$

4. a. $\left|70 - (-220)\right|$ or $\left|-220 - 70\right|$

b. $\left|70 - (-220)\right| = \left|70 + 220\right| = \left|290\right| = 290$

290 °F

5. a. $9\frac{93}{100}$

b. $11\frac{86}{100} = 11\frac{43}{50}$

Writing Expressions, Equations, and Inequalities

WARM-UP

a. 846

$800 \div 2 = 400$

$40 \div 2 = 20$

$6 \div 2 = 3$

$400 + 20 + 3 = 423$

b. 358

$300 \div 2 = 150$

$50 \div 2 = 25$

$8 \div 2 = 4$

$150 + 25 + 4 = 179$

c. 1794

$1000 \div 2 = 500$

$700 \div 2 = 350$

$90 \div 2 = 45$

$4 \div 2 = 2$

$500 + 350 + 45 + 2 = 897$

PRACTICE

1. Note: Any variable may be used.

a. $5n^2+3$

b. $\frac{1}{2}\sqrt{2n} \le 5$

c. $|n-2| = \frac{1}{10}n^3$

d. $12 \div (3n+5) > \frac{1}{2}n$ or $\frac{12}{3n+5} > \frac{1}{2}n$

e. $\frac{1}{3}n \bullet 7 = n^2 - 10$

2. a. Maria: m

Ben: $m+3$

Larry: $2(m+3) = 2m+6$

Total: $m+m+3+2m+6 = 4m+9$

b. Ben: b

Maria: $\frac{1}{2}b$

Larry: $2\left(b+\frac{1}{2}b\right) = 2b+b = 3b$

Total: $b+\frac{1}{2}b+3b = 45$

$4\frac{1}{2}b = 45$

3. a. $t = s+85$

b. $17 \bullet 10 + 5 < \frac{1}{2}w$

$175 < \frac{1}{2}w$

c. $c = \frac{1}{2}b + 0.44$

d. $a > 80l + 1000$

REVIEW

1. a. $\left(8.3\times10^{5}\right)\bullet\left(2.5\times10^{-3}\right)$

$=\left(8.3\bullet2.5\right)\times\left(10^{5}\bullet10^{-3}\right)$

$=20.75\times10^{5+(-3)}$

$=20.75\times10^{2}$

$=2.075\times10^{3}$

b. $\left(6.2\times10^{-7}\right)\div\left(5\times10^{-16}\right)$

$=\dfrac{6.2\times10^{-7}}{5\times10^{-16}}$

$=\dfrac{6.2}{5}\times\dfrac{10^{-7}}{10^{-16}}$

$=1.24\times10^{-7-(-16)}$

$=1.24\times10^{-7+16}$

$=1.24\times10^{9}$

2. $\sqrt{5}\bullet\sqrt{2}+4\sqrt{10}-\sqrt{3}\bullet\sqrt{3}$

$=\sqrt{5\bullet2}+4\sqrt{10}-\sqrt{3^{2}}$

$=\sqrt{10}+4\sqrt{10}-3$

$=5\sqrt{10}-3$

3. $\sqrt[3]{\dfrac{-64}{8}}+2\sqrt{196}$

$=\dfrac{\sqrt[3]{-64}}{\sqrt[3]{8}}+2\bullet14$

$=\dfrac{-4}{2}+2\bullet14$

$=-2+28$

$=26$

4. a. $7\dfrac{54}{60}=7\dfrac{9}{10}$

$7\dfrac{9}{10}$ hours

b. 7.9 hours

c. $7.9\bullet8.25=65.175\approx65.18$

$65.18

d. $65.18 – $16.29 = $48.89

5. Marshall

Solving One-Step Equations

WARM-UP

a. $76 = 4\left(x^2 - 17\right)$

b. $\frac{1}{2}n + 47 \geq 52$

PRACTICE

1. $t + 17 = 14$

$t + 17 - 17 = 14 - 17$

$t = -3$

2. $6s = 42$

$\frac{6s}{6} = \frac{42}{6}$

$s = 7$

3. $r - 11 = 15$

$r - 11 + 11 = 15 + 11$

$r = 26$

4. $\frac{p}{12} = 7$

$12 \bullet \frac{p}{12} = 7 \bullet 12$

$p = 84$

5. $121 + q = 113$

$121 + q - 121 = 113 - 121$

$q = -8$

6. $\frac{2}{3}n = 6$

$\frac{3}{2} \bullet \frac{2}{3}n = 6 \bullet \frac{3}{2}$

$n = 9$

7. $7 = l \div 3$

$7 \bullet 3 = l \div 3 \bullet 3$

$21 = l$

8. $11 = k - 5.5$

$11 + 5.5 = k - 5.5 + 5.5$

$16.5 = k$

9. $1\frac{1}{2} + j = 3\frac{1}{2}$

$1\frac{1}{2} + j - 1\frac{1}{2} = 3\frac{1}{2} - 1\frac{1}{2}$

$j = 2$

10. $8 = -4h$

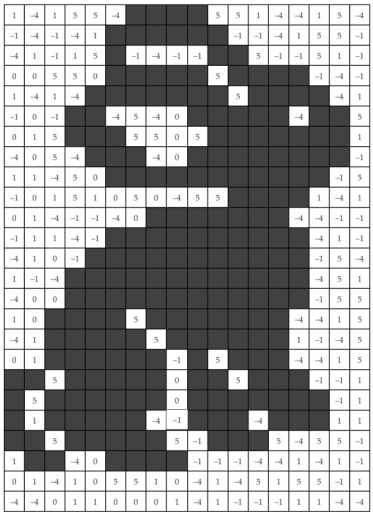
$\frac{8}{-4} = \frac{-4h}{-4}$

$-2 = h$

11. $g \div \frac{2}{5} = 10$

$g \div \frac{2}{5} \bullet \frac{2}{5} = 10 \bullet \frac{2}{5}$

$g = 4$



REVIEW

1. a. $p \leq 250$

   b. $g \geq 10$

2. $4.54 \times 10^{-8} = 0.454 \times 10^{-7}$

   $9.23 - 0.454 = 8.776$

   $\left(9.23 \times 10^{-7}\right) - \left(4.54 \times 10^{-8}\right) = 8.776 \times 10^{-7}$

3. $\left(3.15 \times 10^{14}\right) \div \left(7 \times 10^{6}\right)$

   $= \dfrac{3.15 \times 10^{14}}{7 \times 10^{6}}$

   $= \dfrac{3.15}{7} \times \dfrac{10^{14}}{10^{6}}$

   $= 0.45 \times 10^{14-6}$

   $= 0.45 \times 10^{8}$

   $= 4.5 \times 10^{7}$

4. a. $a \bullet (-8)$

   $= -8 \bullet a$

   $= -8a$

   b. $-26.2 + m$

   $= m + (-26.2)$

   $= m - 26.2$

5. -6.9^{3}

   $= -(6.9 \bullet 6.9 \bullet 6.9)$

   $= -(47.61 \bullet 6.9)$

   $= -328.509$

Solving Two-Step Equations

WARM-UP

a. $4g = 96$

$\frac{4g}{4} = \frac{96}{4}$

$g = 24$

b. $b - 9 = 18$

$b - 9 + 9 = 18 + 9$

$b = 27$

c. $-3t = 201$

$\frac{-3t}{-3} = \frac{201}{-3}$

$t = -67$

PRACTICE

1. a. $5a + 1 = 36$

$5a + 1 - 1 = 36 - 1$

$\frac{5a}{5} = \frac{35}{5}$

$a = 7$

Check:

$5 \cdot 7 + 1 \stackrel{?}{=} 36$

$35 + 1 \stackrel{?}{=} 36$

$36 = 36$ ✓

b. $7(b - 3) = 21$

$\frac{7(b-3)}{7} = \frac{21}{7}$

$b - 3 = 3$

$b - 3 + 3 = 3 + 3$

$b = 6$

Check:

$7(6 - 3) \stackrel{?}{=} 21$

$7 \cdot 3 \stackrel{?}{=} 21$

$21 = 21$ ✓

c. $\frac{(c + 150)}{11} = 12$

$11 \cdot \frac{(c+150)}{11} = 12 \cdot 11$

$c + 150 = 132$

$c + 150 - 150 = 132 - 150$

$c = -18$

Check:

$\frac{(-18 + 150)}{11} \stackrel{?}{=} 12$

$\frac{132}{11} \stackrel{?}{=} 12$

$12 = 12$ ✓

d. $7 - 4d = -5$

$7 - 4d - 7 = -5 - 7$

$\frac{-4d}{-4} = \frac{-12}{-4}$

$d = 3$

Check:

$7 - 4 \cdot 3 \stackrel{?}{=} -5$

$7 - 12 \stackrel{?}{=} -5$

$-5 = -5$ ✓

2. a. $80 + 6l = 200$

b.
$$80 + 6l = 200$$
$$80 + 6l - 80 = 200 - 80$$
$$\frac{6l}{6} = \frac{120}{6}$$
$$l = 20$$

20 laps

3. a. $0.5c - 5 = 40$

b.
$$0.5c - 5 = 40$$
$$0.5c - 5 + 5 = 40 + 5$$
$$\frac{0.5c}{0.5} = \frac{45}{0.5}$$
$$c = 90$$

90 cups

REVIEW

1. a.
$$\frac{5}{7}x = 40$$
$$\frac{7}{5} \bullet \frac{5}{7}x = 40 \bullet \frac{7}{5}$$
$$x = 56$$

b.
$$10{,}800 = 100z$$
$$\frac{10{,}800}{100} = \frac{100z}{100}$$
$$108 = z$$

2. Albert: a years old

Sophie: $a - 2$ years old

Edward: $a - 2 + 6 = a + 4$ years old

$$a + a - 2 + a + 4 = 44$$
$$3a + 2 = 44$$

3. a.
$$\left(\frac{e^{15}r^{-8}}{a^{-3}}\right)^{-3}$$
$$= \frac{e^{-45}r^{24}}{a^{9}}$$
$$= \frac{1}{e^{45}} \bullet \frac{r^{24}}{a^{9}}$$
$$= \frac{r^{24}}{e^{45}a^{9}}$$

b.
$$\sqrt{\frac{-80 \div 4 + 24 \bullet 3 - 2^4}{\left(3^2\right)^2}}$$
$$= \sqrt{\frac{-80 \div 4 + 24 \bullet 3 - 16}{3^4}}$$
$$= \sqrt{\frac{-20 + 72 - 16}{81}}$$
$$= \sqrt{\frac{36}{81}}$$
$$= \frac{\sqrt{36}}{\sqrt{81}}$$
$$= \frac{6}{9} = \frac{2}{3}$$

4.
$$\begin{array}{r} {}^{0}\cancel{1}\,{}^{9}\cancel{0}\,.\,{}^{9}\cancel{0}\,{}^{1}0 \\ -\ 5\,.\,8\,7 \\ \hline 4\,.\,1\,3 \end{array}$$

$4.13

Unit 1 Review

1. a. $-1\frac{1}{2} \bullet 1076$

$= -\frac{3}{\cancel{2}_{1}} \bullet \cancel{1076}^{538}$

$= -1614$

-1614 meters

b.
$$\begin{array}{r} {\scriptstyle 1\ 3}\\ 11.5\\ \times\ 1.07\\ \hline 805\\ +\ 11500\\ \hline 12305 \end{array}$$

12.3 hours

2. a.
$$\begin{array}{r} {\scriptstyle 1\ \cancel{1}^{\ 1}\cancel{0}^{\ 1}\ \cancel{3}^{\ 1}\ \cancel{4}^{\ 1}}\\ \cancel{2}\ \cancel{1}.\cancel{4}0\\ -\quad 2.57\\ \hline 18.83 \end{array}$$

18.83 miles

b. $-2\frac{5}{8} - \left(-3\frac{1}{2}\right)$

$= -\frac{21}{8} - \left(-\frac{7}{2}\right)$

$= -\frac{21}{8} + \frac{28}{8}$

$= \frac{7}{8}$

$\frac{7}{8}$ feet

3. a. $8 \bullet (-6)$

b. $32 \bullet 302$

$= 32(300 + 2)$

$= 32 \bullet 300 + 32 \bullet 2$

$= 9600 + 64$

$= 9664$

4. a. $a \bullet a \bullet a \bullet a \bullet b \bullet b$

b. $3^3 \bullet 2^2$

5. a. $2\overline{)14}$ $\quad$ $2\overline{)12}$

7 $\quad$ $2\overline{)6}$

3

Alexandra: $2 \bullet 7$

Peter: $2 \bullet 2 \bullet 3$ OR $2^2 \bullet 3$

Guinevere: 11

b. GCF: 2

c. LCM: $2 \bullet 2 \bullet 3 \bullet 11 = 132$

6. a. $3a + 2 - 4(a + 2)$

$= 3a + 2 - 4a - 4(2)$

$= 3a + 2 - 4a - 8$

$= 3a - 4a + 2 - 8$

$= -a - 6$

b. $\left(\frac{b^6}{d}\right)^5 = \frac{\left(b^6\right)^5}{d^5} = \frac{b^{30}}{d^5}$

c. $f^4 \bullet g^2 \bullet f^3$

$= f^{4+3} \bullet g^2$

$= f^7 g^2$

d. $\frac{b^{14}}{b^5} = b^{14-5} = b^9$

7. a. $7 + 4\sqrt[3]{-125}$

$= 7 + 4(-5)$

$= 7 + (-20)$

$= 7 - 20$

$= -13$

b. $\left(\frac{2^3}{3^2}\right)^2 = \frac{\left(2^3\right)^2}{\left(3^2\right)^2} = \frac{2^6}{3^4} = \frac{64}{81}$

c. $\frac{2\left(51-2\left(4-19\right)\right)}{5^2-4^2}$

$= \frac{2\left(51-2\left(-15\right)\right)}{25-16}$

$= \frac{2\left(51-\left(-30\right)\right)}{25-16}$

$= \frac{2\left(51+30\right)}{9}$

$= \frac{2\left(81\right)}{9}$

$= 18$

d. $\frac{3^2 \bullet 5-\sqrt{169}}{2\left|5+4^2-25\right|}$

$= \frac{9 \bullet 5-13}{2\left|5+16-25\right|}$

$= \frac{45-13}{2\left|21-25\right|}$

$= \frac{32}{2\left|-4\right|}$

$= \frac{32}{2\left(4\right)}$

$= 4$

8. a. $2m^3n+n-7$

$2\left(-2\right)^3\left(5\right)+5-7$

$= 2\left(-8\right)\left(5\right)+5-7$

$= -16\left(5\right)+5-7$

$= -80+5-7$

$= -75-7$

$= -82$

b. $\frac{\sqrt{2k}}{3j+1}$

$\frac{\sqrt{2\left(8\right)}}{3\left(1\right)+1}$

$= \frac{\sqrt{16}}{3+1}$

$= \frac{4}{4}$

$= 1$

9. a. $25 < 30 < 36$

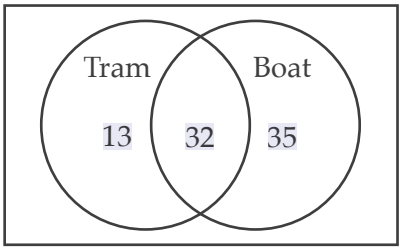
b. $5 < \sqrt{30} < 6$

c. $\sqrt{30} \approx 5.5$

10. a. $45+67-80 = 112-80 = 32$

b. Tram: $45-32 = 13$

Boat: $67-32 = 35$



11. a. $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

b. $\left(-2\right)^{-4} = \frac{1}{\left(-2\right)^4} = \frac{1}{16}$

12. a. $6\sqrt{2^3+2}-4\sqrt{2} \bullet \sqrt{5}$

$= 6\sqrt{8+2}-4\sqrt{2 \bullet 5}$

$= 6\sqrt{10}-4\sqrt{10}$

$= 2\sqrt{10}$

b. $\left(\frac{a^{-2}b^4a}{b^{-5}}\right)^7$

$=\left(a^{-2+1}b^{4-(-5)}\right)^7$

$=\left(a^{-1}b^9\right)^7$

$=a^{-7}b^{63}$

$=\frac{1}{a^7}\bullet b^{63}$

$=\frac{b^{63}}{a^7}$

13. a. 1.9

$190{,}000$

b. $1{,}500{,}000$

1.5×10^6

c. $1.9\times10^5=190\times10^3$

$\left(1.9\times10^5\right)-\left(1.6\times10^3\right)$

$=\left(190\times10^3\right)-\left(1.6\times10^3\right)$

$=188.4\times10^3$

$=1.884\times10^5$

d. $\left(5.6\times10^{-2}\right)\bullet\left(8.04\times10^3\right)$

$=\left(5.6\bullet8.04\right)\times\left(10^{-2}\bullet10^3\right)$

$=45.024\times10^{-2+3}$

$=45.024\times10^1$

$=4.5024\times10^2$

14. a. $\frac{1}{2}g=l-5$

b. $48=2x$

$\frac{48}{2}=\frac{2x}{2}$

$24=x$

24 inches

15. a. $\frac{1}{2}d-3=4$

b. $\frac{1}{2}d-3=4$

$\frac{1}{2}d-3+3=4+3$

$\frac{1}{2}d=7$

$2\bullet\frac{1}{2}d=7\bullet2$

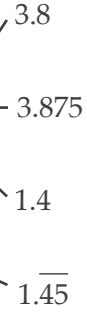
$d=14$

14 years old

Unit 1 Assessment

1. 5043.82

2. **A** $1\frac{2}{5}$ **B** $3\frac{7}{8}$ **C** $1\frac{5}{11}$ **D** $3\frac{8}{9}$



$3.\overline{8}$ 3.875 1.4 $1.\overline{45}$

Detailed work for converting each mixed number to a decimal is shown below.

A $1\frac{2}{5} = 1\frac{4}{10} = 1.4$

B
$$\begin{array}{r} 0.875 \\ 8\overline{)7.000} \\ -\,64 \\ \hline 60 \\ -\,56 \\ \hline 40 \\ -\,40 \\ \hline 0 \end{array}$$
$3\frac{7}{8} = 3.875$

C
$$\begin{array}{r} 0.4545\ldots \\ 11\overline{)5.000\ldots} \\ -\,44 \\ \hline 60 \\ -\,55 \\ \hline 50 \\ -\,44 \\ \hline 60 \\ -\,55 \\ \hline 50 \\ -\,44 \\ \hline 6 \end{array}$$
$1\frac{5}{11} = 1.\overline{45}$

D
$$\begin{array}{r} 0.88\ldots \\ 9\overline{)8.00\ldots} \\ -\,72 \\ \hline 80 \\ -\,72 \\ \hline 8 \end{array}$$
$3\frac{8}{9} = 3.\overline{8}$

3. $|-15-42| = |-57| = 57$

4. a. $5\frac{7}{8} - 2\frac{1}{4}$
$= 5\frac{7}{8} - 2\frac{2}{8}$
$= 3\frac{5}{8}$

b.
$$\begin{array}{r} {\scriptstyle 1\ 1\ 1} \\ 7.485 \\ +\ 2.956 \\ \hline 10.441 \end{array}$$

c. $-\frac{8}{5} \cdot 1\frac{3}{4}$
$= -\frac{8}{5} \cdot \frac{7}{4}$
$= -\frac{14}{5} = -2\frac{4}{5}$

d.
$$\begin{array}{r} {\scriptstyle \cancel{4}^{\,1}\ \ 2} \\ 4.53 \\ \times\ \ 3.8 \\ \hline 3624 \\ +\ 13590 \\ \hline 17214 \end{array}$$
$-3.8 \cdot (-4.53) = 17.214$

e.
$$\begin{array}{r} 70 \\ 6\overline{)420} \\ -\,42 \\ \hline 00 \\ -\,0 \\ \hline 0 \end{array}$$

$-4.2 \div 0.06 = -70$

f. $\dfrac{3\frac{2}{5}}{7\frac{1}{2}}$

$= 3\frac{2}{5} \div 7\frac{1}{2}$

$= \frac{17}{5} \div \frac{15}{2}$

$= \frac{17}{5} \bullet \frac{2}{15}$

$= \frac{34}{75}$

5. a. $536 + 225$

b. $52 \bullet (-43)$

6. a. $b = 123 - 54 = 69$

b. $r = 45 \div (-15) = -3$

7. a. $\left(\frac{2}{5}\right)^3$

$= \frac{2}{5} \bullet \frac{2}{5} \bullet \frac{2}{5}$

$= \frac{8}{125}$

b. -2^5

$= -(2 \bullet 2 \bullet 2 \bullet 2 \bullet 2)$

$= -32$

c. 1

8. $2|\underline{6300}$

$2|\underline{3150}$

$3|\underline{1575}$

$3|\underline{525}$

$5|\underline{175}$

$5|\underline{35}$

7

$6300 = 2^2 \bullet 3^2 \bullet 5^2 \bullet 7$

9. a. $\dfrac{2(54 - 4^3) + 18}{29 - 18 \bullet 3}$

$= \dfrac{2(54 - 64) + 18}{29 - 54}$

$= \dfrac{2(-10) + 18}{-25}$

$= \dfrac{-20 + 18}{-25}$

$= \dfrac{-2}{-25} = \dfrac{2}{25}$

b. $75 \bullet 2 \div 5 - 3^3 + (48 - 7)$

$= 75 \bullet 2 \div 5 - 3^3 + 41$

$= 75 \bullet 2 \div 5 - 27 + 41$

$= 150 \div 5 - 27 + 41$

$= 30 - 27 + 41$

$= 3 + 41$

$= 44$

10. $7q + 3q^2 - 4q + 8q^2 - 4q^2$

$= 7q - 4q + 3q^2 + 8q^2 - 4q^2$

$= 3q + 7q^2$

11. a. $3^2 \bullet 3^5 = 3^{2+5} = 3^7$

b. $a^{15} \div a^8 = a^{15-8} = a^7$

c. $7^{13} \div 7^{11} = 7^{13-11} = 7^2$

d. $z^5 \bullet z^{16} = z^{5+16} = z^{21}$

12. a. $\left(c^2 b a^3\right)^5$

$= \left(c^2\right)^5 b^5 \left(a^3\right)^5$

$= c^{10} b^5 a^{15}$

b. $\left(\frac{r^7}{ts^3}\right)^2$

$= \dfrac{\left(r^7\right)^2}{\left(ts^3\right)^2}$

$= \dfrac{r^{14}}{t^2 \left(s^3\right)^2}$

$= \dfrac{r^{14}}{t^2 s^6}$

13. $\dfrac{\sqrt{225}}{\sqrt[3]{64}+\sqrt{64}}$

$=\dfrac{15}{4+8}$

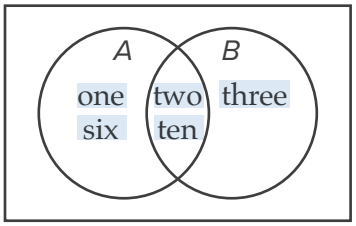
$=\dfrac{15}{12}$

$=\dfrac{5}{4}=1\dfrac{1}{4}$

14. a. 121 and 144

b. 11 and 12

15.



16. a. $\dfrac{1}{b^5}$

b. c^3

c. $q^{-3} \bullet q$

$=q^{-3+1}$

$=q^{-2}$

$=\dfrac{1}{q^2}$

17. a. $\sqrt{25} \bullet \sqrt{4}$

$=\sqrt{25 \bullet 4}$

$=\sqrt{100}$

$=10$

b. $3\sqrt{5}+7\sqrt{5}$

$=10\sqrt{5}$

18. $\dfrac{3^2\sqrt{|-25-11|}}{\sqrt[3]{27}}$

$=\dfrac{3^2\sqrt{|-36|}}{3}$

$=\dfrac{3^2\sqrt{36}}{3}$

$=\dfrac{9(6)}{3}$

$=\dfrac{54}{3}$

$=18$

19. a. $34{,}000{,}000 \rightarrow 3.4\times10^7$

b. $0.0000071 \rightarrow 7.1\times10^{-5}$

20. a. $2.3\times10^4=0.23\times10^5$

$5.4-0.23=5.17$

$\left(5.4\times10^5\right)-\left(2.3\times10^4\right)=5.17\times10^5$

b. $7.5+4.5=12$

$\left(7.5\times10^{-8}\right)+\left(4.5\times10^{-8}\right)=12\times10^{-8}$

$12\times10^{-8}=1.2\times10^{-7}$

$\left(7.5\times10^{-8}\right)+\left(4.5\times10^{-8}\right)=1.2\times10^{-7}$

c. $\left(1.1\times10^4\right)\bullet\left(1.1\times10^8\right)$

$=\left(1.1\bullet1.1\right)\times\left(10^4\bullet10^8\right)$

$=1.21\times10^{4+8}$

$=1.21\times10^{12}$

d. $\left(3.6\times10^{12}\right)\div\left(1.8\times10^7\right)$

$=\dfrac{3.6\times10^{12}}{1.8\times10^7}$

$=\dfrac{3.6}{1.8}\times\dfrac{10^{12}}{10^7}$

$=2\times10^{12-7}$

$=2\times10^5$

21. a. $3n = \frac{1}{2}n^2$

b. $n + 15 \leq n \div 32$

c. $\frac{n - 16}{n^2}$

22. a. $b - 11 = 35$

$b - 11 + 11 = 35 + 11$

$b = 46$

b. $\frac{2}{3}x = -18$

$\frac{3}{2} \bullet \frac{2}{3}x = -18 \bullet \frac{3}{2}$

$x = -27$

c. $5r - 25 = 145$

$5r - 25 + 25 = 145 + 25$

$5r = 170$

$\frac{5r}{5} = \frac{170}{5}$

$r = 34$

d. $\frac{q + 7}{9} = 3$

$9 \bullet \frac{q + 7}{9} = 3 \bullet 9$

$q + 7 = 27$

$q + 7 - 7 = 27 - 7$

$q = 20$

Enrichment: Repeating Decimals

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1. a. $0.1111\ldots$

b. 10

$$\begin{aligned} x &= 0.1111\ldots \\ 10x &= 1.1111\ldots \\ 10x - x &= 1.1111\ldots - 0.1111\ldots \\ 9x &= 1 \\ \frac{9x}{9} &= \frac{1}{9} \\ x &= \frac{1}{9} \end{aligned}$$

c. $\frac{1}{9}$

2. a. $0.1818\ldots$

b. 100

$$\begin{aligned} x &= 0.1818\ldots \\ 100x &= 18.1818\ldots \\ 100x - x &= 18.1818\ldots - 0.1818\ldots \\ 99x &= 18 \\ \frac{99x}{99} &= \frac{18}{99} \\ x &= \frac{18}{99} = \frac{2}{11} \end{aligned}$$

c. $\frac{2}{11}$

3. a. $0.8333\ldots$

b. 10

$$\begin{aligned} x &= 0.8333\ldots \\ 10x &= 8.3333\ldots \\ 10x - x &= 8.3333\ldots - 0.8333\ldots \\ 9x &= 7.5 \\ 90x &= 75 \\ \frac{90x}{90} &= \frac{75}{90} \\ x &= \frac{75}{90} = \frac{5}{6} \end{aligned}$$

c. $\frac{5}{6}$

Solving Multi-Step Equations

WARM-UP

a. $3x = 9$

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

b. $x + 6 = 40$

$x + 6 - 6 = 40 - 6$

$x = 34$

c. $\frac{5}{6}x = 10$

$\frac{6}{5} \bullet \frac{5}{6}x = 10 \bullet \frac{6}{5}$

$x = 12$

PRACTICE

1. $5 + 2x - 4 = 3$

$1 + 2x = 3$

$1 + 2x - 1 = 3 - 1$

$2x = 2$

$\frac{2x}{2} = \frac{2}{2}$

$x = 1$

2. $x - 20 = 2 - x$

$x - 20 + x = 2 - x + x$

$2x - 20 = 2$

$2x - 20 + 20 = 2 + 20$

$2x = 22$

$\frac{2x}{2} = \frac{22}{2}$

$x = 11$

3. $4x = 2x + 8$

$4x - 2x = 2x + 8 - 2x$

$2x = 8$

$\frac{2x}{2} = \frac{8}{2}$

$x = 4$

4. $5x + 2 = 14 - 3x + 4$

$5x + 2 = 18 - 3x$

$5x + 2 + 3x = 18 - 3x + 3x$

$8x + 2 = 18$

$8x + 2 - 2 = 18 - 2$

$8x = 16$

$\frac{8x}{8} = \frac{16}{8}$

$x = 2$

5. $-2(x + 3) - 6 = 4$

$-2x - 6 - 6 = 4$

$-2x - 12 = 4$

$-2x - 12 + 12 = 4 + 12$

$-2x = 16$

$\frac{-2x}{-2} = \frac{16}{-2}$

$x = -8$

6. $\frac{3}{4}(6-2x)=9$

$\frac{4}{3}\cdot\frac{3}{4}(6-2x)=9\cdot\frac{4}{3}$

$6-2x=12$

$6-2x-6=12-6$

$-2x=6$

$\frac{-2x}{-2}=\frac{6}{-2}$

$x=-3$

7. $6=3(x-2)+x$

$6=3x-6+x$

$6=4x-6$

$6+6=4x-6+6$

$12=4x$

$\frac{12}{4}=\frac{4x}{4}$

$3=x$

8. $-54=\frac{5}{8}(24-32x)-\frac{1}{4}(12-36x)$

$-54=15-20x-3-(-9x)$

$-54=12-20x+9x$

$-54=12-11x$

$-54-12=12-11x-12$

$-66=-11x$

$\frac{-66}{-11}=\frac{-11x}{-11}$

$6=x$

9. $2(x+3)=5x+4$

$2x+6=5x+4$

$2x+6-2x=5x+4-2x$

$6=3x+4$

$6-4=3x+4-4$

$2=3x$

$\frac{2}{3}=\frac{3x}{3}$

$\frac{2}{3}=x$

10. $8-2(5x+4)=3x$

$8-10x-8=3x$

$-10x=3x$

$-10x-3x=3x-3x$

$-13x=0$

$\frac{-13x}{-13}=\frac{0}{-13}$

$x=0$

11. $15-3x=2(4-x)$

$15-3x=8-2x$

$15-3x+2x=8-2x+2x$

$15-x=8$

$15-x-15=8-15$

$-x=-7$

$\frac{-x}{-1}=\frac{-7}{-1}$

$x=7$

12. $4(2-x)=3(7x+5)-2$

$8-4x=21x+15-2$

$8-4x=21x+13$

$8-4x+4x=21x+13+4x$

$8=25x+13$

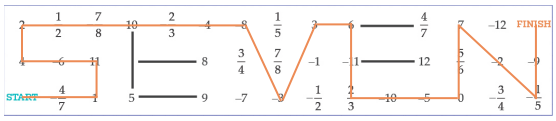
$8-13=25x+13-13$

$-5=25x$

$\frac{-5}{25}=\frac{25x}{25}$

$-\frac{1}{5}=x$

Riddle answer: SEVEN



REVIEW

1. $2000 + 45w = 9650$

$2000 + 45w - 2000 = 9650 - 2000$

$45w = 7650$

$\frac{45w}{45} = \frac{7650}{45}$

$w = 170$

170 ft

2. $a \geq 6$ and $a < 13$

$6 \leq a < 13$

3. a. $10^7 < 10^8$

$4.8 \times 10^7 < 4.7 \times 10^8$

b. $10^{12} = 10^{12}$

$2.6 = 2.60$

$2.6 \times 10^{12} = 2.60 \times 10^{12}$

4. a. $\sqrt[3]{42}$ is between the whole numbers 3 and 4 but is closer to 3.

b. $\sqrt[3]{42} \approx 3.48$

5. a. F

side salad: $15 + 29 + 24 + 8 = 76$

b. F

tomatoes: $29 + 24 = 53$

c. T

d. T

e. T

Modeling Real-World Situations with Equations

WARM-UP

a.
$$3x-14=7$$
$$3x-14+14=7+14$$
$$3x=21$$
$$\frac{3x}{3}=\frac{21}{3}$$
$$x=7$$

b.
$$5(x+6)=40$$
$$\frac{5(x+6)}{5}=\frac{40}{5}$$
$$x+6=8$$
$$x+6-6=8-6$$
$$x=2$$

PRACTICE

1. a. $36d-8$

b. $44d-10$

c.
$$44d-10=36d-8$$
$$44d-10-36d=36d-8-36d$$
$$8d-10=-8$$
$$8d-10+10=-8+10$$
$$8d=2$$
$$\frac{8d}{8}=\frac{2}{8}$$
$$d=\frac{1}{4}$$

$0.25 per cup

2. a. $6b+12$

b. $8b-4$

c.
$$6b+12=8b-4$$
$$6b+12-6b=8b-4-6b$$
$$12=2b-4$$
$$12+4=2b-4+4$$
$$16=2b$$
$$\frac{16}{2}=\frac{2b}{2}$$
$$8=b$$

8 bottles per package

3. a. $p+3$

b. $3(p+3)=3p+9$

c. $p+21$

d.
$$3p+9=p+21$$
$$3p+9-p=p+21-p$$
$$2p+9=21$$
$$2p+9-9=21-9$$
$$2p=12$$
$$\frac{2p}{2}=\frac{12}{2}$$
$$p=6$$

$6 per pair

4. a. $7(6p+2.5)=42p+17.5$

b.
$$55(p-0.34)+10.98$$
$$=55p-18.7+10.98$$
$$=55p-7.72$$

c. $42p + 17.5 = 55p - 7.72$

$42p + 17.5 - 42p = 55p - 7.72 - 42p$

$17.5 = 13p - 7.72$

$17.5 + 7.72 = 13p - 7.72 + 7.72$

$25.22 = 13p$

$\frac{25.22}{13} = \frac{13p}{13}$

$1.94 = p$

$p = 1.94$

$1.94 per pastry

REVIEW

1. $\left(4\sqrt{18} \bullet 11\right) \bullet \sqrt{2}$

$= 44\sqrt{18} \bullet \sqrt{2}$

$= 44\sqrt{18 \bullet 2}$

$= 44\sqrt{36}$

$= 44 \bullet 6$

$= 264$

2. a. $8.2 + 9.5 = 17.7$

$\left(8.2 \times 10^{-13}\right) + \left(9.5 \times 10^{-13}\right)$

$= 17.7 \times 10^{-13}$

$= 1.77 \times 10^{-12}$

b. $3.7 \times 10^{7} = 37 \times 10^{6}$

$37 - 6.01 = 30.99$

$\left(3.7 \times 10^{7}\right) - \left(6.01 \times 10^{6}\right)$

$= 30.99 \times 10^{6}$

$= 3.099 \times 10^{7}$

3. a. $\left(\frac{c^9}{5^2}\right)^4$

$= \frac{\left(c^9\right)^4}{\left(5^2\right)^4}$

$= \frac{c^{36}}{5^8}$

$= \frac{c^{36}}{390{,}625}$

b. $\left(b^{12}e^{11}\right)^{11}$

$= \left(b^{12}\right)^{11}\left(e^{11}\right)^{11}$

$= b^{132}e^{121}$

4. a. $\frac{9}{60} = \frac{3}{20}$

b. $\frac{3}{20} = \frac{15}{100}$

0.15

c. $\frac{7}{25} = \frac{28}{100}$

0.28

Solving for a Specific Variable

WARM-UP

a.
$$\frac{4}{5}x+18=\frac{3}{5}x$$
$$\frac{4}{5}x+18-\frac{4}{5}x=\frac{3}{5}x-\frac{4}{5}x$$
$$18=-\frac{1}{5}x$$
$$-5\bullet 18=-\frac{1}{5}x\bullet(-5)$$
$$-90=x$$

b.
$$x-34=5x+30$$
$$x-34-x=5x+30-x$$
$$-34=4x+30$$
$$-34-30=4x+30-30$$
$$-64=4x$$
$$\frac{-64}{4}=\frac{4x}{4}$$
$$-16=x$$

PRACTICE

1. a.
$$A=\pi rs$$
$$\frac{A}{\pi s}=\frac{\pi rs}{\pi s}$$
$$\frac{A}{\pi s}=r$$
$$r=\frac{A}{\pi s}$$

b.
$$r=\frac{A}{\pi s}$$
$$r=\frac{6}{\pi\bullet 1.3}$$
$$r\approx 1.47$$
1.47 m

2. a.
$$W=mg$$
$$\frac{W}{g}=\frac{mg}{g}$$
$$\frac{W}{g}=m$$
$$m=\frac{W}{g}$$

b.
$$m=\frac{W}{g}$$
$$m=\frac{2}{3.25}$$
$$m\approx 0.6$$
0.6 N

3. a.
$$A=2\pi rh+2\pi r^2$$
$$A-2\pi r^2=2\pi rh+2\pi r^2-2\pi r^2$$
$$A-2\pi r^2=2\pi rh$$
$$\frac{A-2\pi r^2}{2\pi r}=\frac{2\pi rh}{2\pi r}$$
$$\frac{A-2\pi r^2}{2\pi r}=h$$
$$h=\frac{A-2\pi r^2}{2\pi r}$$

b. $h = \dfrac{A - 2\pi r^2}{2\pi r}$

$h = \dfrac{260 - 2\pi(4)^2}{2\pi(4)}$

$h = \dfrac{260 - 32\pi}{8\pi}$

$h \approx \dfrac{159.47}{25.13}$

$h \approx 6.3$

6.3 yd

4. a. $A = lw$

$\dfrac{A}{w} = \dfrac{lw}{w}$

$\dfrac{A}{w} = l$

$l = \dfrac{A}{w}$

b. $l = \dfrac{A}{w}$

$l = \dfrac{343}{7}$

$l = 49$

49 m

REVIEW

1. a. $5 + 2.7m = 3 + 2.95m$

$5 + 2.7m - 2.7m = 3 + 2.95m - 2.7m$

$5 = 3 + 0.25m$

$5 - 3 = 3 + 0.25m - 3$

$2 = 0.25m$

$\dfrac{2}{0.25} = \dfrac{0.25m}{0.25}$

$8 = m$

8 miles

b. $5 + 2.7(8) = 26.6$

$26.60

2. $\dfrac{3}{8}(x - 11) = 9$

$\dfrac{8}{3} \bullet \dfrac{3}{8}(x - 11) = 9 \bullet \dfrac{8}{3}$

$x - 11 = 24$

$x - 11 + 11 = 24 + 11$

$x = 35$

3. $\left(\dfrac{1}{10}\right)^{-3} = 10^3 = 1000$

4. a. $\left(3.36 \times 10^{-15}\right) \div \left(8 \times 10^{-31}\right)$

$= \dfrac{3.36 \times 10^{-15}}{8 \times 10^{-31}}$

$= \dfrac{3.36}{8} \times \dfrac{10^{-15}}{10^{-31}}$

$= 0.42 \times 10^{-15-(-31)}$

$= 0.42 \times 10^{16}$

$= 4.2 \times 10^{15}$

b. $\left(2.24 \times 10^{9}\right) \bullet \left(7 \times 10^{-9}\right)$

$= \left(2.24 \bullet 7\right) \times \left(10^{9} \bullet 10^{-9}\right)$

$= 15.68 \times 10^{-9+9}$

$= 15.68 \times 10^{0}$

$= 1.568 \times 10^{1}$

The Coordinate Plane

WARM-UP

$$F = \frac{9}{5}C + 32$$

$$F - 32 = \frac{9}{5}C + 32 - 32$$

$$F - 32 = \frac{9}{5}C$$

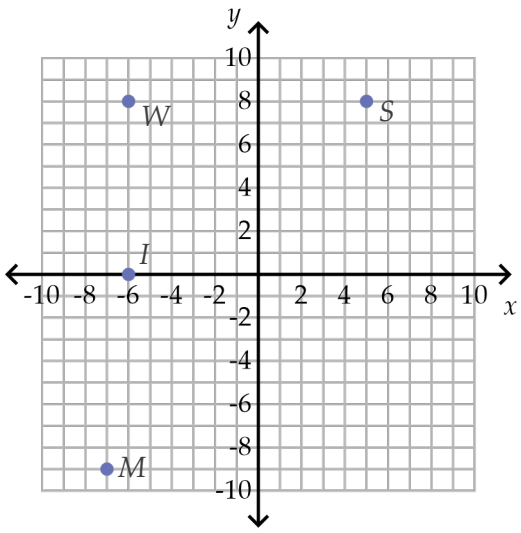
$$\frac{5}{9} \bullet (F - 32) = \frac{9}{5}C \bullet \frac{5}{9}$$

$$\frac{5}{9}(F - 32) = C$$

PRACTICE

1. F: $(-3,8)$ Quadrant: II
   R: $(0,7)$ Quadrant: N/A
   O: $(6,-4)$ Quadrant: IV
   G: $(-9,-5)$ Quadrant: III

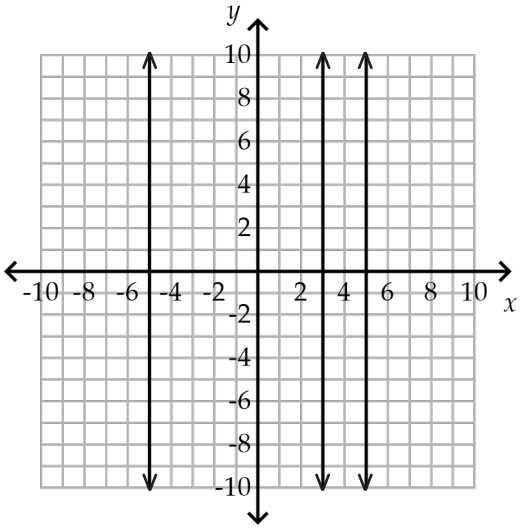
2.



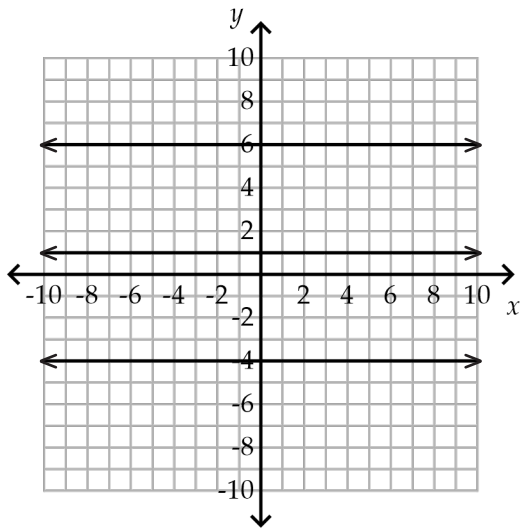
3. a. x
   b. y
   c. axis
   d. $(0,0)$

4. a. $x = -3$
   b. $y = -9$

5.



6.



REVIEW

1. $D = \frac{m}{V}$

$V \bullet D = \frac{m}{V} \bullet V$

$VD = m$

$\frac{VD}{D} = \frac{m}{D}$

$V = \frac{m}{D}$

2. $\frac{\frac{2}{3}(-9r - 60)}{2} = -2$

$2 \bullet \frac{\frac{2}{3}(-9r - 60)}{2} = -2 \bullet 2$

$\frac{2}{3}(-9r - 60) = -4$

$-6r - 40 = -4$

$-6r - 40 + 40 = -4 + 40$

$-6r = 36$

$\frac{-6r}{-6} = \frac{36}{-6}$

$r = -6$

3. a.

$2\overline{)154}$	$2\overline{)330}$
$7\overline{)77}$	$3\overline{)165}$
11	$5\overline{)55}$
	11

$154 = 2 \bullet 7 \bullet 11$

$330 = 2 \bullet 3 \bullet 5 \bullet 11$

GCF: $2 \bullet 11 = 22$

b. $\frac{154 \div 22}{330 \div 22} = \frac{7}{15}$

4. 5,879,000,000,000

5. 9 AM to 3 PM is 6 hours.

$6 \div \frac{3}{4}$

$= 6 \bullet \frac{4}{3}$

$= 8$

8 classes

Relations and Functions

WARM-UP

85

PRACTICE

1. a. 2, 5

   b. 2, 4

   c. one-to-one one-to-many

   many-to-one many-to-many

   d. no

   e. $\{(1,1), (2,2), (2,5), (3,3), (4,2), (4,4), (5,6), (6,5)\}$

2. a. 6

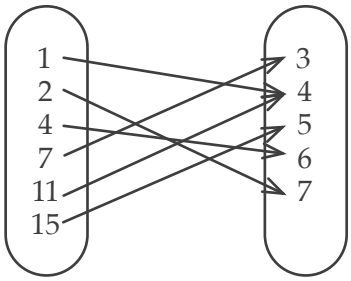
   b. 1, 11

   c. one-to-one one-to-many

   many-to-one many-to-many

   d. yes

   e. Note: Numbers may be in a different order, but each input should match to the output shown.



   f. $\{(1,4), (2,7), (4,6), (7,3), (11,4), (15,5)\}$

3. a. –2

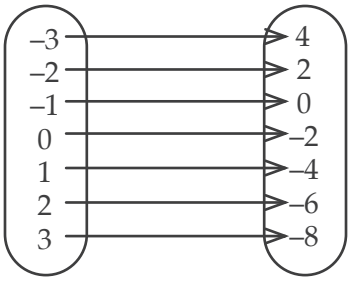
   b. –1

   c. one-to-one one-to-many

   many-to-one many-to-many

   d. yes

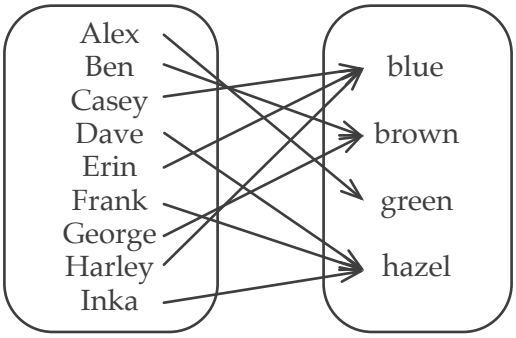
   e. Note: Numbers may be in a different order, but each input should match to the output shown.



   f.

Input	–3	–2	–1	0	1	2	3
Output	4	2	0	–2	–4	–6	–8

4. a. Note: Names may be in a different order, but each input should match to the output shown.



b. one-to-one one-to-many

many-to-one many-to-many

c. yes

REVIEW

1. $$\frac{-7(t+8)}{5} = 5t + 72$$

$$5 \bullet \frac{-7(t+8)}{5} = (5t+72) \bullet 5$$

$$-7(t+8) = 25t + 360$$

$$-7t - 56 = 25t + 360$$

$$-7t - 56 + 7t = 25t + 360 + 7t$$

$$-56 = 32t + 360$$

$$-56 - 360 = 32t + 360 - 360$$

$$-416 = 32t$$

$$\frac{-416}{32} = \frac{32t}{32}$$

$$-13 = t$$

2. **A** $\sqrt{\frac{16}{9}}$ $\sqrt[3]{9}$ **B** $\sqrt[3]{-27}$ **C** $\sqrt{324}$ $\sqrt[3]{81}$ **D** $\sqrt{5^2}$

Detailed work for rational roots is shown below.

A $\sqrt{\frac{16}{9}} = \frac{\sqrt{16}}{\sqrt{9}} = \frac{4}{3}$

B $\sqrt[3]{-27} = -3$

C $\sqrt{324} = 18$

D $\sqrt{5^2} = \sqrt{25} = 5$

3. a. Jacob

b. Answers will vary. An example is given.

$$10^{-4} = \frac{1}{10^4} = \frac{1}{10{,}000} = 0.0001$$

One ten-thousandth is written as 0.0001.

4. a. $$C = \frac{F - 32}{1.8}$$

$$1.8 \bullet C = \frac{F-32}{1.8} \bullet 1.8$$

$$1.8C = F - 32$$

$$1.8C + 32 = F - 32 + 32$$

$$1.8C + 32 = F$$

$$F = 1.8C + 32$$

b. $F = 1.8(37) + 32$

$F = 98.6$

98.6 °F

Domain and Range

WARM-UP

a. one-to-one

b. many-to-many

c. many-to-one

PRACTICE

1. a. Independent variable: number of children

   Dependent variable: number of paper towel rolls

   b.

Number of Children	3	4	5	6	7	8
Number of Rolls	15	20	25	30	35	40

   c. Domain: $\{3, 4, 5, 6, 7, 8\}$

   Range: $\{15, 20, 25, 30, 35, 40\}$

   d. $y = 5x$

2. a. Independent variable: number of bags purchased

   Dependent variable: total cost

   b.

Number of Bags Purchased	4	8	12	16
Total Cost ($)	4.76	9.52	14.28	19.04

   c. Domain: $\{4, 8, 12, 16\}$

   Range: $\{4.76, 9.52, 14.28, 19.04\}$

   d. $y = 1.19x$

3. a.

x	$y = -\frac{2}{5}x$	y
–2	$y = -\frac{2}{5} \cdot (-2)$	$\frac{4}{5}$
–1	$y = -\frac{2}{5} \cdot (-1)$	$\frac{2}{5}$
0	$y = -\frac{2}{5} \cdot 0$	0
1	$y = -\frac{2}{5} \cdot 1$	$-\frac{2}{5}$
2	$y = -\frac{2}{5} \cdot 2$	$-\frac{4}{5}$

   b.

x	$y = x^3$	y
–2	$y = (-2)^3$	–8
–1	$y = (-1)^3$	–1
0	$y = 0^3$	0
1	$y = 1^3$	1
2	$y = 2^3$	8

4. a. Rule: Subtract 8 from the input.

Equation: $y = x - 8$

b. Rule: Multiply the input by –5.

Equation: $y = -5x$

REVIEW

1. $$8.2x - 3.5 = 17$$
$$8.2x - 3.5 + 3.5 = 17 + 3.5$$
$$8.2x = 20.5$$
$$\frac{8.2x}{8.2} = \frac{20.5}{8.2}$$
$$x = 2.5$$

2. a. $g + 4$

b. $g + g + 4 = 14$

Equation: $2g + 4 = 14$

$$2g + 4 = 14$$
$$2g + 4 - 4 = 14 - 4$$
$$2g = 10$$
$$\frac{2g}{2} = \frac{10}{2}$$
$$g = 5$$

5 goals

c. $5 + 4 = 9$

9 goals

3. $$\frac{40\left(h^7u^5m\right)^2}{\left(2h^4um\right)^3}$$
$$= \frac{40h^{14}u^{10}m^2}{8h^{12}u^3m^3}$$
$$= \frac{40}{8} \bullet h^{14-12}u^{10-3}m^{2-3}$$
$$= 5h^2u^7m^{-1}$$
$$= 5h^2u^7 \bullet \frac{1}{m}$$
$$= \frac{5h^2u^7}{m}$$

4. $\$46{,}000 \div 2000 = \$23$

$\$23$ per hour

5. 135 minutes = 2 hours 15 minutes

Graphing Relations and Functions

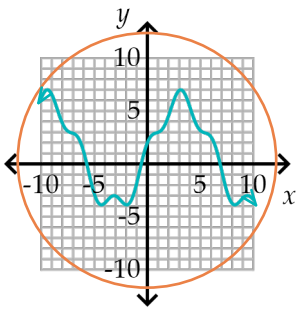
WARM-UP

a. Domain: $\{-2, -1, 0, 1, 2\}$

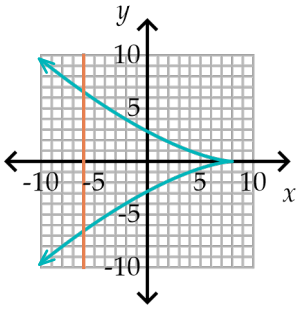
b. Range: $\{-8, -1, 0, 1, 8\}$

PRACTICE

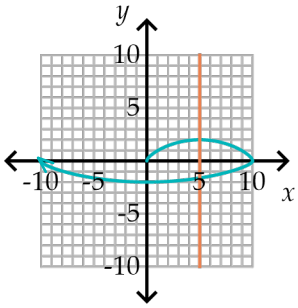
1. a.



b.



c.



2. a.

x	y
–8	–4
–4	0
0	4
2	6
4	8

Rule: Add 4 to the input.

Equation: $y = x + 4$

b.

x	y
–5	5
–3	3
0	0
3	3
5	5

Rule: Take the absolute value of the input.

Equation: $y = |x|$

c.

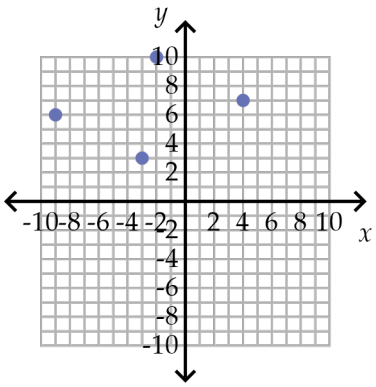
x	y
–3	–9
–2	–4
0	0
2	–4
3	–9

Rule: Square the input and take the opposite.

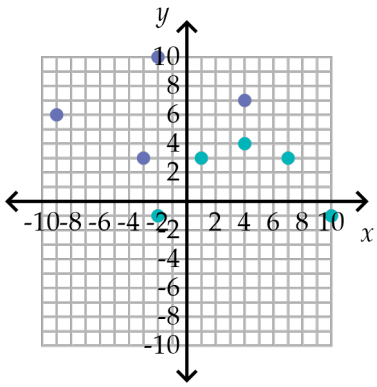
Equation: $y = -x^2$

3. Parts A, B, and C are graphed on the same coordinate plane. For ease of checking answers, a new graph is shown below for each part with the previous relations plotted.

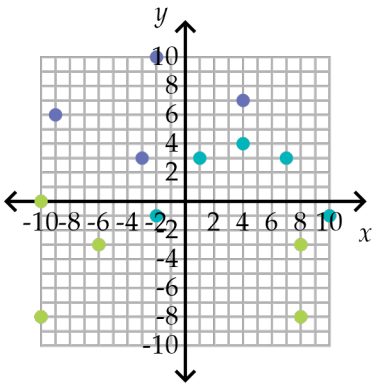
a.



b.



c.



4. Parts A and B are graphed on the coordinate plane from Problem 3. For ease of checking answers, a new graph is shown below for each part with the previous relations plotted.

a.

x	y
–2	2
–1	1
0	0
1	–1
2	–2

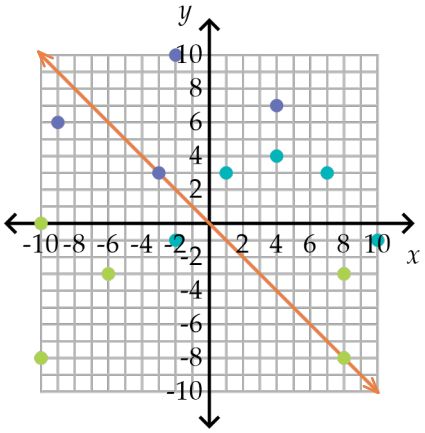
$y=-(-2)=2$

$y=-(-1)=1$

$y=-(0)=0$

$y=-(1)=-1$

$y=-(2)=-2$



b.

x	y
–8	6
–4	–6
0	–10
4	–6
8	6

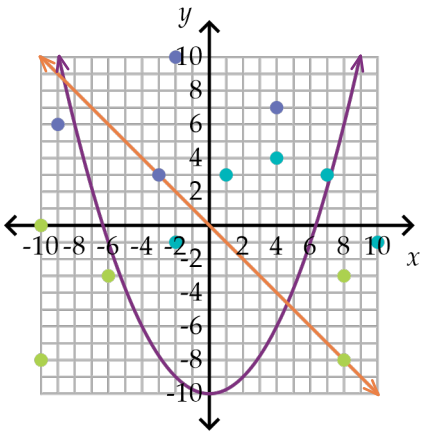
$y=\frac{1}{4}(-8)^2-10=\frac{1}{4}(64)-10=16-10=6$

$y=\frac{1}{4}(-4)^2-10=\frac{1}{4}(16)-10=4-10=-6$

$y=\frac{1}{4}(0)^2-10=\frac{1}{4}(0)-10=0-10=-10$

$y=\frac{1}{4}(4)^2-10=\frac{1}{4}(16)-10=4-10=-6$

$y=\frac{1}{4}(8)^2-10=\frac{1}{4}(64)-10=16-10=6$



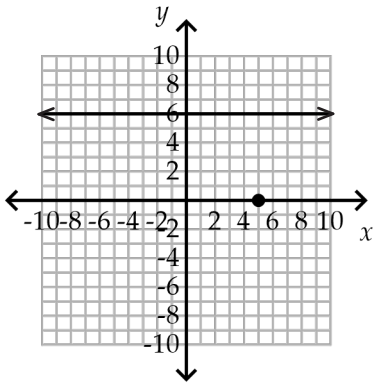
5. First: bakery

Second: school

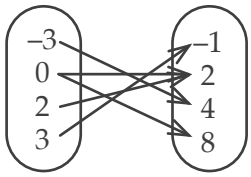
Third: library

REVIEW

1.



2. a.



b. no

3. $\frac{1}{2}\left[-12+5^2 \bullet 3-\left(7-\left|-4^2\right|\right)\right]$

$=\frac{1}{2}\left[-12+5^2 \bullet 3-\left(7-\left|-16\right|\right)\right]$

$=\frac{1}{2}\left[-12+5^2 \bullet 3-\left(7-16\right)\right]$

$=\frac{1}{2}\left[-12+5^2 \bullet 3-\left(-9\right)\right]$

$=\frac{1}{2}\left[-12+25 \bullet 3-\left(-9\right)\right]$

$=\frac{1}{2}\left[-12+75-\left(-9\right)\right]$

$=\frac{1}{2}\left[63-\left(-9\right)\right]$

$=\frac{1}{2}\left[72\right]$

$=36$

4. a. $52 \bullet 2 = 104$
$104 \bullet 2 = 208$

$52 \bullet 4 = 208$

b. $71 \bullet 2 = 142$
$142 \bullet 2 = 284$

$71 \bullet 4 = 284$

c. $112 \bullet 2 = 224$
$224 \bullet 2 = 448$

$112 \bullet 4 = 448$

5. a. 3:00 PM

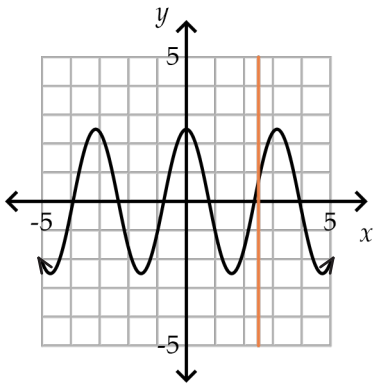
b. 8:00 AM

c. 6:30 PM

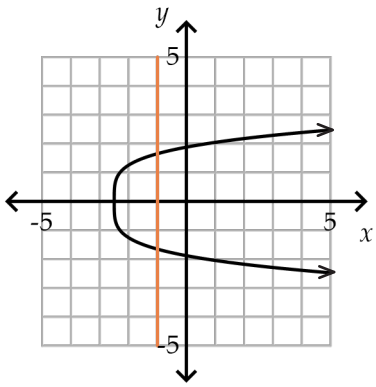
Linear Functions

WARM-UP

a. yes



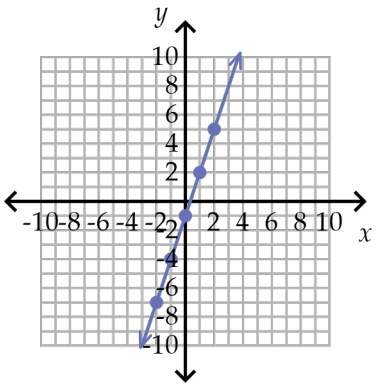
b. no



PRACTICE

1.

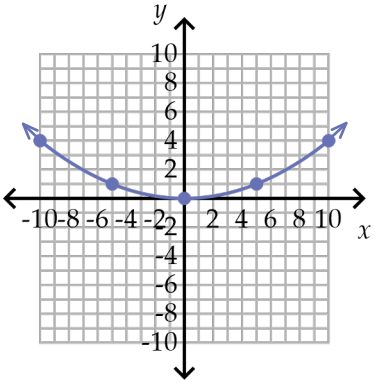
x	y	
–2	–7	$y = 3(-2) - 1 = -6 - 1 = -7$
–1	–4	$y = 3(-1) - 1 = -3 - 1 = -4$
0	–1	$y = 3(0) - 1 = 0 - 1 = -1$
1	2	$y = 3(1) - 1 = 3 - 1 = 2$
2	5	$y = 3(2) - 1 = 6 - 1 = 5$



yes

2.

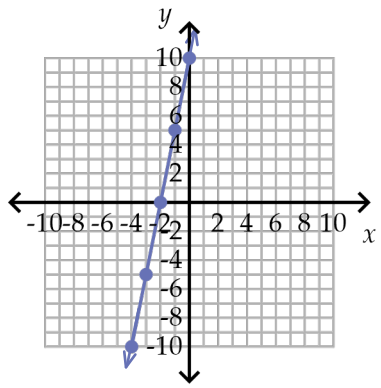
x	y	
–10	4	$y = \left(\frac{-10}{5}\right)^2 = (-2)^2 = 4$
–5	1	$y = \left(\frac{-5}{5}\right)^2 = (-1)^2 = 1$
0	0	$y = \left(\frac{0}{5}\right)^2 = (0)^2 = 0$
5	1	$y = \left(\frac{5}{5}\right)^2 = (1)^2 = 1$
10	4	$y = \left(\frac{10}{5}\right)^2 = (2)^2 = 4$



no

3.

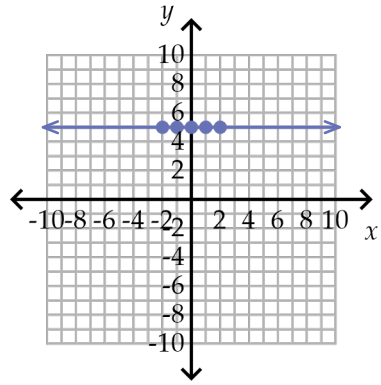
x	y	
–4	–10	$y = 5(-4+2) = 5(-2) = -10$
–3	–5	$y = 5(-3+2) = 5(-1) = -5$
–2	0	$y = 5(-2+2) = 5(0) = 0$
–1	5	$y = 5(-1+2) = 5(1) = 5$
0	10	$y = 5(0+2) = 5(2) = 10$



yes

4.

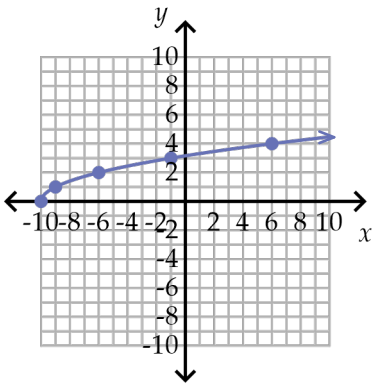
x	y
–2	5
–1	5
0	5
1	5
2	5



yes

5.

x	y	
–10	0	$y = \sqrt{-10+10} = \sqrt{0} = 0$
–9	1	$y = \sqrt{-9+10} = \sqrt{1} = 1$
–6	2	$y = \sqrt{-6+10} = \sqrt{4} = 2$
–1	3	$y = \sqrt{-1+10} = \sqrt{9} = 3$
6	4	$y = \sqrt{6+10} = \sqrt{16} = 4$



no

6. Explanation for each equation that is not linear is shown below.

$y = 3x$	A ~~$y = x^2 - 1$~~	$y + 1 = 1 - x$
B ~~$x = 1$~~	$y - 1 = 2(x + 4)$	C ~~$y = 4x^3$~~
D ~~$y = \frac{3}{x}$~~	$y = 4$	$y = \frac{1}{2}x + 3$

A The variable x is squared.
B Vertical lines are not functions.
C The variable x is to the third power.
D The variable x in the denominator represents x^{-1}.

REVIEW

1. a.

x	y
–3	4
–1	–4
0	–5
2	–1
3	4

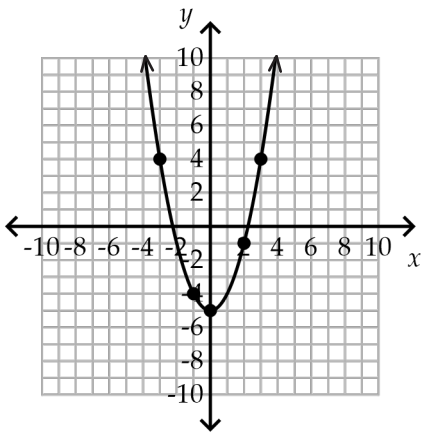
$y = (-3)^2 - 5 = 9 - 5 = 4$

$y = (-1)^2 - 5 = 1 - 5 = -4$

$y = 0^2 - 5 = 0 - 5 = -5$

$y = 2^2 - 5 = 4 - 5 = -1$

$y = 3^2 - 5 = 9 - 5 = 4$



b. yes

2. Rule: Multiply the input by $\frac{1}{2}$, or divide the input by 2.

Equation: $y = \frac{1}{2}x$ or $y = x \div 2$

3. $y = -4$

4. $17 - 5(x + 8) = -83$

$17 - 5x - 40 = -83$

$-23 - 5x = -83$

$-23 - 5x + 23 = -83 + 23$

$-5x = -60$

$\frac{-5x}{-5} = \frac{-60}{-5}$

$x = 12$

5. $60 \div 1\frac{1}{3}$

$= 60 \div \frac{4}{3}$

$= 60 \bullet \frac{3}{4}$

$= 45$

45 bows

Slope as Rate of Change

WARM-UP

a. linear

b. nonlinear

c. linear

PRACTICE

1. a. 3

   b. 1

   c. $m = \frac{3}{1} = 3$

   d. –9

   e. –3

   f. $m = \frac{-9}{-3} = 3$

2. a.

Change in x	x	y	Change in y
	–3	8	
+2			+7
	–1	15	
+2			+7
	1	22	
+2			+7
	3	29	
+2			+7
	5	36	

   b. yes

   c. yes

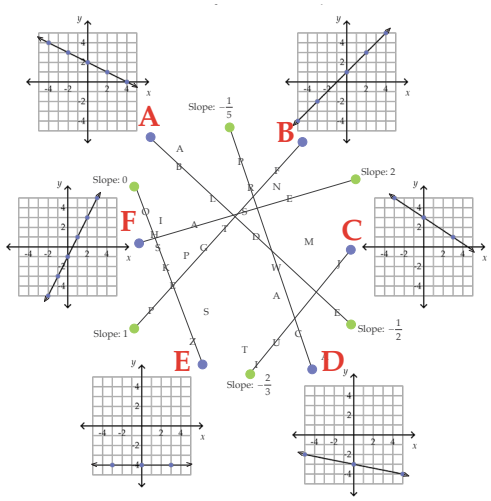
3. a.

Change in x	x	y	Change in y
	0	10	
+1			–1
	1	9	
+1			–2
	2	7	
+1			–3
	3	4	
+1			–4
	4	0	

   b. no

   c. no

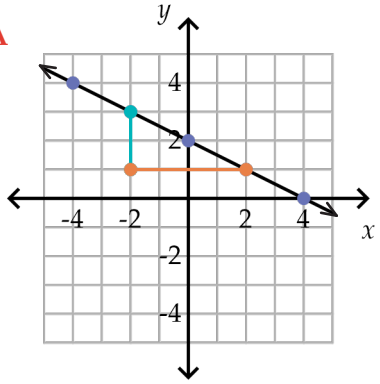
4.



AN IMPASTA

Detailed work for each graph is shown below.

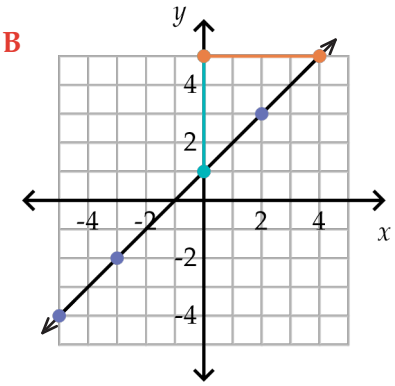
A



Rise: down 2 Run: right 4

Slope: $\frac{-2}{4} = -\frac{1}{2}$

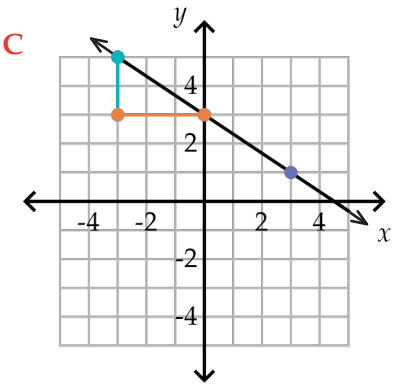
B



Rise: up 4 Run: right 4

Slope: $\frac{4}{4} = 1$

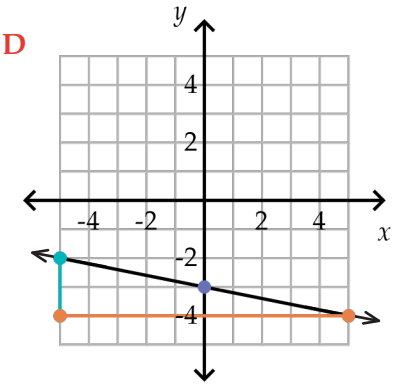
C



Rise: down 2 Run: right 3

Slope: $\frac{-2}{3} = -\frac{2}{3}$

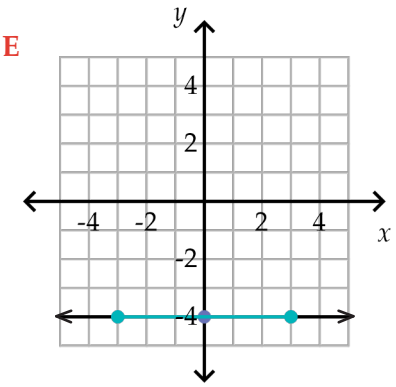
D



Rise: down 2 Run: right 10

Slope: $\frac{-2}{10} = -\frac{1}{5}$

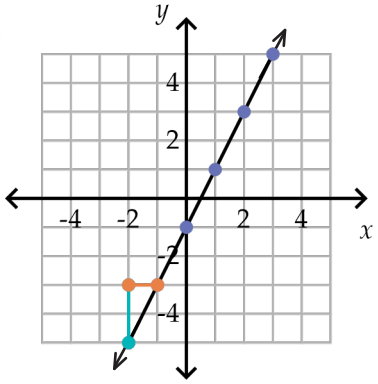
E



Rise: up 0 Run: right 6

Slope: $\frac{0}{6} = 0$

F



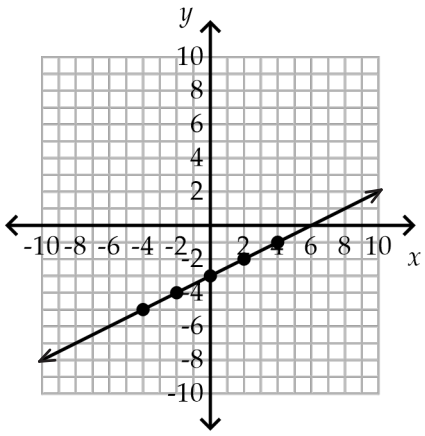
Rise: up 2 Run: right 1

Slope: $\frac{2}{1} = 2$

REVIEW

1. a.

x	y	
–4	–5	$y=\frac{1}{2}(-4)-3=-2-3=-5$
–2	–4	$y=\frac{1}{2}(-2)-3=-1-3=-4$
0	–3	$y=\frac{1}{2}(0)-3=0-3=-3$
2	–2	$y=\frac{1}{2}(2)-3=1-3=-2$
4	–1	$y=\frac{1}{2}(4)-3=2-3=-1$



b. yes

c. Even values make the work easier because multiplying an even number by $\frac{1}{2}$ results in an integer.

d. Detailed explanations for each option are included below.

A	B	C	D	E	F	G
2	150	(–6)	–1	(3)	(0)	4

A The product of $\frac{1}{3}$ and 2 is not an integer.

B The axes only go from –10 to 10.

C The product of $\frac{1}{3}$ and –6 is an integer, and the point will fit on the graph.

D The product of $\frac{1}{3}$ and –1 is not an integer.

E The product of $\frac{1}{3}$ and 3 is an integer, and the point will fit on the graph.

F The product of $\frac{1}{3}$ and 0 is an integer, and the point will fit on the graph.

G The product of $\frac{1}{3}$ and 4 is not an integer.

2. a. $A=\frac{bh}{2}$

$2A=\frac{bh}{2}\bullet 2$

$2A=bh$

$\frac{2A}{b}=\frac{bh}{b}$

$\frac{2A}{b}=h$

b. $h=\frac{2(17)}{8.5}$

$h=4$

4 cm

3. $-4\sqrt{4}-\sqrt{6}+3\sqrt{6}-\sqrt{5}\bullet\sqrt{5}$

$=-4\bullet 2-\sqrt{6}+3\sqrt{6}-\sqrt{5^2}$

$=-8-\sqrt{6}+3\sqrt{6}-5$

$=-8-5-\sqrt{6}+3\sqrt{6}$

$=-13+2\sqrt{6}$

4. a. $8\frac{1}{3}-2=6\frac{1}{3}$

$6\frac{1}{3}-\frac{1}{3}=6$

$6-\frac{1}{3}=5\frac{2}{3}$

$8\frac{1}{3}-2\frac{2}{3}=5\frac{2}{3}$

b. $14\frac{1}{4} - 5 = 9\frac{1}{4}$

$9\frac{1}{4} - \frac{1}{4} = 9$

$9 - \frac{1}{4} = 8\frac{3}{4}$

$14\frac{1}{4} - 5\frac{1}{2} = 8\frac{3}{4}$

c. $12\frac{1}{8} - 7 = 5\frac{1}{8}$

$5\frac{1}{8} - \frac{1}{8} = 5$

$5 - \frac{1}{8} = 4\frac{7}{8}$

$4\frac{7}{8} - \frac{1}{8} = 4\frac{6}{8} = 4\frac{3}{4}$

$12\frac{1}{8} - 7\frac{3}{8} = 4\frac{3}{4}$

Calculating Slope

WARM-UP

a. 10% is 14.5. 1% is 1.45.

$14.5 + 1.45 = 15.95$

b. 10% is 37. 1% is 3.7.

$37 + 3.7 = 40.7$

c. 10% is 122. 1% is 12.2.

$122 + 12.2 = 134.2$

PRACTICE

1. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{2-5}{1-2}$

$= \frac{-3}{-1} = 3$

2. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{4-6}{-3-5}$

$= \frac{-2}{-8} = \frac{1}{4}$

3. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{-1-(-5)}{7-(-2)}$

$= \frac{4}{9}$

4. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{4-(-2)}{8-10}$

$= \frac{6}{-2} = -3$

5. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{5-5}{-6-23}$

$= \frac{0}{-29} = 0$

6. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{15-(-1)}{23-17}$

$= \frac{16}{6} = \frac{8}{3}$

7. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{-3-(-5)}{-1-0}$
$= \frac{2}{-1} = -2$

8. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{6-14}{0-0}$
$= \frac{-8}{0}$ undefined

9. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{8-(-6)}{0-(-7)}$
$= \frac{14}{7} = 2$

10. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{5-7}{-4-3}$
$= \frac{-2}{-7} = \frac{2}{7}$

11. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{3-5}{2-14}$
$= \frac{-2}{-12} = \frac{1}{6}$

12. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{-4-8}{4-7}$
$= \frac{-12}{-3} = 4$

13. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{1-6}{2-(-3)}$
$= \frac{-5}{5} = -1$

14. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{0-(-5)}{0-4}$
$= \frac{5}{-4} = -\frac{5}{4}$

15. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{-2-13}{-7-(-4)}$
$= \frac{-15}{-3} = 5$

16. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{0-20}{10-5}$
$= \frac{-20}{5} = -4$

17. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{-5-3}{24-2}$
$= \frac{-8}{22} = -\frac{4}{11}$

18. $m = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{3-(-1)}{5-8}$
$= \frac{4}{-3} = -\frac{4}{3}$

19. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-2 - 3}{-2 - (-5)}$$
$$= \frac{-5}{3} = -\frac{5}{3}$$

20. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{3 - 51}{5 - (-1)}$$
$$= \frac{-48}{6} = -8$$

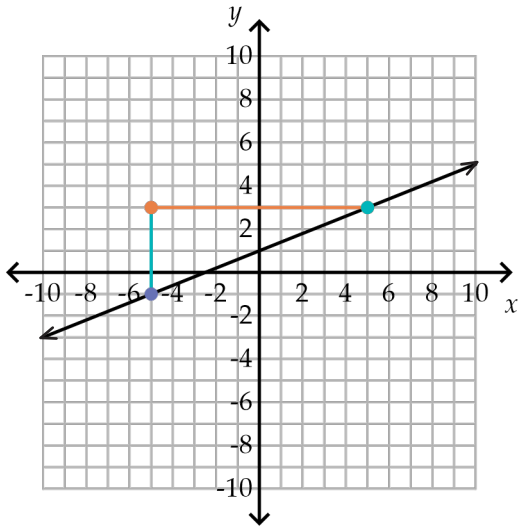
21. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-3 - 3}{6 - (-6)}$$
$$= \frac{-6}{12} = -\frac{1}{2}$$

22. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{2 - 4}{-1 - 5}$$
$$= \frac{-2}{-6} = \frac{1}{3}$$

23. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-3 - 11}{12 - 7}$$
$$= \frac{-14}{5} = -\frac{14}{5}$$

24. $$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-6 - 12}{-1 - 0}$$
$$= \frac{-18}{-1} = 18$$

REVIEW

1. 

Rise: up 4 Run: right 10

$m = \frac{4}{10} = \frac{2}{5}$

2. a. one-to-one one-to-many
many-to-one many-to-many

b. no

c. $\{(0,0), (1,15), (1,25), (2,30), (2,50), (3,45), (3,75)\}$

3. $\frac{2}{5}x + 4 = 9$

$\frac{2}{5}x + 4 - 4 = 9 - 4$

$\frac{2}{5}x = 5$

$\frac{5}{2} \bullet \frac{2}{5}x = 5 \bullet \frac{5}{2}$

$x = \frac{25}{2}$

$x = 12\frac{1}{2}$

4. $7.9 \times 10^{-19} = 0.79 \times 10^{-18}$

$0.79 + 3.5 = 4.29$

$\left(7.9 \times 10^{-19}\right) + \left(3.5 \times 10^{-18}\right)$

$= 4.29 \times 10^{-18}$

5. $\left|-\frac{1}{4}\right|$ ~~0.25%~~ 0.25 $\frac{250}{1000}$ $\left(\frac{1}{2}\right)^2$

Slope-Intercept Form

WARM-UP

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{3-(-6)}{4-(-3)}$$
$$= \frac{9}{7}$$

PRACTICE

1. a. x-intercept: $(4,0)$ y-intercept: $(0,-2)$

   b. x-intercept: $(1,0)$ y-intercept: $(0,5)$

2. a. $m = 1$

   y-intercept: $\left(0,-\frac{1}{2}\right)$ $b = -\frac{1}{2}$

   b. $m = \frac{5}{4}$

   y-intercept: $(0,3)$ $b = 3$

   c. $m = 3$

   y-intercept: $(0,4)$ $b = 4$

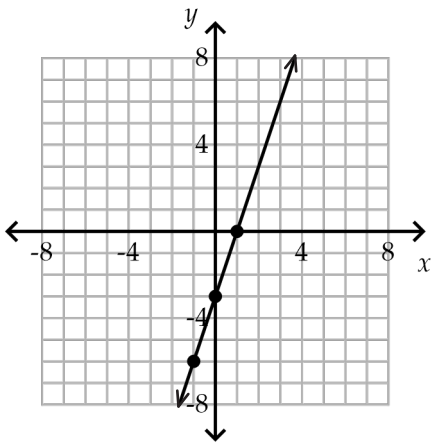
   d. $m = -5$

   y-intercept: $(0,-2)$ $b = -2$

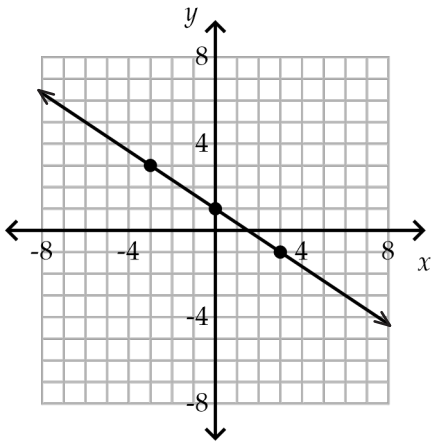
   e. $m = 1$

   y-intercept: $(0,0)$ $b = 0$

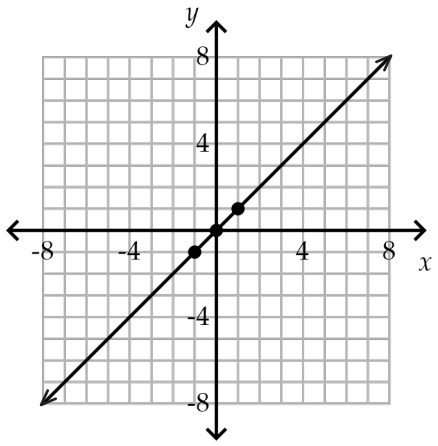
3. a.



b.



c.



4. a. $m = \frac{4}{5}$ $b = -3$

Equation: $y = \frac{4}{5}x - 3$

b. $m = -\frac{2}{7}$ $b = 0$

Equation: $y = -\frac{2}{7}x$

5. a. $y = 3x + 4$ $y = -3x - 4$

$y = -3x + 4$ $y = 3x - 4$

b $y = x + 2$ $y = -x - 2$

$y = -x + 2$ $y = x - 2$

REVIEW

1. Rule: Multiply the input by $\frac{1}{10}$, or divide the input by 10.

Equation: $y = \frac{1}{10}x$ or $y = x \div 10$

2. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{-2 - 14}{-17 - (-49)}$

$= \frac{-16}{32}$

$= -\frac{1}{2}$

3. $(4.888 \times 10^{21}) \div (9.4 \times 10^{11})$

$= \frac{4.888 \times 10^{21}}{9.4 \times 10^{11}}$

$= \frac{4.888}{9.4} \times \frac{10^{21}}{10^{11}}$

$= 0.52 \times 10^{21-11}$

$= 0.52 \times 10^{10}$

$= 5.2 \times 10^{9}$

4. a. $\sqrt{181}$ is between the whole numbers 13 and 14 but is closer to 13.

b. $\sqrt{181} \approx 13.45$

5. $0.555\ldots \approx 0.56$

Writing Linear Equations Using Slope and a Point

WARM-UP

$m = \frac{4}{-1} = -4 \qquad b = 6$

$y = -4x + 6$

PRACTICE

1. a.
$$y = mx + b$$
$$2 = 5(4) + b$$
$$2 = 20 + b$$
$$2 - 20 = 20 + b - 20$$
$$-18 = b$$

Equation: $y = 5x - 18$

b.
$$y = mx + b$$
$$-1 = \frac{3}{5}(1) + b$$
$$-1 = \frac{3}{5} + b$$
$$-1 - \frac{3}{5} = \frac{3}{5} + b - \frac{3}{5}$$
$$-1\frac{3}{5} = b$$

Equation: $y = \frac{3}{5}x - 1\frac{3}{5}$

c.
$$y = mx + b$$
$$0 = -\frac{7}{4}(-8) + b$$
$$0 = 14 + b$$
$$0 - 14 = 14 + b - 14$$
$$-14 = b$$

Equation: $y = -\frac{7}{4}x - 14$

d.
$$y = mx + b$$
$$5 = -\frac{1}{6}(3) + b$$
$$5 = -\frac{1}{2} + b$$
$$5 + \frac{1}{2} = -\frac{1}{2} + b + \frac{1}{2}$$
$$5\frac{1}{2} = b$$

Equation: $y = -\frac{1}{6}x + 5\frac{1}{2}$

2. a. Point-slope form: $y - 2 = 5(x - 4)$
$$y - 2 = 5(x - 4)$$
$$y - 2 = 5x - 20$$
$$y - 2 + 2 = 5x - 20 + 2$$
$$y = 5x - 18$$

Slope-intercept form: $y = 5x - 18$

b. $y-(-1)=\frac{3}{5}(x-1)$

Point-slope form: $y+1=\frac{3}{5}(x-1)$

$$y+1=\frac{3}{5}(x-1)$$

$$y+1=\frac{3}{5}x-\frac{3}{5}$$

$$y+1-1=\frac{3}{5}x-\frac{3}{5}-1$$

$$y=\frac{3}{5}x-1\frac{3}{5}$$

Slope-intercept form: $y=\frac{3}{5}x-1\frac{3}{5}$

c. $y-0=-\frac{7}{4}(x-(-8))$

Point-slope form: $y-0=-\frac{7}{4}(x+8)$

$$y-0=-\frac{7}{4}(x+8)$$

$$y=-\frac{7}{4}(x+8)$$

$$y=-\frac{7}{4}x-14$$

Slope-intercept form: $y=-\frac{7}{4}x-14$

d. Point-slope form: $y-5=-\frac{1}{6}(x-3)$

$$y-5=-\frac{1}{6}(x-3)$$

$$y-5=-\frac{1}{6}x+\frac{1}{2}$$

$$y-5+5=-\frac{1}{6}x+\frac{1}{2}+5$$

$$y=-\frac{1}{6}x+5\frac{1}{2}$$

Slope-intercept form: $y=-\frac{1}{6}x+5\frac{1}{2}$

3. a. Slope: $\frac{1}{5}$ Point: $(3,4)$

b. Slope: 2 Point: $(7,-10)$

c. Slope: $-\frac{3}{4}$ Point: $(-2,5)$

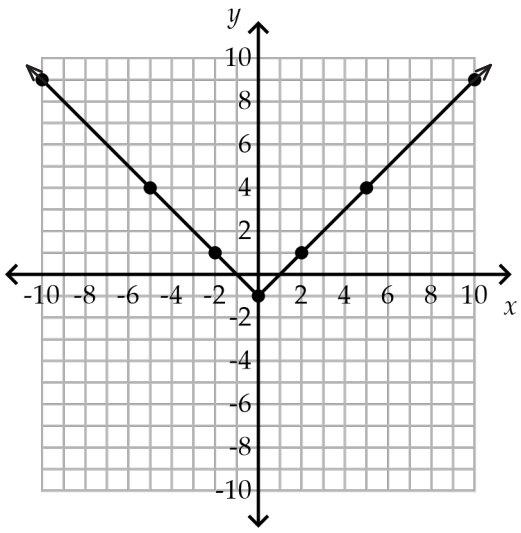
REVIEW

1. $m = \frac{4}{6} = \frac{2}{3}$ $b = -4$

   Equation: $y = \frac{2}{3}x - 4$

2.

x	y	
–10	9	$y = \lvert -10 \rvert - 1 = 10 - 1 = 9$
–5	4	$y = \lvert -5 \rvert - 1 = 5 - 1 = 4$
–2	1	$y = \lvert -2 \rvert - 1 = 2 - 1 = 1$
0	–1	$y = \lvert 0 \rvert - 1 = 0 - 1 = -1$
2	1	$y = \lvert 2 \rvert - 1 = 2 - 1 = 1$
5	4	$y = \lvert 5 \rvert - 1 = 5 - 1 = 4$
10	9	$y = \lvert 10 \rvert - 1 = 10 - 1 = 9$



3. a. $200 + 12w$

   b. $1280 - 15w$

   c. Equation: $200 + 12w = 1280 - 15w$

$$200 + 12w = 1280 - 15w$$
$$200 + 12w + 15w = 1280 - 15w + 15w$$
$$200 + 27w = 1280$$
$$200 + 27w - 200 = 1280 - 200$$
$$27w = 1080$$
$$\frac{27w}{27} = \frac{1080}{27}$$
$$w = 40$$

   40 weeks

4. $-5\frac{3}{4} < -5\frac{1}{4} < 5.5 < 5\frac{3}{4} < 5.9$

Writing Linear Equations Using Multiple Points

WARM-UP

$$y = mx + b$$
$$y = -2x + b$$
$$5 = -2(1) + b$$
$$5 = -2 + b$$
$$5 + 2 = -2 + b + 2$$
$$7 = b$$
$$y = -2x + 7$$

PRACTICE

1. slope — $m = \frac{y_2 - y_1}{x_2 - x_1}$
   slope-intercept form — $y = mx + b$
   y-intercept — $(0, b)$
   point-slope form — $y - y_1 = m(x - x_1)$

2. a. $m = \frac{1-7}{-3-3}$
   $= \frac{-6}{-6}$
   $= 1$

   b. $y = 1x + b$
   $7 = 1(3) + b$
   $7 = 3 + b$
   $7 - 3 = 3 + b - 3$
   $4 = b$

   c. $y = x + 4$

3. $m = \frac{9-0}{2-8}$
   $= \frac{9}{-6}$
   $= -\frac{3}{2}$

   $y = -\frac{3}{2}x + b$
   $0 = -\frac{3}{2}(8) + b$
   $0 = -12 + b$
   $0 + 12 = -12 + b + 12$
   $12 = b$

   $y = -\frac{3}{2}x + 12$

4. a. $m = \frac{11-7}{8-6}$
   $= \frac{4}{2}$
   $= 2$

   b. $y - 7 = 2(x - 6)$ or $y - 11 = 2(x - 8)$

5. $m = \dfrac{-7-(-5)}{-3-(-4)}$

$= \dfrac{-2}{1}$

$= -2$

$y-(-5) = -2\big(x-(-4)\big)$

$y+5 = -2(x+4)$

6. a. $m = \dfrac{15-11}{1-0}$

$= \dfrac{4}{1}$

$= 4$

b. $y-7 = 4\big(x-(-1)\big)$

$y-7 = 4(x+1)$

c. $y-7 = 4(x+1)$

$y-7 = 4x+4$

$y-7+7 = 4x+4+7$

$y = 4x+11$

7. a. $m = \dfrac{0-5}{6-4}$

$= \dfrac{-5}{2}$

$= -\dfrac{5}{2}$

b. $y-0 = -\dfrac{5}{2}(x-6)$

c. $y-0 = -\dfrac{5}{2}(x-6)$

$y = -\dfrac{5}{2}x+15$

REVIEW

1. $y = mx+b$

$11 = 4(2)+b$

$11 = 8+b$

$11-8 = 8+b-8$

$3 = b$

Equation: $y = 4x+3$

2. $y = 6.5$ $\quad y = \dfrac{15}{x}+2$ $\quad y = \dfrac{1}{9}x$ $\quad y = x^2+1$

3. $m = \dfrac{y_2-y_1}{x_2-x_1}$

$= \dfrac{-13-3}{5-(-15)}$

$= \dfrac{-16}{20}$

$= -\dfrac{4}{5}$

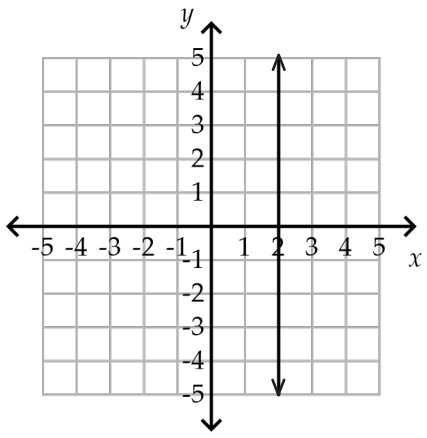
4. $2\sqrt{2} \bullet 7\sqrt{2} \bullet \sqrt{9}$

$= 2 \bullet 7\sqrt{2^2} \bullet 3$

$= 14 \bullet 2 \bullet 3$

$= 84$

5.



Proportional Relationships

WARM-UP

$$m = \frac{7-(-8)}{4-(-3)}$$
$$= \frac{15}{7}$$

Point-slope form: $y - 7 = \frac{15}{7}(x-4)$ or

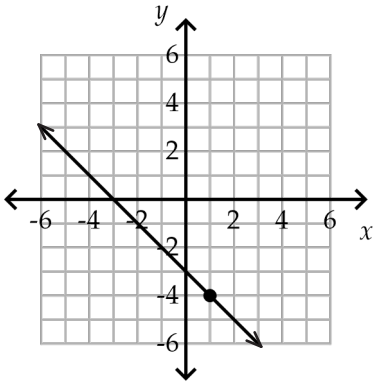
$y + 8 = \frac{15}{7}(x+3)$

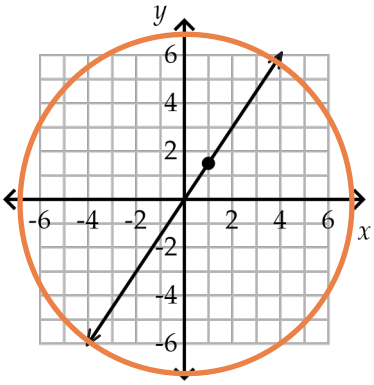
$$y = \frac{15}{7}x + b$$
$$7 = \frac{15}{7}(4) + b$$
$$7 = \frac{60}{7} + b$$
$$\frac{49}{7} - \frac{60}{7} = \frac{60}{7} + b - \frac{60}{7}$$
$$-\frac{11}{7} = b$$

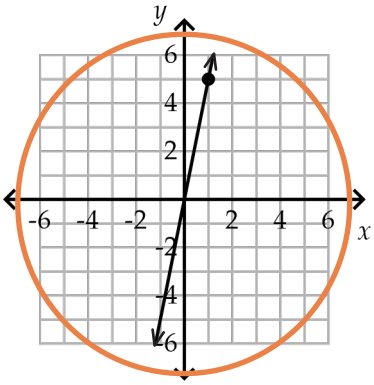
Slope-intercept form: $y = \frac{15}{7}x - \frac{11}{7}$

PRACTICE

1.







2. a. When $x = 1$, $y = 4$.

$k = 4$

b. $y = kx$

$y = 4x$

3. a. rise: 1 run: 2

slope: 1 over 2

$k = \frac{1}{2}$

b. $y = kx$

$y = \frac{1}{2}x$

4. $4 > \frac{1}{2}$

Problem 2

5. a. Rate of change for apples: y-value increase of 2.25 for every x-value increase of 1

Cost: $2.25/pound

b. Rate of change for peaches:

rise: 10 run: 4 slope: $\frac{10}{4} = \frac{5}{2} = 2.5$

Cost: $2.50/pound

c. peaches

6. a. Company A:
slope: 3.5
$3.50 per thousand gallons

Company B:
rise: 9 run: 3 slope: $\frac{9}{3}=3$
$3 per thousand gallons

b. Company A

REVIEW

1. $m=\frac{y_2-y_1}{x_2-x_1}$

$=\frac{-6-(-12)}{-11-(-12)}$

$=\frac{6}{1}$

$=6$

$y=mx+b$

$-12=6(-12)+b$

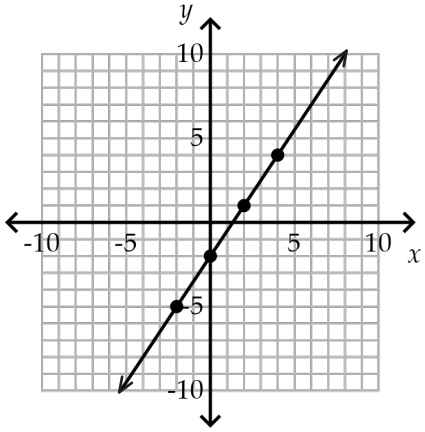
$-12=-72+b$

$-12+72=-72+b+72$

$60=b$

$y=6x+60$

2.



3. $n+n+1+n+2+n+3+n+4+n+5=213$

Equation: $6n+15=213$

$6n+15=213$

$6n+15-15=213-15$

$6n=198$

$\frac{6n}{6}=\frac{198}{6}$

$n=33$

Numbers: 33, 34, 35, 36, 37, 38

4. a. 2|4620
2|2310
3|1155
5|385
7|77
11

$4620=2\cdot2\cdot3\cdot5\cdot7\cdot11$

b. 2|7350
3|3675
5|1225
5|245
7|49
7

$7350=2\cdot3\cdot5\cdot5\cdot7\cdot7$

5. $2\cdot3\cdot5\cdot7=210$

GCF: 210

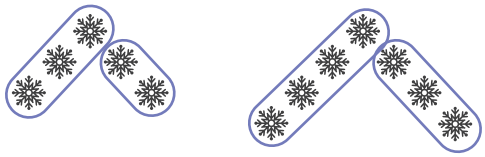
Logic Lesson 2

Logic puzzles can be approached in many different ways. The solutions here may not represent all possible methods or answers.

1. One approach is to look at the snowflakes as accumulating on the left side and right side of the pile, with the top snowflake counted on the left side.

   As shown below, the number of snowflakes on the left side (including the top snowflake) is the same as the number of seconds, and the number of snowflakes on the right side is one less than the number of seconds.

3 seconds		4 seconds	
3 on left	2 on right	4 on left	3 on right

   a. 5 seconds: $5 + 4 = 9$ snowflakes

   b. 25 seconds: $25 + 24 = 49$ snowflakes

   c. 100 seconds: $100 + 99 = 199$ snowflakes

   d. x seconds: $x + (x - 1) = 2x - 1$ snowflakes

2. Fran and her father should take path D.

   If Path A is correct, then both Mr. Jones's and Mr. Huber's statements are correct. Therefore, Path A cannot be correct.

   If Path B is correct, then both Mrs. Cunningham's and Mr. Huber's statements are correct. Therefore, Path B cannot be correct.

   If Path C is correct, then Mrs. Cunningham, Mrs. Smith, and Mr. Huber all gave correct information. Therefore, Path C cannot be correct.

   If Path D is correct, then only Mr. Jones gave correct information.

3. The man with 2 loaves of cornbread should receive 1 coin(s), and the man with 3 loaves should receive 4 coin(s).

   Each person received 5 thirds.

   Traveler A had 3 loaves. If he kept 5 thirds, he shared 4 thirds.

   Traveler B had 2 loaves. If he kept 5 thirds, he shared 1 third.

   Traveler A shared 4 times as much as Traveler B. Therefore, he should receive 4 times as many coins. $1 \bullet 4 = 4$, and $1 + 4 = 5$.

4. a. The sum of the digits 1–9 is 45. Since there are three rows, the sum of each row must be $45 \div 3$, which is 15. The same is true for each column and each diagonal. More than one solution is possible as long as the sum of each row, column, and diagonal is 15. An example solution and a possible approach are given.

2	7	6
9	5	1
4	3	8

   One approach is to list the ways to get a sum of 15 using exactly three of the numbers between 1 and 9. These include:

$1+5+9$	$1+6+8$	$2+4+9$
$2+5+8$	$2+6+7$	$3+4+8$
$3+5+7$	$4+5+6$	

   Since 5 appears in four of the ways, it must go in the middle because the middle square is included in four different sums. Since 2, 4, 6, and 8 each appear in three solutions, they must go in the corners because each corner is included in three different sums. Since 5 is already in the center, 2 and 8 must go in

opposite corners to make 10, and 6 and 4 must also go in opposite corners to make 10. The remaining squares can be filled in with the numbers that result in a sum of 15.

b. $3 \bullet 2 - \sqrt[3]{8} = 4$

$7 - \sqrt{36} = 1$

$4 + \sqrt{9} - 2 = 5$

First Equation:

The only perfect cubes from 1 to 9 are 1 and 8. If the number 1 is under the cube root, then 2 times a number minus 1 must equal 4. Since 5 minus 4 is 1, this cannot work because 2 times any remaining number is not 5. Therefore, the number under the cube root is 8. The cube root of 8 is 2, so the number in the other box must be 3 because 6 minus 2 is 4.

Second Equation:

The only perfect square in the thirties is 36, so a 6 must go under the square root. The remaining numbers are 1, 2, 4, 5, 7, and 9. Since the square root of 36 is 6, one remaining number minus 6 has to equal another remaining number. The only remaining numbers that have a difference of 6 are 7 and 1.

Third Equation:

Now the remaining numbers are 2, 4, 5, and 9. The only perfect squares in this list are 4 and 9. Try 9 first. The square root of 9 is 3. The only way to make a true statement is to add 4 and 3 to get 7 and subtract 2 to get 5.

Graphing from Standard Form

WARM-UP

a. proportional

b. not proportional

PRACTICE

1. a. $5x-4y=60$
$5x-4(0)=60$
$5x=60$
$\frac{5x}{5}=\frac{60}{5}$
$x=12$
$(12,0)$

b. $-x+2y=6$
$-x+2(0)=6$
$-x=6$
$\frac{-x}{-1}=\frac{6}{-1}$
$x=-6$
$(-6,0)$

c. $3x+5y=-120$
$3x+5(0)=-120$
$3x=-120$
$\frac{3x}{3}=\frac{-120}{3}$
$x=-40$
$(-40,0)$

d. $-7x-5y=105$
$-7x-5(0)=105$
$-7x=105$
$\frac{-7x}{-7}=\frac{105}{-7}$
$x=-15$
$(-15,0)$

2. a. $5x-4y=60$
$5(0)-4y=60$
$-4y=60$
$\frac{-4y}{-4}=\frac{60}{-4}$
$y=-15$
$(0,-15)$

b. $-x+2y=6$
$-(0)+2y=6$
$2y=6$
$\frac{2y}{2}=\frac{6}{2}$
$y=3$
$(0,3)$

c. $3x+5y=-120$
$3(0)+5y=-120$
$5y=-120$
$\frac{5y}{5}=\frac{-120}{5}$
$y=-24$
$(0,-24)$

d. $-7x-5y=105$
$-7(0)-5y=105$
$-5y=105$
$\frac{-5y}{-5}=\frac{105}{-5}$
$y=-21$
$(0,-21)$

3. a. $-3x-4y=24$

$-3x-4(0)=24$

$-3x=24$

$\frac{-3x}{-3}=\frac{24}{-3}$

$x=-8$

x-intercept: $(-8,0)$

$-3x-4y=24$

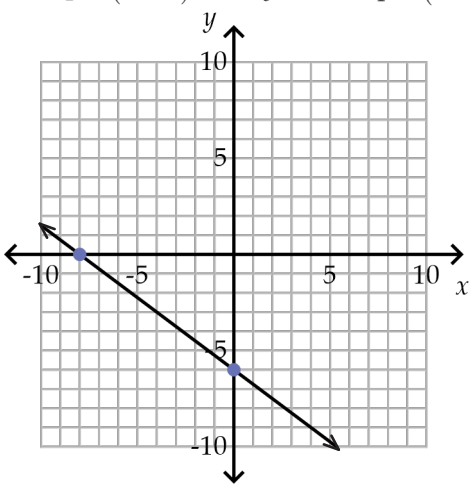
$-3(0)-4y=24$

$-4y=24$

$\frac{-4y}{-4}=\frac{24}{-4}$

$y=-6$

y-intercept: $(0,-6)$



slope $=\frac{\text{rise}}{\text{run}}=\frac{-6}{8}=-\frac{3}{4}$

b. $6x-8y=24$

$6x-8(0)=24$

$6x=24$

$\frac{6x}{6}=\frac{24}{6}$

$x=4$

x-intercept: $(4,0)$

$6x-8y=24$

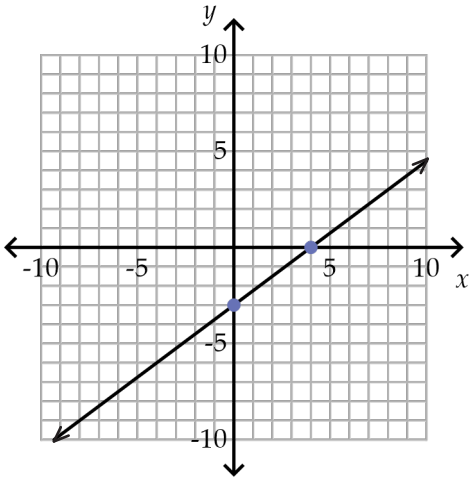
$6(0)-8y=24$

$-8y=24$

$\frac{-8y}{-8}=\frac{24}{-8}$

$y=-3$

y-intercept: $(0,-3)$



slope $=\frac{\text{rise}}{\text{run}}=\frac{3}{4}$

c. $-5x-2y=-10$

$-5x-2(0)=-10$

$-5x=-10$

$\frac{-5x}{-5}=\frac{-10}{-5}$

$x=2$

x-intercept: $(2,0)$

$-5x-2y=-10$

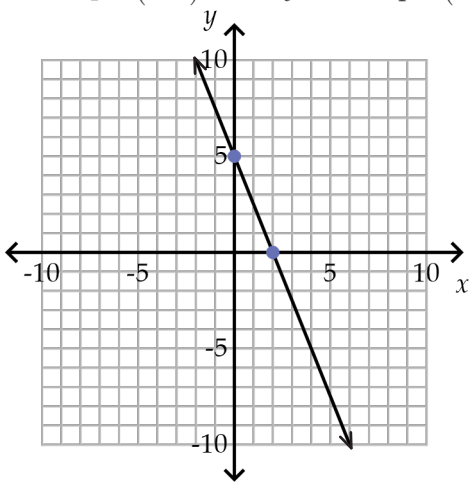
$-5(0)-2y=-10$

$-2y=-10$

$\frac{-2y}{-2}=\frac{-10}{-2}$

$y=5$

y-intercept: $(0,5)$



slope $=\frac{\text{rise}}{\text{run}}=\frac{-5}{2}=-\frac{5}{2}$

d. $7x+5y=35$

$7x+5(0)=35$

$7x=35$

$\frac{7x}{7}=\frac{35}{7}$

$x=5$

x-intercept: $(5,0)$

$7x+5y=35$

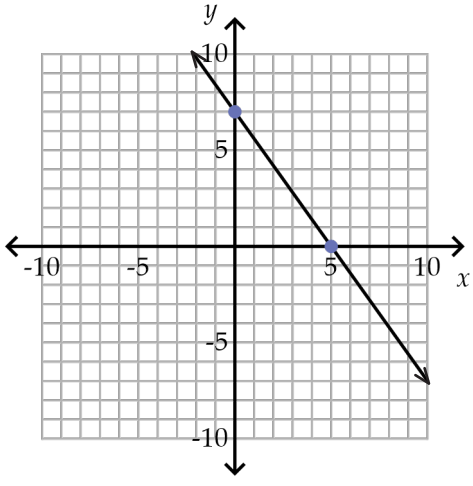
$7(0)+5y=35$

$5y=35$

$\frac{5y}{5}=\frac{35}{5}$

$y=7$

y-intercept: $(0,7)$



slope $=\frac{\text{rise}}{\text{run}}=\frac{-7}{5}=-\frac{7}{5}$

Fact: The blue wildebeest migration in East Africa is the world's largest land migration, where over a million animals may travel more than 1000 km.

REVIEW

1. a. rise: 2 run: 7

slope: 2 over 7

$k = \frac{2}{7}$

b. $y = \frac{2}{7}x$

2. $y = mx + b$

$11 = -\frac{2}{3}(6) + b$

$11 = -4 + b$

$11 + 4 = -4 + b + 4$

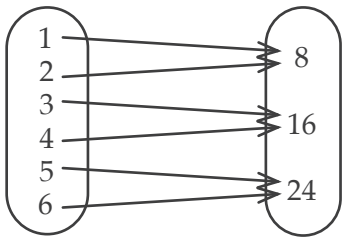
$15 = b$

$y = -\frac{2}{3}x + 15$

3. $3\frac{1}{4}$ hours

4. a. yes

b.



c. $\{(1,8), (2,8), (3,16), (4,16), (5,24), (6,24)\}$

5. a. $V = \frac{1}{3}Bh$

$3 \bullet V = 3 \bullet \frac{1}{3}Bh$

$3V = Bh$

$\frac{3V}{B} = \frac{Bh}{B}$

$\frac{3V}{B} = h$

b. $\frac{3V}{B} = h$

$\frac{3(100)}{25} = h$

$\frac{300}{25} = h$

$12 = h$

12 cm

Standard Form to Slope-Intercept Form

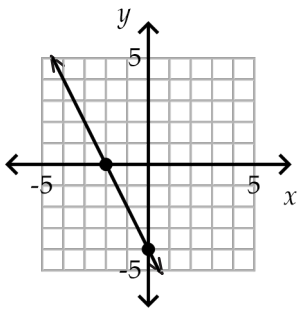
WARM-UP

$$\begin{aligned} 8x+4y&=-16\\ 8x+4(0)&=-16\\ 8x&=-16\\ \frac{8x}{8}&=\frac{-16}{8}\\ x&=-2 \end{aligned}$$

x-intercept: $(-2,0)$

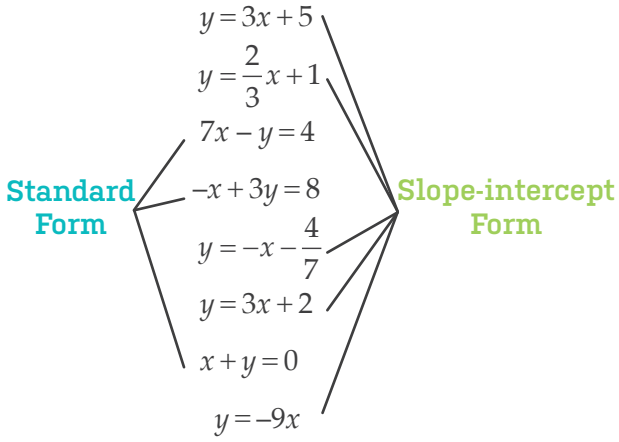
$$\begin{aligned} 8x+4y&=-16\\ 8(0)+4y&=-16\\ 4y&=-16\\ \frac{4y}{4}&=\frac{-16}{4}\\ y&=-4 \end{aligned}$$

y-intercept: $(0,-4)$



PRACTICE

1.



2. a. $A=2$ $B=5$ $C=10$

b. $A=1$ $B=-1$ $C=-8$

c. $A=-3$ $B=4$ $C=12$

d. $A=4$ $B=-7$ $C=15$

3. a.
$$\begin{aligned} 5x+y&=2\\ 5x+y-5x&=2-5x\\ y&=2-5x\\ y&=-5x+2 \end{aligned}$$

Slope: -5 y-intercept: $(0,2)$

b.
$$\begin{aligned} 2x-5y&=-10\\ 2x-5y-2x&=-10-2x\\ -5y&=-10-2x\\ \frac{-5y}{-5}&=\frac{-10-2x}{-5}\\ \frac{-5y}{-5}&=\frac{-10}{-5}-\frac{2x}{-5}\\ y&=2+\frac{2}{5}x\\ y&=\frac{2}{5}x+2 \end{aligned}$$

Slope: $\frac{2}{5}$ y-intercept: $(0,2)$

c.
$$\begin{aligned} -8x+4y&=20\\ -8x+4y+8x&=20+8x\\ 4y&=20+8x\\ \frac{4y}{4}&=\frac{20+8x}{4}\\ \frac{4y}{4}&=\frac{20}{4}+\frac{8x}{4}\\ y&=5+2x\\ y&=2x+5 \end{aligned}$$

Slope: 2 y-intercept: $(0,5)$

d. $3x + 2y = 24$

$3x + 2y - 3x = 24 - 3x$

$2y = 24 - 3x$

$\frac{2y}{2} = \frac{24 - 3x}{2}$

$\frac{2y}{2} = \frac{24}{2} - \frac{3x}{2}$

$y = 12 - \frac{3}{2}x$

$y = -\frac{3}{2}x + 12$

Slope: $-\frac{3}{2}$ y-intercept: $(0,12)$

e. $-x - 2y = 0$

$-x - 2y + x = 0 + x$

$-2y = x$

$\frac{-2y}{-2} = \frac{x}{-2}$

$y = -\frac{1}{2}x$

Slope: $-\frac{1}{2}$ y-intercept: $(0,0)$

f. $6x + 6y = 3$

$6x + 6y - 6x = 3 - 6x$

$6y = 3 - 6x$

$\frac{6y}{6} = \frac{3 - 6x}{6}$

$\frac{6y}{6} = \frac{3}{6} - \frac{6x}{6}$

$y = \frac{1}{2} - x$

$y = -x + \frac{1}{2}$

Slope: -1 y-intercept: $\left(0,\frac{1}{2}\right)$

REVIEW

1. a. Rate of change for math tutoring pay:

y-value increase of 45 for every x-value increase of 2

$\frac{45}{2} = 22.5$

$22.50 per hour

b. Rate of change for grocery store pay:

rise: 45 run: 3 slope: $\frac{45}{3} = 15$

$15 per hour

c. math tutoring

d. $22.50 – $15 = $7.50

$7.50 per hour

2. $8x + 5y = 40$

$8x + 5(0) = 40$

$8x = 40$

$\frac{8x}{8} = \frac{40}{8}$

$x = 5$

x-intercept: $(5,0)$

$8x + 5y = 40$

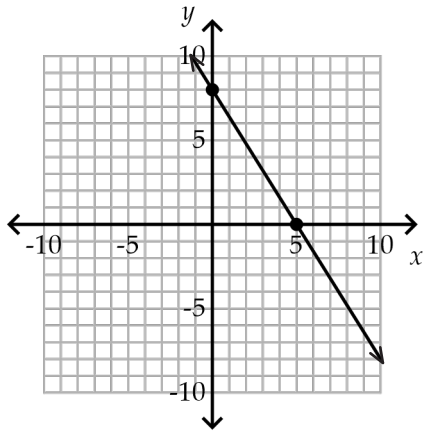
$8(0) + 5y = 40$

$5y = 40$

$\frac{5y}{5} = \frac{40}{5}$

$y = 8$

y-intercept: $(0,8)$



3. $\frac{1}{3}(6a-14)+\frac{5}{3}=19$

$$2a-\frac{14}{3}+\frac{5}{3}=19$$
$$2a-\frac{9}{3}=19$$
$$2a-3=19$$
$$2a-3+3=19+3$$
$$2a=22$$
$$\frac{2a}{2}=\frac{22}{2}$$
$$a=11$$

4. There are 31 days in December. Three weeks (21 days) before December 31 is December 10, so three weeks before January 1 is December 11.

Linear Models

WARM-UP

a.
$$\begin{aligned} -5x-10y &= 20 \\ -5x-10y+5x &= 20+5x \\ -10y &= 20+5x \\ \frac{-10y}{-10} &= \frac{20+5x}{-10} \\ \frac{-10y}{-10} &= \frac{20}{-10}+\frac{5x}{-10} \\ y &= -2-\frac{1}{2}x \\ y &= -\frac{1}{2}x-2 \end{aligned}$$

b.
$$\begin{aligned} 2x-y &= 3 \\ 2x-y-2x &= 3-2x \\ -y &= 3-2x \\ \frac{-y}{-1} &= \frac{3-2x}{-1} \\ \frac{-y}{-1} &= \frac{3}{-1}-\frac{2x}{-1} \\ y &= -3+2x \\ y &= 2x-3 \end{aligned}$$

PRACTICE

1. a. Note: Letters chosen for variables may vary, but the definitions should match.

Let t be the number of minutes Jude walked at the fair.

Let S be the total number of steps Jude walked.

b. 2200

c. 37

d. $S = 37t + 2200$

e.
$$\begin{aligned} S &= 37t+2200 \\ S &= 37(90)+2200 \\ S &= 3330+2200 \\ S &= 5530 \end{aligned}$$

5530 steps

2. a. Note: Letters chosen for variables may vary, but the definitions should match.

Let t be the number of hours Jude is at the fair.

Let D be the amount of money Jude has left.

b. 45

c. –20

d. $D = -20t + 45$

e.
$$\begin{aligned} D &= -20t+45 \\ 0 &= -20t+45 \\ 0-45 &= -20t+45-45 \\ -45 &= -20t \\ \frac{-45}{-20} &= \frac{-20t}{-20} \\ 2\frac{1}{4} &= t \end{aligned}$$

$2\frac{1}{4}$ hours

3. a. $(0,90)$

Nathan spent 90 minutes building at the start of the school year.

b. $\frac{-10}{2} = -5$

Nathan spends 5 minutes less time building each month.

c. $(9,45)$

9 months

4. a. $(0,20)$

Plan A costs a fixed rate of \$20/month when no minutes are used.

b. $(0,40)$

Plan B costs a fixed rate of \$40/month when no minutes are used.

c. up to 100 minutes

d. after 100 minutes

e. At 100 minutes, the cost is the same (\$50).

REVIEW

1. $$\begin{aligned} x+6y &= 36 \\ x+6y-x &= 36-x \\ 6y &= 36-x \\ \frac{6y}{6} &= \frac{36-x}{6} \\ y &= \frac{36}{6} - \frac{x}{6} \\ y &= -\frac{1}{6}x+6 \end{aligned}$$

Slope: $-\frac{1}{6}$ y-intercept: $(0,6)$

2. $$\begin{aligned} m &= \frac{9-(-17)}{-10-3} \\ &= \frac{26}{-13} \\ &= -2 \end{aligned}$$

$$\begin{aligned} y &= mx+b \\ -17 &= -2(3)+b \\ -17 &= -6+b \\ -17+6 &= -6+b+6 \\ -11 &= b \end{aligned}$$

$y = -2x - 11$

3. $(0,6000)$ and $(10,0)$

$$\begin{aligned} m &= \frac{0-6000}{10-0} \\ &= \frac{-6000}{10} \\ &= -600 \end{aligned}$$

4. a. $-\frac{14}{19} \cdot -\frac{19}{14} = 1$

b. $\frac{1}{6} \cdot 6 = 1$

c. $\frac{3}{4} \cdot \frac{4}{3} = 1$

5. a. $$\begin{aligned} \frac{5}{9}b &= 205 \\ \frac{9}{5} \cdot \frac{5}{9}b &= 205 \cdot \frac{9}{5} \\ b &= 369 \end{aligned}$$

b. $$\begin{aligned} \frac{16}{23}e &= 928 \\ \frac{23}{16} \cdot \frac{16}{23}e &= 928 \cdot \frac{23}{16} \\ e &= 1334 \end{aligned}$$

Parallel and Perpendicular Lines

WARM-UP

They both ran two miles in 21 minutes at $x = 3$ (the fourth time they ran).

PRACTICE

1. a. Rate of change of Function 1:

$$\frac{15-0}{10-0}=\frac{15}{10}=\frac{3}{2}$$

Rate of change of Function 2:

$$\frac{-14-(-20)}{-6-(-10)}=\frac{6}{4}=\frac{3}{2}$$

(parallel) / perpendicular / neither

b. Rate of change of Function 1: 3

Rate of change of Function 2: $-\frac{1}{3}$

parallel / (perpendicular) / neither

c. Rate of change of Function 1:

$$\frac{10-(-10)}{2-(-8)}=\frac{20}{10}=2$$

Rate of change of Function 2:

$$\frac{2-(-8)}{4-0}=\frac{10}{4}=\frac{5}{2}$$

parallel / perpendicular / (neither)

2. a. $m = -1$

$$y = mx + b$$
$$7 = -1(-4) + b$$
$$7 = 4 + b$$
$$7 - 4 = 4 + b - 4$$
$$3 = b$$

Equation: $y = -x + 3$

b. $m = \frac{5}{9}$

$$y = mx + b$$
$$0 = \frac{5}{9}(0) + b$$
$$0 = 0 + b$$
$$0 = b$$

Equation: $y = \frac{5}{9}x$

3. a. $m = -\frac{5}{2}$

Equation: $y - 1 = -\frac{5}{2}(x - 2)$

b. $m = -1$

Equation: $y - 4 = -1(x - (-5))$

$y - 4 = -1(x + 5)$

4. a. parallel
b. perpendicular
c. intersect, distance
d. product
e. reciprocal

V	Q	M	N	L	I	J	P	L	E	U	A	R	C	R
P	E	R	P	E	N	D	I	C	U	L	A	R	X	E
S	U	P	V	J	X	S	C	V	A	H	J	A	I	C
P	D	I	S	T	A	N	C	E	J	F	E	W	O	I
R	N	B	B	F	I	N	T	E	R	S	E	C	T	P
O	W	I	L	O	E	B	T	S	R	D	U	B	H	R
D	Q	W	G	N	Z	B	D	O	Z	I	Z	M	E	O
U	K	J	Y	T	E	P	A	R	A	L	L	E	L	C
C	H	T	L	I	B	B	K	D	E	L	L	L	C	A
T	P	T	O	P	Q	X	C	Y	H	O	T	W	V	L

REVIEW

1. $y = mx + b$

$$-1 = \left(-\frac{5}{4}\right)(-8) + b$$

$$-1 = 10 + b$$

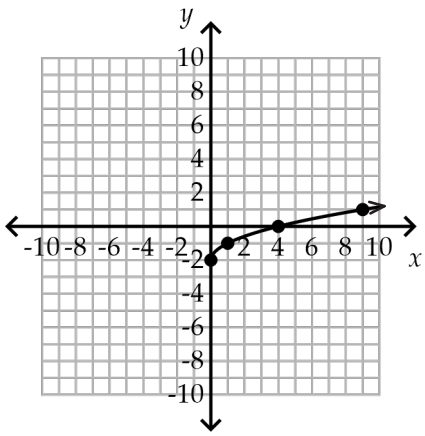
$$-1 - 10 = 10 + b - 10$$

$$-11 = b$$

Equation: $y = -\frac{5}{4}x - 11$

2. a. $y = \sqrt{x} - 2$

x	y	
0	–2	$y = \sqrt{0} - 2 = 0 - 2 = -2$
1	–1	$y = \sqrt{1} - 2 = 1 - 2 = -1$
4	0	$y = \sqrt{4} - 2 = 2 - 2 = 0$
9	1	$y = \sqrt{9} - 2 = 3 - 2 = 1$



b. yes

3. a. $\frac{24}{3} = 8$ A, B, C, D, F

b. $-\sqrt{225} = -15$ C, D, F

c. D, F

d. E, F

4. a. $\left(-\frac{2}{3}\right)^{13} \div \left(-\frac{2}{3}\right)^{10} = \left(-\frac{2}{3}\right)^{13-10} = \left(-\frac{2}{3}\right)^{3} = -\frac{8}{27}$

b. $(ivy)^{19} \bullet (ivy)^{46} = (ivy)^{19+46} = (ivy)^{65}$

c. $e^{7} \bullet z^{4} \bullet e^{6} \bullet z = e^{7+6} \bullet z^{4+1} = e^{13}z^{5}$

Solving Equations with Radicals

WARM-UP

a. 12 b. 5 c. 20

PRACTICE

A $\sqrt{x+3}=6$ $x=33$	**B** $2\sqrt{t}=14$ $t=49$	**C** $\sqrt{r+10}=4$ $r=6$	**D** $\sqrt{a}+10=4$ $a=$ no solution
E $3\sqrt{g-1}=21$ $g=50$	**F** $5\sqrt[3]{w-7}=-5$ $w=6$	**G** $\frac{\sqrt{b+15}}{2}=4$ $b=49$	**H** $\sqrt[3]{7-4f}=-5$ $f=33$
I $\frac{5+2\sqrt{m}}{3}=1$ $m=$ no solution	**J** $\sqrt[3]{2d+5}=3$ $d=11$	**K** $5-\sqrt[3]{3-z}=7$ $z=11$	**L** $10-\sqrt{2h}=0$ $h=50$

A

$$\sqrt{x+3}=6$$
$$\left(\sqrt{x+3}\right)^2=6^2$$
$$x+3=36$$
$$x+3-3=36-3$$
$$x=33$$

Check:

$$\sqrt{33+3}\stackrel{?}{=}6$$
$$\sqrt{36}\stackrel{?}{=}6$$
$$6=6\ \checkmark$$

B

$$2\sqrt{t}=14$$
$$\frac{2\sqrt{t}}{2}=\frac{14}{2}$$
$$\sqrt{t}=7$$
$$\left(\sqrt{t}\right)^2=7^2$$
$$t=49$$

Check:

$$2\sqrt{49}\stackrel{?}{=}14$$
$$2\bullet 7\stackrel{?}{=}14$$
$$14=14\ \checkmark$$

C

$$\sqrt{r+10}=4$$
$$\left(\sqrt{r+10}\right)^2=4^2$$
$$r+10=16$$
$$r+10-10=16-10$$
$$r=6$$

Check:

$$\sqrt{6+10}\stackrel{?}{=}4$$
$$\sqrt{16}\stackrel{?}{=}4$$
$$4=4\ \checkmark$$

D

$$\sqrt{a}+10=4$$
$$\sqrt{a}+10-10=4-10$$
$$\sqrt{a}=-6$$
$$\left(\sqrt{a}\right)^2=(-6)^2$$
$$a=36$$

Check:

$$\sqrt{36}+10\stackrel{?}{=}4$$
$$6+10\stackrel{?}{=}4$$
$$16\neq 4$$

no solution

E

$$3\sqrt{g-1}=21$$
$$\frac{3\sqrt{g-1}}{3}=\frac{21}{3}$$
$$\sqrt{g-1}=7$$
$$\left(\sqrt{g-1}\right)^2=7^2$$
$$g-1=49$$
$$g-1+1=49+1$$
$$g=50$$

Check:

$$3\sqrt{50-1}\stackrel{?}{=}21$$
$$3\sqrt{49}\stackrel{?}{=}21$$
$$3\bullet 7\stackrel{?}{=}21$$
$$21=21\ \checkmark$$

F $5\sqrt[3]{w-7}=-5$

$$\frac{5\sqrt[3]{w-7}}{5}=\frac{-5}{5}$$
$$\sqrt[3]{w-7}=-1$$
$$\left(\sqrt[3]{w-7}\right)^3=(-1)^3$$
$$w-7=-1$$
$$w-7+7=-1+7$$
$$w=6$$

Check:

$$5\sqrt[3]{6-7}\stackrel{?}{=}-5$$
$$5\sqrt[3]{-1}\stackrel{?}{=}-5$$
$$5(-1)\stackrel{?}{=}-5$$
$$-5=-5\ \checkmark$$

G $\frac{\sqrt{b+15}}{2}=4$

$$2\bullet\frac{\sqrt{b+15}}{2}=4\bullet 2$$
$$\sqrt{b+15}=8$$
$$\left(\sqrt{b+15}\right)^2=8^2$$
$$b+15=64$$
$$b+15-15=64-15$$
$$b=49$$

Check:

$$\frac{\sqrt{49+15}}{2}\stackrel{?}{=}4$$
$$\frac{\sqrt{64}}{2}\stackrel{?}{=}4$$
$$\frac{8}{2}\stackrel{?}{=}4$$
$$4=4\ \checkmark$$

H $\sqrt[3]{7-4f}=-5$

$$\left(\sqrt[3]{7-4f}\right)^3=(-5)^3$$
$$7-4f=-125$$
$$7-4f-7=-125-7$$
$$-4f=-132$$
$$\frac{-4f}{-4}=\frac{-132}{-4}$$
$$f=33$$

Check:

$$\sqrt[3]{7-4(33)}\stackrel{?}{=}-5$$
$$\sqrt[3]{7-132}\stackrel{?}{=}-5$$
$$\sqrt[3]{-125}\stackrel{?}{=}-5$$
$$-5=-5\ \checkmark$$

I $\frac{5+2\sqrt{m}}{3}=1$

$$3\bullet\frac{5+2\sqrt{m}}{3}=1\bullet 3$$
$$5+2\sqrt{m}=3$$
$$5+2\sqrt{m}-5=3-5$$
$$2\sqrt{m}=-2$$
$$\frac{2\sqrt{m}}{2}=\frac{-2}{2}$$
$$\sqrt{m}=-1$$
$$\sqrt{m}^2=(-1)^2$$
$$m=1$$

Check:

$$\frac{5+2\sqrt{1}}{3}\stackrel{?}{=}1$$
$$\frac{5+2\bullet 1}{3}\stackrel{?}{=}1$$
$$\frac{5+2}{3}\stackrel{?}{=}1$$
$$\frac{7}{3}\neq 1$$

no solution

J $\sqrt[3]{2d+5}=3$

$$\left(\sqrt[3]{2d+5}\right)^3=3^3$$
$$2d+5=27$$
$$2d+5-5=27-5$$
$$2d=22$$
$$\frac{2d}{2}=\frac{22}{2}$$
$$d=11$$

Check:

$$\sqrt[3]{2\bullet 11+5}\stackrel{?}{=}3$$
$$\sqrt[3]{22+5}\stackrel{?}{=}3$$
$$\sqrt[3]{27}\stackrel{?}{=}3$$
$$3=3\ \checkmark$$

K $5-\sqrt[3]{3-z}=7$

$$5-\sqrt[3]{3-z}-5=7-5$$
$$-\sqrt[3]{3-z}=2$$
$$\frac{-\sqrt[3]{3-z}}{-1}=\frac{2}{-1}$$
$$\sqrt[3]{3-z}=-2$$
$$(3-z)^3=(-2)^3$$
$$3-z=-8$$
$$3-z-3=-8-3$$
$$-z=-11$$
$$\frac{-z}{-1}=\frac{-11}{-1}$$
$$z=11$$

Check:

$$5-\sqrt[3]{3-11}\stackrel{?}{=}7$$
$$5-\sqrt[3]{-8}\stackrel{?}{=}7$$
$$5-(-2)\stackrel{?}{=}7$$
$$7=7\ \checkmark$$

L $10-\sqrt{2h}=0$

$$10-\sqrt{2h}-10=0-10$$
$$-\sqrt{2h}=-10$$
$$\frac{-\sqrt{2h}}{-1}=\frac{-10}{-1}$$
$$\sqrt{2h}=10$$
$$\left(\sqrt{2h}\right)^2=10^2$$
$$2h=100$$
$$\frac{2h}{2}=\frac{100}{2}$$
$$h=50$$

Check:

$$10-\sqrt{2\bullet 50}\stackrel{?}{=}0$$
$$10-\sqrt{100}\stackrel{?}{=}0$$
$$10-10\stackrel{?}{=}0$$
$$0=0\ \checkmark$$

REVIEW

1. a. $-6x+5y=-10$

$-6x+5y+6x=-10+6x$

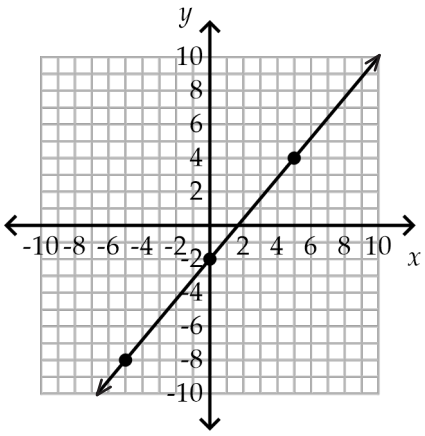
$5y=-10+6x$

$\frac{5y}{5}=\frac{-10}{5}+\frac{6x}{5}$

$y=\frac{6}{5}x-2$

Slope-intercept form: $y=\frac{6}{5}x-2$

Slope: $\frac{6}{5}$ y-intercept: $(0,-2)$



b. $m=\frac{3-(-12)}{-6-12}$

$=\frac{15}{-18}$

$=-\frac{5}{6}$

$y=mx+b$

$-12=-\frac{5}{6}(12)+b$

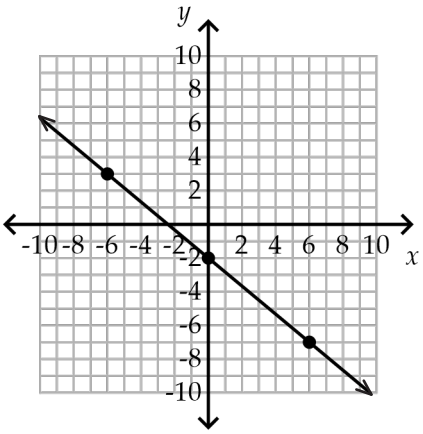
$-12=-10+b$

$-12+10=-10+b+10$

$-2=b$

Equation: $y=-\frac{5}{6}x-2$

Slope: $-\frac{5}{6}$ y-intercept: $(0,-2)$



c. The lines are perpendicular because their slopes are opposite reciprocals.

2. 1×10^{-9}

3. a. $96\div8=12$

$12\bullet5=60$

b. $108\div12=9$

$9\bullet7=63$

c. $330\div11=30$

$30\bullet5=150$

d. $250\div50=5$

$5\bullet9=45$

Solving Equations with Exponents

WARM-UP

$$\sqrt{41+r}+15=22$$
$$\sqrt{41+r}+15-15=22-15$$
$$\sqrt{41+r}=7$$
$$\left(\sqrt{41+r}\right)^2=7^2$$
$$41+r=49$$
$$41+r-41=49-41$$
$$r=8$$

Check:

$$\sqrt{41+8}+15\stackrel{?}{=}22$$
$$\sqrt{49}+15\stackrel{?}{=}22$$
$$7+15\stackrel{?}{=}22$$
$$22=22\checkmark$$

PRACTICE

PRODUCT: 1

$$x^2=121$$
$$\sqrt{x^2}=\pm\sqrt{121}$$
$$x=\pm11$$

$x=11$ and $x=-11$

Check: $(11)^2\stackrel{?}{=}121$ and $(-11)^2\stackrel{?}{=}121$

$121=121\checkmark$ $121=121\checkmark$

PRODUCT: 2

$$4z^3=-108$$
$$\frac{4z^3}{4}=\frac{-108}{4}$$
$$z^3=-27$$
$$\sqrt[3]{z^3}=\sqrt[3]{-27}$$
$$z=-3$$

Check: $4(-3)^3\stackrel{?}{=}-108$

$4(-27)\stackrel{?}{=}-108$

$-108=-108\checkmark$

PRODUCT: 3

$$3+b^2=28$$
$$3+b^2-3=28-3$$
$$b^2=25$$
$$\sqrt{b^2}=\pm\sqrt{25}$$
$$b=\pm5$$

$b=5$ and $b=-5$

Check: $3+(5)^2\stackrel{?}{=}28$ and $3+(-5)^2\stackrel{?}{=}28$

$3+25\stackrel{?}{=}28$ $3+25\stackrel{?}{=}28$

$28=28\checkmark$ $28=28\checkmark$

PRODUCT: 4

$$2f^3-5=681$$
$$2f^3-5+5=681+5$$
$$2f^3=686$$
$$\frac{2f^3}{2}=\frac{686}{2}$$
$$f^3=343$$
$$\sqrt[3]{f^3}=\sqrt[3]{343}$$
$$f=7$$

Check: $2(7)^3 - 5 \stackrel{?}{=} 681$

$2(343) - 5 \stackrel{?}{=} 681$

$686 - 5 \stackrel{?}{=} 681$

$681 = 681$ ✓

PRODUCT: 5

$$12 - \frac{j^2}{3} = -36$$

$$12 - \frac{j^2}{3} - 12 = -36 - 12$$

$$-\frac{j^2}{3} = -48$$

$$-3 \bullet \left(-\frac{j^2}{3}\right) = -48 \bullet (-3)$$

$$j^2 = 144$$

$$\sqrt{j^2} = \pm\sqrt{144}$$

$$j = \pm 12$$

$j = 12$ and $j = -12$

Check:

$12 - \frac{12^2}{3} \stackrel{?}{=} -36$ and $12 - \frac{(-12)^2}{3} \stackrel{?}{=} -36$

$12 - \frac{144}{3} \stackrel{?}{=} -36$ $\quad$ $12 - \frac{144}{3} \stackrel{?}{=} -36$

$12 - 48 \stackrel{?}{=} -36$ $\quad$ $12 - 48 \stackrel{?}{=} -36$

$-36 = -36$ ✓ $\quad$ $-36 = -36$ ✓

PRODUCT: 6

$$u^3 + 350 = -650$$

$$u^3 + 350 - 350 = -650 - 350$$

$$u^3 = -1000$$

$$\sqrt[3]{u^3} = \sqrt[3]{-1000}$$

$$u = -10$$

Check: $(-10)^3 + 350 \stackrel{?}{=} -650$

$-1000 + 350 \stackrel{?}{=} -650$

$-650 = -650$ ✓

PRODUCT: 8

$$(5 - x)^2 = 49$$

$$\sqrt{(5 - x)^2} = \pm\sqrt{49}$$

$$5 - x = \pm 7$$

$5 - x = 7$ $\quad$ $5 - x = -7$

$5 - x - 5 = 7 - 5$ $\quad$ $5 - x - 5 = -7 - 5$

$-x = 2$ $\quad$ $-x = -12$

$\frac{-x}{-1} = \frac{2}{-1}$ $\quad$ $\frac{-x}{-1} = \frac{-12}{-1}$

$x = -2$ and $x = 12$

Check: $(5 - (-2))^2 \stackrel{?}{=} 49$ $\quad$ $(5 - 12)^2 \stackrel{?}{=} 49$

$(5 + 2)^2 \stackrel{?}{=} 49$ $\quad$ $(-7)^2 \stackrel{?}{=} 49$

$7^2 \stackrel{?}{=} 49$ $\quad$ $49 = 49$ ✓

$49 = 49$ ✓

PRODUCT: 9

$$3q^3 = 96$$

$$\frac{3q^3}{3} = \frac{96}{3}$$

$$q^3 = 32$$

$$\sqrt[3]{q^3} = \sqrt[3]{32}$$

$$q = \sqrt[3]{32}$$

Check: $3\left(\sqrt[3]{32}\right)^3 \stackrel{?}{=} 96$

$3(32) \stackrel{?}{=} 96$

$96 = 96$ ✓

PRODUCT: 10

$$(2y + 1)^3 = -125$$

$$\sqrt[3]{(2y + 1)^3} = \sqrt[3]{-125}$$

$$2y + 1 = -5$$

$$2y + 1 - 1 = -5 - 1$$

$$2y = -6$$

$$\frac{2y}{2} = \frac{-6}{2}$$

$$y = -3$$

Check: $\left(2(-3)+1\right)^3 \stackrel{?}{=} -125$

$\left(-6+1\right)^3 \stackrel{?}{=} -125$

$\left(-5\right)^3 \stackrel{?}{=} -125$

$-125 = -125$ ✓

PRODUCT: 12

$2a^3 - 1 = 15$

$2a^3 - 1 + 1 = 15 + 1$

$2a^3 = 16$

$\frac{2a^3}{2} = \frac{16}{2}$

$a^3 = 8$

$\sqrt[3]{a^3} = \sqrt[3]{8}$

$a = 2$

Check:

$2\left(2\right)^3 - 1 \stackrel{?}{=} 15$

$2\left(8\right) - 1 \stackrel{?}{=} 15$

$16 - 1 \stackrel{?}{=} 15$

$15 = 15$ ✓

PRODUCT: 15

$4 + 2n^2 = -24$

$4 + 2n^2 - 4 = -24 - 4$

$2n^2 = -28$

$\frac{2n^2}{2} = \frac{-28}{2}$

$n^2 = -14$

$\sqrt{n^2} = \pm\sqrt{-14}$

$n = \pm\sqrt{-14}$

no solution

PRODUCT: 16

$\left(p+1\right)^2 = 196$

$\sqrt{\left(p+1\right)^2} = \pm\sqrt{196}$

$p + 1 = \pm 14$

$p + 1 = 14$

$p + 1 - 1 = 14 - 1$

$p = 13$

and

$p + 1 = -14$

$p + 1 - 1 = -14 - 1$

$p = -15$

Check: $\left(13+1\right)^2 \stackrel{?}{=} 196$

$\left(14\right)^2 \stackrel{?}{=} 196$

$196 = 196$ ✓

$\left(-15+1\right)^2 \stackrel{?}{=} 196$

$\left(-14\right)^2 \stackrel{?}{=} 196$

$196 = 196$ ✓

PRODUCT: 18

$\left(3+m\right)^3 = -1$

$\sqrt[3]{\left(3+m\right)^3} = \sqrt[3]{-1}$

$3 + m = -1$

$3 + m - 3 = -1 - 3$

$m = -4$

Check: $\left(3+\left(-4\right)\right)^3 \stackrel{?}{=} -1$

$\left(-1\right)^3 \stackrel{?}{=} -1$

$-1 = -1$ ✓

PRODUCT: 20

$4s^2 - 1 = 39$

$4s^2 - 1 + 1 = 39 + 1$

$4s^2 = 40$

$\frac{4s^2}{4} = \frac{40}{4}$

$s^2 = 10$

$\sqrt{s^2} = \pm\sqrt{10}$

$s = \pm\sqrt{10}$

$s = \sqrt{10}$ and $s = -\sqrt{10}$

Check: $4\left(\sqrt{10}\right)^2 - 1 \stackrel{?}{=} 39$

$4(10) - 1 \stackrel{?}{=} 39$

$40 - 1 \stackrel{?}{=} 39$

$39 = 39$ ✓

$4\left(-\sqrt{10}\right)^2 - 1 \stackrel{?}{=} 39$

$4(10) - 1 \stackrel{?}{=} 39$

$40 - 1 \stackrel{?}{=} 39$

$39 = 39$ ✓

PRODUCT: 24

$$3 + \frac{w^3}{6} = 7$$

$$3 + \frac{w^3}{6} - 3 = 7 - 3$$

$$\frac{w^3}{6} = 4$$

$$6 \bullet \frac{w^3}{6} = 4 \bullet 6$$

$$w^3 = 24$$

$$\sqrt[3]{w^3} = \sqrt[3]{24}$$

$$w = \sqrt[3]{24}$$

Check: $3 + \frac{\left(\sqrt[3]{24}\right)^3}{6} \stackrel{?}{=} 7$

$3 + \frac{24}{6} \stackrel{?}{=} 7$

$3 + 4 \stackrel{?}{=} 7$

$7 = 7$ ✓

PRODUCT: 25

$$(3j)^3 = -27$$

$$\sqrt[3]{(3j)^3} = \sqrt[3]{-27}$$

$$3j = -3$$

$$\frac{3j}{3} = \frac{-3}{3}$$

$$j = -1$$

Check: $(3(-1))^3 \stackrel{?}{=} -27$

$(-3)^3 \stackrel{?}{=} -27$

$-27 = -27$ ✓

PRODUCT: 30

$$6 + 2d^2 = -20$$

$$6 + 2d^2 - 6 = -20 - 6$$

$$2d^2 = -26$$

$$\frac{2d^2}{2} = \frac{-26}{2}$$

$$d^2 = -13$$

$$\sqrt{d^2} = \pm\sqrt{-13}$$

$$d = \pm\sqrt{-13}$$

no solution

PRODUCT: 36

$$3 + r^3 = 13$$

$$3 + r^3 - 3 = 13 - 3$$

$$r^3 = 10$$

$$\sqrt[3]{r^3} = \sqrt[3]{10}$$

$$r = \sqrt[3]{10}$$

Check: $3 + \left(\sqrt[3]{10}\right)^3 \stackrel{?}{=} 13$

$3 + 10 \stackrel{?}{=} 13$

$13 = 13$ ✓

REVIEW

1. a. $2\overline{)162}$ $3\overline{)405}$
$3\overline{)81}$ $3\overline{)135}$
$3\overline{)27}$ $3\overline{)45}$
$3\overline{)9}$ $3\overline{)15}$
3 5

LCM: $2 \bullet 3 \bullet 3 \bullet 3 \bullet 3 \bullet 5 = 810$

b. $\frac{11}{162} + \frac{113}{405} = \frac{55}{810} + \frac{226}{810} = \frac{281}{810}$

2. a. $\sqrt{3u+1} - 18 = -8$
$\sqrt{3u+1} - 18 + 18 = -8 + 18$
$\sqrt{3u+1} = 10$
$\left(\sqrt{3u+1}\right)^2 = 10^2$
$3u + 1 = 100$
$3u + 1 - 1 = 100 - 1$
$3u = 99$
$\frac{3u}{3} = \frac{99}{3}$
$u = 33$

b. $\sqrt{3(33)+1} - 18 \stackrel{?}{=} -8$
$\sqrt{99+1} - 18 \stackrel{?}{=} -8$
$\sqrt{100} - 18 \stackrel{?}{=} -8$
$10 - 18 \stackrel{?}{=} -8$
$-8 = -8$ ✓

no

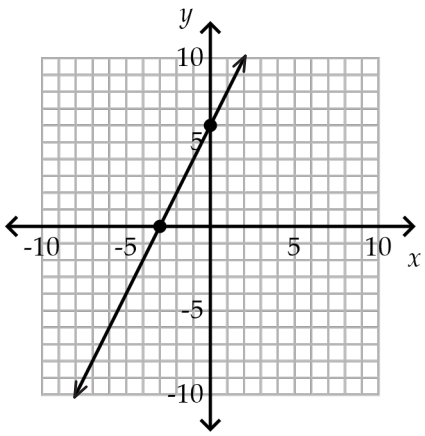
3. $\frac{40 - 4^3}{3\left(2^3 + 19 \bullet 0\right)} - 7$
$= \frac{40 - 64}{3\left(8 + 19 \bullet 0\right)} - 7$
$= \frac{-24}{3\left(8 + 0\right)} - 7$
$= \frac{-24}{3(8)} - 7$
$= \frac{-24}{24} - 7$
$= -1 - 7$
$= -8$

4. $12x - 6y = -36$
$12x - 6(0) = -36$
$12x = -36$
$\frac{12x}{12} = \frac{-36}{12}$
$x = -3$

x-intercept: $(-3, 0)$

$12x - 6y = -36$
$12(0) - 6y = -36$
$-6y = -36$
$\frac{-6y}{-6} = \frac{-36}{-6}$
$y = 6$

y-intercept: $(0, 6)$



The Pythagorean Theorem

WARM-UP

$$(8+c)^2 - 15 = 34$$
$$(8+c)^2 - 15 + 15 = 34 + 15$$
$$(8+c)^2 = 49$$
$$\sqrt{(8+c)^2} = \pm\sqrt{49}$$
$$8 + c = \pm 7$$

$8 + c = 7$ and $8 + c = -7$

$8 + c - 8 = 7 - 8$ and $8 + c - 8 = -7 - 8$

$c = -1$ and $c = -15$

PRACTICE

1. a. $5^2 + 12^2 = 25 + 144 = 169$

   $13^2 = 169$

   b. $5 \bullet 3 = 15 \quad 12 \bullet 3 = 36 \quad 13 \bullet 3 = 39$

   c. $15^2 + 36^2 = 225 + 1296 = 1521$

   $39^2 = 1521$

   yes

2. a. $a^2 + b^2 = c^2$

   $4^2 + 7^2 \stackrel{?}{=} 8^2$

   $16 + 49 \stackrel{?}{=} 64$

   $65 \neq 64$

   no

   b. $a^2 + b^2 = c^2$

   $20^2 + 21^2 \stackrel{?}{=} 29^2$

   $400 + 441 \stackrel{?}{=} 841$

   $841 = 841$

   yes

3. $a^2 + b^2 = c^2$

   $3^2 + 2^2 \stackrel{?}{=} 4^2$

   $9 + 4 \stackrel{?}{=} 16$

   $13 \neq 16$

   no

4. a. c^2

   e. a^2

   f. b^2

   g. $a^2 + b^2$

   h. $c^2 = a^2 + b^2$

REVIEW

1. a. y-intercept: $(0,0)$

Zero pounds of wheat are needed for zero people.

b. Slope: 400

400 pounds of wheat storage per person are recommended.

c. $(6,2400)$

6 people

2. $$82+c^3=-43$$
$$82+c^3-82=-43-82$$
$$c^3=-125$$
$$\sqrt[3]{c^3}=\sqrt[3]{-125}$$
$$c=-5$$

Check: $82+(-5)^3 \stackrel{?}{=} -43$

$82+(-125) \stackrel{?}{=} -43$

$-43=-43$ ✓

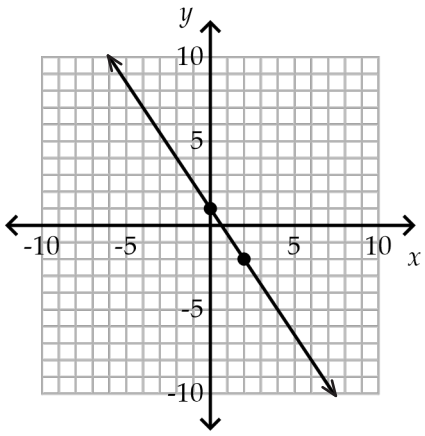
3. $$2x+3y=-9$$
$$2x+3y-2x=-9-2x$$
$$3y=-9-2x$$
$$\frac{3y}{3}=\frac{-9-2x}{3}$$
$$y=\frac{-9}{3}-\frac{2x}{3}$$
$$y=-3-\frac{2}{3}x$$
$$y=-\frac{2}{3}x-3$$

Slope: $-\frac{2}{3}$ y-intercept: $(0,-3)$

4. $m=-\frac{3}{2}$

$$y=mx+b$$
$$4=\left(-\frac{3}{2}\right)(-2)+b$$
$$4=3+b$$
$$4-3=3+b-3$$
$$1=b$$

Equation: $y=-\frac{3}{2}x+1$



Using the Pythagorean Theorem

WARM-UP

a. $6^2 + 8^2 \stackrel{?}{=} 12^2$

$36 + 64 \stackrel{?}{=} 144$

$100 \neq 144$

no

b. $8^2 + 15^2 \stackrel{?}{=} 17^2$

$64 + 225 \stackrel{?}{=} 289$

$289 = 289$ ✓

yes

PRACTICE

1. Detailed solutions are shown below.

First Leg	Second Leg	Hypotenuse
7 m	**A** 24 m	25 m
B 12 yd	5 yd	13 yd
$\sqrt{6}$ km	3 km	**C** 3.87 km

A

$a^2 + b^2 = c^2$

$7^2 + b^2 = 25^2$

$49 + b^2 = 625$

$49 + b^2 - 49 = 625 - 49$

$b^2 = 576$

$\sqrt{b^2} = \sqrt{576}$

$b = 24$

B

$a^2 + b^2 = c^2$

$a^2 + 5^2 = 13^2$

$a^2 + 25 = 169$

$a^2 + 25 - 25 = 169 - 25$

$a^2 = 144$

$\sqrt{a^2} = \sqrt{144}$

$a = 12$

C

$a^2 + b^2 = c^2$

$\left(\sqrt{6}\right)^2 + 3^2 = c^2$

$6 + 9 = c^2$

$15 = c^2$

$\sqrt{15} = \sqrt{c^2}$

$\sqrt{15} = c$

$3.87 \approx c$

2. a.

$a^2 + b^2 = c^2$

$9^2 + b^2 = 12^2$

$81 + b^2 = 144$

$81 + b^2 - 81 = 144 - 81$

$b^2 = 63$

$\sqrt{b^2} = \sqrt{63}$

$b = \sqrt{63}$

$b \approx 7.94$

7.94 m

b. $a^2 + b^2 = c^2$

$3^2 + 7^2 = c^2$

$9 + 49 = c^2$

$58 = c^2$

$\sqrt{58} = \sqrt{c^2}$

$\sqrt{58} = c$

$7.62 \approx c$

7.62 mi

c. $a^2+b^2=c^2$

$a^2+5^2=8^2$

$a^2+25=64$

$a^2+25-25=64-25$

$a^2=39$

$\sqrt{a^2}=\sqrt{39}$

$a=\sqrt{39}$

$a\approx 6.24$

6.24 mm

3. $a^2+b^2=c^2$

$800^2+1500^2=c^2$

$640{,}000+2{,}250{,}000=c^2$

$2{,}890{,}000=c^2$

$\sqrt{2{,}890{,}000}=\sqrt{c^2}$

$1700=c$

1700 ft

4. $a^2+b^2=c^2$

$a^2+12^2=26^2$

$a^2+144=676$

$a^2+144-144=676-144$

$a^2=532$

$\sqrt{a^2}=\sqrt{532}$

$a=\sqrt{532}$

$a\approx 23.07$

23.07 inches

5. $a^2+b^2=c^2$

$a^2+a^2=5^2$

$2a^2=25$

$\frac{2a^2}{2}=\frac{25}{2}$

$a^2=\frac{25}{2}$

$\sqrt{a^2}=\sqrt{\frac{25}{2}}$

$a=\sqrt{\frac{25}{2}}$

$a\approx 3.54$

3.54 m

REVIEW

1. $3x-7y=21$

$3x-7(0)=21$

$3x=21$

$\frac{3x}{3}=\frac{21}{3}$

$x=7$

x-intercept: $(7,0)$

$3x-7y=21$

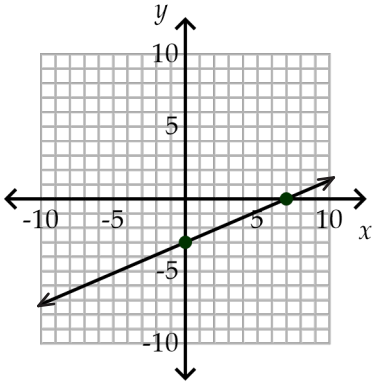
$3(0)-7y=21$

$-7y=21$

$\frac{-7y}{-7}=\frac{21}{-7}$

$y=-3$

y-intercept: $(0,-3)$



2. a. $\frac{\sqrt[3]{7n-15}}{2}=-2$

$2\bullet\frac{\sqrt[3]{7n-15}}{2}=-2\bullet 2$

$\sqrt[3]{7n-15}=-4$

$\left(\sqrt[3]{7n-15}\right)^3=(-4)^3$

$7n-15=-64$

$7n-15+15=-64+15$

$7n=-49$

$\frac{7n}{7}=\frac{-49}{7}$

$n=-7$

b. Check:

$$\frac{\sqrt[3]{7(-7)-15}}{2} \stackrel{?}{=} -2$$

$$\frac{\sqrt[3]{-49-15}}{2} \stackrel{?}{=} -2$$

$$\frac{\sqrt[3]{-64}}{2} \stackrel{?}{=} -2$$

$$\frac{-4}{2} \stackrel{?}{=} -2$$

$$-2 = -2 \checkmark$$

no

3. a. y-intercept: $(0,45)$

Arturo bench-presses 45 pounds now.

b. Slope: 10

Arturo will increase the weight he can bench-press by 10 pounds each month.

c. $(5,95)$

5 months

4. $24^2 + 18^2 = 576 + 324 = 900$

$29^2 = 841$

no

Distance on a Coordinate Plane

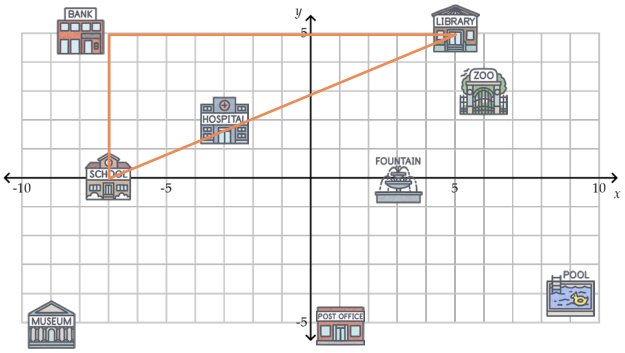
WARM-UP

$$a^2 + b^2 = c^2$$
$$3^2 + b^2 = 5^2$$
$$9 + b^2 = 25$$
$$9 + b^2 - 9 = 25 - 9$$
$$b^2 = 16$$
$$\sqrt{b^2} = \sqrt{16}$$
$$b = 4$$

4 in

PRACTICE

1. Note: Graphing is not required for this problem. The relevant triangle is outlined on the graph below for reference.



a. $5 - (-7) = 12$

12 units

b. $5 - 0 = 5$

5 units

c. $d = \sqrt{12^2 + 5^2}$

$d = \sqrt{144 + 25}$

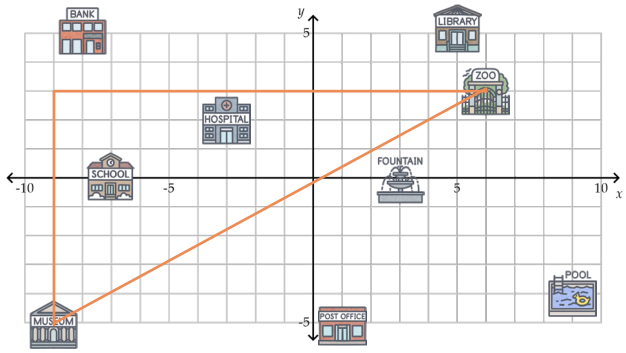
$d = \sqrt{169}$

$d = 13$

13 units

d. $\left(\frac{-7+5}{2}, \frac{0+5}{2}\right) = \left(\frac{-2}{2}, \frac{5}{2}\right) = \left(-1, 2\frac{1}{2}\right)$

2. Note: Graphing is not required for this problem. The relevant triangle is outlined on the graph below for reference.



a. $6 - (-9) = 15$

15 units

b. $3 - (-5) = 8$

8 units

c. $d = \sqrt{15^2 + 8^2}$

$d = \sqrt{225 + 64}$

$d = \sqrt{289}$

$d = 17$

17 units

d. $\left(\frac{-9+6}{2}, \frac{-5+3}{2}\right) = \left(\frac{-3}{2}, \frac{-2}{2}\right) = \left(-1\frac{1}{2}, -1\right)$

3. $(3,0)$ and $(9,-4)$

$$d=\sqrt{(y_2-y_1)^2+(x_2-x_1)^2}$$
$$d=\sqrt{(-4-0)^2+(9-3)^2}$$
$$d=\sqrt{(-4)^2+(6)^2}$$
$$d=\sqrt{16+36}$$
$$d=\sqrt{52}$$

7.2 units

4. $(1,-5)$ and $(-8,5)$

$$d=\sqrt{(y_2-y_1)^2+(x_2-x_1)^2}$$
$$d=\sqrt{(5-(-5))^2+(-8-1)^2}$$
$$d=\sqrt{(10)^2+(-9)^2}$$
$$d=\sqrt{100+81}$$
$$d=\sqrt{181}$$

13.5 units

5. $(-3,2)$ and $(3,0)$

$$\left(\frac{-3+3}{2},\frac{2+0}{2}\right)=\left(\frac{0}{2},\frac{2}{2}\right)=(0,1)$$

REVIEW

1. $(n+7)^2 = 225$

$\sqrt{(n+7)^2} = \pm\sqrt{225}$

$n+7 = \pm 15$

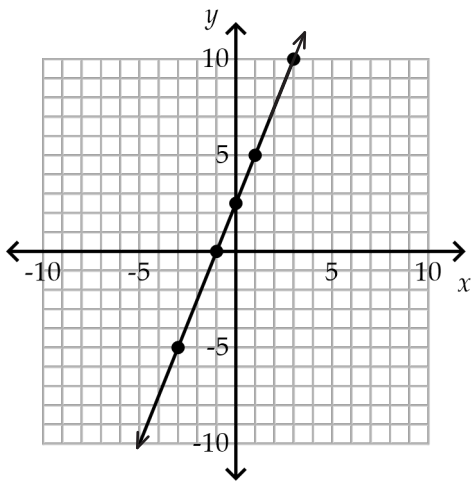
$n+7 = 15$ and $n+7 = -15$

$n+7-7 = 15-7$ and $n+7-7 = -15-7$

$n = 8$ and $n = -22$

2. $y = 2.5(x+1)$

x	y	
–3	–5	$y = 2.5(-3+1) = 2.5(-2) = -5$
–1	0	$y = 2.5(-1+1) = 2.5(0) = 0$
0	2.5	$y = 2.5(0+1) = 2.5(1) = 2.5$
1	5	$y = 2.5(1+1) = 2.5(2) = 5$
3	10	$y = 2.5(3+1) = 2.5(4) = 10$



yes

3. Rule: Subtract $4\frac{1}{2}$ from the input.

Equation: $y = x - 4\frac{1}{2}$

4. a. They should use the 50-foot ladder. In a right triangle, the hypotenuse is the longest side. If the window is 40 feet above ground, the length of the ladder must be greater than 40 feet.

b. $a^2 + b^2 = c^2$

$40^2 + 10^2 = c^2$

$1600 + 100 = c^2$

$1700 = c^2$

$\sqrt{1700} = \sqrt{c^2}$

$\sqrt{1700} = c$

$41.23 \approx c$

41.23 feet

Parts and Wholes with Fractions

WARM-UP

a. $3+(-5)+1+(-2)=-3$

b. $-2+6+1+(-5)=0$

PRACTICE

1. a. $\frac{3}{4}\bullet 28=21$

   b. When 28 is split into 4 equal groups, each group contains 7. Therefore, the total amount in 3 groups is 21.

2. a. $\frac{7}{5}\bullet 40=56$

   b. When 40 is split into 5 equal groups, each group contains 8. Therefore, the total amount in 7 groups is 56.

3. $\frac{3}{8}\bullet 24=9$

   9 aisles

4. a. $\frac{5}{2}\bullet x=60$

   $\frac{2}{5}\bullet\frac{5}{2}\bullet x=60\bullet\frac{2}{5}$

   $x=24$

   b. When 24 is split into 2 equal groups, each group contains 12. Therefore, the total amount in 5 groups is 60.

5. a. $\frac{5}{6}\bullet x=75$

   $\frac{6}{5}\bullet\frac{5}{6}\bullet x=75\bullet\frac{6}{5}$

   $x=90$

   b. When 90 is split into 6 equal groups, each group contains 15. Therefore, the total amount in 5 groups is 75.

6. $\frac{2}{3}\bullet x=100$

   $\frac{3}{2}\bullet\frac{2}{3}\bullet x=100\bullet\frac{3}{2}$

   $x=150$

   150 pounds of bananas

7. a. $x\bullet 45=21$

   $\frac{x\bullet 45}{45}=\frac{21}{45}$

   $x=\frac{21}{45}=\frac{7}{15}$

   b. When 45 is split into 15 equal groups, each group contains 3. Therefore, the total amount in 7 groups is 21.

8. a. $x\bullet 75=30$

   $\frac{x\bullet 75}{75}=\frac{30}{75}$

   $x=\frac{30}{75}=\frac{2}{5}$

   b. When 75 is split into 5 equal groups, each group contains 15. Therefore, the total amount in 2 groups is 30.

9. $x\bullet 77=56$

   $\frac{x\bullet 77}{77}=\frac{56}{77}$

   $x=\frac{56}{77}=\frac{8}{11}$

10. #1 $\frac{6}{5} \cdot 110 = 132$

#4 $x \cdot 30 = 21$

$\frac{x \cdot 30}{30} = \frac{21}{30}$

$x = \frac{21}{30} = \frac{7}{10}$

#6 $\frac{7}{12} \cdot x = 42$

$\frac{12}{7} \cdot \frac{7}{12} \cdot x = 42 \cdot \frac{12}{7}$

$x = 72$

#2 $x \cdot 165 = 132$

$\frac{x \cdot 165}{165} = \frac{132}{165}$

$x = \frac{132}{165} = \frac{4}{5}$

#7 $\frac{8}{3} \cdot 72 = 192$

#3 $\frac{4}{5} \cdot x = 24$

$\frac{5}{4} \cdot \frac{4}{5} \cdot x = 24 \cdot \frac{5}{4}$

$x = 30$

#5 $\frac{7}{10} \cdot 60 = 42$

REVIEW

1. a. $y = kx$

$k = 15$

The cost of each ticket to the aerospace museum is $15.

b. When $x = 1$, $y = 80$.

$k = 80$

The cost of each ticket to the amusement park is $80.

$y = kx$

$y = 80x$

c. Aerospace museum: $15 \cdot 5 = $75

Amusement park: $80 \cdot 5 = $400

2. $-3(2r - 8) + 15 = -(11r - 24) - 30$

$-6r + 24 + 15 = -11r + 24 - 30$

$-6r + 39 = -11r - 6$

$-6r + 39 + 11r = -11r - 6 + 11r$

$5r + 39 = -6$

$5r + 39 - 39 = -6 - 39$

$5r = -45$

$\frac{5r}{5} = \frac{-45}{5}$

$r = -9$

3. $m = \frac{1}{3}$

$y = mx + b$

$2 = \frac{1}{3}(-15) + b$

$2 = -5 + b$

$2 + 5 = -5 + b + 5$

$7 = b$

Equation: $y = \frac{1}{3}x + 7$

4. 24 hours per day • 31 days = 744 hours

Fractions, Decimals, and Percents

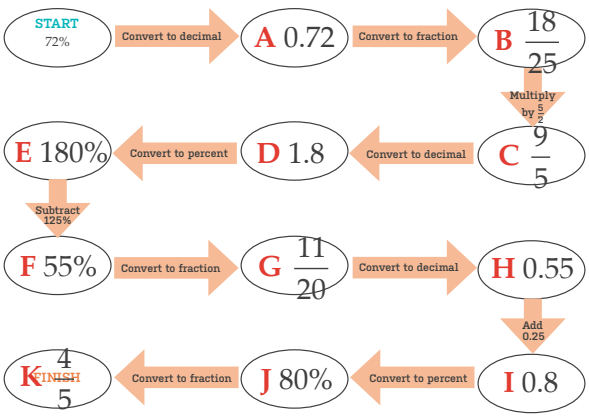
WARM-UP

$$x \cdot 75 = 45$$
$$\frac{x \cdot 75}{75} = \frac{45}{75}$$
$$x = \frac{3}{5}$$

Meaning: When 75 is split into 5 equal groups, the total in 3 of those groups is 45.

PRACTICE

1.



A $72 \div 100 = 0.72$

B $\frac{72}{100} = \frac{18}{25}$

C $\frac{18}{25} \cdot \frac{5}{2} = \frac{9}{5}$

D
$$5\overline{)9.0}\quad 1.8$$
$$-5$$
$$40$$
$$-40$$
$$0$$

E $1.8 \cdot 100 = 180$

F $180\% - 125\% = 55\%$

G $\frac{55}{100} = \frac{11}{20}$

H
$$20\overline{)11.00}\quad 0.55$$
$$-100$$
$$100$$
$$-100$$
$$0$$

I $0.55 + 0.25 = 0.8$

J $0.8 \cdot 100 = 80$

K $\frac{80}{100} = \frac{4}{5}$

2.
$$50\overline{)18.00}\quad 0.36$$
$$-150$$
$$300$$
$$-300$$
$$0$$

$0.36 \cdot 100 = 36$

36%

3. $\frac{74}{100} = \frac{37}{50}$

4. $1 - 0.8 = 0.2$

$0.2 = \frac{2}{10} = \frac{1}{5}$

5. $40\overline{)50.00}$ 1.25

-40

100

-80

200

-200

0

$1.25 = 125\%$

REVIEW

1. a. $-4\frac{5}{9} \bullet \frac{7}{8}$

$= -\frac{41}{9} \bullet \frac{7}{8}$

$= -\frac{287}{72} = -3\frac{71}{72}$

b. $14\frac{3}{5} \div 1\frac{1}{5}$

$= \frac{73}{5} \div \frac{6}{5}$

$= \frac{73}{5} \bullet \frac{5}{6}$

$= \frac{73}{6} = 12\frac{1}{6}$

2. a. $\frac{1}{3^{-3}}$

$= 3^3$

$= 27$

b. 10^{-5}

$= \frac{1}{10^5}$

$= \frac{1}{100{,}000}$

3. $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

$= \sqrt{(-8 - 13)^2 + (18 - 2)^2}$

$= \sqrt{(-21)^2 + (16)^2}$

$= \sqrt{441 + 256}$

$= \sqrt{697}$

26.4 units

4. $8\sqrt{9z + 22} = 88$

$\frac{8\sqrt{9z + 22}}{8} = \frac{88}{8}$

$\sqrt{9z + 22} = 11$

$\left(\sqrt{9z + 22}\right)^2 = 11^2$

$9z + 22 = 121$

$9z + 22 - 22 = 121 - 22$

$9z = 99$

$\frac{9z}{9} = \frac{99}{9}$

$z = 11$

5. $\frac{7}{3} \bullet x = 63$

$\frac{3}{7} \bullet \frac{7}{3} \bullet x = 63 \bullet \frac{3}{7}$

$x = 27$

Parts and Wholes with Percents

WARM-UP

Fraction: $4.65 = 4\frac{65}{100} = 4\frac{13}{20}$

Percent: $4.65 \bullet 100 = 465$

$465 = 465\%$

PRACTICE

1. $0.35 \bullet 25 = 8.75$

   8.75 lb

2. $x \bullet 56 = 3$

   $\frac{x \bullet 56}{56} = \frac{3}{56}$

   $x = \frac{3}{56} = 0.053571...$

   5.36%

3. $0.8 \bullet x = 900$

   $\frac{0.8 \bullet x}{0.8} = \frac{900}{0.8}$

   $x = 1125$

   1125 mL

4. $0.2 \bullet 50 = 10$

5. $x \bullet 40 = 24$

   $\frac{x \bullet 40}{40} = \frac{24}{40}$

   $x = 0.6$

   60%

6. $0.4 \bullet x = 56$

   $\frac{0.4 \bullet x}{0.4} = \frac{56}{0.4}$

   $x = 140$

7. $1.4 \bullet 25 = 35$

8. $2.5 \bullet x = 32$

   $\frac{2.5 \bullet x}{2.5} = \frac{32}{2.5}$

   $x = 12.8$

9. $0.06 \bullet 75 = 4.5$

10. $x \bullet 125 = 36$

    $\frac{x \bullet 125}{125} = \frac{36}{125}$

    $x = 0.288$

    28.8%

11. $0.3 \bullet x = 12$

    $\frac{0.3 \bullet x}{0.3} = \frac{12}{0.3}$

    $x = 40$

12. $x \bullet 1200 = 1455$

    $\frac{x \bullet 1200}{1200} = \frac{1455}{1200}$

    $x = 1.2125$

    121.25%

I don't usually make puns about fractions, but I will make one if…

I HALVE TWO!

REVIEW

1. a.
$$a^2 + b^2 = c^2$$
$$a^2 + 96^2 = 100^2$$
$$a^2 + 9216 = 10{,}000$$
$$a^2 + 9216 - 9216 = 10{,}000 - 9216$$
$$a^2 = 784$$
$$\sqrt{a^2} = \sqrt{784}$$
$$a = \sqrt{784}$$
$$a = 28$$

28 mm

b.
$$a^2 + b^2 = c^2$$
$$9^2 + 5^2 = c^2$$
$$81 + 25 = c^2$$
$$106 = c^2$$
$$\sqrt{106} = \sqrt{c^2}$$
$$\sqrt{106} = c$$
$$10.3 \approx c$$

10.3 in

2.
$$d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$
$$d = \sqrt{(12 - (-12))^2 + (5 - (-5))^2}$$
$$d = \sqrt{(24)^2 + (10)^2}$$
$$d = \sqrt{576 + 100}$$
$$d = \sqrt{676}$$
$$d = 26$$

26 units

3. $64\% = 0.64 = \frac{64}{100} = \frac{16}{25}$

4.
$$\frac{5}{8} \bullet x = 65$$
$$\frac{8}{5} \bullet \frac{5}{8} \bullet x = 65 \bullet \frac{8}{5}$$
$$x = 104$$

5.
$$8x - 9y = 36$$
$$8x - 9y - 8x = 36 - 8x$$
$$-9y = 36 - 8x$$
$$\frac{-9y}{-9} = \frac{36 - 8x}{-9}$$
$$y = -4 + \frac{8}{9}x$$
$$y = \frac{8}{9}x - 4$$

Slope: $\frac{8}{9}$ y-intercept: $(0, -4)$

Unit 2 Review

1. $2700 + 726t = 5400$

2. a.
$$\begin{aligned} 3x+1 &= 9-x \\ 3x+1+x &= 9-x+x \\ 4x+1 &= 9 \\ 4x+1-1 &= 9-1 \\ 4x &= 8 \\ \frac{4x}{4} &= \frac{8}{4} \\ x &= 2 \end{aligned}$$

b.
$$\begin{aligned} \frac{(7+19x)}{5} &= 3+4x \\ 5 \bullet \frac{(7+19x)}{5} &= (3+4x) \bullet 5 \\ 7+19x &= 15+20x \\ 7+19x-19x &= 15+20x-19x \\ 7 &= 15+x \\ 7-15 &= 15+x-15 \\ -8 &= x \end{aligned}$$

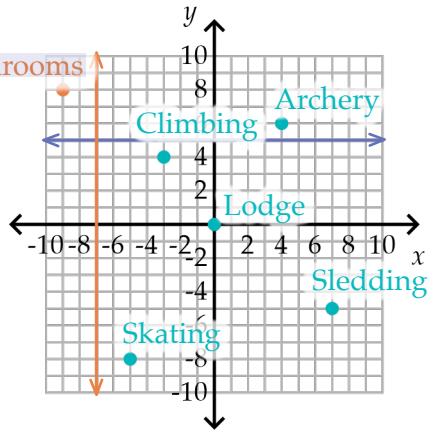
3.
$$\begin{aligned} P &= \frac{3}{2}A+5 \\ P-5 &= \frac{3}{2}A+5-5 \\ P-5 &= \frac{3}{2}A \\ \frac{2}{3} \bullet (P-5) &= \frac{3}{2}A \bullet \frac{2}{3} \\ \frac{2}{3}(P-5) &= A \end{aligned}$$

4. a. Archery: I Climbing: II
Sledding: IV Skating: III

b. Skating: $(-5,-8)$ Lodge: $(0,0)$

c. Purple: $y = 5$ Orange: $x = -7$

d.



5. a. Domain: $\{13, 14, 15\}$
Range: $\{\text{Cabin 1, Cabin 2, Cabin 3}\}$

b. no
The input of 13 has two outputs.

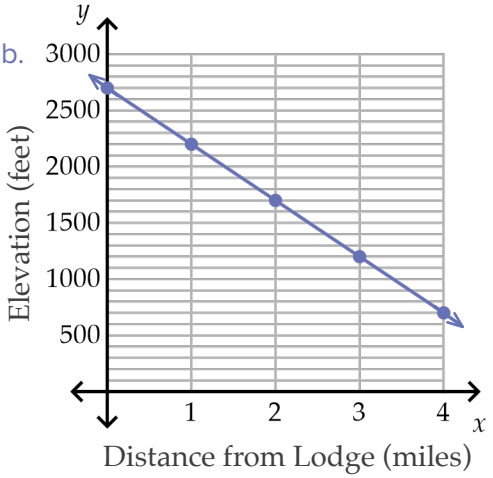
c. Independent variable: age
Dependent variable: cabin number

6. Rule: Multiply the input by $\frac{2}{5}$.
Equation: $y = \frac{2}{5}x$

7. a.

x	y	
0	2700	$-500 \bullet 0 + 2700 = 0 + 2700 = 2700$
1	2200	$-500 \bullet 1 + 2700 = -500 + 2700 = 2200$
2	1700	$-500 \bullet 2 + 2700 = -1000 + 2700 = 1700$
3	1200	$-500 \bullet 3 + 2700 = -1500 + 2700 = 1200$
4	700	$-500 \bullet 4 + 2700 = -2000 + 2700 = 700$

b.



8. a. Function? yes
Linear? yes
Proportional? yes

b. Function? yes
Linear? no
Proportional? no

9. $y = 3x + 5$ $\quad y = x^2 - 1$ $\quad 1 + y = \frac{1}{2}x$

$2x - 5y = 4$ $\quad 2x^2 - 5y^2 = 4$ $\quad y = |x|$

10. a. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{5-7}{7-1}$

$= \frac{-2}{6}$

$= -\frac{1}{3}$

b. $y = mx + b$

$7 = -\frac{1}{3}(1) + b$

$7 = -\frac{1}{3} + b$

$7 + \frac{1}{3} = -\frac{1}{3} + b + \frac{1}{3}$

$7\frac{1}{3} = b$

$y = -\frac{1}{3}x + 7\frac{1}{3}$

11. a. $m = \frac{\text{rise}}{\text{run}} = \frac{40}{5} = 8$

b. $(0, 30)$

c. $y = 8x + 30$

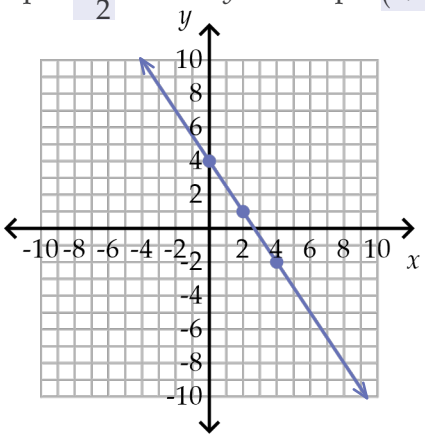
12. a. $y - (-3) = 5(x - 4)$

$y + 3 = 5(x - 4)$

b. $y - (-3) = -\frac{1}{5}(x - 4)$

$y + 3 = -\frac{1}{5}(x - 4)$

13. Slope: $-\frac{3}{2}$ $\quad y$-intercept: $(0, 4)$



14. a. $3\sqrt{a} + 1 = 13$

$3\sqrt{a} + 1 - 1 = 13 - 1$

$3\sqrt{a} = 12$

$\frac{3\sqrt{a}}{3} = \frac{12}{3}$

$\sqrt{a} = 4$

$(\sqrt{a})^2 = 4^2$

$a = 16$

Check:

$3\sqrt{16} + 1 \stackrel{?}{=} 13$

$3(4) + 1 \stackrel{?}{=} 13$

$12 + 1 \stackrel{?}{=} 13$

$13 = 13$ ✓

b. $1 - \sqrt[3]{b} = -3$

$1 - \sqrt[3]{b} - 1 = -3 - 1$

$-\sqrt[3]{b} = -4$

$\frac{-\sqrt[3]{b}}{-1} = \frac{-4}{-1}$

$\sqrt[3]{b} = 4$

$(\sqrt[3]{b})^3 = 4^3$

$b = 64$

Check:

$1 - \sqrt[3]{64} \stackrel{?}{=} -3$

$1 - 4 \stackrel{?}{=} -3$

$-3 = -3$ ✓

c. $(2c - 4)^2 = 100$

$\sqrt{(2c-4)^2} = \pm\sqrt{100}$

$2c - 4 = \pm 10$

$2c - 4 = 10$ $\quad$ $2c - 4 = -10$

$2c - 4 + 4 = 10 + 4$ $\quad$ $2c - 4 + 4 = -10 + 4$

$2c = 14$ $\quad$ $2c = -6$

$\frac{2c}{2} = \frac{14}{2}$ $\quad$ $\frac{2c}{2} = \frac{-6}{2}$

$c = 7$ $\quad$ $c = -3$

The number of snowballs Clarice made cannot be negative.

d. $\frac{d^3}{24} = 9$

$24 \bullet \frac{d^3}{24} = 9 \bullet 24$

$d^3 = 216$

$\sqrt[3]{d^3} = \sqrt[3]{216}$

$d = 6$

15. a. $6^2 + 8^2 \stackrel{?}{=} 9^2$

$36 + 64 \stackrel{?}{=} 81$

$100 \neq 81$

no

b. $a^2 + b^2 = c^2$

$4^2 + b^2 = 7^2$

$16 + b^2 = 49$

$16 + b^2 - 16 = 49 - 16$

$b^2 = 33$

$\sqrt{b^2} = \sqrt{33}$

$b = \sqrt{33}$

$b \approx 5.74$

5.74 in

16. a. $6x + 4y = 12$

$6x + 4(0) = 12$

$6x = 12$

$\frac{6x}{6} = \frac{12}{6}$

$x = 2$

$6x + 4y = 12$

$6(0) + 4y = 12$

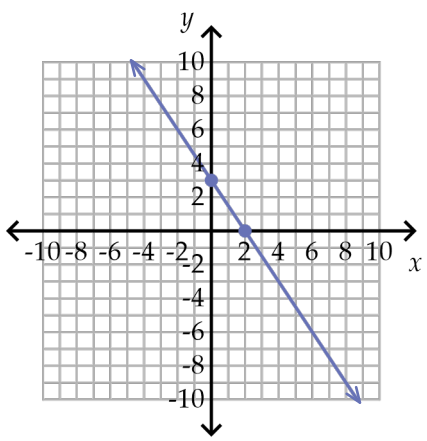
$4y = 12$

$\frac{4y}{4} = \frac{12}{4}$

$y = 3$

x-intercept: $(2,0)$ y-intercept: $(0,3)$

b.



c. $6x + 4y = 12$

$6x + 4y - 6x = 12 - 6x$

$4y = 12 - 6x$

$\frac{4y}{4} = \frac{12 - 6x}{4}$

$y = \frac{12}{4} - \frac{6}{4}x$

$y = 3 - \frac{3}{2}x$

$y = -\frac{3}{2}x + 3$

17. a. Note: Letters chosen for variables may vary, but the definitions should be similar.

Let w be the number of miles a horse walks.

Let h be the pounds of hay the horse is fed.

b. $b = 10$ $m = \frac{1}{5}$

c. $h = \frac{1}{5}w + 10$

d. $h = \frac{1}{5}w + 10$

$13 = \frac{1}{5}w + 10$

$13 - 10 = \frac{1}{5}w + 10 - 10$

$3 = \frac{1}{5}w$

$5 \bullet 3 = \frac{1}{5}w \bullet 5$

$15 = w$

15 miles

18. a. $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

$d = \sqrt{(-4 - 4)^2 + (7 - (-3))^2}$

$d = \sqrt{(-8)^2 + (10)^2}$

$d = \sqrt{64 + 100}$

$d = \sqrt{164}$

$d \approx 12.81$

12.81 units

b. $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$=\left(\frac{-3+7}{2}, \frac{4+(-4)}{2}\right)$

$=\left(\frac{4}{2}, \frac{0}{2}\right)$

$=(2,0)$

19. a. $\frac{2}{5} \bullet 80 = 32$

32 Douglas fir trees

b. $\frac{3}{8} \bullet x = 6$

$\frac{8}{3} \bullet \frac{3}{8} \bullet x = 6 \bullet \frac{8}{3}$

$x = 16$

16 animals

c. $80\overline{)36.00}$ 0.45

-320

400

-400

0

$0.45 \bullet 100 = 45$

45%

d. $\frac{15}{100} = \frac{3}{20}$

20. a. $0.36 \bullet x = 63$

$\frac{0.36 \bullet x}{0.36} = \frac{63}{0.36}$

$x = 175$

175 cars

b. $x \bullet 20 = 31$

$\frac{x \bullet 20}{20} = \frac{31}{20}$

$x = 1.55$

155%

c. $0.05 \bullet 2.40 = 0.12$

$2.40 + 0.12 = 2.52$

$2.52

Unit 2 Assessment

1. a. $3x+18-2x=9x-30$
$x+18=9x-30$
$x+18-x=9x-30-x$
$18=8x-30$
$18+30=8x-30+30$
$48=8x$
$\frac{48}{8}=\frac{8x}{8}$
$6=x$

b. $5(a-12)=3a+25$
$5a-60=3a+25$
$5a-60-3a=3a+25-3a$
$2a-60=25$
$2a-60+60=25+60$
$2a=85$
$\frac{2a}{2}=\frac{85}{2}$
$a=42.5$

c. $\frac{36-p}{4}=p-1$
$4\bullet\frac{36-p}{4}=(p-1)\bullet 4$
$36-p=4p-4$
$36-p+p=4p-4+p$
$36=5p-4$
$36+4=5p-4+4$
$40=5p$
$\frac{40}{5}=\frac{5p}{5}$
$8=p$

2. a. $2m+10$

b. $8m-2$

c. $2m+10=8m-2$
$2m+10-2m=8m-2-2m$
$10=6m-2$
$10+2=6m-2+2$
$12=6m$
$\frac{12}{6}=\frac{6m}{6}$
$2=m$

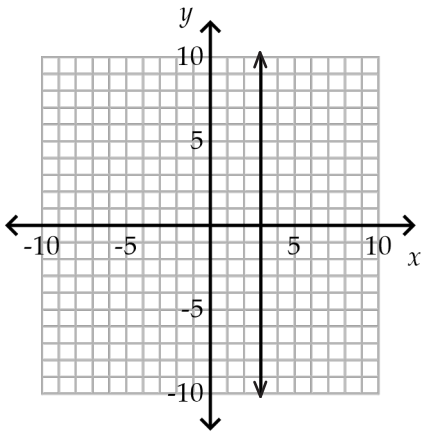
$2 per extra chore

3. a. $A=lw$
$\frac{A}{l}=\frac{lw}{l}$
$\frac{A}{l}=w$

b. $w=\frac{A}{l}$
$w=\frac{27}{9}$
$w=3$

3 ft

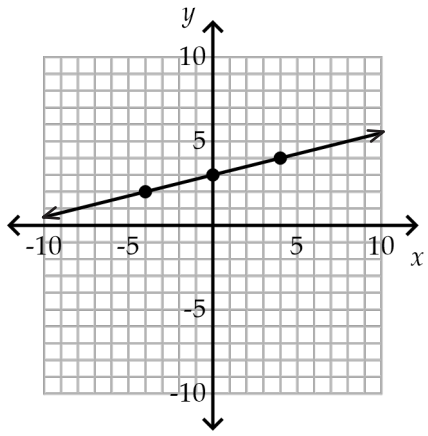
4.



5. $\{(0,a),(0,f),(1,b),(2,d),(3,c),(4,b),(5,f)\}$

6. Rule: Multiply the input by $\frac{1}{2}$.
Equation: $y=\frac{1}{2}x$

7.



linear

8. a.

Change in x	x	y	Change in y
	–5	–2.5	
+3	–2	–1	+1.5
+3	1	0.5	+1.5
+3	4	2	+1.5
+3	7	3.5	+1.5

b. yes

c. yes

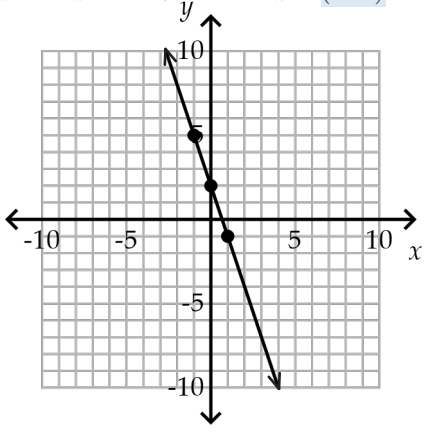
9. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$= \dfrac{-3-11}{-5-3}$

$= \dfrac{-14}{-8}$

$= \dfrac{14}{8} = \dfrac{7}{4}$

10. Slope: -3 y-intercept: $(0,2)$



11. Point-slope form: $y+1=\frac{3}{2}(x-4)$

$y+1=\frac{3}{2}(x-4)$

$y+1=\frac{3}{2}x-6$

$y+1-1=\frac{3}{2}x-6-1$

$y=\frac{3}{2}x-7$

Slope-intercept form: $y=\frac{3}{2}x-7$

12. $m=\dfrac{-4-(-7)}{0-(-4)}=\dfrac{3}{4}$

$y=\frac{3}{4}x+b$

$-4=\frac{3}{4}(0)+b$

$-4=b$

$y=\frac{3}{4}x-4$

13. Cost: $3/pound

Equation: $y=3x$

14. a.

$4x+3y=24$

$4x+3(0)=24$

$4x=24$

$\frac{4x}{4}=\frac{24}{4}$

$x=6$

x-intercept: $(6,0)$

$4x+3y=24$

$4(0)+3y=24$

$3y=24$

$\frac{3y}{3}=\frac{24}{3}$

$y=8$

y-intercept: $(0,8)$

b.

$-x+y=-36$

$-x+0=-36$

$-x=-36$

$x=36$

x-intercept: $(36,0)$

$-x+y=-36$

$-0+y=-36$

$y=-36$

y-intercept: $(0,-36)$

15. $4x+6y=18$

$4x+6y-4x=18-4x$

$6y=18-4x$

$\frac{6y}{6}=\frac{18-4x}{6}$

$y=3-\frac{2}{3}x$

$y=-\frac{2}{3}x+3$

16. a. Let x be the number of weeks.

Let y be the pounds of flour she has left.

b. 5

c. $-\frac{1}{2}$

d. $y=-\frac{1}{2}x+5$

e. $y=-\frac{1}{2}x+5$

$0=-\frac{1}{2}x+5$

$0-5=-\frac{1}{2}x+5-5$

$-5=-\frac{1}{2}x$

$(-2)\bullet -5=-\frac{1}{2}x\bullet(-2)$

$10=x$

10 weeks

17. a. perpendicular

b. neither

c. parallel

18. a. $3+\sqrt{x+8}=4$

$3+\sqrt{x+8}-3=4-3$

$\sqrt{x+8}=1$

$\left(\sqrt{x+8}\right)^2=1^2$

$x+8=1$

$x+8-8=1-8$

$x=-7$

Check:

$3+\sqrt{(-7)+8}\stackrel{?}{=}4$

$3+\sqrt{1}\stackrel{?}{=}4$

$3+1\stackrel{?}{=}4$

$4=4\checkmark$

b. $10-\sqrt[3]{c}=13$

$10-\sqrt[3]{c}-10=13-10$

$-\sqrt[3]{c}=3$

$(-1)\bullet -\sqrt[3]{c}=3\bullet(-1)$

$\sqrt[3]{c}=-3$

$\left(\sqrt[3]{c}\right)^3=(-3)^3$

$c=-27$

Check:

$10-\sqrt[3]{-27}\stackrel{?}{=}13$

$10-(-3)\stackrel{?}{=}13$

$13=13\checkmark$

c. $\sqrt{z-60}+8=-7$

$\sqrt{z-60}+8-8=-7-8$

$\sqrt{z-60}=-15$

$\left(\sqrt{z-60}\right)^2=(-15)^2$

$z-60=225$

$z-60+60=225+60$

$z=285$

Check:

$\sqrt{285-60}+8\stackrel{?}{=}-7$

$\sqrt{225}+8\stackrel{?}{=}-7$

$15+8\stackrel{?}{=}-7$

$23\neq -7$

no solution

d. $t^2+26=90$

$t^2+26-26=90-26$

$t^2=64$

$\sqrt{t^2}=\pm\sqrt{64}$

$t=\pm 8$

$t=8$ and $t=-8$

Check:

$8^2+26\stackrel{?}{=}90$

$64+26\stackrel{?}{=}90$

$90=90\checkmark$

$(-8)^2+26\stackrel{?}{=}90$

$64+26\stackrel{?}{=}90$

$90=90\checkmark$

19. a. $a^2 + b^2 = c^2$

$7^2 + 8^2 \stackrel{?}{=} 12^2$

$49 + 64 \stackrel{?}{=} 144$

$113 \neq 144$

no

b. $a^2 + b^2 = c^2$

$4^2 + 3^3 \stackrel{?}{=} 5^2$

$16 + 9 \stackrel{?}{=} 25$

$25 = 25$ ✓

yes

20. $a^2 + b^2 = c^2$

$a^2 + 12^2 = 13^2$

$a^2 + 144 = 169$

$a^2 + 144 - 144 = 169 - 144$

$a^2 = 25$

$\sqrt{a^2} = \sqrt{25}$

$a = 5$

5 ft

21. a. $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

$d = \sqrt{(7-6)^2 + (11-5)^2}$

$d = \sqrt{1^2 + 6^2}$

$d = \sqrt{1 + 36}$

$d = \sqrt{37}$

$d \approx 6.08$

6.08 units

b. $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$\left(\frac{5+11}{2}, \frac{6+7}{2}\right)$

$\left(\frac{16}{2}, \frac{13}{2}\right)$

$\left(8, 6\frac{1}{2}\right)$

22. a. $\frac{7}{4} \bullet 4 = 7$

7 fish

b. $x \bullet 85 = 76.5$

$\frac{x \bullet 85}{85} = \frac{76.5}{85}$

$x = 0.9$

90%

c. Decimal: 0.45

Fraction: $45\% = \frac{45}{100} = \frac{9}{20}$

Enrichment: Collatz Conjecture

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1. 6 is even. $6 \div 2 = 3$
   3 is odd. $3 \bullet 3 + 1 = 10$
   10 is even. $10 \div 2 = 5$
   5 is odd. $5 \bullet 3 + 1 = 16$
   16 is even. $16 \div 2 = 8$
   8 is even. $8 \div 2 = 4$
   4 is even. $4 \div 2 = 2$
   2 is even. $2 \div 2 = 1$
   1 is odd. $1 \bullet 3 + 1 = 4$

   Repeat answer: 4

2. 7 is odd. $7 \bullet 3 + 1 = 22$
   22 is even. $22 \div 2 = 11$
   11 is odd. $11 \bullet 3 + 1 = 34$
   34 is even. $34 \div 2 = 17$
   17 is odd. $17 \bullet 3 + 1 = 52$
   52 is even. $52 \div 2 = 26$
   26 is even. $26 \div 2 = 13$
   13 is odd. $13 \bullet 3 + 1 = 40$
   40 is even. $40 \div 2 = 20$
   20 is even. $20 \div 2 = 10$
   10 is even. $10 \div 2 = 5$
   5 is odd. $5 \bullet 3 + 1 = 16$
   16 is even. $16 \div 2 = 8$
   8 is even. $8 \div 2 = 4$
   4 is even. $4 \div 2 = 2$
   2 is even. $2 \div 2 = 1$
   1 is odd. $1 \bullet 3 + 1 = 4$

   Repeat answer: 4

3. 8 is even. $8 \div 2 = 4$
   4 is even. $4 \div 2 = 2$
   2 is even. $2 \div 2 = 1$
   1 is odd. $1 \bullet 3 + 1 = 4$

   Repeat answer: 4

4. The first answer to repeat in these examples is 4.

5. and 6. Answers will vary based on the starting integer chosen. Answers should follow the two rules listed at the beginning of the lesson.

7. Yes, the first repeated answer is still 4.

8. –5 is odd. $-5 \bullet 3 + 1 = -14$
   –14 is even. $-14 \div 2 = -7$
   –7 is odd. $-7 \bullet 3 + 1 = -20$
   –20 is even. $-20 \div 2 = -10$
   –10 is even. $-10 \div 2 = -5$

   Repeat answer: –5

9. –6 is even. $-6 \div 2 = -3$
   –3 is odd. $-3 \bullet 3 + 1 = -8$
   –8 is even. $-8 \div 2 = -4$
   –4 is even. $-4 \div 2 = -2$
   –2 is even. $-2 \div 2 = -1$
   –1 is odd. $-1 \bullet 3 + 1 = -2$

   Repeat answer: –2

10. –17 is odd. $-17 \cdot 3 + 1 = -50$
–50 is even. $-50 \div 2 = -25$
–25 is odd. $-25 \cdot 3 + 1 = -74$
–74 is even. $-74 \div 2 = -37$
–37 is odd. $-37 \cdot 3 + 1 = -110$
–110 is even. $-110 \div 2 = -55$
–55 is odd. $-55 \cdot 3 + 1 = -164$
–164 is even. $-164 \div 2 = -82$
–82 is even. $-82 \div 2 = -41$
–41 is odd. $-41 \cdot 3 + 1 = -122$
–122 is even. $-122 \div 2 = -61$
–61 is odd. $-61 \cdot 3 + 1 = -182$
–182 is even. $-182 \div 2 = -91$
–91 is odd. $-91 \cdot 3 + 1 = -272$
–272 is even. $-272 \div 2 = -136$
–136 is even. $-136 \div 2 = -68$
–68 is even. $-68 \div 2 = -34$
–34 is even. $-34 \div 2 = -17$

Repeat answer: –17

11. Answers may vary, but there is no obvious pattern.

Percent Increase and Decrease

WARM-UP

a. $0.25 \cdot 236 = 59$

b. $2 \cdot x = 89$

$$\frac{2 \cdot x}{2} = \frac{89}{2}$$

$$x = 44.5$$

c. $x \cdot 171 = 51.3$

$$\frac{x \cdot 171}{171} = \frac{51.3}{171}$$

$$x = 0.3$$

30%

PRACTICE

1. a. $15\% + 100\% = 115\%$

$1.15 \cdot 140 = 161$

b. $100\% - 70\% = 30\%$

$0.3 \cdot 350 = 105$

c. $84 - 60 = 24$

$x \cdot 60 = 24$

$$\frac{x \cdot 60}{60} = \frac{24}{60}$$

$$x = \frac{24}{60} = 0.4$$

40%

d. $40 - 31 = 9$

$x \cdot 40 = 9$

$$\frac{x \cdot 40}{40} = \frac{9}{40}$$

$$x = \frac{9}{40} = 0.225$$

22.5%

e. $15.25\% + 100\% = 115.25\%$

$1.1525 \cdot x = 96.81$

$$\frac{1.1525 \cdot x}{1.1525} = \frac{96.81}{1.1525}$$

$$x = \frac{96.81}{1.1525} = 84$$

f. $100\% - 12\% = 88\%$

$0.88 \cdot x = 66$

$$\frac{0.88 \cdot x}{0.88} = \frac{66}{0.88}$$

$$x = \frac{66}{0.88} = 75$$

2. $11\frac{1}{2}\% = 11.5\%$

$11.5\% + 100\% = 111.5\%$

$1.115 \cdot 5000 = 5575$

$5575

3. $100\% - 30\% = 70\%$

$$0.7 \bullet x = 2800$$
$$\frac{0.7 \bullet x}{0.7} = \frac{2800}{0.7}$$
$$x = \frac{2800}{0.7} = 4000$$

4000 foreign language books

4. $6\% + 100\% = 106\%$

$$1.06 \bullet x = 26{,}500$$
$$\frac{1.06 \bullet x}{1.06} = \frac{26{,}500}{1.06}$$
$$x = \frac{26{,}500}{1.06} = 25{,}000$$

25,000 patrons

5. $40 - 38 = 2$

$$x \bullet 40 = 2$$
$$\frac{x \bullet 40}{40} = \frac{2}{40}$$
$$x = \frac{2}{40} = 0.05$$

5%

6. $100\% - 60\% = 40\%$

$$0.4 \bullet x = 0.14$$
$$\frac{0.4 \bullet x}{0.4} = \frac{0.14}{0.4}$$
$$x = \frac{0.14}{0.4} = 0.35$$

$0.35 per item

7. $99 - 96 = 3$

$$x \bullet 96 = 3$$
$$\frac{x \bullet 96}{96} = \frac{3}{96}$$
$$x = \frac{3}{96} = 0.03125$$

3.125%

Note: An example Number Search solution is shown below. Some answers may be circled in places other than what is shown.

3	8	7	.	9	2
.	1	2	1	4	2
1	0	6	5	4	.
2	2	.	1	0	5
5	8	5	6	7	5
8	4	0	0	0	7
6	.	2	.	0	5
0	.	3	5	.	0

REVIEW

1. $x \cdot 90 = 63$

$$\frac{x \cdot 90}{90} = \frac{63}{90}$$

$$x = \frac{63}{90} = \frac{7}{10}$$

2. $y = mx + b$

$$14 = \frac{11}{12}(48) + b$$

$$14 = 44 + b$$

$$14 - 44 = 44 + b - 44$$

$$-30 = b$$

Equation: $y = \frac{11}{12}x - 30$

3. a. $2 + 2.75g$

b. $3 + 2.5g$

c. $2 + 2.75g = 3 + 2.5g$

$$2 + 2.75g - 2.5g = 3 + 2.5g - 2.5g$$

$$2 + 0.25g = 3$$

$$2 + 0.25g - 2 = 3 - 2$$

$$0.25g = 1$$

$$\frac{0.25g}{0.25} = \frac{1}{0.25}$$

$$g = 4$$

4 games

4. $\left(\frac{-32 + 22}{2}, \frac{17 + (-9)}{2}\right) = \left(\frac{-10}{2}, \frac{8}{2}\right) = (-5, 4)$

5. $\frac{15(b^4)^4}{(3b^6)^3}$

$$= \frac{15b^{16}}{27b^{18}}$$

$$= \frac{15}{27} \cdot b^{16-18}$$

$$= \frac{5}{9} \cdot b^{-2}$$

$$= \frac{5}{9} \cdot \frac{1}{b^2}$$

$$= \frac{5}{9b^2}$$

Calculating Interest

WARM-UP

$63 - 35 = 28$

$x \cdot 35 = 28$

$\frac{x \cdot 35}{35} = \frac{28}{35}$

$x = 0.8$

80%

PRACTICE

Note: Students were instructed to circle Part A or B for Problems 1–3. The student is supposed to guess and then check in order to grow their mathematical intuition.

1. a. $I = Prt$

$I = 150 \cdot 0.04 \cdot 6$

$I = 36$

$36

b. $I = Prt$

$I = 120 \cdot 0.035 \cdot 8$

$I = 33.6$

$33.60

2. a. $I = Prt$

$234 = 600 \cdot r \cdot 6$

$234 = 3600 \cdot r$

$\frac{234}{3600} = \frac{3600 \cdot r}{3600}$

$0.065 = r$

6.5%

b. $I = Prt$

$453.6 = 900 \cdot r \cdot 8$

$453.6 = 7200 \cdot r$

$\frac{453.6}{7200} = \frac{7200 \cdot r}{7200}$

$0.063 = r$

6.3%

3. a. $I = Prt$

$480 = 1000 \cdot 0.04 \cdot t$

$480 = 40 \cdot t$

$\frac{480}{40} = \frac{40 \cdot t}{40}$

$12 = t$

12 years

b. $I = Prt$

$720 = 2000 \cdot 0.03 \cdot t$

$720 = 60 \cdot t$

$\frac{720}{60} = \frac{60 \cdot t}{60}$

$12 = t$

12 years

4.

Years	Principal	$I = Prt$	Total Amount: $A = P + I$
1	\$500	$I = 500 \cdot 0.03 \cdot 1 = 15$	\$500 + \$15 = \$515
2	\$515	$I = 515 \cdot 0.03 \cdot 1 = 15.45$	\$515 + \$15.45 = \$530.45
3	\$530.45	$I = 530.45 \cdot 0.03 \cdot 1 = 15.91$	\$530.45 + \$15.91 = \$546.36
4	\$546.36	$I = 546.36 \cdot 0.03 \cdot 1 = 16.39$	\$546.36 + \$16.39 = \$562.75
5	\$562.75	$I = 562.75 \cdot 0.03 \cdot 1 = 16.88$	\$562.75 + \$16.88 = \$579.63
6	\$579.63	$I = 579.63 \cdot 0.03 \cdot 1 = 17.39$	\$579.63 + \$17.39 = \$597.02

5. a. $A = P(1+r)^t$

$A = 300(1+0.0625)^{10}$

$A = 300(1.0625)^{10}$

$A \approx 550.06$

\$550.06

b. $A = P(1+r)^t$

$9905.19 = P(1+0.04)^{15}$

$9905.19 \approx P(1.80094351)$

$\frac{9905.19}{1.80094351} \approx \frac{P(1.80094351)}{1.80094351}$

$5500 \approx P$

\$5500

6. Simple interest:

$I = Prt$

$I = 1000 \cdot 0.05 \cdot 50$

$I = 2500$

$1000 + 2500 = 3500$

\$3500 in account

Compound interest:

$A = P(1+r)^t$

$A = 1000(1+0.05)^{50}$

$A = 1000(1.05)^{50}$

$A \approx 11,467.40$

\$11,467.40 in account

\$11,467.40 – \$3500 = \$7967.40

REVIEW

1. $a^2 + b^2 = c^2$

$3^2 + 3^2 = c^2$

$9 + 9 = c^2$

$18 = c^2$

$\sqrt{18} = \sqrt{c^2}$

$\sqrt{18} = c$

$4.24 \approx c$

4.24 in

2. $\sqrt{18} \bullet \sqrt{18} = \sqrt{18^2} = 18$

18 in^2

3. a. $\frac{12}{20} = \frac{3}{5}$

b.
$$\begin{array}{r} 0.6 \\ 5\overline{)\,3.0} \\ -30 \\ \hline 0 \end{array}$$

60%

4. a. Area of quilt: 84 in $\bullet$ 96 in = 8064 in^2

Area of one quilt block: 12 in $\bullet$ 12 in = 144 in^2

$8064 \div 144 = 56$

56 blocks

b. $100\% - 37.5\% = 62.5\%$

$0.625 \bullet 56 = 35$

35 blocks

Simple Probability

WARM-UP

$A = P(1+r)^t$

$A = 2000(1+0.0375)^{15}$

$A = 3474.17$

$3474.17

PRACTICE

1. a. $\frac{20}{40} = 0.5 = 50\%$

   b. $\frac{10}{40} = 0.25 = 25\%$

   c. $\frac{8}{40} = 0.2 = 20\%$

   d. Note: The prime numbers from 1 to 40 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, and 37.

   $\frac{12}{40} = 0.3 = 30\%$

   e. Note: The two-digit palindromes from 1 to 40 are 11, 22, and 33.

   $\frac{3}{40} = 0.075 = 7.5\%$

2. a. $P(\text{green}) = \frac{2}{11} = 0.181818... \approx 18.18\%$

   $P(\text{yellow}) = \frac{1}{11} = 0.090909... \approx 9.09\%$

   $P(\text{red}) = \frac{3}{11} = 0.272727... \approx 27.27\%$

   $P(\text{blue}) = \frac{4}{11} = 0.363636... \approx 36.36\%$

   $P(\text{purple}) = \frac{1}{11} = 0.090909... \approx 9.09\%$

   b. green: $0.1818 \bullet 550 = 99.99 \approx 100$

   yellow: $0.0909 \bullet 550 = 49.995 \approx 50$

   red: $0.2727 \bullet 550 = 149.985 \approx 150$

   blue: $0.3636 \bullet 550 = 199.98 \approx 200$

   purple: $0.0909 \bullet 550 = 49.995 \approx 50$

   c. $P(\text{green}) = \frac{105}{550} = 0.190909... \approx 19.09\%$

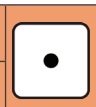
   $P(\text{yellow}) = \frac{61}{550} = 0.110909... \approx 11.09\%$

   $P(\text{red}) = \frac{152}{550} = 0.276363... \approx 27.64\%$

   $P(\text{blue}) = \frac{207}{550} = 0.376363... \approx 37.64\%$

   $P(\text{purple}) = \frac{25}{550} = 0.045454... \approx 4.55\%$

3. a.

First die → / Second die ↓						
	0	1	2	3	4	5
	1	0	1	2	3	4
	2	1	0	1	2	3
	3	2	1	0	1	2
	4	3	2	1	0	1
	5	4	3	2	1	0

b. $P(0) = \frac{6}{36} = 0.1666\ldots \approx 16.67\%$

$P(1) = \frac{10}{36} = 0.2777\ldots \approx 27.78\%$

$P(2) = \frac{8}{36} = 0.2222\ldots \approx 22.22\%$

$P(3) = \frac{6}{36} = 0.1666\ldots \approx 16.67\%$

$P(4) = \frac{4}{36} = 0.1111\ldots \approx 11.11\%$

$P(5) = \frac{2}{36} = 0.0555\ldots \approx 5.56\%$

c. Number of 0s: $0.1667 \cdot 400 = 66.68 \approx 67$

Number of 1s: $0.2778 \cdot 400 = 111.12 \approx 111$

Number of 2s: $0.2222 \cdot 400 = 88.88 \approx 89$

Number of 3s: $0.1667 \cdot 400 = 66.68 \approx 67$

Number of 4s: $0.1111 \cdot 400 = 44.44 \approx 44$

Number of 5s: $0.0556 \cdot 400 = 22.24 \approx 22$

REVIEW

1. $5x - 3y = -15$

$5x - 3(0) = -15$

$5x = -15$

$\frac{5x}{5} = \frac{-15}{5}$

$x = -3$

x-intercept: $(-3, 0)$

$5x - 3y = -15$

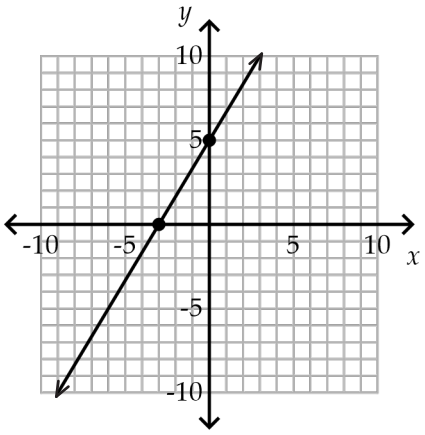
$5(0) - 3y = -15$

$-3y = -15$

$\frac{-3y}{-3} = \frac{-15}{-3}$

$y = 5$

y-intercept: $(0, 5)$



2. $I = Prt$

$237.5 = 950 \cdot r \cdot 10$

$237.5 = 9500 \cdot r$

$\frac{237.5}{9500} = \frac{9500 \cdot r}{9500}$

$0.025 = r$

2.5%

3. $100\% + 56.25\% = 156.25\% = 1.5625$

$1.5625 \cdot x = 25$

$\frac{1.5625 \cdot x}{1.5625} = \frac{25}{1.5625}$

$x = 16$

16 servings per week

4. $x \cdot 525 = 168$

$\frac{x \cdot 525}{525} = \frac{168}{525}$

$x = 0.32$

32%

5. $11x^3 = 275$

$\frac{11x^3}{11} = \frac{275}{11}$

$x^3 = 25$

$\sqrt[3]{x^3} = \sqrt[3]{25}$

$x = \sqrt[3]{25}$

Compound Probability

WARM-UP

a. $P(\text{keychain}) = \frac{100}{300} = \frac{1}{3} \approx 33.33\%$

b. $P(\text{sticker sheet}) = \frac{50}{300} = \frac{1}{6} \approx 16.67\%$

c. $P(\text{bouncy ball}) = \frac{150}{300} = \frac{1}{2} = 50\%$

PRACTICE

1. a. mutually exclusive, complementary
   b. neither
   c. mutually exclusive

2. a. independent
   b. dependent
   c. independent

3. a. $24 + 27 + 29 = 80$

   $P(\text{red or blue}) = \frac{24}{80} + \frac{29}{80} = \frac{53}{80} = 0.6625$

   66.25%

   b. $P(\text{not blue}) = 1 - \frac{29}{80} = \frac{51}{80} = 0.6375$

   63.75%

4. a. $P(\text{not } 1) = 1 - P(1) = 1 - 0.43 = 0.57 = 57\%$
   b. $P(1 \text{ or } 2) = 0.43 + 0.27 = 0.70 = 70\%$
   c. $P(\text{odd}) = 0.43 + 0.3 = 0.73 = 73\%$
   d. $P(\text{not odd}) = 1 - P(\text{odd}) = 1 - 0.73 = 0.27 = 27\%$

5. a. $26 \cdot 26 \cdot 26 \cdot 26 \cdot 10 \cdot 10$

   $= 45{,}697{,}600$

   b. $26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

   $= 6{,}760{,}000$

   c. $36 \cdot 36 \cdot 36 \cdot 36 \cdot 36 \cdot 36$

   $= 2{,}176{,}782{,}336$

6. a. $6 \cdot 8 \cdot 10 = 480$
   b. $6 \cdot 8 \cdot 1 = 48$
   c. $P(\text{roast beef}) = \frac{48}{480} = 10\%$
   d. $5 \cdot 8 \cdot 10 = 400$
   e. $P(\text{not banana}) = \frac{400}{480} = 0.833\ldots \approx 83.33\%$
   f. independent
   g. $P(\text{roast beef and no banana})$

   $= P(\text{roast beef}) \cdot P(\text{no banana})$

   $= \frac{48}{480} \cdot \frac{400}{480}$

   ≈ 0.0833

   8.33%

7.

	With replacement	Without replacement
$P(\text{both odd})$	**A** 25%	**D** 20%
$P(\text{1 first, then even})$	**B** 8.33%	**E** 10%
$P(\text{1 first, then odd})$	**C** 8.33%	**F** 6.67%

Detailed work for each value in the chart is shown below.

With replacement, the two draws are independent.

A With replacement:

$$\begin{aligned} &P(\text{both odd}) \\ &= P(\text{odd}) \bullet P(\text{odd}) \\ &= \frac{3}{6} \bullet \frac{3}{6} \\ &= \frac{9}{36} = 0.25 = 25\% \end{aligned}$$

B With replacement:

$$\begin{aligned} &P(\text{1 first, then even}) \\ &= P(1) \bullet P(\text{even}) \\ &= \frac{1}{6} \bullet \frac{3}{6} \\ &= \frac{3}{36} \approx 0.0833 = 8.33\% \end{aligned}$$

C With replacement:

$$\begin{aligned} &P(\text{1 first, then odd}) \\ &= P(1) \bullet P(\text{odd}) \\ &= \frac{1}{6} \bullet \frac{3}{6} \\ &= \frac{3}{36} \approx 0.0833 = 8.33\% \end{aligned}$$

Without replacement, the two draws are dependent.

D Without replacement:

$$\begin{aligned} &P(\text{both odd}) \\ &= P(\text{odd first}) \bullet P(\text{odd second} \mid \text{odd first}) \\ &= \frac{3}{6} \bullet \frac{2}{5} \\ &= \frac{6}{30} = 0.2 = 20\% \end{aligned}$$

E Without replacement:

$$\begin{aligned} &P(\text{1 first, then even}) \\ &= P(\text{1 first}) \bullet P(\text{even second} \mid \text{1 first}) \\ &= \frac{1}{6} \bullet \frac{3}{5} \\ &= \frac{3}{30} = 0.1 = 10\% \end{aligned}$$

F Without replacement:

$$\begin{aligned} &P(\text{1 first, then odd}) \\ &= P(\text{1 first}) \bullet P(\text{odd second} \mid \text{1 first}) \\ &= \frac{1}{6} \bullet \frac{2}{5} \\ &= \frac{2}{30} \approx 0.0667 = 6.67\% \end{aligned}$$

REVIEW

1. a. $A = P(1+r)^t$

$A = 1800(1+0.0125)^{20}$

$A = 1800(1.0125)^{20}$

$A \approx 2307.67$

$2307.67

b. $A = P(1+r)^t$

$5200.82 = P(1+0.02)^{20}$

$5200.82 \approx P(1.485947)$

$\frac{5200.82}{1.485947} \approx \frac{P(1.485947)}{1.485947}$

$3500 \approx P$

$3500

2. $180 - 90 = 90$

$x \bullet 90 = 90$

$\frac{x \bullet 90}{90} = \frac{90}{90}$

$x = 1$

100%

3. $8 - 7 = 1$

$x \bullet 8 = 1$

$\frac{x \bullet 8}{8} = \frac{1}{8}$

$x = \frac{1}{8} = 0.125$

12.5%

4. Note: Any two points can be used to find the slope.

$m = \frac{8-6}{0-(-3)}$

$m = \frac{2}{3}$

Work may vary, but the final answer should be the same.

$y - 8 = \frac{2}{3}(x-0)$

$y - 8 = \frac{2}{3}x$

$y - 8 + 8 = \frac{2}{3}x + 8$

$y = \frac{2}{3}x + 8$

5. $a^2 + b^2 = c^2$

$15^2 + 20^2 \stackrel{?}{=} 25^2$

$225 + 400 \stackrel{?}{=} 625$

$625 = 625$

yes

Ratios and Unit Rates

WARM-UP

a. $12 \cdot 4 = 48$
$12 \cdot 0.4 = 4.8$

b. $5 \cdot 11 = 55$
$5 \cdot 1.1 = 5.5$

c. $32 \cdot 5 = 160$
$32 \cdot 0.5 = 16$

PRACTICE

1.

Words	Colon	Fraction
7 to 5	7 : 5	$\frac{7}{5}$
2 to 3	2 : 3	$\frac{2}{3}$
3 to 8	3 : 8	$\frac{3}{8}$
13 to 4	13 : 4	$\frac{13}{4}$
1 to 5	1 : 5	$\frac{1}{5}$
15 to 2	15 : 2	$\frac{15}{2}$

2. a. $24 : 30 = 4 : 5$

b. $30 : 54 = 5 : 9$

3. a. $350 : 50$

b. $200 : 400$

c. $50 : 600$

4. a. Flour Option 1
$\$0.89 \div 20 \text{ oz} \approx \$0.04$ per oz

Flour Option 2
$\$2.79 \div 80 \text{ oz} \approx \$0.03$ per oz

b. Egg Option 1
$\$3.89 \div 12$ eggs $\approx \$0.32$ per egg

Egg Option 2
$\$5.89 \div 18$ eggs $\approx \$0.33$ per egg

c. Butter Option 1
$\$3.79 \div 1 \text{ lb} = \$3.79$ per lb

Butter Option 2
$\$6.49 \div 2 \text{ lb} \approx \$3.25$ per lb

d. Banana Option 1
$\$0.59 \div 1 \text{ lb} = \$0.59$ per lb

Banana Option 2
$\$1.29 \div 3 \text{ lb} = \$0.43$ per lb

e. Nut Option 1
$\$3.59 \div 16 \text{ oz} \approx \$0.22$ per oz

Nut Option 2
$\$5.49 \div 24 \text{ oz} \approx \$0.23$ per oz

REVIEW

1. a. When $x = 1$, $y = 3.5$.

$k = 3.5$

b. $y = kx$

$y = 3.5x$

2. a. $I = Prt$

$113 = 950 \cdot r \cdot 6$

$113 = 5700 \cdot r$

$\frac{113}{5700} = \frac{5700 \cdot r}{5700}$

$0.0198 \approx r$

1.98%

b. $x \cdot 950 = 113$

$\frac{x \cdot 950}{950} = \frac{113}{950}$

$x \approx 0.119$

11.9%

3. a. $8 \cdot 5 \cdot 7 = 280$

b. $\frac{5}{20} = \frac{1}{4} = 25\%$

4. $-23 - 3(q - 16) = 7q$

$-23 - 3q + 48 = 7q$

$25 - 3q = 7q$

$25 - 3q + 3q = 7q + 3q$

$25 = 10q$

$\frac{25}{10} = \frac{10q}{10}$

$2.5 = q$

Proportions

WARM-UP

$\$4.50 \div 10 = \$0.45$

$0.45 per pound

PRACTICE

1. a. $\frac{4}{x} = \frac{6}{3}$

$4 \cdot 3 = x \cdot 6$

$12 = 6x$

$\frac{12}{6} = \frac{6x}{6}$

$2 = x$

b. $\frac{34}{51} = \frac{x}{6}$

$34 \cdot 6 = 51 \cdot x$

$204 = 51x$

$\frac{204}{51} = \frac{51x}{51}$

$4 = x$

c. $\frac{54}{42} = \frac{27}{x}$

$54 \cdot x = 42 \cdot 27$

$54x = 1134$

$\frac{54x}{54} = \frac{1134}{54}$

$x = 21$

d. $\frac{x}{35} = \frac{2}{28}$

$x \cdot 28 = 35 \cdot 2$

$28x = 70$

$\frac{28x}{28} = \frac{70}{28}$

$x = \frac{70}{28} = 2\frac{1}{2}$

2. a. $\frac{25 \text{ grams starter}}{50 \text{ grams flour}} = \frac{75 \text{ grams starter}}{x \text{ grams flour}}$

$\frac{25}{50} = \frac{75}{x}$

$25x = 50 \cdot 75$

$25x = 3750$

$\frac{25x}{25} = \frac{3750}{25}$

$x = 150$

150 grams

b. $\frac{25 \text{ grams starter}}{50 \text{ grams water}} = \frac{x \text{ grams starter}}{160 \text{ grams water}}$

$\frac{25}{50} = \frac{x}{160}$

$25 \cdot 160 = 50x$

$4000 = 50x$

$\frac{4000}{50} = \frac{50x}{50}$

$80 = x$

80 grams

3. a. $\dfrac{5 \text{ cups corn}}{0.5 \text{ cups cream}} = \dfrac{8 \text{ cups corn}}{x \text{ cups cream}}$

$$\frac{5}{0.5} = \frac{8}{x}$$
$$5x = 0.5 \bullet 8$$
$$5x = 4$$
$$\frac{5x}{5} = \frac{4}{5}$$
$$x = \frac{4}{5}$$

$\frac{4}{5}$ cups

b. $\dfrac{5 \text{ cups corn}}{6 \text{ servings}} = \dfrac{x \text{ cups corn}}{10 \text{ servings}}$

$$\frac{5}{6} = \frac{x}{10}$$
$$5 \bullet 10 = 6x$$
$$50 = 6x$$
$$\frac{50}{6} = \frac{6x}{6}$$
$$\frac{50}{6} = x$$
$$x = 8\frac{2}{6} = 8\frac{1}{3}$$

$8\frac{1}{3}$ cups

4. $\dfrac{160 \text{ miles}}{3 \text{ hours}} = \dfrac{400 \text{ miles}}{x \text{ hours}}$

$$\frac{160}{3} = \frac{400}{x}$$
$$160x = 3 \bullet 400$$
$$160x = 1200$$
$$\frac{160x}{160} = \frac{1200}{160}$$
$$x = \frac{1200}{160} = 7\frac{1}{2}$$

$7\frac{1}{2}$ hours

5. a. $\dfrac{38 \text{ laps}}{45 \text{ minutes}} = \dfrac{18 \text{ laps}}{x \text{ minutes}}$

$$\frac{38}{45} = \frac{18}{x}$$
$$38x = 45 \bullet 18$$
$$38x = 810$$
$$\frac{38x}{38} = \frac{810}{38}$$
$$x = \frac{810}{38} \approx 21$$

21 minutes

b. $\dfrac{38 \text{ laps}}{45 \text{ minutes}} = \dfrac{x \text{ laps}}{75 \text{ minutes}}$

$$\frac{38}{45} = \frac{x}{75}$$
$$38 \bullet 75 = 45x$$
$$2850 = 45x$$
$$\frac{2850}{45} = \frac{45x}{45}$$
$$\frac{2850}{45} = x$$
$$x = \frac{2850}{45} \approx 63$$

63 laps

6. a. $\dfrac{5 \text{ gallons}}{2000 \text{ square feet}} = \dfrac{x \text{ gallons}}{6600 \text{ square feet}}$

$$\frac{5}{2000} = \frac{x}{6600}$$
$$5 \bullet 6600 = 2000x$$
$$33{,}000 = 2000x$$
$$\frac{33{,}000}{2000} = \frac{2000x}{2000}$$
$$\frac{33{,}000}{2000} = x$$
$$x = \frac{33{,}000}{2000} = 16\frac{1}{2}$$

$16\frac{1}{2}$ gallons

b. $\dfrac{5 \text{ gallons}}{2000 \text{ square feet}} = \dfrac{11 \text{ gallons}}{x \text{ square feet}}$

$$\frac{5}{2000} = \frac{11}{x}$$
$$5x = 2000 \cdot 11$$
$$5x = 22{,}000$$
$$\frac{5x}{5} = \frac{22{,}000}{5}$$
$$x = \frac{22{,}000}{5} = 4400$$

4400 square feet

7. a. $\dfrac{15 \text{ lb food}}{1.5 \text{ months}} = \dfrac{20 \text{ lb food}}{x \text{ months}}$

$$\frac{15}{1.5} = \frac{20}{x}$$
$$15x = 1.5 \cdot 20$$
$$15x = 30$$
$$\frac{15x}{15} = \frac{30}{15}$$
$$x = \frac{30}{15} = 2$$

2 months

b. $\dfrac{15 \text{ lb food}}{1.5 \text{ months}} = \dfrac{x \text{ lb food}}{2.5 \text{ months}}$

$$\frac{15}{1.5} = \frac{x}{2.5}$$
$$15 \cdot 2.5 = 1.5x$$
$$37.5 = 1.5x$$
$$\frac{37.5}{1.5} = \frac{1.5x}{1.5}$$
$$\frac{37.5}{1.5} = x$$
$$x = \frac{37.5}{1.5} = 25$$

25 lb

REVIEW

1. $\sqrt{5-x} = 8$

$$\left(\sqrt{5-x}\right)^2 = 8^2$$
$$5 - x = 64$$
$$5 - x - 5 = 64 - 5$$
$$-x = 59$$
$$\frac{-x}{-1} = \frac{59}{-1}$$
$$x = -59$$

Check:

$$\sqrt{5-(-59)} \stackrel{?}{=} 8$$
$$\sqrt{5+59} \stackrel{?}{=} 8$$
$$\sqrt{64} \stackrel{?}{=} 8$$
$$8 = 8 \checkmark$$

2. a. $17 + 9 = 26$

$22 : 26 = 11 : 13$

b. $22 + 17 + 9 = 48$

$9 : 48 = 3 : 16$

3. $1.1 \cdot x = 495$

$$\frac{1.1 \cdot x}{1.1} = \frac{495}{1.1}$$
$$x = 450$$

450 square feet

4. $10 \cdot 10 \cdot 10 = 1000$

1000 PIN options

Note: This could also be found by considering that there are 1000 3-digit numbers from 000 to 999.

5. $\dfrac{2}{44} = \dfrac{1}{22}$

Measurement Systems

WARM-UP

$$\frac{3}{25} = \frac{x}{21}$$
$$3 \cdot 21 = 25 \cdot x$$
$$63 = 25x$$
$$\frac{63}{25} = \frac{25x}{25}$$
$$2.52 = x$$

PRACTICE

1. a. $324 \div 10^2 = 3.24$
   $324 \text{ cm} = 3.24 \text{ m}$

   b. $0.4 \cdot 10^2 = 40$
   $0.4 \text{ kL} = 40 \text{ daL}$

   c. $32 \div 8 = 4$
   $32 \text{ pt} = 4 \text{ gal}$

   d. $2.04 \cdot 2000 = 4080$
   $2.04 \text{ t} = 4080 \text{ lb}$
   $4080 \cdot 16 = 65{,}280$
   $4080 \text{ lb} = 65{,}280 \text{ oz}$

   e. $0.324 \cdot 10^2 = 32.4$
   $0.324 \text{ dag} = 32.4 \text{ dg}$

   f. $25{,}344 \div 12 = 2112$
   $25{,}344 \text{ in} = 2112 \text{ ft}$
   $2112 \div 5280 = 0.4$
   $2112 \text{ ft} = 0.4 \text{ mi}$

2. a.
$$\begin{array}{r} 6 \text{ mi } 2600 \text{ ft} \\ +\ 2 \text{ mi } 4080 \text{ ft} \\ \hline 8 \text{ mi } 6680 \text{ ft} \end{array}$$
   $6680 \text{ ft} = 1 \text{ mi } 1400 \text{ ft}$
   $8 \text{ mi} + 1 \text{ mi } 1400 \text{ ft} = 9 \text{ mi } 1400 \text{ ft}$

   b.
$$\begin{array}{r} {\scriptstyle 1} \quad {\scriptstyle 2300} \\ \cancel{2}\text{ t } \cancel{300}\text{ lb} \\ -\ 1 \text{ t } 800 \text{ lb} \\ \hline 1500 \text{ lb} \end{array}$$

   c. $5 \text{ gal } 2 \text{ pt} \cdot 8 = 40 \text{ gal } 16 \text{ pt}$
   $16 \text{ pt} = 2 \text{ gal}$
   $40 \text{ gal} + 2 \text{ gal} = 42 \text{ gal}$

   d.
$$\begin{array}{r} 5 \text{ lb } 14 \text{ oz} \\ +\ 4 \text{ lb } 10 \text{ oz} \\ \hline 9 \text{ lb } 24 \text{ oz} \end{array}$$
   $24 \text{ oz} = 1 \text{ lb } 8 \text{ oz}$
   $9 \text{ lb} + 1 \text{ lb } 8 \text{ oz} = 10 \text{ lb } 8 \text{ oz}$

   e. $11 \text{ ft} \div 7 = 1 \text{ ft R } 4 \text{ ft}$
   $4 \text{ ft} = 48 \text{ in}$
   $48 \text{ in} + 8 \text{ in} = 56 \text{ in}$
   $56 \text{ in} \div 7 = 8 \text{ in}$
   $11 \text{ ft } 8 \text{ in} \div 7 = 1 \text{ ft } 8 \text{ in}$

   f. $3 \text{ lb } 8 \text{ oz} \cdot 5 = 15 \text{ lb } 40 \text{ oz}$
   $40 \text{ oz} = 2 \text{ lb } 8 \text{ oz}$
   $15 \text{ lb} + 2 \text{ lb } 8 \text{ oz} = 17 \text{ lb } 8 \text{ oz}$

g. 8 qt ÷ 5 = 1 qt R 3 qt
3 qt = 6 pt
1 pt + 6 pt = 7 pt
7 pt ÷ 5 = 1 pt R 2 pt
2 pt = 4 c
1 c + 4 c = 5 c
5 c ÷ 5 = 1 c
8 qt 1 pt 1 c ÷ 5 = 1 qt 1 pt 1 c

h.
$$\begin{array}{r} \cancel{5}^{4}\ \text{ft}\ \cancel{8}^{20}\ \text{in} \\ -\quad 10\ \text{in} \\ \hline 4\ \text{ft}\ 10\ \text{in} \end{array}$$

REVIEW

1. a. 6.92 ÷ 8 = 0.865
$0.87 per pound

b. 15.14 ÷ 20 = 0.757
$0.76 per pound

c. the 20-lb bag

2. a. 30 : 24 = 5 : 4

b. 15 : 69 = 5 : 23

3. $m = 5.5$

$$\begin{aligned} y &= mx + b \\ -30 &= 5.5(-4) + b \\ -30 &= -22 + b \\ -30 + 22 &= -22 + b + 22 \\ -8 &= b \end{aligned}$$

Equation: $y = 5.5x - 8$

4. a.
$$\begin{aligned} A &= 2\pi rh \\ \frac{A}{2\pi h} &= \frac{2\pi rh}{2\pi h} \\ \frac{A}{2\pi h} &= r \\ r &= \frac{A}{2\pi h} \end{aligned}$$

b.
$$\begin{aligned} r &= \frac{A}{2\pi h} \\ r &= \frac{376.8}{2 \bullet 3.14 \bullet 10} \\ r &= 6 \end{aligned}$$

6 in

Unit Conversions and Unit Multipliers

WARM-UP

a. $140 \div 1000 = 0.14$
0.14 km

b. $5000 \bullet 100 = 500{,}000$
$500{,}000$ dL

c. $0.008 \div 10{,}000 = 0.0000008$
0.0000008 hg

PRACTICE

1. a. $\frac{4 \text{ qt}}{1 \text{ gal}}$ $\frac{1 \text{ gal}}{4 \text{ qt}}$

b. $\frac{1.6 \text{ km}}{1 \text{ mi}}$ $\frac{1 \text{ mi}}{1.6 \text{ km}}$

c. $\frac{1 \text{ oz}}{28.35 \text{ g}}$ $\frac{28.35 \text{ g}}{1 \text{ oz}}$

d. $\frac{1 \text{ mi}}{1760 \text{ yd}}$ $\frac{1760 \text{ yd}}{1 \text{ mi}}$

2. $1.5 \cancel{\text{qt}} \bullet \frac{0.95 \text{ L}}{1 \cancel{\text{qt}}} = \frac{1.5 \bullet 0.95 \text{ L}}{1} = 1.425 \text{ L}$

3. Students may have used different unit multipliers. Two examples are shown below. Because some unit multipliers are approximate conversions, answers may not be exactly the same when using different unit multipliers.

$$7140 \cancel{\text{m}} \bullet \cancel{\text{m}} \bullet \frac{1.1 \cancel{\text{yd}}}{1 \cancel{\text{m}}} \bullet \frac{1.1 \cancel{\text{yd}}}{1 \cancel{\text{m}}} \bullet \frac{3 \text{ ft}}{1 \cancel{\text{yd}}} \bullet \frac{3 \text{ ft}}{1 \cancel{\text{yd}}}$$

$$= \frac{7140 \bullet 1.1 \bullet 1.1 \bullet 3 \bullet 3 \text{ ft} \bullet \text{ft}}{1}$$

$$= 77{,}754.6 \text{ ft}^2$$

OR

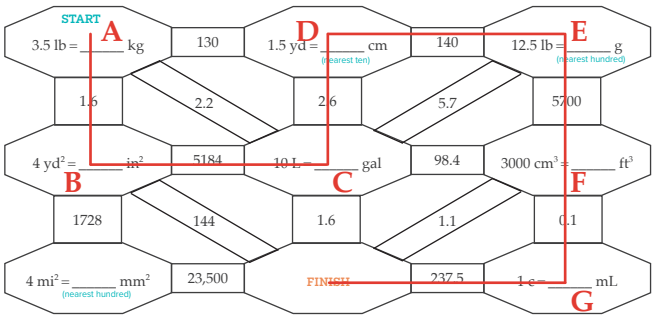
$$7140 \cancel{\text{m}} \bullet \cancel{\text{m}} \bullet \frac{100 \cancel{\text{cm}}}{1 \cancel{\text{m}}} \bullet \frac{100 \cancel{\text{cm}}}{1 \cancel{\text{m}}} \bullet \frac{1 \cancel{\text{in}}}{2.54 \cancel{\text{cm}}} \bullet \frac{1 \cancel{\text{in}}}{2.54 \cancel{\text{cm}}} \bullet \frac{1 \text{ ft}}{12 \cancel{\text{in}}} \bullet \frac{1 \text{ ft}}{12 \cancel{\text{in}}}$$

$$= \frac{7140 \bullet 100 \bullet 100 \text{ ft} \bullet \text{ft}}{2.54 \bullet 2.54 \bullet 12 \bullet 12}$$

$$\approx 76{,}854.3 \text{ ft}^2$$

The soccer field is larger.

4. Detailed work is shown below.



A $3.5 \text{ lb} \cdot \dfrac{1 \text{ kg}}{2.2 \text{ lb}} = \dfrac{3.5 \text{ kg}}{2.2} \approx 1.6 \text{ kg}$

B $4 \text{ yd} \cdot \text{yd} \cdot \dfrac{3 \text{ ft}}{1 \text{ yd}} \cdot \dfrac{3 \text{ ft}}{1 \text{ yd}} \cdot \dfrac{12 \text{ in}}{1 \text{ ft}} \cdot \dfrac{12 \text{ in}}{1 \text{ ft}}$

$= \dfrac{4 \cdot 3 \cdot 3 \cdot 12 \cdot 12 \text{ in} \cdot \text{in}}{1}$

$= 5184 \text{ in}^2$

C $10 \text{ L} \cdot \dfrac{1 \text{ gal}}{3.8 \text{ L}} = \dfrac{10 \text{ gal}}{3.8} \approx 2.6 \text{ gal}$

D $1.5 \text{ yd} \cdot \dfrac{3 \text{ ft}}{1 \text{ yd}} \cdot \dfrac{12 \text{ in}}{1 \text{ ft}} \cdot \dfrac{2.54 \text{ cm}}{1 \text{ in}}$

$= \dfrac{1.5 \cdot 3 \cdot 12 \cdot 2.54 \text{ cm}}{1} = 137.16 \text{ cm} \approx 140 \text{ cm}$

OR

$1.5 \text{ yd} \cdot \dfrac{1 \text{ m}}{1.1 \text{ yd}} \cdot \dfrac{100 \text{ cm}}{1 \text{ m}} = \dfrac{1.5 \cdot 100 \text{ cm}}{1.1} \approx 136.36 \text{ cm} \approx 140 \text{ cm}$

E $12.5 \text{ lb} \cdot \dfrac{1 \text{ kg}}{2.2 \text{ lb}} \cdot \dfrac{1000 \text{ g}}{1 \text{ kg}} = \dfrac{12.5 \cdot 1000 \text{ g}}{2.2} \approx 5681.82 \text{ g} \approx 5700 \text{ g}$

OR

$12.5 \text{ lb} \cdot \dfrac{16 \text{ oz}}{1 \text{ lb}} \cdot \dfrac{28.35 \text{ g}}{1 \text{ oz}} = \dfrac{12.5 \cdot 16 \cdot 28.35 \text{ g}}{1} = 5670 \text{ g} \approx 5700 \text{ g}$

F $3000 \text{ cm} \cdot \text{cm} \cdot \text{cm} \cdot \dfrac{1 \text{ in}}{2.54 \text{ cm}} \cdot \dfrac{1 \text{ in}}{2.54 \text{ cm}} \cdot \dfrac{1 \text{ in}}{2.54 \text{ cm}} \cdot \dfrac{1 \text{ ft}}{12 \text{ in}} \cdot \dfrac{1 \text{ ft}}{12 \text{ in}} \cdot \dfrac{1 \text{ ft}}{12 \text{ in}}$

$= \dfrac{3000 \text{ ft} \cdot \text{ft} \cdot \text{ft}}{2.54 \cdot 2.54 \cdot 2.54 \cdot 12 \cdot 12 \cdot 12}$

$\approx 0.1 \text{ ft}^3$

G $1 \text{ c} \cdot \dfrac{1 \text{ qt}}{4 \text{ c}} \cdot \dfrac{0.95 \text{ L}}{1 \text{ qt}} \cdot \dfrac{1000 \text{ mL}}{1 \text{ L}} = \dfrac{0.95 \cdot 1000 \text{ mL}}{4} = 237.5 \text{ mL}$

REVIEW

1. a. 3 weeks = 21 days

$$\frac{22 \text{ eggs}}{6 \text{ days}} = \frac{x \text{ eggs}}{21 \text{ days}}$$
$$\frac{22}{6} = \frac{x}{21}$$
$$22 \cdot 21 = 6 \cdot x$$
$$462 = 6x$$
$$\frac{462}{6} = \frac{6x}{6}$$
$$77 = x$$

77 eggs

b. $100 ÷ $2.50 per dozen = 40 dozen eggs

40 dozen • 12 = 480 eggs

$$\frac{22 \text{ eggs}}{6 \text{ days}} = \frac{480 \text{ eggs}}{x \text{ days}}$$
$$\frac{22}{6} = \frac{480}{x}$$
$$22 \cdot x = 6 \cdot 480$$
$$22x = 2880$$
$$\frac{22x}{22} = \frac{2880}{22}$$
$$x \approx 131$$

131 days

2. a. $426 ÷ 10^3 = 0.426$

426 m = 0.426 km

b. $7058 \cdot 10^2 = 705{,}800$

7058 dL = 705,800 mL

3. $$\frac{9}{16} \cdot x = 63$$
$$\frac{16}{9} \cdot \frac{9}{16} \cdot x = 63 \cdot \frac{16}{9}$$
$$x = 112$$

4. $6 \cdot 4 \cdot 3 = 72$

72 uniforms

5. $$-3x + 4y = 24$$
$$-3x + 4y + 3x = 24 + 3x$$
$$4y = 24 + 3x$$
$$\frac{4y}{4} = \frac{24 + 3x}{4}$$
$$y = 6 + \frac{3}{4}x$$
$$y = \frac{3}{4}x + 6$$

Slope: $\frac{3}{4}$ y-intercept: $(0,6)$

Scales and Scale Factors

WARM-UP

$$853.44 \text{ cm} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} \cdot \frac{1 \text{ ft}}{12 \text{ in}}$$

$$= \frac{853.44 \cdot 1 \text{ ft}}{2.54 \cdot 12}$$

$$= 28 \text{ ft}$$

PRACTICE

1. 0.4 (5) $\frac{2}{3}$ (1.1) (10) $1\frac{1}{5}$

2. a. $\frac{2 \text{ cm}}{25 \text{ in}} = \frac{x \text{ cm}}{62.5 \text{ in}}$

$$\frac{2}{25} = \frac{x}{62.5}$$

$$2 \cdot 62.5 = 25x$$

$$125 = 25x$$

$$\frac{125}{25} = \frac{25x}{25}$$

$$5 = x$$

5 cm

b. $\frac{2 \text{ cm}}{25 \text{ in}} = \frac{7.2 \text{ cm}}{x \text{ in}}$

$$\frac{2}{25} = \frac{7.2}{x}$$

$$2x = 25 \cdot 7.2$$

$$2x = 180$$

$$\frac{2x}{2} = \frac{180}{2}$$

$$x = 90$$

90 in

3. $\frac{3 \text{ in}}{38 \text{ yd}} = \frac{7.5 \text{ in}}{x \text{ yd}}$

$$\frac{3}{38} = \frac{7.5}{x}$$

$$3x = 38 \cdot 7.5$$

$$3x = 285$$

$$\frac{3x}{3} = \frac{285}{3}$$

$$x = 95$$

95 yd

4. a. $0.5 \cdot x = 6$

$$\frac{0.5 \cdot x}{0.5} = \frac{6}{0.5}$$

$$x = \frac{6}{0.5} = 12$$

b. $168 \cdot x = 4$

$$\frac{168 \cdot x}{168} = \frac{4}{168}$$

$$x = \frac{4}{168} = \frac{1}{42}$$

c. $12^2 = 144$

5. a. $117 \bullet x = 9$

$$\frac{117 \bullet x}{117} = \frac{9}{117}$$

$$x = \frac{9}{117} = \frac{1}{13}$$

b. $x \bullet \frac{1}{13} = 3$

$$13 \bullet x \bullet \frac{1}{13} = 3 \bullet 13$$

$$x = 39$$

39 in

c. $78 \bullet \frac{1}{13} = 6$

6 in

6. a. Exhibits A and D are 7 cm apart on the map. The scale is 1 cm : 4 m.

$$\frac{1 \text{ cm}}{4 \text{ m}} = \frac{7 \text{ cm}}{x \text{ m}}$$

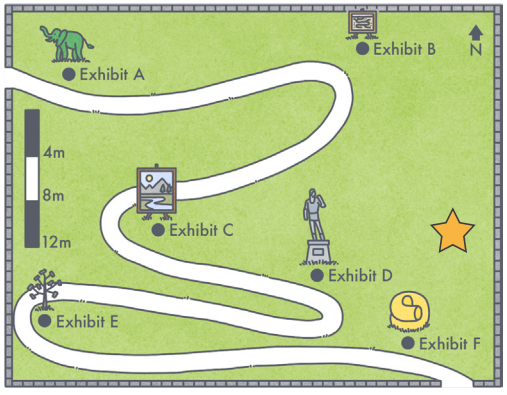
$$\frac{1}{4} = \frac{7}{x}$$

$$x = 4 \bullet 7$$

$$x = 28$$

28 m

b. The star should be 2 cm east and 4 cm south of Exhibit B.



$$\frac{1 \text{ cm}}{4 \text{ m}} = \frac{x \text{ cm}}{8 \text{ m}}$$

$$\frac{1}{4} = \frac{x}{8}$$

$$8 = 4x$$

$$\frac{8}{4} = \frac{4x}{4}$$

$$2 = x$$

8 m east is 2 cm east on the map.

$$\frac{1 \text{ cm}}{4 \text{ m}} = \frac{x \text{ cm}}{16 \text{ m}}$$

$$\frac{1}{4} = \frac{x}{16}$$

$$16 = 4x$$

$$\frac{16}{4} = \frac{4x}{4}$$

$$4 = x$$

16 m south is 4 cm south on the map.

c. Length: 8.5 cm

Width: 11 cm

Area of map: $8.5 \bullet 11 = 93.5$

93.5 cm^2

d. Length:

$$\frac{1 \text{ cm}}{4 \text{ m}} = \frac{8.5 \text{ cm}}{x \text{ m}}$$

$$\frac{1}{4} = \frac{8.5}{x}$$

$$x = 34$$

34 m

Width:

$$\frac{1 \text{ cm}}{4 \text{ m}} = \frac{11 \text{ cm}}{x \text{ m}}$$

$$\frac{1}{4} = \frac{11}{x}$$

$$x = 44$$

44 m

Area of art gallery: $34 \bullet 44 = 1496$

1496 m^2

e. $6^2 = 36$

f. $93.5 \bullet 36 = 3366$

3366 cm^2

REVIEW

1. $\begin{array}{r} \overset{15}{\cancel{16}}\text{ lb } \overset{21}{\cancel{5}}\text{ oz} \\ -\ 9\text{ lb } 9\text{ oz} \\ \hline 6\text{ lb } 12\text{ oz} \end{array}$

2. a. $13.5\text{ ft} \bullet 7\text{ ft} = 94.5\text{ ft}^2$

$$\frac{6\text{ tulip bulbs}}{1\text{ ft}^2} = \frac{x\text{ tulip bulbs}}{94.5\text{ ft}^2}$$

$$\frac{6}{1} = \frac{x}{94.5}$$

$$6 \bullet 94.5 = 1 \bullet x$$

$$567 = x$$

567 tulip bulbs

b. $\frac{108}{567} = \frac{4}{21}$

3. $880 \bullet \cancel{\text{ft}} \bullet \cancel{\text{ft}} \bullet \frac{1\ \cancel{\text{yd}}}{3\ \cancel{\text{ft}}} \bullet \frac{1\ \cancel{\text{yd}}}{3\ \cancel{\text{ft}}} \bullet \frac{1\text{ m}}{1.1\ \cancel{\text{yd}}} \bullet \frac{1\text{ m}}{1.1\ \cancel{\text{yd}}}$

$$= \frac{880 \bullet \text{m} \bullet \text{m}}{3 \bullet 3 \bullet 1.1 \bullet 1.1}$$

$$\approx 80.8\text{ m}^2$$

4. Detailed work is shown below.

A	$-18 + 5$	$-19 - (-32)$	**F**
B	$0 - (-11)$	$-8 - 5$	**G**
C	$-4 + 17$	$-84 \div (-7)$	**H**
D	$6 - (-6)$	$27 + (-16)$	**I**
E	$49 \div (-7)$	$11 + (-18)$	**J**

A $-18 + 5 = -13$

B $0 - (-11) = 0 + 11 = 11$

C $-4 + 17 = 13$

D $6 - (-6) = 6 + 6 = 12$

E $49 \div (-7) = -7$

F $-19 - (-32) = -19 + 32 = 13$

G $-8 - 5 = -13$

H $-84 \div (-7) = 12$

I $27 + (-16) = 11$

J $11 + (-18) = -7$

5. $25 - 20 = 5$

$$x \bullet 20 = 5$$

$$\frac{x \bullet 20}{20} = \frac{5}{20}$$

$$x = \frac{5}{20} = 0.25$$

25%

Basic Geometry Terms

WARM-UP

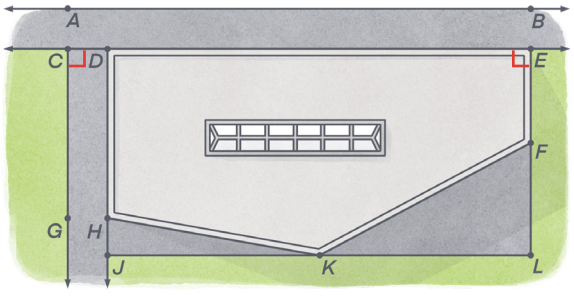
a. 6
b. 5
c. 10

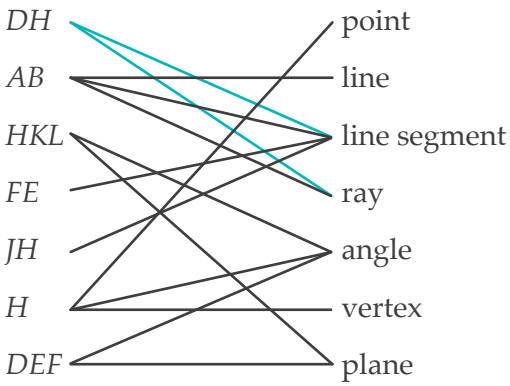
PRACTICE

1. a. $\overleftrightarrow{DE}$
   b. $\overrightarrow{CG}$
   c. K
   d. $\angle DHK$
   e. $\overline{FL}$

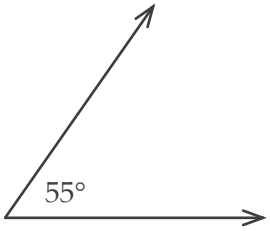
2. The exact angle measures are shown below. Answers within 1–3 degrees of the measure listed are acceptable.

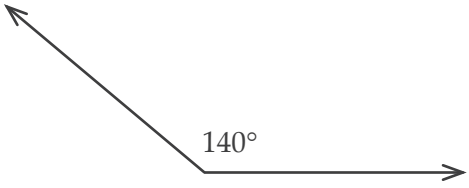
Angle	Classification	Measure
$\angle DEF$	right	90°
$\angle DHK$	obtuse	100°
$\angle HKJ$	acute	10°
$\angle GCE$	right	90°
$\angle LFK$	acute	62°

3. 

4. 

5. a. no
   b. ≅
   c. no

6. a. 

   b. 

REVIEW

1. $x \bullet 12 = 5$

$$\frac{x \bullet 12}{12} = \frac{5}{12}$$

$$x = 0.41\overline{6} \approx 0.42$$

42%

2. a. $(0,30)$

Phillip already knew 30 digits of pi when he signed up for the competition.

b. Rise: up 80 Run: right 8

$$m = \frac{80}{8} = 10$$

Phillip learned 10 new digits per week.

c. $y = mx + b$

$y = 10x + 30$

d. $(0,5)$

Jasmine already knew five digits of pi when she signed up for the competition.

e. Rise: up 120 Run: right 8

$$m = \frac{120}{8} = 15$$

Jasmine learned 15 new digits per week.

f. $y - 80 = 15(x - 5)$

g. up to week 5

h. after week 5

i. At week 5, Phillip and Jasmine both have 80 digits of pi memorized.

j. January 17

Go back eight weeks from March 14. Two weeks (14 days) before March 14 is February 28. Four weeks (28 days) before February 28 is January 31. Two weeks (14 days) before January 31 is January 17.

Angle Relationships and Transversals

WARM-UP

123°

PRACTICE

1. Detailed work is shown below.

Angle	Complementary	Supplementary
37°	53° **A**	143° **B**
69°	21° **C**	111° **D**
104°	none **E**	76° **F**
192°	none **G**	none **H**

A
$90° - 37° = 53°$

B
$180° - 37° = 143°$

C
$90° - 69° = 21°$

D
$180° - 69° = 111°$

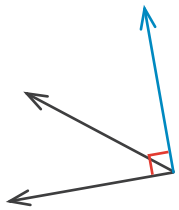
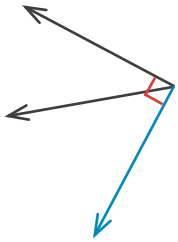
E
104° is greater than 90°.

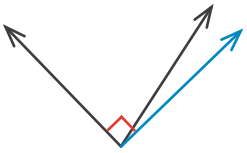
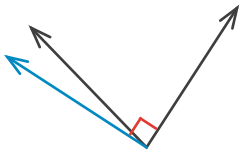
F
$180° - 104° = 76°$

G
192° is greater than 90°.

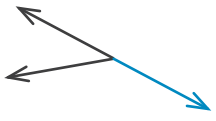
H
192° is greater than 180°.

2. The student should have drawn a ray to form a right angle with the angle given. Possible answers are shown in blue.

a.  or 

b.  or 

3. The student should have drawn a ray to form a straight line with the angle given. Possible answers are shown in blue.

a.  or 

b.  or 

4. a. The angle that corresponds to $\angle a$ is $\angle e$, so it measures 65°.

b. $180° - 65° = 115°$

The interior angle that is adjacent to $\angle a$ is $\angle d$, and it measures 115°.

c. The angle vertical to $\angle a$ is $\angle c$, so it measures 65°.

d. An alternate interior angle for $\angle a$ is $\angle g$, so it measures 65°.

e. $180° - 65° = 115°$

The exterior angle that is adjacent to $\angle a$ is $\angle b$, and it measures 115°.

f. The angle that corresponds to $\angle b$ is $\angle f$, so it measures 115°.

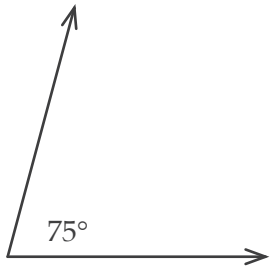
g. The angle that corresponds to $\angle d$ is $\angle h$, so it measures 115°.

5.

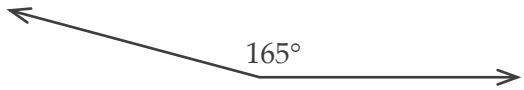
Word	Definition
supplementary angles	two angles whose sum is 180°
adjacent angles	two angles that have the same vertex and a common side
alternate exterior angles	nonadjacent exterior angles that are located on opposite sides of the transversal
transversal	line that intersects two or more lines
corresponding angles	angles located in the same position on parallel lines when the parallel lines are cut by a transversal
vertical angles	nonadjacent angles that are opposite each other at the intersection of two lines
complementary angles	two angles whose sum is 90°
alternate interior angles	nonadjacent interior angles that are located on opposite sides of the transversal
parallel lines	lines that never intersect and are always the same distance apart

REVIEW

1. a. acute



b. obtuse



2. $$\begin{aligned} -6(6s-7)+s &= 476 \\ -36s+42+s &= 476 \\ -35s+42 &= 476 \\ -35s+42-42 &= 476-42 \\ -35s &= 434 \\ \frac{-35s}{-35} &= \frac{434}{-35} \\ s &= -12.4 \end{aligned}$$

3. $$\begin{aligned} &\left(9.8\times10^{-12}\right)\bullet\left(5\times10^{-13}\right) \\ &=\left(9.8\bullet5\right)\times\left(10^{-12}\bullet10^{-13}\right) \\ &=49\times10^{-12+(-13)} \\ &=49\times10^{-25} \\ &=4.9\times10^{-24} \end{aligned}$$

4. $l+w+d\le62$

5. $\frac{7}{15}$ and $\frac{7}{16}$ are both less than $\frac{1}{2}$. The numerators are the same, so the larger denominator is the smaller fraction.

$$\frac{7}{16}<\frac{7}{15}$$

$\frac{3}{5}$ and $\frac{4}{5}$ are both greater than $\frac{1}{2}$ but less than 1.

The denominators are the same, so the smaller numerator is the smaller fraction.

$$\frac{3}{5}<\frac{4}{5}$$

$\frac{3}{2}$ is greater than 1.

Least to greatest:

$$\frac{7}{16},\ \frac{7}{15},\ \frac{1}{2},\ \frac{3}{5},\ \frac{4}{5},\ \frac{3}{2}$$

Properties of Triangles

WARM-UP

$180° - 101° = 79°$

PRACTICE

Note: Students did not need to complete all problems in this practice section. They could choose problems to complete until five in a row (vertically, horizontally, or diagonally) are crossed off in the table. All answers are shown below.

1. obtuse, scalene

2. $6 + 8 = 14 \quad 14 > 10$

   $6 + 10 = 16 \quad 16 > 8$

   $8 + 10 = 18 \quad 18 > 6$

   yes

3. $50 + 45 + x = 180$

   $95 + x = 180$

   $95 + x - 95 = 180 - 95$

   $x = 85$

   $85°$

4. $5x + 4x + 10x + 9 = 180$

   $19x + 9 = 180$

   $19x + 9 - 9 = 180 - 9$

   $19x = 171$

   $\frac{19x}{19} = \frac{171}{19}$

   $x = 9$

   $m\angle A = 4x° = 4 \bullet 9° = 36°$

5. $100 + x + x = 180$

   $100 + 2x = 180$

   $100 + 2x - 100 = 180 - 100$

   $2x = 80$

   $\frac{2x}{2} = \frac{80}{2}$

   $x = 40$

   $40°$ and $40°$

6. right, scalene

7. $83 + 25 + x = 180$

   $108 + x = 180$

   $108 + x - 108 = 180 - 108$

   $x = 72$

   $72°$

8. $x + x + x = 180$

   $3x = 180$

   $\frac{3x}{3} = \frac{180}{3}$

   $x = 60$

   $60°$

9. $11x-10+7x+x=180$

$19x-10=180$

$19x-10+10=180+10$

$19x=190$

$\frac{19x}{19}=\frac{190}{19}$

$x=10$

$(11x-10)^\circ=(11\bullet 10-10)^\circ=100^\circ$

10. $4+5=9 \qquad 9<10$

no

11. acute, isosceles

12. $80+80+x=180$

$160+x=180$

$160+x-160=180-160$

$x=20$

20°

13. $7x+6+5x+3+3x+6=180$

$15x+15=180$

$15x+15-15=180-15$

$15x=165$

$\frac{15x}{15}=\frac{165}{15}$

$x=11$

$m\angle D=(7x+6)^\circ=(7\bullet 11+6)^\circ=83^\circ$

14. $2+2=4 \qquad 4<5$

no

15. $139+12+x=180$

$151+x=180$

$151+x-151=180-151$

$x=29$

29°

16. $90+x+x=180$

$90+2x=180$

$90+2x-90=180-90$

$2x=90$

$\frac{2x}{2}=\frac{90}{2}$

$x=45$

45°

17. $4x-4+100+2x=180$

$96+6x=180$

$96+6x-96=180-96$

$6x=84$

$\frac{6x}{6}=\frac{84}{6}$

$x=14$

$m\angle G=(4x-4)^\circ=(4\bullet 14-4)^\circ=52^\circ$

18. $40+35+x=180$

$75+x=180$

$75+x-75=180-75$

$x=105$

105°

19. acute, equilateral

20. $2x+40+2x=180$

$40+4x=180$

$40+4x-40=180-40$

$4x=140$

$\frac{4x}{4}=\frac{140}{4}$

$x=35$

$m\angle J=2x^\circ=2\bullet 35^\circ=70^\circ$

21. $2+4=6 \qquad 6>5$

$2+5=7 \qquad 7>4$

$4+5=9 \qquad 9>2$

yes

22. $90 + 25 + x = 180$

$115 + x = 180$

$115 + x - 115 = 180 - 115$

$x = 65$

$65°$

23. $90 + 3x + 5x - 6 = 180$

$84 + 8x = 180$

$84 + 8x - 84 = 180 - 84$

$8x = 96$

$\frac{8x}{8} = \frac{96}{8}$

$x = 12$

$(5x - 6)° = (5 \bullet 12 - 6)° = 54°$

24. obtuse, isosceles

REVIEW

1. a. The angle that corresponds to $\angle a$ is $\angle o$, so it measures $87°$.

   b. $180° - 87° = 93°$

   The interior angle that is adjacent to $\angle a$ is $\angle m$, and it measures $93°$.

   c. The angle vertical to $\angle a$ is $\angle h$, so it measures $87°$.

   d. An alternate interior angle for $\angle a$ is $\angle i$, so it measures $87°$.

   e. $180° - 87° = 93°$

   The exterior angle that is adjacent to $\angle a$ is $\angle c$, and it measures $93°$.

   f. An alternate exterior angle for $\angle c$ is $\angle n$, so it measures $93°$.

   g. The angle that corresponds to $\angle c$ is $\angle p$, so it measures $93°$.

2. $12 + 15 + 15 + 12 + 6 = 60$

   $\frac{12}{60} = 0.2 = 20\%$

3. a. $4 \cancel{\text{ ft}} \bullet \frac{12 \text{ in}}{1 \cancel{\text{ ft}}} = \frac{48 \text{ in}}{1} = 48 \text{ in}$

   b. $48 \bullet x = 6$

   $\frac{48 \bullet x}{48} = \frac{6}{48}$

   $x = \frac{6}{48} = \frac{1}{8}$

4. $\frac{key - 2ey}{e^2}$

   $\frac{(-6)(4)(-2.5) - 2(4)(-2.5)}{(4)^2}$

   $= \frac{60 - (-20)}{16}$

   $= \frac{80}{16}$

   $= 5$

Polygons and Interior Angles

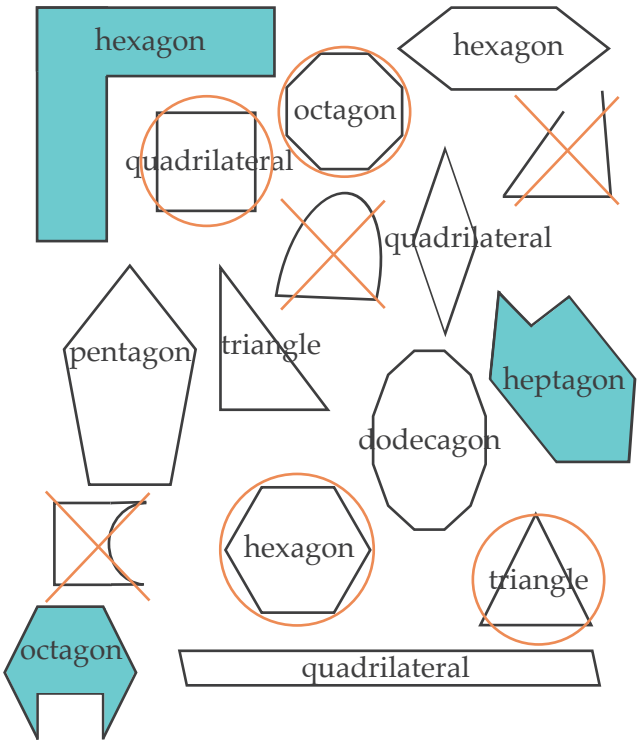
WARM-UP

$$48 + 71 + x = 180$$
$$119 + x = 180$$
$$119 + x - 119 = 180 - 119$$
$$x = 61$$

$61°$

PRACTICE

1. Answers for Parts A–D are in the diagram below.



2. a.

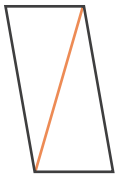
Shape	Reason
kite	It has two sets of adjacent, congruent sides.
quadrilateral	It has four sides.

b.

Shape	Reason
rectangle	It has four right angles.
parallelogram	It has two pairs of parallel sides.
quadrilateral	It has four sides.

3. Note: Position of diagonals may vary, but the number of diagonals should be the same.

a.



$2 \bullet 180° = 360°$

b.

$8 \bullet 180° = 1440°$

4. a. Interior angle sum: $3 \bullet 180° = 540°$

$$\begin{aligned} 110 + 4x + 40 + 8x + 3x &= 540 \\ 150 + 15x &= 540 \\ 150 + 15x - 150 &= 540 - 150 \\ 15x &= 390 \\ \frac{15x}{15} &= \frac{390}{15} \\ x &= 26 \end{aligned}$$

$m\angle B = 4x° = 4 \bullet 26° = 104°$

$m\angle D = 8x° = 8 \bullet 26° = 208°$

b. Interior angle sum: $2 \bullet 180° = 360°$

$$\begin{aligned} 4x - 5 + 2x + 11 + 4x - 5 + 2x + 11 &= 360 \\ 12x + 12 &= 360 \\ 12x + 12 - 12 &= 360 - 12 \\ 12x &= 348 \\ \frac{12x}{12} &= \frac{348}{12} \\ x &= 29 \end{aligned}$$

$m\angle G = (2x + 11)° = (2 \bullet 29 + 11)° = 69°$

$m\angle H = (4x - 5)° = (4 \bullet 29 - 5)° = 111°$

c. Interior angle sum: $5 \bullet 180° = 900°$

$$\begin{aligned} 120 + 3x + 15 + 2x - 10 + 150 + 4x - 8 + 140 + 5x - 11 &= 900 \\ 396 + 14x &= 900 \\ 396 + 14x - 396 &= 900 - 396 \\ 14x &= 504 \\ \frac{14x}{14} &= \frac{504}{14} \\ x &= 36 \end{aligned}$$

$m\angle K = (3x + 15)° = (3 \bullet 36 + 15)° = 123°$

$m\angle N = (4x - 8)° = (4 \bullet 36 - 8)° = 136°$

REVIEW

1. a. 9 sections: 1 orange, 4 green, 4 purple

orange: $\frac{1}{9}$ green: $\frac{4}{9}$ purple: $\frac{4}{9}$

b. $a^2 + b^2 = c^2$

$15^2 + 15^2 = c^2$

$225 + 225 = c^2$

$450 = c^2$

$\sqrt{450} = \sqrt{c^2}$

$\sqrt{450} = c$

$21.2 \approx c$

21.2 in

c. $P(\text{orange and green})$

$= P(\text{orange}) \bullet P(\text{green})$

$= \frac{1}{9} \bullet \frac{4}{9}$

$= \frac{4}{81} \approx 0.0494$

4.94%

d. right and isosceles

e. $2 + 1.5 = 3.5$ $3.5 < 4$

no

f. 3 children + 2 adults = 5 people

$\frac{2 \text{ adults}}{5 \text{ people}} = \frac{x \text{ adults}}{35 \text{ people}}$

$\frac{2}{5} = \frac{x}{35}$

$2 \bullet 35 = 5x$

$70 = 5x$

$\frac{70}{5} = \frac{5x}{5}$

$14 = x$

14 adults

g. $0.32 \bullet x = 5000$

$\frac{0.32 \bullet x}{0.32} = \frac{5000}{0.32}$

$x = 15{,}625$

$15,625

h. $15{,}625 = 25x$

$\frac{15{,}625}{25} = \frac{25x}{25}$

$625 = x$

625 games

Congruence and Similarity in Figures

WARM-UP

$(n-2)\cdot 180°$

$(10-2)\cdot 180°$

$=8\cdot 180°$

$=1440°$

PRACTICE

1. a. $GH = DE$

$2y = 14$

$\frac{2y}{2} = \frac{14}{2}$

$y = 7$

b. $HI = EF$

$3z - 1 = 11$

$3z - 1 + 1 = 11 + 1$

$3z = 12$

$\frac{3z}{3} = \frac{12}{3}$

$z = 4$

2. $\frac{AB}{DE} = \frac{9}{14} \approx 0.643$

$\frac{BC}{EF} = \frac{7}{11} \approx 0.636$

no

3. $\frac{DE}{JK} = \frac{14}{8} = 1.75$

$\frac{EF}{KL} = \frac{11}{6} \approx 1.833$

no

4. $\overline{LK} \cong \overline{MN}$

$\angle K \cong \angle N$

$\overline{KJ} \cong \overline{NO}$

side-angle-side

5. $\frac{14}{7} = 2$

$\frac{12}{6} = 2$

yes

6. $\frac{19}{13} \approx 1.5$

$\frac{8}{5} = 1.6$

no

7.

$TU = SR$	$WV = PQ$
$4a + 2 = 10$	$2b - 2 = 14$
$4a + 2 - 2 = 10 - 2$	$2b - 2 + 2 = 14 + 2$
$4a = 8$	$2b = 16$
$\frac{4a}{4} = \frac{8}{4}$	$\frac{2b}{2} = \frac{16}{2}$
$a = 2$	$b = 8$

8. a. angle-side-angle

b. none

REVIEW

1. a. $9x+5x-4+8x+8=180$

$$22x+4=180$$
$$22x+4-4=180-4$$
$$22x=176$$
$$\frac{22x}{22}=\frac{176}{22}$$
$$x=8$$

$m\angle C=(9x)^\circ=(9\bullet 8)^\circ=72^\circ$

$m\angle A=(5x-4)^\circ=(5\bullet 8-4)^\circ=36^\circ$

$m\angle N=(8x+8)^\circ=(8\bullet 8+8)^\circ=72^\circ$

b. acute, isosceles

2. a. alternate interior

b. congruent

c. $16y=19y-15$

$$16y-19y=19y-15-19y$$
$$-3y=-15$$
$$\frac{-3y}{-3}=\frac{-15}{-3}$$
$$y=5$$

$(16y)^\circ=(16\bullet 5)^\circ=80^\circ$

$(19y-15)^\circ=(19\bullet 5-15)^\circ=80^\circ$

3. $-2x+3y=9$

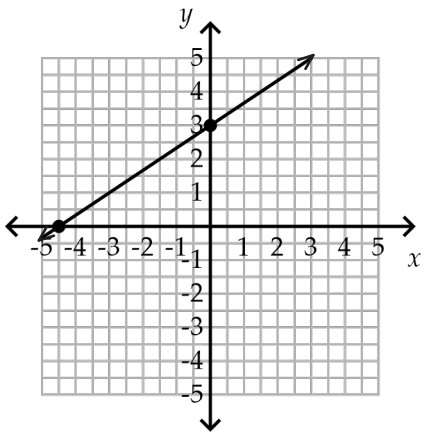
$$-2x+3(0)=9$$
$$-2x=9$$
$$\frac{-2x}{-2}=\frac{9}{-2}$$
$$x=-4.5$$

x-intercept: $(-4.5,0)$

$-2x+3y=9$

$$-2(0)+3y=9$$
$$3y=9$$
$$\frac{3y}{3}=\frac{9}{3}$$
$$y=3$$

y-intercept: $(0,3)$



Logic Lesson 3

Logic puzzles can be approached in many different ways. The solutions here may not represent all possible methods or answers.

1. 8 people

   There are four children (two boys and two girls), their parents, and their grandparents (their mother's mother and their father's father). The grandfather is also a father, and the grandmother is also a mother. The parents are also children: the father is a son and the mother a daughter. The grandparents are each in-laws of one of the parents, and the mother is the grandfather's daughter-in-law.

2. More than one solution is possible. One solution for each number is shown below.

   a. $13 = \frac{55+5+5}{5}$

   b. $14 = 5+5+5-\frac{5}{5}$

   c. $15 = \frac{5}{5} \bullet (5+5+5)$

3. The son is 37 years old, and his mother is 73 years old.

   Guess-and-check method:

   Start with a possible adult age for the son and reverse the digits: 24 and 42. Since 41 is not twice 23, try a new starting age close to the first one. Try 25 and 52. 51 is not double 24, but a pattern can be observed. The second digit in 41 and 51 is odd, so it cannot be twice another number. Whenever a number in the twenties is doubled and then one is subtracted, the second digit will be odd. Therefore, the son is not in his twenties.

   Start with a possible adult age for the son in the thirties and reverse the digits: 35 and 53. Since 52 is not twice 34, try a new starting age. Try 36 and 63. Since 62 is not twice 35, try a new starting age. Try 37 and 73. 72 is twice 36.

4. 1st: Somsak's family
   2nd: Malee's family
   3rd: Arthit's family
   4th: Kate's family

   If Arthit was wrong, then he was either first or last. This would mean that Malee was also wrong. The organizer said only one person was wrong, so it couldn't have been Arthit.

   If Somsak was wrong, then he did finish last. That would mean that Kate was also wrong. Only one person can be wrong, so it couldn't have been Somsak.

   If Malee was wrong, then she was not first and Arthit was not second. The other three statements could be correct, and this would be the order:

   1st: Somsak (not last)
   2nd: Malee (not first)
   3rd: Arthit (in the middle but not second)
   4th: Kate (last)

5. Logic puzzles can be completed in different ways. Information that can be gathered from each clue is shown below.

   Because there are two April 14ths, there are two possible solutions:

	Favorite Day				Favorite Event			
	April 13th	April 14th	April 14th	April 15th	Dancing	Making Garlands	Water Fight	Building Sand Pagodas
Dara (girl)	✗	✓	✗	✗	✗	✗	✗	✓
Mali (girl)	✓	✗	✗	✗	✓	✗	✗	✗
Saksit (boy)	✗	✗	✓	✗	✗	✓	✗	✗
Phet (boy)	✗	✗	✗	✓	✗	✗	✓	✗
Dancing	✓	✗	✗	✗				
Making Garlands	✗	✗	✓	✗				
Water Fight	✗	✗	✗	✓				
Building Sand Pagodas	✗	✓	✗	✗				

	Favorite Day				Favorite Event			
	April 13th	April 14th	April 14th	April 15th	Dancing	Making Garlands	Water Fight	Building Sand Pagodas
Dara (girl)	X	X	✓	X	X	X	X	✓
Mali (girl)	✓	X	X	X	✓	X	X	X
Saksit (boy)	X	✓	X	X	X	✓	X	X
Phet (boy)	X	X	X	✓	X	X	✓	X
Dancing	✓	X	X	X				
Making Garlands	X	✓	X	X				
Water Fight	X	X	X	✓				
Building Sand Pagodas	X	X	✓	X				

Clue #1: Because the event that matches to April 14 cannot be Water Fight or Dancing, the other two events must go with April 14. Put a check mark in an April 14 column for Making Garlands and a check mark in the other April 14 column for Building Sand Pagodas.

Clue #2: Put a check mark in the April 15 column (final day of festival) for Water Fight. That means Dancing goes with April 13. Also, since a boy chose Water Fight, put an X in the row for both girls for Water Fight.

Clue #3: Since a boy chose Making Garlands, put an X in the row for both girls for Making Garlands.

Clue #4: If Dara's favorite day is not April 13 (first day), her favorite event was not Dancing. That means her favorite event was Building Sand Pagodas, which was on April 14.

From Clue #1, a boy and a girl did not choose the Water Fight and Dancing, so the other boy and girl must have chosen those events. From Clue #2, a boy chose Water Fight. Therefore, a girl chose Dancing. Since Dara did not choose Dancing, Mali chose Dancing on April 13.

Clue #5: If Phet did not choose Making Garlands, then Saksit did. Therefore, Saksit chose April 14, and Phet chose the Water Fight and April 15.

a. Dara's favorite day: April 14th
   Dara's favorite event: building sand pagodas

b. Mali's favorite day: April 13th
   Mali's favorite event: dancing

c. Saksit's favorite day: April 14th
   Saksit's favorite event: making garlands

d. Phet's favorite day: April 15th
   Phet's favorite event: water fight

Proportions with Similar Figures

WARM-UP

$\frac{7.5}{5} = 1.5$

$\frac{10.5}{7} = 1.5$

yes

PRACTICE

1. a. $\frac{EF}{BC} = \frac{4.5}{3} = 1.5 \quad \frac{DF}{AC} = \frac{6}{4} = 1.5$

$m\angle C = m\angle F$

yes

b. $\frac{DE}{AB} = \frac{12}{6} = 2 \quad \frac{EF}{BC} = \frac{16}{8} = 2$

$\frac{FD}{CA} = \frac{20}{10} = 2$

yes

c. $\frac{AC}{DF} = \frac{2}{8} = \frac{1}{4} \quad \frac{BC}{EF} = \frac{3}{12} = \frac{1}{4}$

The included angle for sides AC and BC is angle C. The included angle for sides DF and EF is angle F. The congruent angles are not the included angles for the given sides.

no

d. Two pairs of corresponding angles have equal measure.

yes

2. a. $\frac{AB}{DE} = \frac{BC}{EF}$

$\frac{26}{x} = \frac{38}{19}$

$26 \cdot 19 = 38x$

$494 = 38x$

$\frac{494}{38} = \frac{38x}{38}$

$13 = x$

$\frac{AC}{DF} = \frac{BC}{EF}$

$\frac{37}{y} = \frac{38}{19}$

$37 \cdot 19 = 38y$

$703 = 38y$

$\frac{703}{38} = \frac{38y}{38}$

$18.5 = y$

b. $\frac{GH}{KL} = \frac{HI}{LM}$

$\frac{60}{15} = \frac{w}{17}$

$60 \cdot 17 = 15w$

$1020 = 15w$

$\frac{1020}{15} = \frac{15w}{15}$

$68 = w$

$$\frac{GH}{KL}=\frac{JI}{NM}$$
$$\frac{60}{15}=\frac{124}{z}$$
$$60z=124\bullet 15$$
$$60z=1860$$
$$\frac{60z}{60}=\frac{1860}{60}$$
$$z=31$$

c. $122=3a+5$
$$122-5=3a+5-5$$
$$117=3a$$
$$\frac{117}{3}=\frac{3a}{3}$$
$$39=a$$

$$\frac{10}{5}=\frac{QR}{VW}$$
$$\frac{10}{5}=\frac{2}{b}$$
$$10b=5\bullet 2$$
$$10b=10$$
$$\frac{10b}{10}=\frac{10}{10}$$
$$b=1$$

d. $\frac{14}{c}=\frac{DC}{HG}$
$$\frac{14}{c}=\frac{3}{9}$$
$$14\bullet 9=3c$$
$$126=3c$$
$$\frac{126}{3}=\frac{3c}{3}$$
$$42=c$$

$$2d-7=77$$
$$2d-7+7=77+7$$
$$2d=84$$
$$\frac{2d}{2}=\frac{84}{2}$$
$$d=42$$

3. Ratio of sides: $\frac{3}{5}$

Ratio of areas: $\left(\frac{3}{5}\right)^2=\frac{9}{25}$

$$\frac{9}{25}=\frac{x}{15}$$
$$9\bullet 15=25x$$
$$135=25x$$
$$\frac{135}{25}=\frac{25x}{25}$$
$$5.4=x$$

$5.4\ \text{km}^2$

4. Ratio of areas: $\frac{368}{23}=16$

Ratio of sides: $\sqrt{16}=4$

$$\frac{20}{g}=4$$
$$g\bullet\frac{20}{g}=4\bullet g$$
$$20=4g$$
$$\frac{20}{4}=\frac{4g}{4}$$
$$5=g$$

REVIEW

1. a. $6 \bullet 180° = 1080°$

   b. $1080° \div 8 = 135°$

2. a. First equation: $m = 1$

   Second equation: $m = 1$

   $\parallel$

   b. First equation: $m = -2$

   Second equation: $m = -\frac{1}{2}$

   ~~$y = -2x$ and $y = -\frac{1}{2}x + 2$~~

   c. First equation: $m = 2.5 = \frac{5}{2}$

   Second equation: $m = -0.4 = -\frac{2}{5}$

   $\perp$

3. $$\frac{5}{8} \bullet x = 15$$
   $$\frac{8}{5} \bullet \frac{5}{8} \bullet x = 15 \bullet \frac{8}{5}$$
   $$x = 24$$

   24 pianists

4. a. side-side-side

   b. $$JO = LU$$
   $$x + 6 = 2x - 3$$
   $$x + 6 - x = 2x - 3 - x$$
   $$6 = x - 3$$
   $$6 + 3 = x - 3 + 3$$
   $$9 = x$$

5. 105°

Drawings and Constructions

WARM-UP

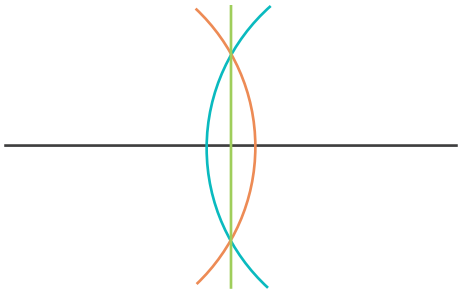
$$\frac{25}{50} = \frac{7}{3x+2}$$
$$25(3x+2) = 50 \bullet 7$$
$$75x + 50 = 350$$
$$75x + 50 - 50 = 350 - 50$$
$$75x = 300$$
$$\frac{75x}{75} = \frac{300}{75}$$
$$x = 4$$

$3(4)+2=14$

14 in

PRACTICE

1. a. Note: Arcs drawn from a compass are shown. The perpendicular bisector is the green line segment.

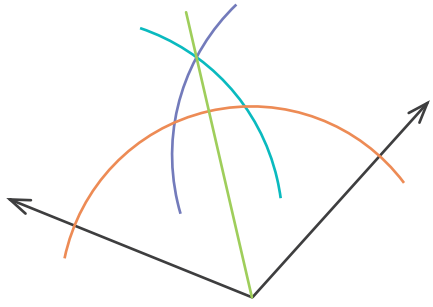


b. Left side: 3 cm Right side: 3 cm

c. The answer should be within a few degrees of 90.

90°

2. a. Note: Arcs drawn from a compass are shown. The angle bisector is the green line segment.



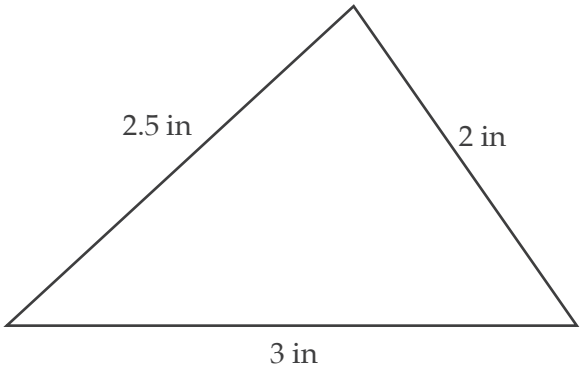
b. The answers should be within a few degrees of 55.

Left angle measure: 55°

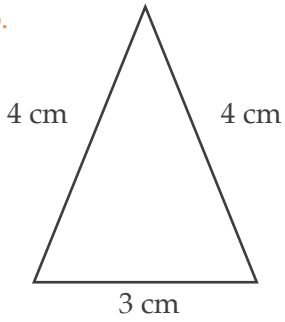
Right angle measure: 55°

3. Note: Triangles may be oriented differently, but they should have the same side lengths.

a.

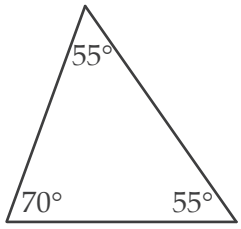


b.

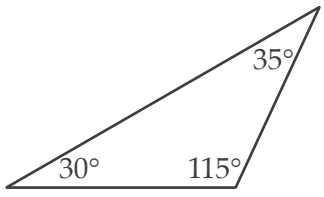


4. Note: Triangles may be oriented differently, but they should have the same angle measures.

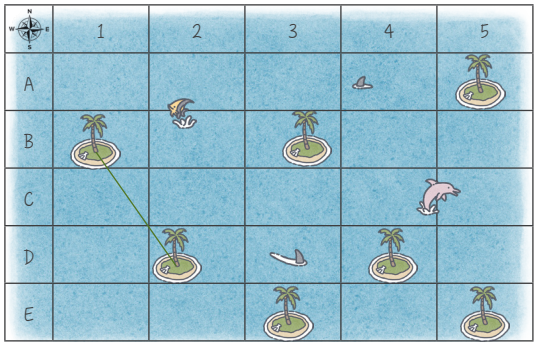
a.



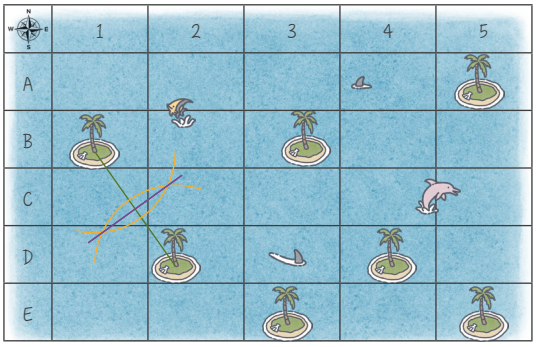
b.



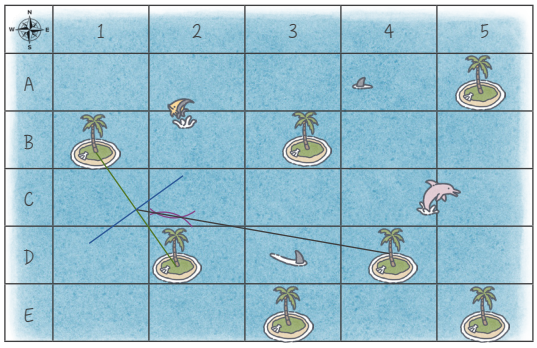
5. a.



b. Note: Arcs drawn from a compass are shown. The perpendicular bisector is the purple line segment.



c. Note: Arcs drawn from a compass are shown. The angle bisector is the black line segment.



d. D4

REVIEW

1. a. quadrilaterals

   b. irregular

   convex

   c. $$\begin{aligned} 8(x-3) &= 120 \\ 8x-24 &= 120 \\ 8x-24+24 &= 120+24 \\ 8x &= 144 \\ \frac{8x}{8} &= \frac{144}{8} \\ x &= 18 \end{aligned}$$

   d. $$\begin{aligned} \frac{MA}{LO} &= \frac{AT}{OV} \\ \frac{2}{8} &= \frac{y}{5} \\ 2 \bullet 5 &= 8y \\ 10 &= 8y \\ \frac{10}{8} &= \frac{8y}{8} \\ 1.25 &= y \end{aligned}$$

2. $$23{,}225 \text{ cm} \bullet \text{cm} \bullet \frac{1 \text{ in}}{2.54 \text{ cm}} \bullet \frac{1 \text{ in}}{2.54 \text{ cm}} \bullet \frac{1 \text{ ft}}{12 \text{ in}} \bullet \frac{1 \text{ ft}}{12 \text{ in}}$$
   $$= \frac{23{,}225 \text{ ft} \bullet \text{ft}}{2.54 \bullet 2.54 \bullet 12 \bullet 12}$$
   $$= \frac{23{,}225 \text{ ft}^2}{929.0304}$$
   $$\approx 25 \text{ ft}^2$$

3. $$\begin{aligned} 42 \bullet x &= 3 \\ \frac{42 \bullet x}{42} &= \frac{3}{42} \\ x &= \frac{3}{42} = \frac{1}{14} \end{aligned}$$

4. a. corresponding

   b. congruent

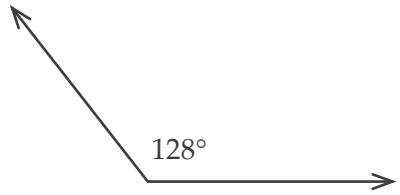
   c. $$\begin{aligned} 23x-4 &= 16x+24 \\ 23x-4-16x &= 16x+24-16x \\ 7x-4 &= 24 \\ 7x-4+4 &= 24+4 \\ 7x &= 28 \\ \frac{7x}{7} &= \frac{28}{7} \\ x &= 4 \end{aligned}$$

   $$(23x-4)^\circ = (23 \bullet 4-4)^\circ = 88^\circ$$

   $$(16x+24)^\circ = (16 \bullet 4+24)^\circ = 88^\circ$$

Circles, Circumference, and Perimeter

WARM-UP



PRACTICE

1.

		[e]P							
		E							
[a]A	R	O	U	N	D				
	I								
[b]S	A	M	E						
	E					[c]C	H	O	R	D
	T					I				
[d]C	E	N	T	E	R					
	R					C				
						L				
						E				

2. a. $C = 2\pi r$

$C = 2\pi \cdot 2$

$C = 4\pi$

$C \approx 12.57$

12.57 cm

b. $P = 15 \text{ in} + 15 \text{ in} + 23 \text{ in} + 23 \text{ in} = 76 \text{ in}$

c. $P = 30 \text{ yd} + 6 \text{ yd} + 10 \text{ yd} + 7 \text{ yd} + 10 \text{ yd} + 6 \text{ yd} + 30 \text{ yd} + 6 \text{ yd} + 10 \text{ yd} + 7 \text{ yd} + 10 \text{ yd} + 6 \text{ yd} = 138 \text{ yd}$

d. The perimeter includes the curved part of two semicircles. Together these parts make the circumference of a circle with a diameter of 5 cm.

$C = \pi d$

$C = \pi \cdot 5$

$C \approx 15.71$

15.71 cm

$P = 15.71 \text{ cm} + 5 \text{ cm} + 5 \text{ cm} = 25.71 \text{ cm}$

3. a. $C = 2\pi r$

$45 = 2\pi r$

$\frac{45}{2\pi} = \frac{2\pi r}{2\pi}$

$7.16 \approx r$

7.16 in

b. $P = 6 + 6 + x + x$

$25 = 12 + 2x$

$25 - 12 = 12 + 2x - 12$

$13 = 2x$

$\frac{13}{2} = \frac{2x}{2}$

$6.5 = x$

6.5 cm

c. $P = 3 \cdot 4 + 1 \cdot 2 + f$

$16 = 12 + 2 + f$

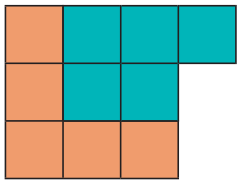
$16 = 14 + f$

$16 - 14 = 14 + f - 14$

$2 = f$

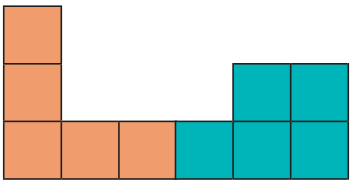
2 in

4. a. To have the smallest possible perimeter, the pentominoes must share as many unit sides as possible.



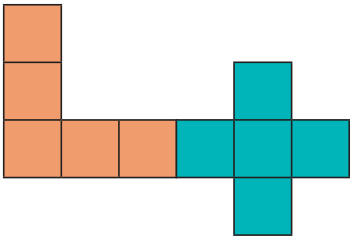
14 units

b. To have the largest possible perimeter, the pentominoes must share as few sides as possible. In this case, only one side is shared.



20 units

c. Optional: There are several possible answers. Two pentominoes that can be arranged to obtain a perimeter of 22 units are shown below.



REVIEW

1. a. $\dfrac{26 \text{ pages}}{20 \text{ minutes}} = \dfrac{312 \text{ pages}}{x \text{ minutes}}$

$\dfrac{26}{20} = \dfrac{312}{x}$

$26x = 20 \cdot 312$

$26x = 6240$

$\dfrac{26x}{26} = \dfrac{6240}{26}$

$x = 240$

240 minutes

b. $240 \text{ minutes} \cdot \dfrac{1 \text{ hour}}{60 \text{ minutes}} = \dfrac{240 \cdot 1 \text{ hour}}{60}$

$= 4$ hours

2. Number of odd dates in March: 16

$\dfrac{16}{31}$

3. $\left(\dfrac{16+38}{2}, \dfrac{-5+(-29)}{2}\right) = \left(\dfrac{54}{2}, \dfrac{-34}{2}\right) = (27, -17)$

4. $(5k+18)^3 = -343$

$\sqrt[3]{(5k+18)^3} = \sqrt[3]{-343}$

$5k + 18 = -7$

$5k + 18 - 18 = -7 - 18$

$5k = -25$

$\dfrac{5k}{5} = \dfrac{-25}{5}$

$k = -5$

5. $240 \text{ servings} \cdot \dfrac{\frac{1}{2} \text{ cup}}{1 \text{ serving}} = \dfrac{240 \cdot \frac{1}{2} \text{ cups}}{1}$

$= 120$ cups

$120 \text{ cups} \cdot \dfrac{1 \text{ gallon}}{16 \text{ cups}} = \dfrac{120 \cdot 1 \text{ gallons}}{16}$

$= 7.5$ gallons

Arcs, Sectors, and Angles in a Circle

WARM-UP

$P = 1.5 \text{ in} + 3.5 \text{ in} + 3.5 \text{ in} + 3 \text{ in} + 3 \text{ in} = 14.5 \text{ in}$

PRACTICE

1. Note: Work may vary, but the final answers should be the same.

a. $\angle AXF$ and $\angle CXD$ are vertical angles.

$a = 68°$

$$90° + b + 68° = 180°$$
$$b + 158° = 180°$$
$$b + 158° - 158° = 180° - 158°$$
$$b = 22°$$

$$a + 37° + c = 180°$$
$$68° + 37° + c = 180°$$
$$105° + c = 180°$$
$$105° + c - 105° = 180° - 105°$$
$$c = 75°$$

b. $\angle BXG$ and $\angle DXE$ are vertical angles.

$$41° + a = 95°$$
$$41° + a - 41° = 95° - 41°$$
$$a = 54°$$

$$a + 41° + b + 41° = 180°$$
$$54° + 41° + b + 41° = 180°$$
$$136° + b = 180°$$
$$136° + b - 136° = 180° - 136°$$
$$b = 44°$$

$$70° + c + 95° = 180°$$
$$165° + c = 180°$$
$$165° + c - 165° = 180° - 165°$$
$$c = 15°$$

c.
$$a + 40° = 90°$$
$$a + 40° - 40° = 90° - 40°$$
$$a = 50°$$

$$a + 40° + b = 180°$$
$$50° + 40° + b = 180°$$
$$90° + b = 180°$$
$$90° + b - 90° = 180° - 90°$$
$$b = 90°$$

$$40° + b + c = 180°$$
$$40° + 90° + c = 180°$$
$$130° + c = 180°$$
$$130° + c - 130° = 180° - 130°$$
$$c = 50°$$

$\angle FXE$ and $\angle BXC$ are vertical angles.

$d = 40°$

$\angle FXA$ and $\angle CXD$ are vertical angles.

$e = 90°$

2. a. $\frac{150°}{360°} = \frac{5}{12}$

$\frac{5}{12} \cdot 9\pi = \frac{15}{4}\pi \approx 11.8$

11.8 ft^2

b. $\frac{330°}{360°} = \frac{11}{12}$

$\frac{11}{12} \cdot 64\pi = \frac{176}{3}\pi \approx 184.3$

184.3 ft^2

c. $360° - 100° = 260°$

$\frac{260°}{360°} = \frac{13}{18}$

$\frac{13}{18} \cdot 16\pi = \frac{104}{9}\pi \approx 36.3$

36.3 m^2

3. a. $\frac{40°}{360°} = \frac{1}{9}$

$\frac{1}{9} \cdot 36\pi = 4\pi \approx 12.6$

12.6 in

b. $\frac{125°}{360°} = \frac{25}{72}$

$\frac{25}{72} \cdot 50\pi = \frac{625}{36}\pi \approx 54.5$

54.5 cm

c. $C = 2\pi r$

$C = 2\pi \cdot 2$

$C = 4\pi$

$\frac{210°}{360°} = \frac{7}{12}$

$\frac{7}{12} \cdot 4\pi = \frac{7}{3}\pi \approx 7.3$

7.3 ft

REVIEW

1. a. $40 + 20 + x = 180$

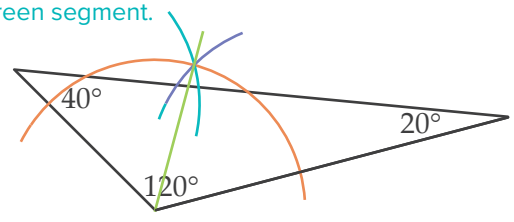
$60 + x = 180$

$60 + x - 60 = 180 - 60$

$x = 120$

120°

b. Note: The triangle may be oriented differently, but it should have the same angle measures. Arcs drawn from a compass are shown. The angle bisector is the green segment.



c. obtuse, scalene

2. $9 \cdot 180° = 1620°$

$1620° \div 11 \approx 147.3°$

3. $\frac{5 + 25 \cdot 3 - 2^4}{-\sqrt{64}}$

$= \frac{5 + 25 \cdot 3 - 16}{-8}$

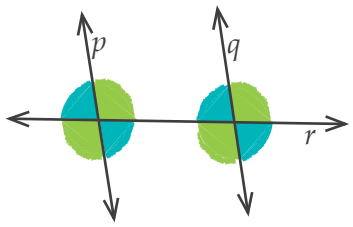
$= \frac{5 + 75 - 16}{-8}$

$= \frac{80 - 16}{-8}$

$= \frac{64}{-8}$

$= -8$

4.



5. a. angle-side-angle

b.
$$\begin{aligned} SP &= IN \\ 9(x+3) &= 8x+34 \\ 9x+27 &= 8x+34 \\ 9x+27-8x &= 8x+34-8x \\ x+27 &= 34 \\ x+27-27 &= 34-27 \\ x &= 7 \end{aligned}$$

Area of Polygons and Circles

WARM-UP

a. $11 \cdot 4 = 44$
$11 \cdot 40 = 440$

b. $7 \cdot 4 = 28$
$7 \cdot 40 = 280$

c. $21 \cdot 4 = 84$
$21 \cdot 40 = 840$

PRACTICE

1. $A = bh$
$A = 4 \cdot 1.7 = 6.8$
6.8 in^2

2. $A = \frac{1}{2}bh$
$A = \frac{1}{2}(2.5)(3)$
$A = 3.75$
3.75 in^2

3. $A = bh$
$9.23 = 3.25h$
$\frac{9.23}{3.25} = \frac{3.25h}{3.25}$
$2.84 = h$
2.84 in

4. Diameter of red circle: $\frac{1}{2}(4 \text{ in}) = 2 \text{ in}$
Radius of red circle: 1 in
$A = \pi r^2$
$A = \pi(1)^2$
$A = \pi \approx 3.14$
3.14 in^2

5. $A = \pi r^2$
$1.77 = \pi r^2$
$\frac{1.77}{\pi} = \frac{\pi r^2}{\pi}$
$0.56 \approx r^2$
$\sqrt{0.56} \approx \sqrt{r^2}$
$0.75 \approx r$
0.75 in

6. $A = bh$
$0.75 = (b)(3b)$
$0.75 = 3b^2$
$\frac{0.75}{3} = \frac{3b^2}{3}$
$0.25 = b^2$
$\sqrt{0.25} = \sqrt{b^2}$
$0.5 = b$
0.5 in

7. Area of one trapezoid (half of the hexagon):

$$\frac{1}{2}\left(22 \text{ in}^2\right) = 11 \text{ in}^2$$

Height of one trapezoid (half of the hexagon):

$$\frac{1}{2}\left(4 \text{ in}\right) = 2 \text{ in}$$

$$A = \frac{1}{2}\left(b_1 + b_2\right)h$$
$$11 = \frac{1}{2}\left(b_1 + 4\right)\left(2\right)$$
$$11 = b_1 + 4$$
$$11 - 4 = b_1 + 4 - 4$$
$$7 = b_1$$

7 in

REVIEW

1. $(-18,-3)$ and $(14,-9)$

$$d = \sqrt{\left(y_2 - y_1\right)^2 + \left(x_2 - x_1\right)^2}$$
$$d = \sqrt{\left(-9 - \left(-3\right)\right)^2 + \left(14 - \left(-18\right)\right)^2}$$
$$d = \sqrt{\left(-6\right)^2 + \left(32\right)^2}$$
$$d = \sqrt{36 + 1024}$$
$$d = \sqrt{1060}$$
$$d \approx 32.6$$

32.6 units

2. $P(\text{higher than 3 and green})$
$= P(\text{higher than 3}) \bullet P(\text{green})$
$= \frac{3}{6} \bullet \frac{2}{6} = \frac{1}{2} \bullet \frac{1}{3} = \frac{1}{6}$
$\approx 16.67\%$

3. a. $1.5 \text{ km} \bullet \frac{1 \text{ mi}}{1.6 \text{ km}} = \frac{1.5 \bullet 1 \text{ mi}}{1.6} = \frac{1.5 \text{ mi}}{1.6} \approx 0.9 \text{ mi}$

b. $40 \text{ km} \bullet \frac{1 \text{ mi}}{1.6 \text{ km}} = \frac{40 \bullet 1 \text{ mi}}{1.6} = \frac{40 \text{ mi}}{1.6} = 25 \text{ mi}$

c. $10 \text{ km} \bullet \frac{1 \text{ mi}}{1.6 \text{ km}} = \frac{10 \bullet 1 \text{ mi}}{1.6} = \frac{10 \text{ mi}}{1.6} \approx 6.3 \text{ mi}$

4. Rule: Subtract 9 from the input.

Equation: $y = x - 9$

5. $2.48 \times 10^{16} = 0.248 \times 10^{17}$

$3.19 - 0.248 = 2.942$

$\left(3.19 \times 10^{17}\right) - \left(2.48 \times 10^{16}\right) = 2.942 \times 10^{17}$

Area of Composite Figures

WARM-UP

Area of the trapezoid:

$$A = \frac{1}{2}(b_1 + b_2)h$$
$$A = \frac{1}{2}(9+3)(4)$$
$$A = \frac{1}{2}(12)(4)$$
$$A = 24$$

24 cm^2

PRACTICE

Note: There are multiple ways to solve these problems. Student work may vary, but the final answer should be the same.

1. Area of the rectangle:

$A_{rect} = bh$
$A_{rect} = 10 \bullet 6$
$A_{rect} = 60$
60 m^2

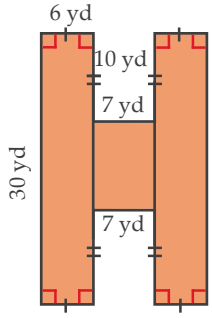
Area of the triangle:
base: $6 \text{ m} + 6 \text{ m} = 12 \text{ m}$

$$A_{tri} = \frac{1}{2}bh$$
$$A_{tri} = \frac{1}{2}(12)(3)$$
$$A_{tri} = 18$$

18 m^2

Total Area: $60 \text{ m}^2 + 18 \text{ m}^2 = 78 \text{ m}^2$

2. Note: The work shown corresponds to the figure's being divided into three rectangles as shown below.



Area of one large rectangle:
$A_{rect1} = bh$
$A_{rect1} = 30 \bullet 6$
$A_{rect1} = 180$
180 yd^2

Area of the smaller rectangle:
base: 7 yd
height: $30 \text{ yd} - 10 \text{ yd} - 10 \text{ yd} = 10 \text{ yd}$
$A_{rect2} = bh$
$A_{rect2} = 7 \bullet 10$
$A_{rect2} = 70$
70 yd^2

Total Area: $180 \text{ yd}^2 + 180 \text{ yd}^2 + 70 \text{ yd}^2 = 430 \text{ yd}^2$

3. Area of the square:

$A_{square} = s^2$
$A_{square} = 5^2$
$A_{square} = 25$

25 cm^2

Area of the circle (two semicircles):
diameter: 5 cm radius: 2.5 cm

$A_{circle} = \pi r^2$
$A_{circle} = \pi(2.5)^2$
$A_{circle} = 6.25\pi$
$A_{circle} \approx 19.63$

19.63 cm^2

Total Area: 25 cm^2 + 19.63 cm^2 = 44.63 cm^2

4. Area of the rectangle:

$A_{rect} = bh$
$A_{rect} = 15 \bullet 10$
$A_{rect} = 150$
150 in^2

Area of the trapezoid:

$A_{trap} = \frac{1}{2}(b_1 + b_2)h$
$A_{trap} = \frac{1}{2}(45 + 35)(12)$
$A_{trap} = \frac{1}{2}(80)(12)$
$A_{trap} = 480$

480 in^2

Area of the triangle:

$A_{tri} = \frac{1}{2}bh$
$A_{tri} = \frac{1}{2}(45)(18)$
$A_{tri} = 405$

405 in^2

Total Area: 150 in^2 + 480 in^2 + 405 in^2 = 1035 in^2

5. Area of the large square:

$A_{square} = s^2$
$A_{square} = 23^2$
$A_{square} = 529$

529 yd^2

Area of the white square:

$A_{square} = s^2$
$A_{square} = 17^2$
$A_{square} = 289$

289 yd^2

Area of the colored section:

529 yd^2 – 289 yd^2 = 240 yd^2

6. Area of the large rectangle:

$A_{rect} = 10 \bullet 20$
$A_{rect} = 200$

200 mm^2

Area of a white circle:

$A_{circle} = \pi r^2$
$A_{circle} = \pi(5)^2$
$A_{circle} = 25\pi$
$A_{circle} \approx 78.54$

78.54 mm^2

Area of two white circles:

78.54 $mm^2 \bullet 2 = 157.08\ mm^2$

Area of the small orange triangle:

$A_{tri} = \frac{1}{2}bh$
$A_{tri} = \frac{1}{2}(5)(5)$
$A_{tri} = 12.5$

12.5 mm^2

Area of the large orange triangle (two of the small triangles):

12.5 $mm^2 \bullet 2 = 25\ mm^2$

Area of the shaded section (area of large rectangle minus area of two circles plus area of small and large orange triangles):

$200\ \text{mm}^2 - 157.08\ \text{mm}^2 + 12.5\ \text{mm}^2 + 25\ \text{mm}^2 = 80.42\ \text{mm}^2$

REVIEW

1. a. The radius of the parsley patch is 1 cm. The scale of the map is 1 cm : 2 ft.

   2 ft

   b. $A = \pi r^2$

   $A = \pi(2)^2$

   $A = 4\pi \approx 12.57$

   $12.57\ \text{ft}^2$

2. a. The length and width of the drawing are each 6 cm.

   $A = s^2$

   $A = (6)^2 = 36$

   $36\ \text{cm}^2$

   b. $\frac{1\ \text{cm}}{2\ \text{ft}} = \frac{6\ \text{cm}}{x\ \text{ft}}$

   $\frac{1}{2} = \frac{6}{x}$

   $1 \bullet x = 2 \bullet 6$

   $x = 12$

   The length and width of the garden are each 12 ft.

   $A = s^2$

   $A = (12)^2 = 144$

   $144\ \text{ft}^2$

3. a. 3 : 2

   b. 6 : 24 = 1 : 4

4. a. $12\ \cancel{\text{ft}} \bullet \frac{12\ \text{in}}{1\ \cancel{\text{ft}}} = \frac{12 \bullet 12\ \text{in}}{1} = 144\ \text{in}$

   $144 \bullet x = 6$

   $\frac{144 \bullet x}{144} = \frac{6}{144}$

   $x = \frac{1}{24}$

   b. $\left(\frac{1}{24}\right)^2 = \frac{1}{576}$

   c. $a^2 + b^2 = c^2$

   $12^2 + 12^2 = c^2$

   $144 + 144 = c^2$

   $\sqrt{288} = \sqrt{c^2}$

   $\sqrt{288} = c$

   $16.97 \approx c$

   16.97 ft

Surface Area of Polyhedra

WARM-UP

Area of the triangle:

$$A_{tri} = \frac{1}{2}bh$$
$$A_{tri} = \frac{1}{2}(5)(9)$$
$$A_{tri} = 22.5$$

22.5 in^2

Area of the circle:

$$A_{circ} = \pi r^2$$
$$A_{circ} = \pi(1.75)^2$$
$$A_{circ} = 3.0625\pi$$
$$A_{circ} \approx 9.62$$

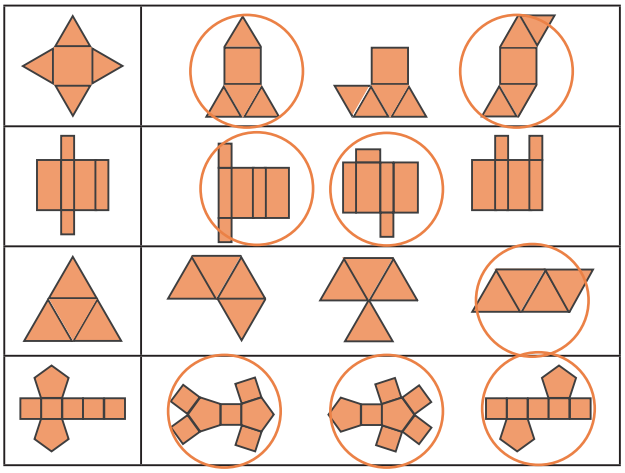
9.62 in^2

Area of shaded region:

$22.5 \text{ in}^2 - 9.62 \text{ in}^2 = 12.88 \text{ in}^2$

PRACTICE

1.



2. Triangle Faces (4):

$$A_{tri} = \frac{1}{2}bh$$
$$A_{tri} = \frac{1}{2}(6)(\sqrt{45})$$
$$A_{tri} = 3\sqrt{45}$$
$$A_{tri} \approx 20.1$$

20.1 in^2

Square Face (1):

$$A_{square} = s^2$$
$$A_{square} = 6 \cdot 6$$
$$A_{square} = 36$$

36 in^2

Surface Area:

$4 \cdot 20.1 \text{ in}^2 + 36 \text{ in}^2 = 116.4 \text{ in}^2$

3. Front and Back Rectangle Faces (2):

$$A_{rect1} = bh$$
$$A_{rect1} = 10 \cdot 6$$
$$A_{rect1} = 60$$

60 cm^2

Left and Right Rectangle Faces (2):

$$A_{rect2} = bh$$
$$A_{rect2} = 8 \cdot 6$$
$$A_{rect2} = 48$$

48 cm^2

Top and Bottom Rectangle Faces (2):

$A_{rect3} = bh$

$A_{rect3} = 10 \bullet 8$

$A_{rect3} = 80$

80 cm^2

Surface Area:

$2 \bullet 60 \text{ cm}^2 + 2 \bullet 48 \text{ cm}^2 + 2 \bullet 80 \text{ cm}^2 = 376 \text{ cm}^2$

4. Triangle Bases (2):

$$A_{tri} = \frac{1}{2}bh$$

$$A_{tri} = \frac{1}{2}(10)(12)$$

$$A_{tri} = 60$$

60 yd^2

Bottom Rectangle Face (1):

$A_{rect1} = bh$

$A_{rect1} = 10 \bullet 40$

$A_{rect1} = 400$

400 yd^2

Side Rectangle Faces (2):

Base: 40 yd

Height:

$$a^2 + b^2 = c^2$$
$$5^2 + 12^2 = c^2$$
$$25 + 144 = c^2$$
$$169 = c^2$$
$$\sqrt{169} = \sqrt{c^2}$$
$$13 = c$$

13 yd

$A_{rect2} = bh$

$A_{rect2} = 40 \bullet 13$

$A_{rect2} = 520$

520 yd^2

Surface Area:

$2 \bullet 60 \text{ yd}^2 + 400 \text{ yd}^2 + 2 \bullet 520 \text{ yd}^2 = 1560 \text{ yd}^2$

REVIEW

1.
$$a^2 + b^2 = c^2$$
$$5^2 + b^2 = 13^2$$
$$25 + b^2 = 169$$
$$25 + b^2 - 25 = 169 - 25$$
$$b^2 = 144$$
$$\sqrt{b^2} = \sqrt{144}$$
$$b = 12$$

12 cm

2. Area of the semicircle:

diameter: 12 cm radius: 6 cm

$$A_{semi} = \frac{1}{2}\pi r^2$$

$$A_{semi} = \frac{1}{2}\pi(6)^2$$

$$A_{semi} = \frac{1}{2}\pi(36)$$

$A_{semi} = 18\pi$

$A_{semi} \approx 56.55$

56.55 cm^2

Area of the triangle:

base: 10 cm height: 12 cm

$A_{tri} = \frac{1}{2}bh$

$A_{tri} = \frac{1}{2}(10)(12)$

$A_{tri} = 5 \bullet 12$

$A_{tri} = 60$

60 cm^2

Area of the figure:

$A = 56.55\ cm^2 + 60\ cm^2 = 116.55\ cm^2$

3. Circumference of a circle with diameter of 12 cm:

$C = \pi d$

$C = \pi \bullet 12$

$C \approx 37.70$

Perimeter of the semicircle curved part:

$37.70 \div 2 = 18.85$ cm

Perimeter of the two straight parts on the semicircle:

12 cm – 10 cm = 2 cm

Perimeter of the triangle section:

13 cm + 13 cm = 26 cm

Perimeter of the figure:

$P = 18.85\ cm + 2\ cm + 26\ cm = 46.85\ cm$

4. a. 100% + 25% = 125%

$1.25 \bullet 12 = 15$

15 cm

b. $15\ \cancel{cm} \bullet \frac{1\ in}{2.54\ \cancel{cm}} = \frac{15 \bullet 1\ in}{2.54} \approx 5.91\ in$

Surface Area of Other Solids

WARM-UP

Triangle Faces (2):

$A_{tri} = \frac{1}{2}bh$

$A_{tri} = \frac{1}{2}(8)(3)$

$A_{tri} = 12$

12 mm^2

Side Rectangle Faces (2):

$A_{rect1} = bh$

$A_{rect1} = 12 \bullet 5$

$A_{rect1} = 60$

60 mm^2

Bottom Rectangle Face (1):

$A_{rect2} = bh$

$A_{rect2} = 12 \bullet 8$

$A_{rect2} = 96$

96 mm^2

Surface Area: $2 \bullet 12 \text{ mm}^2 + 2 \bullet 60 \text{ mm}^2 + 96 \text{ mm}^2 = 240 \text{ mm}^2$

PRACTICE

1. $SA = 4\pi r^2$

$SA = 4\pi(2.5)^2$

$SA = 4\pi \bullet 6.25$

$SA = 25\pi$

$SA \approx 78.54$

78.54 in^2

2. $a^2 + b^2 = c^2$

$2.5^2 + 6^2 = c^2$

$6.25 + 36 = c^2$

$42.25 = c^2$

$\sqrt{42.25} = \sqrt{c^2}$

$6.5 = c$

6.5 in

3. One cone:

$SA = \pi rl$

$SA = \pi(2.5)(6.5)$

$SA = 16.25\pi$

$SA \approx 51.05$

51.05 in^2

Two cones: $2 \bullet 51.05 \text{ in}^2 = 102.1 \text{ in}^2$

4. One cylinder:

$SA = \pi r^2 + 2\pi rh$

$SA = \pi(2.5)^2 + 2\pi(2.5)(16)$

$SA = 6.25\pi + 80\pi$

$SA = 86.25\pi$

$SA \approx 270.96$

270.96 in^2

Four cylinders: $4 \bullet 270.96 \text{ in}^2 = 1083.84 \text{ in}^2$

5. Sphere:

$SA = 4\pi r^2$

$SA = 4\pi \bullet 12^2$

$SA = 4\pi \bullet 144$

$SA = 576\pi$

$SA \approx 1809.56$

1809.56 in^2

Hemisphere:

$\frac{1}{2}(1809.56) = 904.78$

904.78 in^2

Bottom of hemisphere:

$A = \pi r^2$

$A = \pi \bullet 12^2$

$A = 144\pi$

$A \approx 452.39$

452.39 in^2

Total Surface Area:

$904.78 \text{ in}^2 + 452.39 \text{ in}^2 = 1357.17 \text{ in}^2$

6. $78.54 \text{ in}^2 + 102.1 \text{ in}^2 + 1083.84 \text{ in}^2 + 1357.17 \text{ in}^2 = 2621.65 \text{ in}^2$

REVIEW

1.
$$\begin{array}{r} 0.2125 \\ 80\overline{)17.0000} \\ -160 \\ \hline 100 \\ -80 \\ \hline 200 \\ -160 \\ \hline 400 \\ -400 \\ \hline 0 \end{array}$$

$0.2125 \bullet 100 = 21.25$

21.25%

2. Rise: down 3 Run: right 9

$m = \frac{-3}{9} = -\frac{1}{3}$

3. a. $35h - 535$

b. $30h - 285$

c. $35h - 535 = 30h - 285$

$35h - 535 - 30h = 30h - 285 - 30h$

$5h - 535 = -285$

$5h - 535 + 535 = -285 + 535$

$5h = 250$

$\frac{5h}{5} = \frac{250}{5}$

$h = 50$

50 haircuts

4. a. $\sqrt{77}$ is between the whole numbers 8 and 9 but is closer to 9.

b. $\sqrt{77} \approx 8.77$

5. $I = Prt$

$156 = 2600 \bullet 0.004 \bullet t$

$156 = 10.4t$

$\frac{156}{10.4} = \frac{10.4t}{10.4}$

$15 = t$

15 years

Volume of Prisms and Cylinders

WARM-UP

$SA = 4\pi r^2$

$SA = 4\pi(4.5)^2$

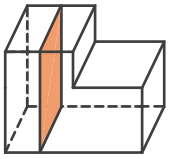
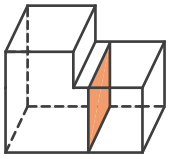
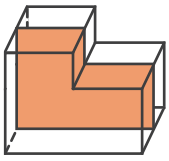
$SA = 4\pi(20.25)$

$SA \approx 254.47$

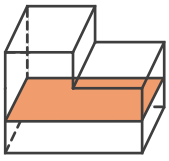
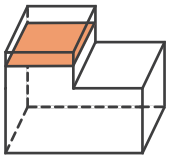
254.47 ft^2

PRACTICE

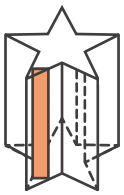
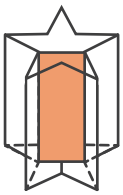
1. Answers may vary. Some examples are given.

a.  or  or 

Vertical cross section: rectangle or hexagon

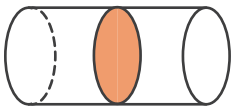
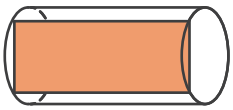
 or 

Horizontal cross section: rectangle

b.  or  or 

Vertical cross section: rectangle

Horizontal cross section: star

c.  or 

Vertical cross section: circle or rectangle

Horizontal cross section: rectangle

2. a. $V = lwh$

$V = 1.5 \cdot 2 \cdot 12 = 36$

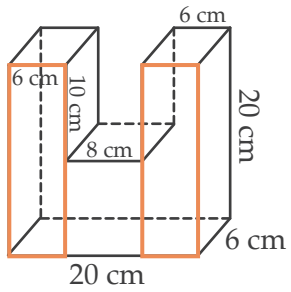
36 in^3

b. $V = Bh$

$V = 16 \cdot 10 = 160$

160 cm^3

c.



Area of middle front section:

$b = 8$ cm $\quad h = 20$ cm $- 10$ cm $= 10$ cm

$A_{rect1} = 8 \bullet 10 = 80$

80 cm^2

Area of one of two side sections (orange rectangles):

$A_{rect2} = 6 \bullet 20 = 120$

120 cm^2

Total area of front face:

80 cm$^2 + 2 \bullet 120$ cm$^2 = 320$ cm^2

Volume of prism:

$V = Bh$

$V = 320 \bullet 6 = 1920$

1920 cm^3

3. $V = Bh$

$V = 7 \bullet 4 = 28$

28 in^3

4. $V = \frac{1}{2}bhl$

$V = \frac{1}{2}(14)(16)(40)$

$V = 4480$

4480 m^3

5. $V = Bh$

$1980 = B(8)$

$1980 = 8B$

$\frac{1980}{8} = \frac{8B}{8}$

$247.5 = B$

247.5 in^2

6. $V = \pi r^2 h$

$216{,}000 = \pi r^2 (110)$

$216{,}000 = 110\pi r^2$

$\frac{216{,}000}{110\pi} = \frac{110\pi r^2}{110\pi}$

$625.04 \approx r^2$

$\sqrt{625.04} \approx \sqrt{r^2}$

$25 \approx r$

25 ft

7. $V = Bh$

$3.75 = 5h$

$\frac{3.75}{5} = \frac{5h}{5}$

$0.75 = h$

0.75 m

REVIEW

1. a. $C = 2\pi r$

$C = 2\pi \bullet 3.18$

$C = 6.36\pi$

$C \approx 19.98$

19.98 cm

b. $A = \pi r^2$

$A = \pi(3.18)^2$

$A = 10.1124\pi$

$A \approx 31.77$

31.77 cm^2

c. $\frac{80°}{360°} = \frac{2}{9}$

$\frac{2}{9} \bullet 19.98 = 4.44$

4.44 cm

d. $360° - 80° = 280°$

$\frac{280°}{360°} = \frac{7}{9}$

$\frac{7}{9} \bullet 31.77 = 24.71$

24.71 cm^2

2. a. $\frac{-5 - \sqrt{4h + 13}}{-3} = 6$

$-3 \bullet \frac{-5 - \sqrt{4h + 13}}{-3} = 6 \bullet (-3)$

$-5 - \sqrt{4h + 13} = -18$

$-5 - \sqrt{4h + 13} + 5 = -18 + 5$

$-\sqrt{4h + 13} = -13$

$\frac{-\sqrt{4h + 13}}{-1} = \frac{-13}{-1}$

$\sqrt{4h + 13} = 13$

$\left(\sqrt{4h + 13}\right)^2 = 13^2$

$4h + 13 = 169$

$4h + 13 - 13 = 169 - 13$

$4h = 156$

$\frac{4h}{4} = \frac{156}{4}$

$h = 39$

b. $\frac{-5 - \sqrt{4(39) + 13}}{-3} \stackrel{?}{=} 6$

$\frac{-5 - \sqrt{169}}{-3} \stackrel{?}{=} 6$

$\frac{-18}{-3} \stackrel{?}{=} 6$

$6 = 6$

no

3. a. $a^2 + b^2 = c^2$

$21^2 + 28^2 = c^2$

$441 + 784 = c^2$

$1225 = c^2$

$\sqrt{1225} = \sqrt{c^2}$

$35 = c$

$PI = 35$ dm

b. Ratio of areas: $\frac{1029}{84} = \frac{49}{4}$

Ratio of lengths: $\sqrt{\frac{49}{4}} = \frac{7}{2} = 3.5$

$\frac{b}{6} = 3.5$

$6 \bullet \frac{b}{6} = 3.5 \bullet 6$

$b = 21$

c. $\frac{35}{c} = 3.5$

$c \bullet \frac{35}{c} = 3.5 \bullet c$

$35 = 3.5c$

$\frac{35}{3.5} = \frac{3.5c}{3.5}$

$10 = c$

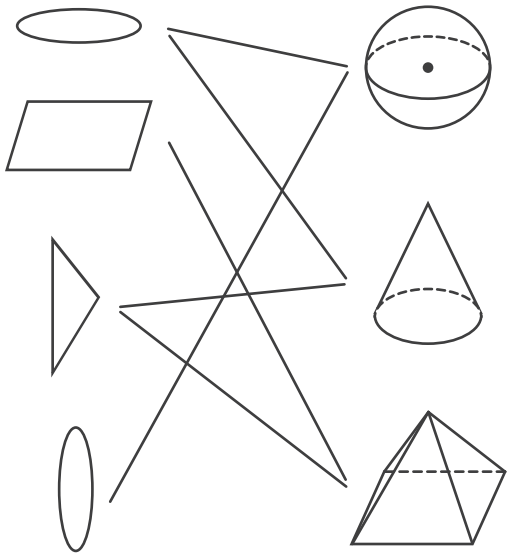
Volume of Pyramids, Cones, and Spheres

WARM-UP

a. $3\frac{6}{7}$ b. $2\frac{6}{7}$ c. $\frac{6}{7}$

PRACTICE

1.



2. a. $V = \frac{1}{3}Bh$

$V = \frac{1}{3}(7)(3)$

$V = 7$

7 ft^3

b. $V = \frac{1}{3}Bh$

$V = \frac{1}{3}(24)(13)$

$V = 104$

104 cm^3

c. $V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(1)^3$

$V \approx 4.19$

4.19 ft^3

d. $V = \frac{1}{3}lwh$

$V = \frac{1}{3}(12)(14)(20)$

$V = 1120$

1120 mm^3

3. Problem 3 is a discovery activity. There are no answers to check for parts a, b, d, or e.

c. 3

f. 3

REVIEW

1. $$\begin{aligned} -5+9x^2 &= 148 \\ -5+9x^2+5 &= 148+5 \\ 9x^2 &= 153 \\ \frac{9x^2}{9} &= \frac{153}{9} \\ x^2 &= 17 \\ \sqrt{x^2} &= \pm\sqrt{17} \\ x &= \pm\sqrt{17} \end{aligned}$$

$x = \sqrt{17}$ and $x = -\sqrt{17}$

2. $$\begin{aligned} SA &= \pi rl \\ SA &= \pi(4.5)(9.5) \\ SA &= 42.75\pi \\ SA &\approx 134.3 \end{aligned}$$

134.3 in^2

3. $$\begin{aligned} V &= Bh \\ 3.63 &= B(3) \\ \frac{3.63}{3} &= \frac{3B}{3} \\ 1.21 &= B \end{aligned}$$

1.21 dm^2

4. $$\begin{aligned} -12x-5y &= 40 \\ -12x-5y+12x &= 40+12x \\ -5y &= 40+12x \\ \frac{-5y}{-5} &= \frac{40+12x}{-5} \\ \frac{-5y}{-5} &= \frac{40}{-5}+\frac{12x}{-5} \\ y &= -8-\frac{12}{5}x \\ y &= -\frac{12}{5}x-8 \end{aligned}$$

Slope: $-\frac{12}{5}$ y-intercept: $(0,-8)$

5. Area of the rectangle:

$$\begin{aligned} A_{rect} &= bh \\ A_{rect} &= 24 \bullet 48 \\ A_{rect} &= 1152 \end{aligned}$$

1152 in^2

Area of circle:

$$\begin{aligned} A_{circle} &= \pi r^2 \\ A_{circle} &= \pi(3)^2 \\ A_{circle} &= 9\pi \\ A_{circle} &\approx 28.3 \end{aligned}$$

28.3 in^2

Area of surface:

$1152 \text{ in}^2 - 28.3 \text{ in}^2 = 1123.7 \text{ in}^2$

Volume of Composite Solids

WARM-UP

$$V = \frac{1}{3}Bh$$
$$V = \frac{1}{3}(15)(8)$$
$$V = 40$$

40 in^3

PRACTICE

1. a. Cylinders (2):

$$V_{cyl} = \pi r^2 h$$
$$V_{cyl} = \pi(0.3)^2(1.2)$$
$$V_{cyl} \approx 0.34$$

0.34 cm^3

Sphere:

$$V_{sphere} = \frac{4}{3}\pi r^3$$
$$V_{sphere} = \frac{4}{3}\pi(2)^3$$
$$V_{sphere} \approx 33.51$$

33.51 cm^3

Total Volume:

$2 \cdot 0.34 \text{ cm}^3 + 33.51 \text{ cm}^3 = 34.19 \text{ cm}^3$

b. Rectangular Prism:

$$V_{prism} = lwh$$
$$V_{prism} = (4)(4)(3.5)$$
$$V_{prism} = 56$$

56 cm^3

Cone:

$$V_{cone} = \frac{1}{3}\pi r^2 h$$
$$V_{cone} = \frac{1}{3}\pi(1)^2(2)$$
$$V_{cone} \approx 2.09$$

2.09 cm^3

Total Volume:

$56 \text{ cm}^3 + 2.09 \text{ cm}^3 = 58.09 \text{ cm}^3$

c. Prism:

$$V_{prism} = Bh$$
$$V_{prism} = (7.5)(5)$$
$$V_{prism} = 37.5$$

37.5 cm^3

Square Pyramid:

$$V_{pyr} = \frac{1}{3}lwh$$
$$V_{pyr} = \frac{1}{3}(1)(1)(1)$$
$$V_{pyr} \approx 0.33$$

$0.33\ \text{cm}^3$

Total Volume:

$37.5\ \text{cm}^3 + 0.33\ \text{cm}^3 = 37.83\ \text{cm}^3$

2. a. Cube:

$$V_{cube} = s^3$$
$$V_{cube} = 2.5^3$$
$$V_{cube} \approx 15.63$$

$15.63\ \text{cm}^3$

Spheres (2):

$$V_{sphere} = \frac{4}{3}\pi r^3$$
$$V_{sphere} = \frac{4}{3}\pi(0.5)^3$$
$$V_{sphere} \approx 0.52$$

$0.52\ \text{cm}^3$

Remaining Volume:

$15.63\ \text{cm}^3 - 2 \bullet 0.52\ \text{cm}^3 = 14.59\ \text{cm}^3$

b. Sphere:

$$V_{sphere} = \frac{4}{3}\pi r^3$$
$$V_{sphere} = \frac{4}{3}\pi(24)^3$$
$$V_{sphere} \approx 57,905.84$$

$57{,}905.84\ \text{mm}^3$

Cylinder:

$$V_{cyl} = \pi r^2 h$$
$$V_{cyl} = \pi(5)^2(35)$$
$$V_{cyl} \approx 2748.89$$

$2748.89\ \text{mm}^3$

Remaining Volume:

$57{,}905.84\ \text{mm}^3 - 2748.89\ \text{mm}^3 = 55{,}156.95\ \text{mm}^3$

c. Triangular Prism:

$$V_{prism} = \frac{1}{2}bhl$$
$$V_{prism} = \frac{1}{2}(38)(36)(45)$$
$$V_{prism} = 30,780$$

$30{,}780\ \text{mm}^3$

Cylinder:

$$V_{cyl} = \pi r^2 h$$
$$V_{cyl} = \pi(6)^2(45)$$
$$V_{cyl} \approx 5089.38$$

$5089.38\ \text{mm}^3$

Remaining Volume:

$30{,}780\ \text{mm}^3 - 5089.38\ \text{mm}^3 = 25{,}690.62\ \text{mm}^3$

REVIEW

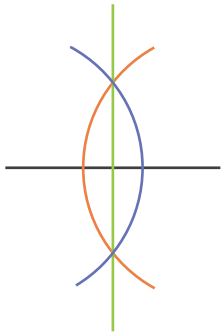
1. $\frac{JO}{FU} = \frac{33}{39.6} = 0.8\overline{3}$

$\frac{OY}{UL} = \frac{46}{55.2} = 0.8\overline{3}$

$\frac{YJ}{LF} = \frac{44}{52.8} = 0.8\overline{3}$

yes

2. Note: Arcs drawn from a compass are shown. The perpendicular bisector is the green line segment.



3. a. $C = 2\pi r$

$29 = 2\pi r$

$\frac{29}{2\pi} = \frac{2\pi r}{2\pi}$

$4.62 \approx r$

4.62 inches

b. $V = \frac{4}{3}\pi r^3$

$V \approx \frac{4}{3}\pi(4.62)^3$

$V \approx 413.06$

413.06 in^3

4. $19(c-7) - 32.2 = 5c$

$19c - 133 - 32.2 = 5c$

$19c - 165.2 = 5c$

$19c - 165.2 - 19c = 5c - 19c$

$-165.2 = -14c$

$\frac{-165.2}{-14} = \frac{-14c}{-14}$

$11.8 = c$

Solving One-Step and Two-Step Inequalities

WARM-UP

Volume of the cube:

$V_{cube} = s^3$

$V_{cube} = 6^3$

$V_{cube} = 216$

216 cm^3

Volume of the cylinder:

$V_{cyl} = \pi r^2 h$

$V_{cyl} = \pi(1)^2(6)$

$V_{cyl} = 6\pi$

$V_{cyl} \approx 18.85$

18.85 cm^3

Remaining volume:

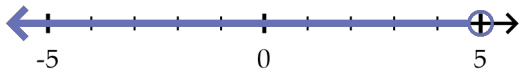
$216 \text{ cm}^3 - 18.85 \text{ cm}^3 = 197.15 \text{ cm}^3$

PRACTICE

1. $a + 2 < 7$

$a + 2 - 2 < 7 - 2$

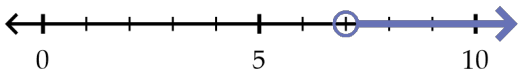
$a < 5$



2. $b - 4 > 3$

$b - 4 + 4 > 3 + 4$

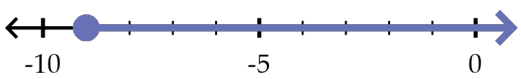
$b > 7$



3. $3c \geq -27$

$\frac{3c}{3} \geq \frac{-27}{3}$

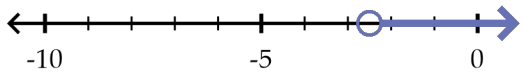
$c \geq -9$



4. $-8d < 20$

$\frac{-8d}{-8} < \frac{20}{-8}$

$d > -2\frac{1}{2}$



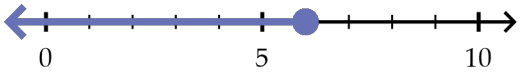
5. $2e + 5 \leq 17$

$2e + 5 - 5 \leq 17 - 5$

$2e \leq 12$

$\frac{2e}{2} \leq \frac{12}{2}$

$e \leq 6$



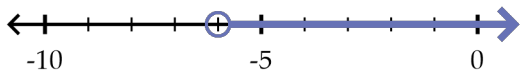
6. $4f-6>-30$

$4f-6+6>-30+6$

$4f>-24$

$\frac{4f}{4}>\frac{-24}{4}$

$f>-6$



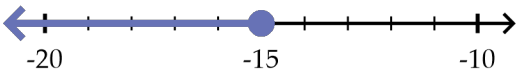
7. $-g+2\geq 17$

$-g+2-2\geq 17-2$

$-g\geq 15$

$\frac{-g}{-1}\geq\frac{15}{-1}$

$g\leq -15$



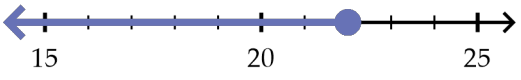
8. $\frac{1}{2}h-4\leq 7$

$\frac{1}{2}h-4+4\leq 7+4$

$\frac{1}{2}h\leq 11$

$2\bullet\frac{1}{2}h\leq 11\bullet 2$

$h\leq 22$



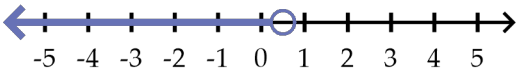
9. $\frac{2}{5}-\frac{4}{5}i>0$

$\frac{2}{5}-\frac{4}{5}i-\frac{2}{5}>0-\frac{2}{5}$

$-\frac{4}{5}i>-\frac{2}{5}$

$-\frac{5}{4}\bullet\left(-\frac{4}{5}\right)i>-\frac{2}{5}\bullet\left(-\frac{5}{4}\right)$

$i<\frac{1}{2}$



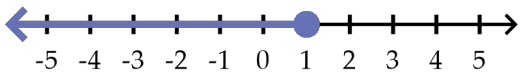
10. $8-10j\geq -2$

$8-10j-8\geq -2-8$

$-10j\geq -10$

$\frac{-10j}{-10}\geq\frac{-10}{-10}$

$j\leq 1$



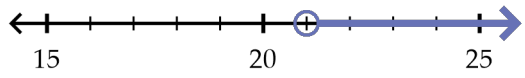
11. $3+\frac{4}{7}k>15$

$3+\frac{4}{7}k-3>15-3$

$\frac{4}{7}k>12$

$\frac{7}{4}\bullet\frac{4}{7}k>12\bullet\frac{7}{4}$

$k>21$



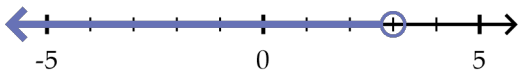
12. $1.2l+4.7<8.3$

$1.2l+4.7-4.7<8.3-4.7$

$1.2l<3.6$

$\frac{1.2l}{1.2}<\frac{3.6}{1.2}$

$l<3$



Answer:

He knew he wasn't less than or greater than anyone else.

REVIEW

1. a. Rectangular prism:

$V_{prism} = lwh$

$V_{prism} = (5)(2)(3)$

$V_{prism} = 30$

30 cm^3

Half-cylinder:

$V_{half-cyl} = \frac{1}{2}\pi r^2 h$

$V_{half-cyl} = \frac{1}{2}\pi(1)^2(5)$

$V_{half-cyl} \approx 7.85$

7.85 cm^3

Total Volume:

$30 \text{ cm}^3 + 7.85 \text{ cm}^3 = 37.85 \text{ cm}^3$

b. Front and Back Rectangle Faces (2):

$A_{rect1} = bh$

$A_{rect1} = 2 \bullet 3$

$A_{rect1} = 6$

6 cm^2

Left and Right Rectangle Faces (2):

$A_{rect2} = bh$

$A_{rect2} = 5 \bullet 3$

$A_{rect2} = 15$

15 cm^2

Bottom Rectangle Face (1):

$A_{rect3} = bh$

$A_{rect3} = 2 \bullet 5$

$A_{rect3} = 10$

10 cm^2

Half-cylinder:

$SA = \frac{1}{2}(2\pi r^2 + 2\pi rh) = \pi r^2 + \pi rh$

$SA = \pi(1)^2 + \pi(1)(5)$

$SA = \pi + 5\pi$

$SA = 6\pi$

$SA \approx 18.85$

18.85 cm^2

Total Surface Area:

$2 \bullet 6 \text{ cm}^2 + 2 \bullet 15 \text{ cm}^2 + 10 \text{ cm}^2 + 18.85 \text{ cm}^2 = 70.85 \text{ cm}^2$

2. $18 \div 8 = 2.25$

$18 \text{ pt} = 2.25 \text{ gal}$

3. Note: Work may vary, but the final answers should be the same.

$\angle YRN$ and $\angle URJ$ are vertical angles.

$72° + a = 90°$

$72° + a - 72° = 90° - 72°$

$a = 18°$

$90° + b = 180°$

$90° + b - 90° = 180° - 90°$

$b = 90°$

$c = d$

$72° + 2c = 180°$

$72° + 2c - 72° = 180° - 72°$

$2c = 108°$

$\frac{2c}{2} = \frac{108°}{2}$

$c = 54°$

$d = 54°$

4. a. $0.225 \bullet w = 27$

$$\frac{0.225 \bullet w}{0.225} = \frac{27}{0.225}$$

$$w = 120$$

120 people

b. $0.125 \bullet 120 = p$

$15 = p$

15 people

Unit 3 Review

1. a. $40\% + 100\% = 140\%$

$1.4 \bullet 15 = 21$

b. $8280 - 7200 = 1080$

$$x \bullet 7200 = 1080$$
$$\frac{x \bullet 7200}{7200} = \frac{1080}{7200}$$
$$x = \frac{1080}{7200} = 0.15$$

15%

c. $100\% - 15\% = 85\%$

$$0.85 \bullet x = 78.2$$
$$\frac{0.85 \bullet x}{0.85} = \frac{78.2}{0.85}$$
$$x = 92$$

92 kg

2. a. $I = Prt$

$I = 400 \bullet 0.045 \bullet 10$

$I = 180$

$400 + 180 = 580$

$580

b. $A = P(1+r)^t$

$2{,}200{,}000 = P(1+0.07)^{30}$

$2{,}200{,}000 = P(1.07)^{30}$

$2{,}200{,}000 \approx P(7.61225504)$

$$\frac{2{,}200{,}000}{7.61225504} \approx \frac{P(7.61225504)}{7.61225504}$$
$$289{,}007 \approx P$$

$289,000

3. a. $P(\text{biologist or ecologist})$

$= P(\text{biologist}) + P(\text{ecologist})$

$$= \frac{56}{175} + \frac{62}{175}$$
$$= \frac{118}{175} \approx 0.6743$$

67.43%

b. $56 \bullet 62 \bullet 45 = 156{,}240$

156,240

c. $P(\text{no biologist, ecologist, or oceanographer})$

$= P(\text{other scientist first})$

$\bullet P(\text{other scientist second} \mid \text{other scientist first})$

$$= \frac{12}{175} \bullet \frac{11}{174}$$
$$= \frac{132}{30{,}450} \approx 0.0043$$

0.43%

4. a. $56 : 62 = 28 : 31$

b. $$\frac{45 \text{ oceanographers}}{175 \text{ scientists}} = \frac{x \text{ oceanographers}}{245 \text{ scientists}}$$
$$\frac{45}{175} = \frac{x}{245}$$
$$45 \bullet 245 = 175x$$
$$11{,}025 = 175x$$
$$\frac{11{,}025}{175} = \frac{175x}{175}$$
$$63 = x$$

5. a. $2 \text{ gal } 1 \text{ c} \bullet 24 = 48 \text{ gal } 24 \text{ c}$

$24 \text{ c} = 1 \text{ gal } 8 \text{ c} = 1 \text{ gal } 2 \text{ qt}$

$48 \text{ gal} + 1 \text{ gal } 2 \text{ qt} = 49 \text{ gal } 2 \text{ qt}$

b. $12{,}100\ \text{yd}^2$

$$= 12{,}100\ \cancel{\text{yd}} \bullet \cancel{\text{yd}} \bullet \frac{1\ \cancel{\text{m}}}{1.1\ \cancel{\text{yd}}} \bullet \frac{1\ \cancel{\text{m}}}{1.1\ \cancel{\text{yd}}} \bullet \frac{1\ \text{km}}{1000\ \cancel{\text{m}}} \bullet \frac{1\ \text{km}}{1000\ \cancel{\text{m}}}$$

$$= \frac{12{,}100\ \text{km} \bullet \text{km}}{1.1 \bullet 1.1 \bullet 1000 \bullet 1000}$$

$$= 0.01\ \text{km}^2$$

6. a. $450 \bullet x = 1.5$

$$\frac{450 \bullet x}{450} = \frac{1.5}{450}$$

$$x = \frac{1.5}{450} = \frac{3}{900} = \frac{1}{300}$$

b. $x \bullet \frac{1}{300} = 8$

$$300 \bullet x \bullet \frac{1}{300} = 8 \bullet 300$$

$$x = 2400$$

2400 cm

c. $0.3 \bullet 300^2 = 27{,}000$

$27{,}000\ \text{m}^2$

7. $5 \bullet 250\ \text{m} = 1250\ \text{m}$

8. a. $\overleftrightarrow{AB}$

b. A

c. $\overline{AB}$

9. a. f

b. h

c. Angles a and c are supplementary, so angle c measures $180° - 73° = 107°$.

Angles c and g correspond, so angle g measures 107°.

10. a. obtuse, scalene

b. $110 + 3x + 2x - 5 = 180$

$$105 + 5x = 180$$

$$105 + 5x - 105 = 180 - 105$$

$$5x = 75$$

$$\frac{5x}{5} = \frac{75}{5}$$

$$x = 15$$

$3x = 3 \bullet 15 = 45$

$2x - 5 = 2 \bullet 15 - 5 = 30 - 5 = 25$

45° and 25°

11. a. concave

b. 5 sides $\rightarrow 3 \bullet 180° = 540°$

c. $90 + 5x + (4x - 3) + (x + 13) + 10x = 540$

$$100 + 20x = 540$$

$$100 + 20x - 100 = 540 - 100$$

$$20x = 440$$

$$\frac{20x}{20} = \frac{440}{20}$$

$$x = 22$$

A: 90°

B: $10 \bullet 22 = 220 \rightarrow$ 220°

C: $22 + 13 = 35 \rightarrow$ 35°

D: $4 \bullet 22 - 3 = 88 - 3 = 85 \rightarrow$ 85°

E: $5 \bullet 22 = 110 \rightarrow$ 110°

12. (AAA) ASA AAS

SAS (SSA) SSS

13. $\frac{30}{5} = 6$

$\frac{36}{6} = 6$

$\frac{50}{8} = 6.25$

no

14. a.
$$AB = FG$$
$$2w + 2 = 6$$
$$2w + 2 - 2 = 6 - 2$$
$$2w = 4$$
$$\frac{2w}{2} = \frac{4}{2}$$
$$w = 2$$

$$AE = FJ$$
$$x = 3$$

$$CD = HI$$
$$2y - 4 = 6$$
$$2y - 4 + 4 = 6 + 4$$
$$2y = 10$$
$$\frac{2y}{2} = \frac{10}{2}$$
$$y = 5$$

$$m\angle D = m\angle I$$
$$84 = 4z$$
$$\frac{84}{4} = \frac{4z}{4}$$
$$21 = z$$

b.
$$\frac{BC}{AB} = \frac{FG}{EF}$$
$$\frac{3}{2} = \frac{4a - \frac{1}{2}}{5}$$
$$5 \cdot \frac{3}{2} = \frac{4a - \frac{1}{2}}{5} \cdot 5$$
$$\frac{15}{2} = 4a - \frac{1}{2}$$
$$\frac{15}{2} + \frac{1}{2} = 4a - \frac{1}{2} + \frac{1}{2}$$
$$\frac{16}{2} = 4a$$
$$8 = 4a$$
$$\frac{8}{4} = \frac{4a}{4}$$
$$2 = a$$

$$\angle D \cong \angle H$$
$$m\angle D = m\angle H$$
$$3b + 10 = 70$$
$$3b + 10 - 10 = 70 - 10$$
$$3b = 60$$
$$\frac{3b}{3} = \frac{60}{3}$$
$$b = 20$$

c. $2 \text{ cm} + 3 \text{ cm} + 2 \text{ cm} + 3 \text{ cm} = 10 \text{ cm}$

15. a. **A** 3 cm, 6 cm, 9 cm **B** 4 cm, 5 cm, 7 cm

Detailed work for each group of side lengths is shown below.

A $3 + 6 = 9$

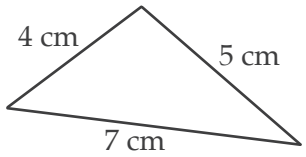
9 is not greater than $9 \rightarrow$ no

B $4 + 5 = 9$ $\quad 9 > 7$

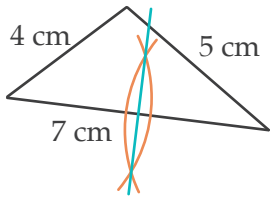
$4 + 7 = 11$ $\quad 11 > 5$

$5 + 7 = 12$ $\quad 12 > 4$

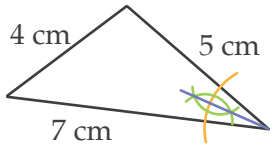
b. Note: The triangle may be oriented differently, but the side lengths should be the same.



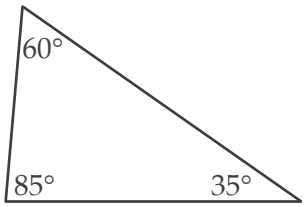
c. Note: The triangle is shown smaller below. The perpendicular bisector is the blue line.



d. Note: The triangle is shown smaller below. The angle bisector is the purple line.



e. Note: The triangle may be oriented differently and may be larger or smaller, but the angle measures should be the same.



16. $C = \pi d = 24\pi \approx 75.398$

75.40 mm

17. a. $\frac{135}{360} = \frac{3}{8}$

Green arc length:

$\frac{3}{8}(2\pi r)$

$= \frac{3}{8}(2\pi \bullet 2)$

$= \frac{3}{2}\pi$

≈ 4.71

4.71 cm

Blue sector area:

$\frac{3}{8}(\pi r^2)$

$= \frac{3}{8}(\pi \bullet 2^2)$

$= \frac{3}{2}\pi$

≈ 4.71

4.71 cm^2

b. $\overleftrightarrow{FB}$ is a straight line.

$180° - 50° = 130°$

$w = 130°$

$\angle AXB$ and $\angle FXE$ are vertical angles.

$50° = 2y$

$\frac{50°}{2} = \frac{2y}{2}$

$25° = y$

$\overleftrightarrow{FB}$ is a straight line.

$180° - 3 \bullet 25° = 105°$

$z = 105°$

18. a. $A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(22 + 15)(8)$

$A = 148$

148 cm^2

b. Rectangle:

$A_{rect} = b \bullet h$

$A_{rect} = 8 \bullet 3$

$A_{rect} = 24$

24 in^2

Semicircle:

$A_{semi} = \frac{1}{2}\pi r^2$

$A_{semi} = \frac{1}{2}\pi \bullet 1.5^2$

$A_{semi} \approx 3.53$

3.53 in^2

Triangle:

$A_{tri} = \frac{1}{2}bh$

$A_{tri} = \frac{1}{2}(3)(4)$

$A_{tri} = 6$

6 in^2

Total area:

24 in^2 + 3.53 in^2 + 6 in^2 = 33.53 in^2

19. a. Bottom rectangle:

$A_{rect} = b \bullet h$

$A_{rect} = 78 \bullet 50$

$A_{rect} = 3900$

3900 mm^2

Smaller side triangles (2):

$A_{tri1} = \frac{1}{2}bh$

$A_{tri1} = \frac{1}{2}(50)(60)$

$A_{tri1} = 1500$

1500 mm^2

Larger front and back triangles (2):

$A_{tri2} = \frac{1}{2}bh$

$A_{tri2} = \frac{1}{2}(78)(52)$

$A_{tri2} = 2028$

2028 mm^2

Total surface area:

$3900 \text{ mm}^2 + 2 \bullet 1500 \text{ mm}^2 + 2 \bullet 2028 \text{ mm}^2 =$
$10{,}956 \text{ mm}^2$

b. $SA = 4\pi r^2$

$SA = 4\pi \bullet 5^2$

$SA = 100\pi$

$SA \approx 314.16$

314.16 in^2

20. a. $V = Bh$

$V = 3 \bullet 3$

$V = 9$

9 ft^3

b. $V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi(4)^2(8)$

$V = \frac{128}{3}\pi$

$V \approx 134.04$

134.04 yd^3

Unit 3 Assessment

1. $420{,}000 - 350{,}000 = 70{,}000$

$$x \bullet 350{,}000 = 70{,}000$$
$$\frac{x \bullet 350{,}000}{350{,}000} = \frac{70{,}000}{350{,}000}$$
$$x = 0.2$$

20% increase

2. $A = P(1+r)^t$

$A = 450(1+0.035)^{12}$

$A = 450 \bullet 1.035^{12}$

$A \approx 450 \bullet 1.511$

$A \approx 679.95$

$679.95

3. a. $120 + 80 + 100 + 150 + 50 = 500$

Pink: $\frac{120}{500} = 0.24 = 24\%$

Yellow: $\frac{80}{500} = 0.16 = 16\%$

Blue: $\frac{100}{500} = 0.2 = 20\%$

Green: $\frac{150}{500} = 0.3 = 30\%$

White: $\frac{50}{500} = 0.1 = 10\%$

b. $n = 50$

Pink: $50 \bullet 0.24 = 12$

Yellow: $50 \bullet 0.16 = 8$

Blue: $50 \bullet 0.2 = 10$

Green: $50 \bullet 0.3 = 15$

White: $50 \bullet 0.1 = 5$

4. $\frac{3}{6} \bullet \frac{1}{5} = \frac{3}{30} = \frac{1}{10}$

5. $3.78 \div 46 \approx 0.08$

$0.08 per cookie

6. $\frac{500 \text{ grams pasta}}{0.5 \text{ onions}} = \frac{x \text{ grams pasta}}{0.75 \text{ onions}}$

$$\frac{500}{0.5} = \frac{x}{0.75}$$
$$500 \bullet 0.75 = 0.5x$$
$$375 = 0.5x$$
$$\frac{375}{0.5} = \frac{0.5x}{0.5}$$
$$750 = x$$

750 grams

7. a. $4 \text{ lb} \bullet 3 = 12 \text{ lb}$

$6 \text{ oz} \bullet 3 = 18 \text{ oz}$

$18 \text{ oz} = 1 \text{ lb } 2 \text{ oz}$

$12 \text{ lb} + 1 \text{ lb } 2 \text{ oz} = 13 \text{ lb } 2 \text{ oz}$

b. $2 \text{ ft } 5 \text{ in} + 4 \text{ ft } 8 \text{ in} = 6 \text{ ft } 13 \text{ in}$

$13 \text{ in} = 1 \text{ ft } 1 \text{ in}$

$6 \text{ ft} + 1 \text{ ft } 1 \text{ in} = 7 \text{ ft } 1 \text{ in}$

8. $\frac{40 \text{ lb}}{1} \bullet \frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{40 \text{ kg}}{2.2} \approx 18.18 \text{ kg}$

9. $320 \text{ ft} : 4 \text{ in} \rightarrow 80 \text{ ft} : 1 \text{ in}$

10. acute

11. $\angle a$ and $\angle f$

$\angle b$ and $\angle e$

$\angle c$ and $\angle h$

$\angle d$ and $\angle g$

12. $6x+1+8x+1+11x+3=180$

$25x+5=180$

$25x+5-5=180-5$

$25x=175$

$\frac{25x}{25}=\frac{175}{25}$

$x=7$

$m\angle P=(11(7)+3)°$

$m\angle P=(77+3)°$

$m\angle P=80°$

13.

Shape	Reason
quadrilateral	It has four sides.
parallelogram	It has two pairs of parallel sides.
rhombus	All sides are congruent.

14. side-angle-side

15. $\frac{JG}{NK}=\frac{GH}{KL}$

$\frac{2.5}{1}=\frac{4.5}{p}$

$2.5p=4.5$

$\frac{2.5p}{2.5}=\frac{4.5}{2.5}$

$p=1.8$

16. Perimeter of semicircle:

$C=\pi d$

$C=25\pi$

$C\approx 78.54$

Divide C by 2: $78.54\div 2=39.27$

Hypotenuse of triangle:

$25^2+25^2=c^2$

$625+625=c^2$

$1250=c^2$

$\sqrt{1250}=\sqrt{c^2}$

$c\approx 35.36$

$P=39.27\text{ ft}+35.36\text{ ft}+25\text{ ft}=99.63\text{ ft}$

17. a. $\frac{22.5°}{360°}=\frac{1}{16}$

$C=2\pi r$

$C=2\pi\bullet 6.5=13\pi$

$13\pi\bullet\frac{1}{16}=\frac{13}{16}\pi\approx 2.55$

2.55 cm

b. $A=\pi r^2$

$A=\pi(6.5)^2$

$A=42.25\pi$

$42.25\pi\bullet\frac{1}{16}=\frac{42.25}{16}\pi\approx 8.30$

8.30 cm^2

18. $A_{tri}=\frac{1}{2}bh$

$A_{tri}=\frac{1}{2}(0.5)(0.75)$

$A_{tri}\approx 0.188$

0.188 in^2

$A_{semi}=\frac{1}{2}\pi r^2$

$A_{semi}=\frac{1}{2}\pi(0.25)^2$

$A_{semi}=\frac{1}{2}\pi(0.0625)$

$A_{semi}=0.03125\pi$

$A_{semi}\approx 0.098$

0.098 in^2

Total Area: $6(0.188\text{ in}^2+0.098\text{ in}^2)=1.716\text{ in}^2$

19. $SA_{cyl}=\pi r^2+2\pi rh$

$SA_{cyl}=\pi(15)^2+2\pi(15)(25)$

$SA_{cyl}=225\pi+750\pi$

$SA_{cyl}=975\pi$

$SA_{cyl}\approx 3063.05$

3063.05 ft^2

$$SA_{hemi} = \left(\frac{1}{2}\right)4\pi r^2$$
$$SA_{hemi} = \left(\frac{1}{2}\right)4\pi(15)^2$$
$$SA_{hemi} = 2\pi(225)$$
$$SA_{hemi} = 450\pi$$
$$SA_{hemi} \approx 1413.72$$

1413.72 ft^2

Total Surface Area:
3063.05 ft^2 + 1413.72 ft^2 = 4476.77 ft^2

20. $V_{pyramid} = \frac{1}{3}lwh$
$$V_{pyramid} = \frac{1}{3}(2)(2)(2)$$
$$V_{pyramid} = \frac{8}{3} \approx 2.67$$

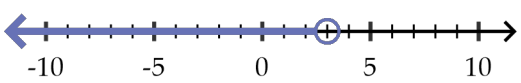
2.67 in^3

$V_{prism} = lwh$
$V_{prism} = 2 \bullet 2 \bullet 5$
$V_{prism} = 20$

20 in^3

Total Volume:
20 in^3 + 2.67 in^3 = 22.67 in^3

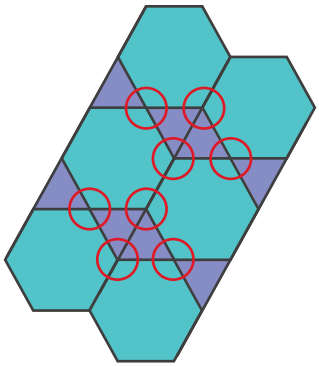
21. $-3t + 26 > 17$
$-3t + 26 - 26 > 17 - 26$
$-3t > -9$
$\frac{-3t}{-3} > \frac{-9}{-3}$
$t < 3$



Enrichment: Tessellations

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

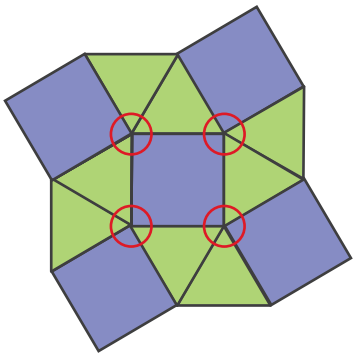
Shape (number of sides)	Interior Angle Measure	360° ÷ Interior Angle Measure	Does the shape tessellate?
Equilateral Triangle (3)	$\frac{180°(n-2)}{n}$ $= \frac{180°(3-2)}{3}$ $= 60°$	$360° \div 60° = 6$	yes
Square (4)	$\frac{180°(n-2)}{n}$ $= \frac{180°(4-2)}{4}$ $= 90°$	$360° \div 90° = 4$	yes
Regular Pentagon (5)	$\frac{180°(n-2)}{n}$ $= \frac{180°(5-2)}{5}$ $= 108°$	$360° \div 108° = 3.\overline{3}$	no
Regular Hexagon (6)	$\frac{180°(n-2)}{n}$ $= \frac{180°(6-2)}{6}$ $= 120°$	$360° \div 120° = 3$	yes
Regular Heptagon (7)	$\frac{180°(n-2)}{n}$ $= \frac{180°(7-2)}{7}$ $\approx 128.57°$	$360° \div 128.57° \approx 2.8$	no
Regular Octagon (8)	$\frac{180°(n-2)}{n}$ $= \frac{180°(8-2)}{8}$ $= 135°$	$360° \div 135° = 2.\overline{6}$	no



Regular hexagon: 120°

Equilateral triangle: 60°

Interior angle sum at intersection:
60° + 60° + 120° + 120° = 360°



Square: 90°

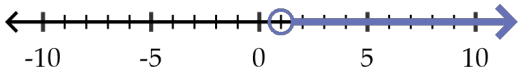
Equilateral triangle: 60°

Interior angle sum at intersection:
90° + 90° + 60° + 60° + 60° = 360°

Advanced Inequalities

WARM-UP

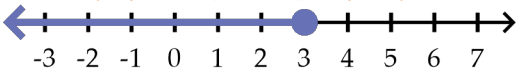
$$5r + 18 > 23$$
$$5r + 18 - 18 > 23 - 18$$
$$5r > 5$$
$$\frac{5r}{5} > \frac{5}{5}$$
$$r > 1$$



PRACTICE

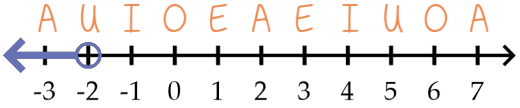
1. $$3 + 4a \geq 9a - 12$$
$$3 + 4a + 12 \geq 9a - 12 + 12$$
$$15 + 4a \geq 9a$$
$$15 + 4a - 4a \geq 9a - 4a$$
$$15 \geq 5a$$
$$\frac{15}{5} \geq \frac{5a}{5}$$
$$3 \geq a$$
$$a \leq 3$$

A U I O E A E I U O A



2. $$2b - 7 < -6b - 23$$
$$2b - 7 + 6b < -6b - 23 + 6b$$
$$8b - 7 < -23$$
$$8b - 7 + 7 < -23 + 7$$
$$8b < -16$$
$$\frac{8b}{8} < \frac{-16}{8}$$
$$b < -2$$

A U I O E A E I U O A

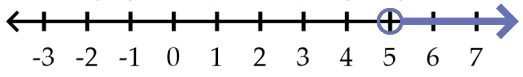


3. $$\frac{1}{2}c + 3 > 10 - \frac{2}{3}c$$
$$\frac{1}{2}c + 3 - 3 > 10 - \frac{2}{3}c - 3$$
$$\frac{1}{2}c > 7 - \frac{2}{3}c$$
$$\frac{1}{2}c + \frac{2}{3}c > 7 - \frac{2}{3}c + \frac{2}{3}c$$
$$\frac{7}{6}c > 7$$
$$\frac{6}{7} \cdot \frac{7}{6}c > 7 \cdot \frac{6}{7}$$
$$c > 6$$

A U I O E A E I U O A

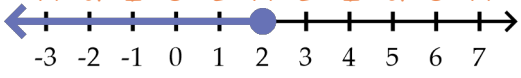
4. $$\frac{3}{4}-\frac{1}{6}d<-\frac{1}{2}+\frac{1}{12}d$$
$$\frac{3}{4}-\frac{1}{6}d+\frac{1}{2}<-\frac{1}{2}+\frac{1}{12}d+\frac{1}{2}$$
$$\frac{5}{4}-\frac{1}{6}d<\frac{1}{12}d$$
$$\frac{5}{4}-\frac{1}{6}d+\frac{1}{6}d<\frac{1}{12}d+\frac{1}{6}d$$
$$\frac{5}{4}<\frac{1}{4}d$$
$$4\bullet\frac{5}{4}<\frac{1}{4}d\bullet 4$$
$$5<d$$
$$d>5$$

A U I O E A E I U O A



5. $$-1\frac{1}{4}e+1\geq -e+\frac{1}{2}$$
$$-1\frac{1}{4}e+1+1\frac{1}{4}e\geq -e+\frac{1}{2}+1\frac{1}{4}e$$
$$1\geq\frac{1}{4}e+\frac{1}{2}$$
$$1-\frac{1}{2}\geq\frac{1}{4}e+\frac{1}{2}-\frac{1}{2}$$
$$\frac{1}{2}\geq\frac{1}{4}e$$
$$4\bullet\frac{1}{2}\geq\frac{1}{4}e\bullet 4$$
$$2\geq e$$
$$e\leq 2$$

A U I O E A E I U O A



6. $$3\left(h-\frac{4}{9}\right)\geq\frac{6h-1}{3}$$
$$3h-\frac{4}{3}\geq\frac{6h-1}{3}$$
$$3\bullet\left(3h-\frac{4}{3}\right)\geq\frac{6h-1}{3}\bullet 3$$
$$9h-4\geq 6h-1$$
$$9h-4+4\geq 6h-1+4$$
$$9h\geq 6h+3$$
$$9h-6h\geq 6h+3-6h$$
$$3h\geq 3$$
$$\frac{3h}{3}\geq\frac{3}{3}$$
$$h\geq 1$$

A U I O E A E I U O A

EUOUAE

7. Inequality: $3p+4\geq 24$

Solution: $$3p+4\geq 24$$
$$3p+4-4\geq 24-4$$
$$3p\geq 20$$
$$\frac{3p}{3}\geq\frac{20}{3}$$
$$p\geq 6\frac{2}{3}$$

Answer in words: at least 7 pieces

8. Inequality: $200\leq 34+40b$

Solution: $$200\leq 34+40b$$
$$200-34\leq 34+40b-34$$
$$166\leq 40b$$
$$\frac{166}{40}\leq\frac{40b}{40}$$
$$4.15\leq b$$
$$b\geq 4.15$$

Answer in words: at least 5 books

9. Inequality: $3f + \frac{1}{2} \le 5$

Solution:
$$3f + \frac{1}{2} \le 5$$
$$3f + \frac{1}{2} - \frac{1}{2} \le 5 - \frac{1}{2}$$
$$3f \le 4\frac{1}{2}$$
$$\frac{3f}{3} \le \frac{4\frac{1}{2}}{3}$$
$$f \le \frac{9}{2} \bullet \frac{1}{3}$$
$$f \le \frac{3}{2}$$
$$f \le 1\frac{1}{2}$$

Answer in words: no more than $1\frac{1}{2}$ cups

10. Inequality: $475 + 21h \ge 1000$

Solution:
$$475 + 21h \ge 1000$$
$$475 + 21h - 475 \ge 1000 - 475$$
$$21h \ge 525$$
$$\frac{21h}{21} \ge \frac{525}{21}$$
$$h \ge 25$$

Answer in words: at least 25 hours

REVIEW

1. $V = \frac{1}{3}lwh$

$$25 = \frac{1}{3}(3)(5)h$$
$$25 = 5h$$
$$\frac{25}{5} = \frac{5h}{5}$$
$$5 = h$$

5 in

2. a. $$\frac{18}{x} = \frac{117}{273}$$
$$18 \bullet 273 = x \bullet 117$$
$$4914 = 117x$$
$$\frac{4914}{117} = \frac{117x}{117}$$
$$42 = x$$

b. $$\frac{15 \text{ lb Earth weight}}{5.7 \text{ lb Mars weight}} = \frac{110 \text{ lb Earth weight}}{x \text{ lb Mars weight}}$$
$$\frac{15}{5.7} = \frac{110}{x}$$
$$15 \bullet x = 5.7 \bullet 110$$
$$15x = 627$$
$$\frac{15x}{15} = \frac{627}{15}$$
$$x = 41.8$$

41.8 lb

3.

x	y
7	–2
9	1
11	5

(+2, +2; +3, +4)

$\frac{3}{2} \ne \frac{4}{2}$, not linear

x	y
2	11
4	14
10	23

(+2, +6; +3, +9)

$\frac{3}{2} = \frac{9}{6}$, linear

$m = \frac{3}{2}$

$$y = \frac{3}{2}x + b$$
$$11 = \frac{3}{2}(2) + b$$
$$11 = 3 + b$$
$$11 - 3 = 3 + b - 3$$
$$8 = b$$

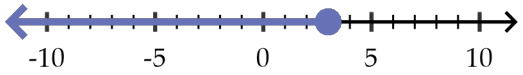
Equation: $y = \frac{3}{2}x + 8$

4. $x = -5$ $y = -5$ $y = -5x$ $y = x - 5$

Graphing Linear Inequalities

WARM-UP

$$4t - 8 \geq 9t - 23$$
$$4t - 8 + 8 \geq 9t - 23 + 8$$
$$4t \geq 9t - 15$$
$$4t - 9t \geq 9t - 15 - 9t$$
$$-5t \geq -15$$
$$\frac{-5t}{-5} \geq \frac{-15}{-5}$$
$$t \leq 3$$



PRACTICE

1. Red:

Slope: 2

y-intercept: $(0,-6)$

Test $(0,0)$:

$y > 2x - 6$

$0 \stackrel{?}{>} 2 \bullet 0 - 6$

$0 \stackrel{?}{>} 0 - 6$

$0 \stackrel{?}{>} -6$ ✓

Yellow:

Slope: $\frac{3}{4}$

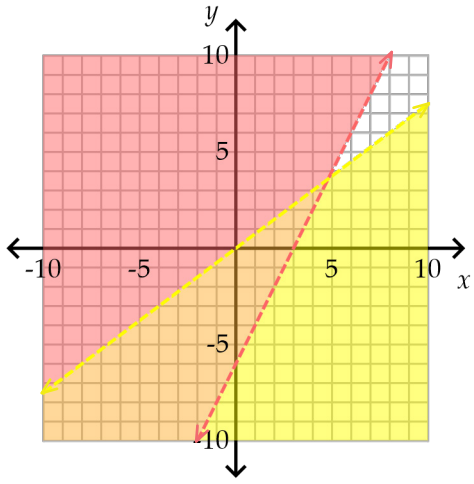
y-intercept: $(0,0)$

Test $(0,1)$:

$y < \frac{3}{4}x$

$1 \stackrel{?}{<} \frac{3}{4}(0)$

$1 \stackrel{?}{<} 0$ ✗



2.

Ordered pair	$y > 2x - 6$	$y < \frac{3}{4}x$
$(0,4)$	$y > 2x - 6$ $4 \stackrel{?}{>} 2(0) - 6$ $4 \stackrel{?}{>} -6$ ✓ yes	$y < \frac{3}{4}x$ $4 \stackrel{?}{<} \frac{3}{4}(0)$ $4 \stackrel{?}{<} 0$ ✗ no
$(0,-4)$	$y > 2x - 6$ $-4 \stackrel{?}{>} 2(0) - 6$ $-4 \stackrel{?}{>} -6$ ✓ yes	$y < \frac{3}{4}x$ $-4 \stackrel{?}{<} \frac{3}{4}(0)$ $-4 \stackrel{?}{<} 0$ ✓ yes
$(4,0)$	$y > 2x - 6$ $0 \stackrel{?}{>} 2(4) - 6$ $0 \stackrel{?}{>} 2$ ✗ no	$y < \frac{3}{4}x$ $0 \stackrel{?}{<} \frac{3}{4}(4)$ $0 \stackrel{?}{<} 3$ ✓ yes
$(-4,0)$	$y > 2x - 6$ $0 \stackrel{?}{>} 2(-4) - 6$ $0 \stackrel{?}{>} -14$ ✓ yes	$y < \frac{3}{4}x$ $0 \stackrel{?}{<} \frac{3}{4}(-4)$ $0 \stackrel{?}{<} -3$ ✗ no

3. Blue:

Slope: $-\frac{5}{3}$

y-intercept: $(0,3)$

Test $(0,0)$:

$y \leq -\frac{5}{3}x + 3$

$0 \stackrel{?}{\leq} -\frac{5}{3}(0) + 3$

$0 \stackrel{?}{\leq} 3$ ✓

Yellow:

Slope: $\frac{1}{2}$

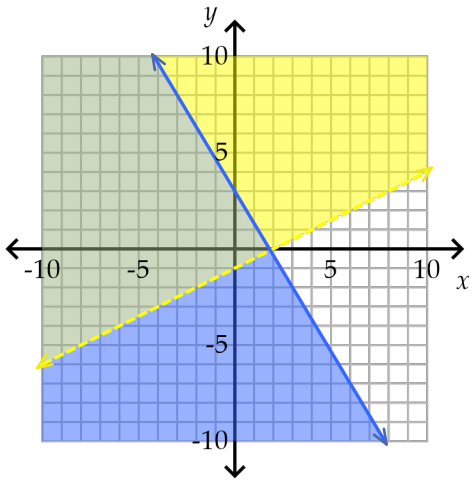
y-intercept: $(0,-1)$

Test $(0,0)$:

$y > \frac{1}{2}x - 1$

$0 \stackrel{?}{>} \frac{1}{2}(0) - 1$

$0 \stackrel{?}{>} -1$ ✓



4.

Ordered pair	$y \le -\frac{5}{3}x+3$	$y > \frac{1}{2}x-1$
$(0,4)$	$y \le -\frac{5}{3}x+3$ $4 \stackrel{?}{\le} -\frac{5}{3}(0)+3$ $4 \stackrel{?}{\le} 3$ ✗ no	$y > \frac{1}{2}x-1$ $4 \stackrel{?}{>} \frac{1}{2}(0)-1$ $4 \stackrel{?}{>} -1$ ✓ yes
$(0,-4)$	$y \le -\frac{5}{3}x+3$ $-4 \stackrel{?}{\le} -\frac{5}{3}(0)+3$ $-4 \stackrel{?}{\le} 3$ ✓ yes	$y > \frac{1}{2}x-1$ $-4 \stackrel{?}{>} \frac{1}{2}(0)-1$ $-4 \stackrel{?}{>} -1$ ✗ no
$(4,0)$	$y \le -\frac{5}{3}x+3$ $0 \stackrel{?}{\le} -\frac{5}{3}(4)+3$ $0 \stackrel{?}{\le} -\frac{20}{3}+\frac{9}{3}$ $0 \stackrel{?}{\le} -\frac{11}{3}$ $0 \stackrel{?}{\le} -3\frac{2}{3}$ ✗ no	$y > \frac{1}{2}x-1$ $0 \stackrel{?}{>} \frac{1}{2}(4)-1$ $0 \stackrel{?}{>} 1$ ✗ no
$(-4,0)$	$y \le -\frac{5}{3}x+3$ $0 \stackrel{?}{\le} -\frac{5}{3}(-4)+3$ $0 \stackrel{?}{\le} \frac{20}{3}+\frac{9}{3}$ $0 \stackrel{?}{\le} \frac{29}{3}$ $0 \stackrel{?}{\le} 9\frac{2}{3}$ ✓ yes	$y > \frac{1}{2}x-1$ $0 \stackrel{?}{>} \frac{1}{2}(-4)-1$ $0 \stackrel{?}{>} -3$ ✓ yes

5. Red: $6x+6(0)=24$ $\quad$ $6(0)+6y=24$

$6x=24$ $\quad$ $6y=24$

$\frac{6x}{6}=\frac{24}{6}$ $\quad$ $\frac{6y}{6}=\frac{24}{6}$

$x=4$ $\quad$ $y=4$

$(4,0)$ $\quad$ $(0,4)$

Test $(0,0)$:

$6x+6y<24$

$6(0)+6(0) \stackrel{?}{<} 24$

$0 \stackrel{?}{<} 24$ ✓

Blue: $3x-4(0)=12$ $\quad$ $3(0)-4y=12$

$3x=12$ $\quad$ $-4y=12$

$\frac{3x}{3}=\frac{12}{3}$ $\quad$ $\frac{-4y}{-4}=\frac{12}{-4}$

$x=4$ $\quad$ $y=-3$

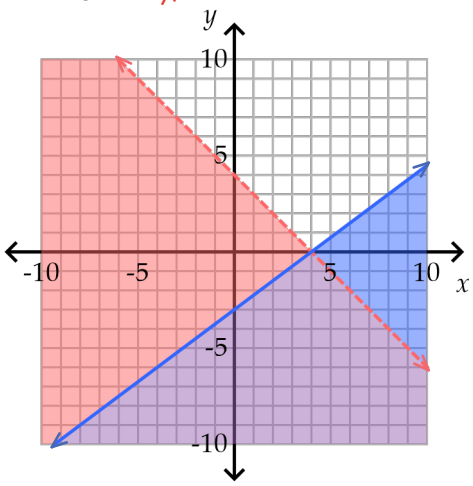
$(4,0)$ $\quad$ $(0,-3)$

Test $(0,0)$:

$3x-4y \ge 12$

$3(0)-4(0) \stackrel{?}{\ge} 12$

$0 \stackrel{?}{\ge} 12$ ✗



6.

Ordered pair	$6x + 6y < 24$	$3x - 4y \geq 12$
$(0,4)$	$6x + 6y < 24$ $6(0) + 6(4) \stackrel{?}{<} 24$ $24 < 24$ ✗ no	$3x - 4y \geq 12$ $3(0) - 4(4) \stackrel{?}{\geq} 12$ $-16 \geq 12$ ✗ no
$(0,-4)$	$6x + 6y < 24$ $6(0) + 6(-4) \stackrel{?}{<} 24$ $-24 < 24$ ✓ yes	$3x - 4y \geq 12$ $3(0) - 4(-4) \stackrel{?}{\geq} 12$ $16 \geq 12$ ✓ yes
$(4,0)$	$6x + 6y < 24$ $6(4) + 6(0) \stackrel{?}{<} 24$ $24 < 24$ ✗ no	$3x - 4y \geq 12$ $3(4) - 4(0) \stackrel{?}{\geq} 12$ $12 \geq 12$ ✓ yes
$(-4,0)$	$6x + 6y < 24$ $6(-4) + 6(0) \stackrel{?}{<} 24$ $-24 < 24$ ✓ yes	$3x - 4y \geq 12$ $3(-4) - 4(0) \stackrel{?}{\geq} 12$ $-12 \geq 12$ ✗ no

REVIEW

1. a. $-15-2x \le 24$

$-15-2x+15 \le 24+15$

$-2x \le 39$

$\frac{-2x}{-2} \le \frac{39}{-2}$

$x \ge -19.5$

b. $\frac{5}{3}x+18 > 2x+22$

$\frac{5}{3}x+18-\frac{5}{3}x > 2x+22-\frac{5}{3}x$

$18 > \frac{1}{3}x+22$

$18-22 > \frac{1}{3}x+22-22$

$-4 > \frac{1}{3}x$

$3 \bullet (-4) > \frac{1}{3}x \bullet 3$

$-12 > x$

$x < -12$

c. **A** $x = 0$

B $x = -10$

C $x = -30$

D $x = -16$

Detailed work for each x-value is shown below.

A Part A:

$-15-2(0) \stackrel{?}{\le} 24$

$-15 \stackrel{?}{\le} 24$ ✓

0 satisfies the inequality.

Part B:

$\frac{5}{3}(0)+18 \stackrel{?}{>} 2(0)+22$

$18 \stackrel{?}{>} 22$ ✗

0 does not satisfy the inequality.

B Part A:

$-15-2(-10) \stackrel{?}{\le} 24$

$-15+20 \stackrel{?}{\le} 24$

$5 \stackrel{?}{\le} 24$ ✓

–10 satisfies the inequality.

Part B:

$\frac{5}{3}(-10)+18 \stackrel{?}{>} 2(-10)+22$

$\frac{-50}{3}+18 \stackrel{?}{>} -20+22$

$1\frac{1}{3} \stackrel{?}{>} 2$ ✗

–10 does not satisfy the inequality.

C Part A:

$-15-2(-30) \stackrel{?}{\le} 24$

$-15+60 \stackrel{?}{\le} 24$

$45 \stackrel{?}{\le} 24$ ✗

–30 does not satisfy the inequality.

Part B:

$\frac{5}{3}(-30)+18 \stackrel{?}{>} 2(-30)+22$

$-50+18 \stackrel{?}{>} -60+22$

$-32 \stackrel{?}{>} -38$ ✓

–30 satisfies the inequality.

D Part A:

$-15-2(-16) \stackrel{?}{\le} 24$

$-15+32 \stackrel{?}{\le} 24$

$17 \stackrel{?}{\le} 24$ ✓

–16 satisfies the inequality.

$\frac{5}{3}(-16)+18 \stackrel{?}{>} 2(-16)+22$

$\frac{-80}{3}+18 \stackrel{?}{>} -32+22$

$-8\frac{2}{3} \stackrel{?}{>} -10$ ✓

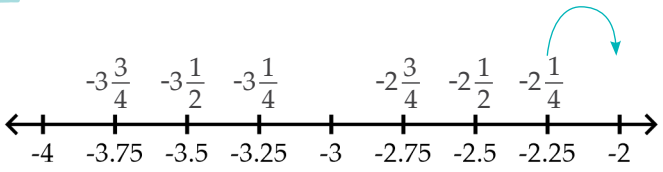
–16 satisfies the inequality.

2. $\frac{21}{4} \cdot x = 252$

$\frac{4}{21} \cdot \frac{21}{4} \cdot x = 252 \cdot \frac{4}{21}$

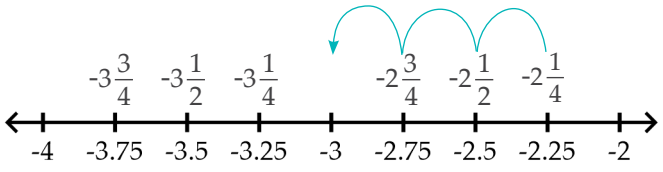
$x = 48$

3. a.



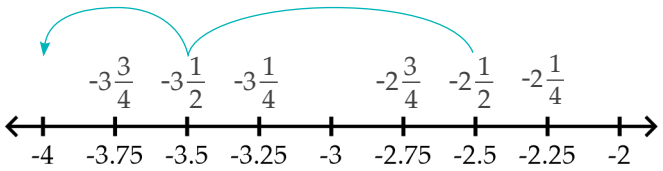
–2

b.



–3

c.



–4

4.

$9x - 6y = -18$

$9x - 6(0) = -18$

$9x = -18$

$\frac{9x}{9} = \frac{-18}{9}$

$x = -2$

x-intercept: $(-2, 0)$

$9x - 6y = -18$

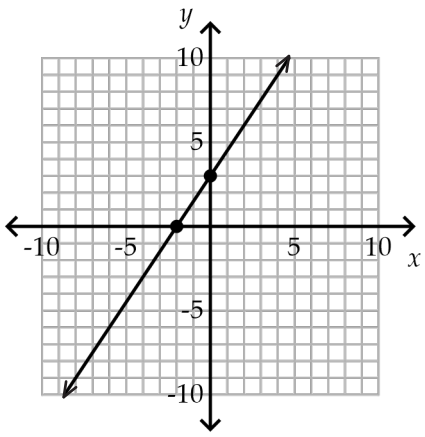
$9(0) - 6y = -18$

$-6y = -18$

$\frac{-6y}{-6} = \frac{-18}{-6}$

$y = 3$

y-intercept: $(0, 3)$



slope = $\frac{\text{rise}}{\text{run}} = \frac{3}{2}$

Types of Solutions

WARM-UP

Slope: $\frac{1}{3}$

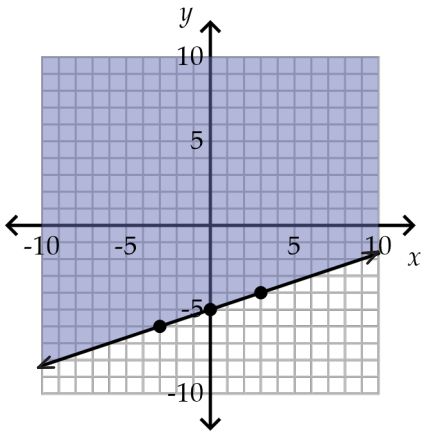
y-intercept: $(0,-5)$

Test $(0,0)$:

$y \geq \frac{1}{3}x - 5$

$0 \stackrel{?}{\geq} \frac{1}{3}(0) - 5$

$0 \stackrel{?}{\geq} -5$ ✓



PRACTICE

1.

Given...	Find the value of...	Answer
$3a+1=16$	$2a-5$	5 **A**
$\frac{2}{5}b+6=7+b$	$4\left(2+\frac{6}{5}b\right)$	0 **B**
$5c-3=57$ $6d+1=10$	$3d+c$	$16\frac{1}{2}$ **C**

A $3a+1=16$

$3a+1-1=16-1$

$3a=15$

$\frac{3a}{3}=\frac{15}{3}$

$a=5$

$2a-5$

$2(5)-5$

$=10-5$

$=5$

B $\frac{2}{5}b+6=7+b$

$\frac{2}{5}b+6-6=7+b-6$

$\frac{2}{5}b=1+b$

$\frac{2}{5}b-b=1+b-b$

$-\frac{3}{5}b=1$

$-\frac{5}{3}\bullet\left(-\frac{3}{5}b\right)=1\bullet\left(-\frac{5}{3}\right)$

$b=-\frac{5}{3}$

$4\left(2+\frac{6}{5}b\right)$

$4\left(2+\frac{6}{5}\left(-\frac{5}{3}\right)\right)$

$=4(2-2)$

$=4(0)$

$=0$

C

$$5c-3=57$$
$$5c-3+3=57+3$$
$$5c=60$$
$$\frac{5c}{5}=\frac{60}{5}$$
$$c=12$$

$$6d+1=10$$
$$6d+1-1=10-1$$
$$6d=9$$
$$\frac{6d}{6}=\frac{9}{6}$$
$$d=1\frac{1}{2}$$

$$3d+c$$
$$3\left(1\frac{1}{2}\right)+12$$
$$=3\left(\frac{3}{2}\right)+12$$
$$=\frac{9}{2}+12$$
$$=\frac{9}{2}+\frac{24}{2}$$
$$=\frac{33}{2}$$
$$=16\frac{1}{2}$$

2. Equation for Monday:

$$3t+20=128$$
$$3t+20-20=128-20$$
$$3t=108$$
$$\frac{3t}{3}=\frac{108}{3}$$
$$t=36$$

Expression for Tuesday:

$$5t+10$$
$$5(36)+10$$
$$=180+10$$
$$=190$$

190 minutes or 3 hours 10 minutes

3. Equation for Monday with warm-up:

$$4.5+37x=60$$
$$4.5+37x-4.5=60-4.5$$
$$37x=55.5$$
$$\frac{37x}{37}=\frac{55.5}{37}$$
$$x=1.5$$

Equation for Tuesday with cooldown:

$$32x+c=56$$
$$32(1.5)+c=56$$
$$48+c=56$$
$$48+c-48=56-48$$
$$c=8$$

Expression for warm-up and cooldown:

$$4.5+c$$
$$4.5+8$$
$$=12.5$$

12.5 minutes

4. Equation for Bella:

$$4d+45=345$$
$$4d+45-45=345-45$$
$$4d=300$$
$$\frac{4d}{4}=\frac{300}{4}$$
$$d=75$$

Equation for Ben:

$$5t=125$$
$$\frac{5t}{5}=\frac{125}{5}$$
$$t=25$$

Expression for their combined time:

$$6(d+t)$$
$$6(75+25)$$
$$=6(100)$$
$$=600$$

600 minutes or 10 hours

5. a. $3e+4=5e+2$

$3e+4-4=5e+2-4$

$3e=5e-2$

$3e-5e=5e-2-5e$

$-2e=-2$

$\frac{-2e}{-2}=\frac{-2}{-2}$

$e=1$

one / infinite / zero

b. $4(2+3f)=12f-5$

$8+12f=12f-5$

$8+12f-12f=12f-5-12f$

$8\neq -5$

no solution

one / infinite / zero

c. $6g-3=g+2(1-g)$

$6g-3=g+2-2g$

$6g-3=-g+2$

$6g-3-2=-g+2-2$

$6g-5=-g$

$6g-5-6g=-g-6g$

$-5=-7g$

$\frac{-5}{-7}=\frac{-7g}{-7}$

$\frac{5}{7}=g$

one / infinite / zero

d. $8-3(2-h)=h+2(h+1)$

$8-6+3h=h+2h+2$

$2+3h=3h+2$

$2+3h-3h=3h+2-3h$

$2=2$

all real numbers

one / infinite / zero

e. $\frac{4j+3}{2}=\frac{-7+6j}{3}$

$3(4j+3)=2(-7+6j)$

$12j+9=-14+12j$

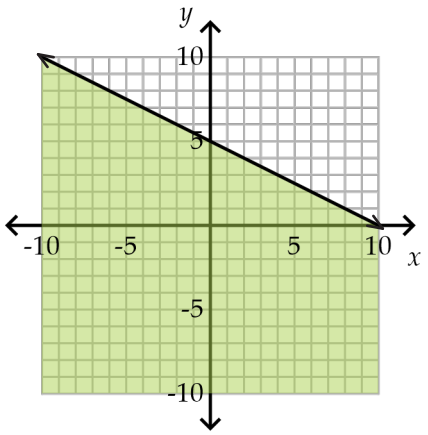
$12j+9-12j=-14+12j-12j$

$9\neq -14$

no solution

one / infinite / zero

REVIEW

1. 

Check for shading:

$$y \le -\frac{1}{2}x + 5$$
$$0 \stackrel{?}{\le} -\frac{1}{2}(0) + 5$$
$$0 \stackrel{?}{\le} 5 \checkmark$$

2. $$\frac{1}{660} \bullet x = 11$$
$$660 \bullet \frac{1}{660} \bullet x = 11 \bullet 660$$
$$x = 7260$$

7260 inches

$$7260 \text{ } \cancel{\text{in}} \bullet \frac{1 \text{ ft}}{12 \text{ } \cancel{\text{in}}} = \frac{7260 \bullet 1 \text{ ft}}{12} = \frac{7260 \text{ ft}}{12} = 605 \text{ ft}$$

3. $$d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$
$$= \sqrt{(2 - (-18))^2 + (9 - (-12))^2}$$
$$= \sqrt{(20)^2 + (21)^2}$$
$$= \sqrt{400 + 441}$$
$$= \sqrt{841}$$
$$= 29$$

29 units

4. a. $$2^{-5}$$
$$= \frac{1}{2^5}$$
$$= \frac{1}{2 \bullet 2 \bullet 2 \bullet 2 \bullet 2}$$
$$= \frac{1}{32}$$

b. $$\frac{1}{3^{-3}}$$
$$= 3^3$$
$$= 27$$

5. a. Julie:

Slope: 25

$25 per month

b. Jett:

rise: 60 run: 3 Slope: $\frac{60}{3} = 20$

$20 per month

Systems of Equations

WARM-UP

$$5x+4=2(x+2)+3x$$
$$5x+4=2x+4+3x$$
$$5x+4=5x+4$$
$$5x+4-5x=5x+4-5x$$
$$4=4$$

infinitely many solutions

PRACTICE

1. $y=5x-3$

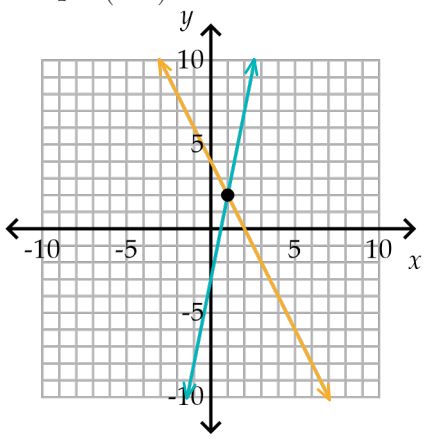
Slope: 5

y-intercept: $(0,-3)$

$y=-2x+4$

Slope: -2

y-intercept: $(0,4)$



Solution: $(1,2)$

2.
$$6x+4y=12$$
$$6x+4(0)=12$$
$$6x=12$$
$$\frac{6x}{6}=\frac{12}{6}$$
$$x=2$$

x-intercept: $(2,0)$

$$6x+4y=12$$
$$6(0)+4y=12$$
$$4y=12$$
$$\frac{4y}{4}=\frac{12}{4}$$
$$y=3$$

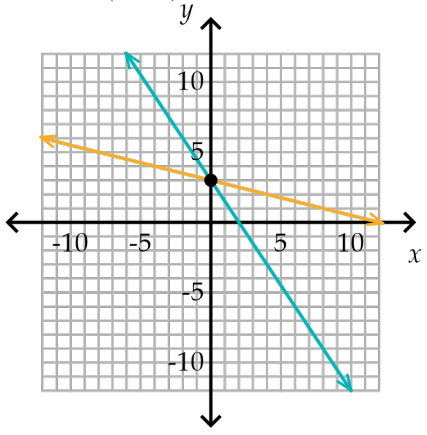
y-intercept: $(0,3)$

$$2x+8y=24$$
$$2x+8(0)=24$$
$$2x=24$$
$$\frac{2x}{2}=\frac{24}{2}$$
$$x=12$$

x-intercept: $(12,0)$

$$2x+8y=24$$
$$2(0)+8y=24$$
$$8y=24$$
$$\frac{8y}{8}=\frac{24}{8}$$
$$y=3$$

y-intercept: $(0,3)$



Solution: $(0,3)$

3. $y = -3x - 4$

Slope: -3

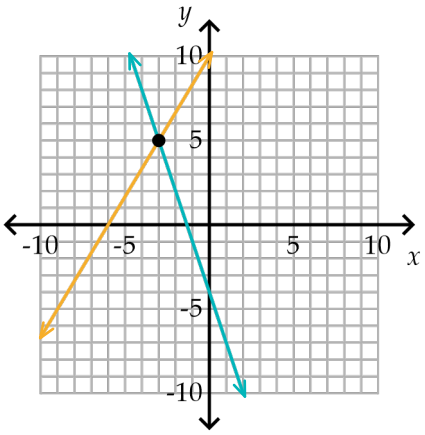
y-intercept: $(0,-4)$

$$\begin{aligned} -5x + 3y &= 30 \\ -5x + 3(0) &= 30 \\ -5x &= 30 \\ \frac{-5x}{-5} &= \frac{30}{-5} \\ x &= -6 \end{aligned}$$

x-intercept: $(-6,0)$

$$\begin{aligned} -5x + 3y &= 30 \\ -5(0) + 3y &= 30 \\ 3y &= 30 \\ \frac{3y}{3} &= \frac{30}{3} \\ y &= 10 \end{aligned}$$

y-intercept: $(0,10)$



Solution: $(-3,5)$

4. $8x - 4y = 16$

$$\begin{aligned} 8x - 4(0) &= 16 \\ 8x &= 16 \\ \frac{8x}{8} &= \frac{16}{8} \\ x &= 2 \end{aligned}$$

x-intercept: $(2,0)$

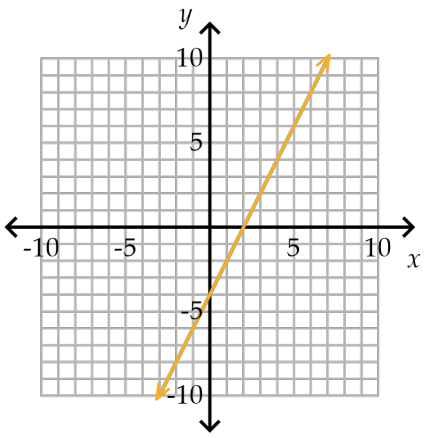
$$\begin{aligned} 8x - 4y &= 16 \\ 8(0) - 4y &= 16 \\ -4y &= 16 \\ \frac{-4y}{-4} &= \frac{16}{-4} \\ y &= -4 \end{aligned}$$

y-intercept: $(0,-4)$

$y = 2x - 4$

Slope: 2

y-intercept: $(0,-4)$



Solution: infinite

5. $y = -\frac{3}{5}x + 2$

Slope: $-\frac{3}{5}$

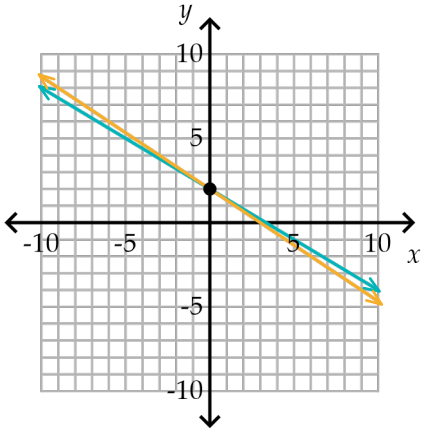
y-intercept: $(0,2)$

$$\begin{aligned} 2x + 3y &= 6 \\ 2x + 3(0) &= 6 \\ 2x &= 6 \\ \frac{2x}{2} &= \frac{6}{2} \\ x &= 3 \end{aligned}$$

x-intercept: $(3,0)$

$$\begin{aligned} 2x + 3y &= 6 \\ 2(0) + 3y &= 6 \\ 3y &= 6 \\ \frac{3y}{3} &= \frac{6}{3} \\ y &= 2 \end{aligned}$$

y-intercept: $(0,2)$



Solution: $(0,2)$

6. $y = \frac{1}{2}x + 3$

Slope: $\frac{1}{2}$

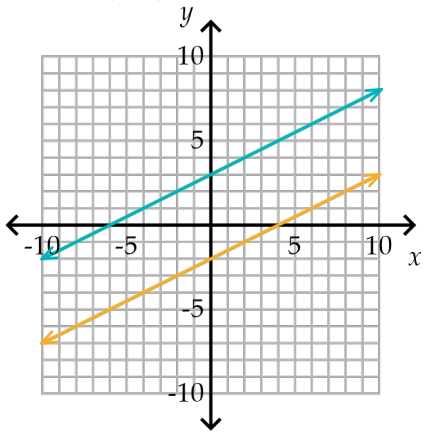
y-intercept: $(0,3)$

$$x - 2y = 4$$
$$x - 2(0) = 4$$
$$x = 4$$

x-intercept: $(4,0)$

$$x - 2y = 4$$
$$0 - 2y = 4$$
$$-2y = 4$$
$$\frac{-2y}{-2} = \frac{4}{-2}$$
$$y = -2$$

y-intercept: $(0,-2)$



Solution: none

7. $y = \frac{2}{3}x - 7$

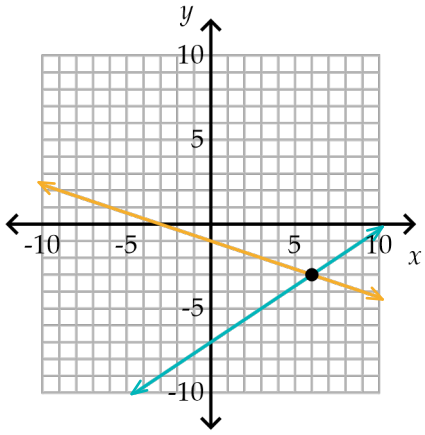
Slope: $\frac{2}{3}$

y-intercept: $(0,-7)$

$y = -\frac{1}{3}x - 1$

Slope: $-\frac{1}{3}$

y-intercept: $(0,-1)$



Solution: $(6,-3)$

Riddle: What do you call more than one L?

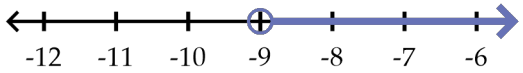
Answer: A PARALLEL

REVIEW

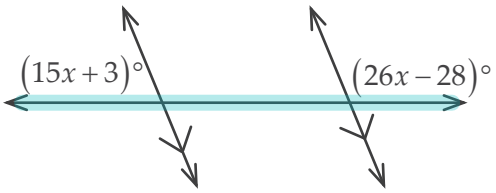
1. $$15 - 12x = \frac{1}{2}(-4x + 10) - 40$$
$$15 - 12x = -2x + 5 - 40$$
$$15 - 12x = -2x - 35$$
$$15 - 12x + 12x = -2x - 35 + 12x$$
$$15 = 10x - 35$$
$$15 + 35 = 10x - 35 + 35$$
$$50 = 10x$$
$$\frac{50}{10} = \frac{10x}{10}$$
$$5 = x$$

(one) / infinite / zero

2. $$-2(3x - 4) - 2 < -4x + 24$$
$$-6x + 8 - 2 < -4x + 24$$
$$-6x + 6 < -4x + 24$$
$$-6x + 6 + 6x < -4x + 24 + 6x$$
$$6 < 2x + 24$$
$$6 - 24 < 2x + 24 - 24$$
$$-18 < 2x$$
$$\frac{-18}{2} < \frac{2x}{2}$$
$$-9 < x$$
$$x > -9$$



3. a.



b. supplementary

c. $15x+3+26x-28=180$

$41x-25=180$

$41x-25+25=180+25$

$41x=205$

$\frac{41x}{41}=\frac{205}{41}$

$x=5$

$(15x+3)°=(15\bullet 5+3)°=78°$

$(26x-28)°=(26\bullet 5-28)°=102°$

4. $\sqrt{\frac{14+11^2-6^3}{-\left(\frac{1}{2}\right)^2}}$

$=\sqrt{\frac{14+121-216}{-\frac{1}{4}}}$

$=\sqrt{\frac{-81}{-\frac{1}{4}}}$

$=\sqrt{-81\bullet(-4)}$

$=\sqrt{324}$

$=18$

Solving Systems by Substitution

WARM-UP

a. 1700

b. 2.31

c. 0.0005487

PRACTICE

Note: There are many ways to solve systems of equations. Work may vary, but the solutions should be the same.

1. Solve for x:

$$\begin{aligned} -x-3y &= -1 \\ -x-3y+3y &= -1+3y \\ -x &= -1+3y \\ \frac{-x}{-1} &= \frac{-1}{-1}+\frac{3y}{-1} \\ x &= 1-3y \end{aligned}$$

Substitution:

$$\begin{aligned} 3x+4y &= -2 \\ 3(1-3y)+4y &= -2 \\ 3-9y+4y &= -2 \\ 3-5y &= -2 \\ 3-5y-3 &= -2-3 \\ -5y &= -5 \\ \frac{-5y}{-5} &= \frac{-5}{-5} \\ y &= 1 \end{aligned}$$

$$\begin{aligned} x &= 1-3y \\ x &= 1-3(1) \\ x &= -2 \end{aligned}$$

Solution: $(-2,1)$

2. Solve for y:

$$\begin{aligned} 4x+2y &= 22 \\ 4x+2y-4x &= 22-4x \\ 2y &= 22-4x \\ \frac{2y}{2} &= \frac{22}{2}-\frac{4x}{2} \\ y &= 11-2x \end{aligned}$$

Substitution:

$$\begin{aligned} 2x-3y &= -9 \\ 2x-3(11-2x) &= -9 \\ 2x-33+6x &= -9 \\ 8x-33 &= -9 \\ 8x-33+33 &= -9+33 \\ 8x &= 24 \\ \frac{8x}{8} &= \frac{24}{8} \\ x &= 3 \end{aligned}$$

$$\begin{aligned} y &= 11-2x \\ y &= 11-2(3) \\ y &= 5 \end{aligned}$$

Solution: $(3,5)$

3. Solve for y:

$$\begin{aligned}
-3x-5y&=25\\
-3x-5y+3x&=25+3x\\
-5y&=25+3x\\
\frac{-5y}{-5}&=\frac{25}{-5}+\frac{3x}{-5}\\
y&=-5-\frac{3}{5}x
\end{aligned}$$

Substitution:

$$\begin{aligned}
-x+2y&=-10\\
-x+2\left(-5-\frac{3}{5}x\right)&=-10\\
-x-10-\frac{6}{5}x&=-10\\
-\frac{11}{5}x-10&=-10\\
-\frac{11}{5}x-10+10&=-10+10\\
-\frac{11}{5}x&=0\\
-\frac{5}{11}\left(-\frac{11}{5}x\right)&=0\bullet\left(-\frac{5}{11}\right)\\
x&=0
\end{aligned}$$

$$\begin{aligned}
y&=-5-\frac{3}{5}x\\
y&=-5-\frac{3}{5}(0)\\
y&=-5
\end{aligned}$$

Solution: $(0,-5)$

4. Solve for y:

$$\begin{aligned}
-5x+2y&=16\\
-5x+2y+5x&=16+5x\\
2y&=16+5x\\
\frac{2y}{2}&=\frac{16}{2}+\frac{5x}{2}\\
y&=8+\frac{5}{2}x
\end{aligned}$$

Substitution:

$$\begin{aligned}
-4x+4y&=8\\
-4x+4\left(8+\frac{5}{2}x\right)&=8\\
-4x+32+10x&=8\\
6x+32&=8\\
6x+32-32&=8-32\\
6x&=-24\\
\frac{6x}{6}&=\frac{-24}{6}\\
x&=-4
\end{aligned}$$

$$\begin{aligned}
y&=8+\frac{5}{2}x\\
y&=8+\frac{5}{2}(-4)\\
y&=-2
\end{aligned}$$

Solution: $(-4,-2)$

5. Solve for x:

$$\begin{aligned}
x+6y&=6\\
x+6y-6y&=6-6y\\
x&=6-6y
\end{aligned}$$

Substitution:

$$\begin{aligned}
-5x-30y&=-10\\
-5(6-6y)-30y&=-10\\
-30+30y-30y&=-10\\
-30&\neq-10
\end{aligned}$$

Solution: no solution

6. Solve for x:

$$\begin{aligned}
2x-3y&=26\\
2x-3y+3y&=26+3y\\
2x&=26+3y\\
\frac{2x}{2}&=\frac{26}{2}+\frac{3y}{2}\\
x&=13+\frac{3}{2}y
\end{aligned}$$

Substitution:

$$\begin{aligned} -4x+6y &= -52 \\ -4\left(13+\frac{3}{2}y\right)+6y &= -52 \\ -52-6y+6y &= -52 \\ -52 &= -52 \end{aligned}$$

Solution: infinitely many solutions

7. Solve for y:

$$\begin{aligned} -5x-y &= 0 \\ -5x-y+5x &= 0+5x \\ -y &= 5x \\ \frac{-y}{-1} &= \frac{5x}{-1} \\ y &= -5x \end{aligned}$$

Substitution:

$$\begin{aligned} x+y &= 0 \\ x+(-5x) &= 0 \\ -4x &= 0 \\ \frac{-4x}{-4} &= \frac{0}{-4} \\ x &= 0 \end{aligned}$$

$$\begin{aligned} y &= -5x \\ y &= -5(0) \\ y &= 0 \end{aligned}$$

Solution: $(0,0)$

8. Solve for y:

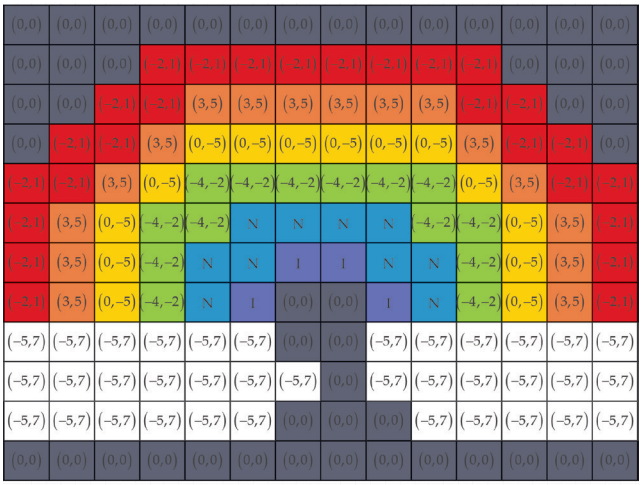
$$\begin{aligned} 2x+y &= -3 \\ 2x+y-2x &= -3-2x \\ y &= -3-2x \end{aligned}$$

Substitution:

$$\begin{aligned} 3x+2y &= -1 \\ 3x+2(-3-2x) &= -1 \\ 3x-6-4x &= -1 \\ -x-6 &= -1 \\ -x-6+6 &= -1+6 \\ -x &= 5 \\ \frac{-x}{-1} &= \frac{5}{-1} \\ x &= -5 \end{aligned}$$

$$\begin{aligned} y &= -3-2x \\ y &= -3-2(-5) \\ y &= 7 \end{aligned}$$

Solution: $(-5,7)$



REVIEW

1. a. Interior angle sum: $3 \bullet 180° = 540°$

b. $2x + x + 3x - 40 + 2x + 100 = 540$

$8x + 60 = 540$

$8x + 60 - 60 = 540 - 60$

$8x = 480$

$\frac{8x}{8} = \frac{480}{8}$

$x = 60$

$m\angle M = x° = 60°$

$m\angle I = (3x - 40)° = 140°$

$m\angle L = 2x° = 120°$

2. $y = \frac{2}{3}x + 7$

Slope: $\frac{2}{3}$ y-intercept: $(0,7)$

$3x - 3y = -18$

$3x - 3(0) = -18$

$3x = -18$

$\frac{3x}{3} = \frac{-18}{3}$

$x = -6$

$3x - 3y = -18$

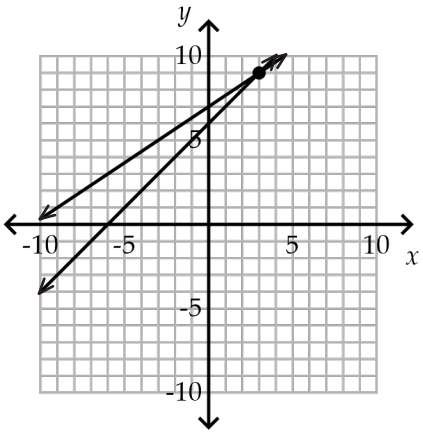
$3(0) - 3y = -18$

$-3y = -18$

$\frac{-3y}{-3} = \frac{-18}{-3}$

$y = 6$

x-intercept: $(-6,0)$ y-intercept: $(0,6)$

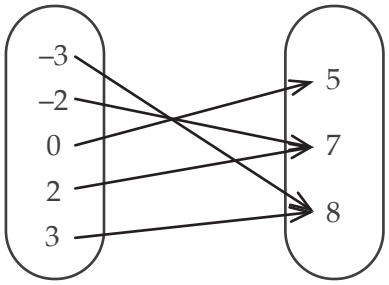


$(3,9)$

3. a. 8

b. yes

c.



d. $\{(-3,8), (-2,7), (0,5), (2,7), (3,8)\}$

4. $(8.47 \times 10^{-5}) \div (15.4 \times 10^{-12})$

$= \frac{8.47 \times 10^{-5}}{15.4 \times 10^{-12}}$

$= \frac{8.47}{15.4} \times \frac{10^{-5}}{10^{-12}}$

$= 0.55 \times 10^{-5-(-12)}$

$= 0.55 \times 10^{7}$

$= 5.5 \times 10^{6}$

Solving Systems by Elimination

WARM-UP

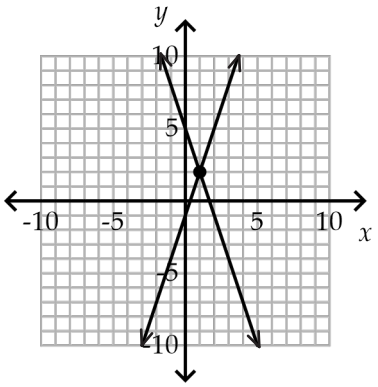
$y = 3x - 1$

Slope: 3 y-intercept: $(0, -1)$

$y = -3x + 5$

Slope: -3 y-intercept: $(0, 5)$

Solution: $(1, 2)$



PRACTICE

Note: There are many ways to solve systems of equations. Work may vary, but the solutions should be the same.

1. Elimination:

$$\begin{array}{r} -4x + y = -6 \\ 3x - y = 5 \\ \hline -x + 0y = -1 \end{array}$$

$$-x = -1$$

$$\frac{-x}{-1} = \frac{-1}{-1}$$

$$x = 1$$

$$-4(1) + y = -6$$

$$-4 + y = -6$$

$$-4 + y + 4 = -6 + 4$$

$$y = -2$$

Solution: $(1, -2)$

2. Elimination:

$$\begin{array}{r} 2x - 3y = 2 \\ -2x + 4y = -6 \\ \hline 0x + 1y = -4 \end{array}$$

$$y = -4$$

$$2x - 3(-4) = 2$$

$$2x + 12 = 2$$

$$2x + 12 - 12 = 2 - 12$$

$$2x = -10$$

$$\frac{2x}{2} = \frac{-10}{2}$$

$$x = -5$$

Solution: $(-5, -4)$

3. Multiply bottom equation by -1:

$$-1 \cdot (3x + y) = -1 \cdot (-1)$$

$$-3x - y = 1$$

Elimination:

$$\begin{array}{r} 6x + y = -7 \\ -3x - y = 1 \\ \hline 3x + 0y = -6 \end{array}$$

$$3x = -6$$

$$\frac{3x}{3} = \frac{-6}{3}$$

$$x = -2$$

$$6(-2)+y=-7$$
$$-12+y=-7$$
$$-12+y+12=-7+12$$
$$y=5$$

Solution: $(-2,5)$

4. Multiply top equation by –2:

$$-2\bullet(x+7y)=21\bullet(-2)$$
$$-2x-14y=-42$$

Elimination:

$$-2x-14y=-42$$
$$\underline{2x+14y=-21}$$
$$0x+0y=-63$$
$$0\neq-63$$

Solution: no solution

5. Multiply bottom equation by –2:

$$-2\bullet(-3x+2y)=-18\bullet(-2)$$
$$6x-4y=36$$

Elimination:

$$5x+4y=30$$
$$\underline{6x-4y=36}$$
$$11x+0y=66$$
$$11x=66$$
$$\frac{11x}{11}=\frac{66}{11}$$
$$x=6$$

$$5(6)+4y=30$$
$$30+4y=30$$
$$30+4y-30=30-30$$
$$4y=0$$
$$\frac{4y}{4}=\frac{0}{4}$$
$$y=0$$

Solution: $(6,0)$

6. Multiply bottom equation by –5:

$$-5\bullet(3x+y)=18\bullet(-5)$$
$$-15x-5y=-90$$

Elimination:

$$x+5y=6$$
$$\underline{-15x-5y=-90}$$
$$-14x+0y=-84$$
$$-14x=-84$$
$$\frac{-14x}{-14}=\frac{-84}{-14}$$
$$x=6$$

$$6+5y=6$$
$$6+5y-6=6-6$$
$$5y=0$$
$$\frac{5y}{5}=\frac{0}{5}$$
$$y=0$$

Solution: $(6,0)$

7. Multiply top equation by 2:

$$2\bullet(5x-2y)=-20\bullet2$$
$$10x-4y=-40$$

Elimination:

$$10x-4y=-40$$
$$\underline{-10x+6y=50}$$
$$0x+2y=10$$
$$2y=10$$
$$\frac{2y}{2}=\frac{10}{2}$$
$$y=5$$

$$5x-2(5)=-20$$
$$5x-10=-20$$
$$5x-10+10=-20+10$$
$$5x=-10$$
$$\frac{5x}{5}=\frac{-10}{5}$$
$$x=-2$$

Solution: $(-2,5)$

8. Multiply bottom equation by 3:

$$3 \cdot (2x - y) = -6 \cdot 3$$
$$6x - 3y = -18$$

Elimination:

$$\begin{array}{r} -x + 3y = -7 \\ \underline{6x - 3y = -18} \\ 5x + 0y = -25 \end{array}$$
$$5x = -25$$
$$\frac{5x}{5} = \frac{-25}{5}$$
$$x = -5$$

$$2(-5) - y = -6$$
$$-10 - y = -6$$
$$-10 - y + 10 = -6 + 10$$
$$-y = 4$$
$$\frac{-y}{-1} = \frac{4}{-1}$$
$$y = -4$$

Solution: $(-5, -4)$

9. Multiply bottom equation by 2:

$$2 \cdot (4x - 2y) = -9 \cdot 2$$
$$8x - 4y = -18$$

Elimination:

$$\begin{array}{r} -8x + 4y = 18 \\ \underline{8x - 4y = -18} \\ 0x + 0y = 0 \end{array}$$
$$0 = 0$$

Solution: infinitely many solutions

10. Multiply bottom equation by –4:

$$-4 \cdot (x + 3y) = -5 \cdot (-4)$$
$$-4x - 12y = 20$$

Elimination:

$$\begin{array}{r} 4x - y = 6 \\ \underline{-4x - 12y = 20} \\ 0x - 13y = 26 \end{array}$$
$$-13y = 26$$
$$\frac{-13y}{-13} = \frac{26}{-13}$$
$$y = -2$$

$$4x - (-2) = 6$$
$$4x + 2 = 6$$
$$4x + 2 - 2 = 6 - 2$$
$$4x = 4$$
$$\frac{4x}{4} = \frac{4}{4}$$
$$x = 1$$

Solution: $(1, -2)$

REVIEW

1. Note: Work may vary, but the solution should be the same.

Solve for y:

$$\begin{aligned} -16x+8y &= 40 \\ -16x+8y+16x &= 40+16x \\ 8y &= 40+16x \\ \frac{8y}{8} &= \frac{40}{8}+\frac{16x}{8} \\ y &= 5+2x \end{aligned}$$

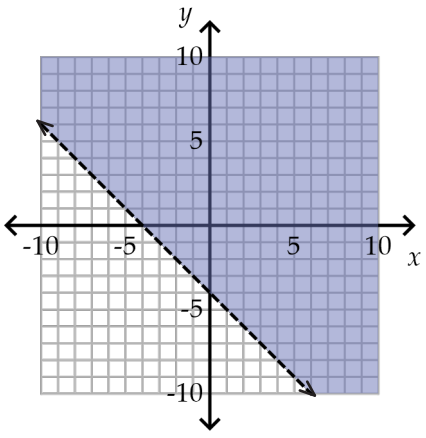
Substitution:

$$\begin{aligned} 9x+3y &= 15 \\ 9x+3(5+2x) &= 15 \\ 9x+15+6x &= 15 \\ 15x+15 &= 15 \\ 15x+15-15 &= 15-15 \\ 15x &= 0 \\ \frac{15x}{15} &= \frac{0}{15} \\ x &= 0 \end{aligned}$$

$$\begin{aligned} y &= 5+2x \\ y &= 5+2(0) \\ y &= 5 \end{aligned}$$

Solution: $(0,5)$

2.



Slope: -1

y-intercept: $(0,-4)$

Test $(0,0)$:

$$\begin{aligned} y &> -x-4 \\ 0 &\stackrel{?}{>} -(0)-4 \\ 0 &\stackrel{?}{>} -4 \quad \checkmark \end{aligned}$$

3. $100\%+35\%=135\%$

$$\begin{aligned} 1.35 \bullet x &= 114.75 \\ \frac{1.35x}{1.35} &= \frac{114.75}{1.35} \\ x &= 85 \end{aligned}$$

$85

4.

$$\begin{aligned} y &= mx+b \\ 9 &= -8(20)+b \\ 9 &= -160+b \\ 9+160 &= -160+b+160 \\ 169 &= b \end{aligned}$$

Equation: $y=-8x+169$

5. Note: Students may have filled the boxes with any matching colors or patterns.

A $-\frac{22}{3}-\frac{2}{3}$	B $49\div(-7)$	C $18.25+5.75$
D $-2.5-3.5$	E $-2\div\frac{1}{4}$	F $\frac{1}{3}\bullet(-18)$
G $-3\bullet(-8)$	H $-30\bullet\frac{1}{10}$	I $\frac{44}{4}$
J $1\div\frac{1}{11}$	K $10-17$	L $-19+16$

Detailed work for the problems is shown below.

A $-\frac{22}{3}-\frac{2}{3}=-\frac{24}{3}=-8$

B $49\div(-7)=-7$

C $18.25+5.75=24$

D $-2.5-3.5=-6$

E $-2\div\frac{1}{4}=-2\bullet 4=-8$

F $\frac{1}{3}\bullet(-18)=-6$

G $-3\bullet(-8)=24$

H $-30\bullet\frac{1}{10}=-3$

I $\frac{44}{4}=11$

J $1\div\frac{1}{11}=1\bullet 11=11$

K $10-17=-7$

L $-19+16=-3$

Practice Solving Systems

PRACTICE

Note: These problems can be solved in a variety of ways, but the final answer should be the same.

1. Substitution:

$$3x-2(2x+6)=-7$$
$$3x-4x-12=-7$$
$$-x-12=-7$$
$$-x-12+12=-7+12$$
$$-x=5$$
$$\frac{-x}{-1}=\frac{5}{-1}$$
$$x=-5$$

$$y=2x+6$$
$$y=2(-5)+6=-4$$

Solution: $(-5,-4)$

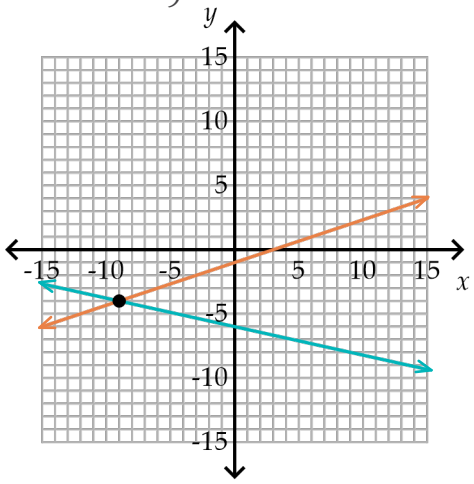
2. Graphing:

$$y=\frac{1}{3}x-1$$

Slope: $\frac{1}{3}$ y-intercept: $(0,-1)$

$$y=-\frac{2}{9}x-6$$

Slope: $-\frac{2}{9}$ y-intercept: $(0,-6)$



Solution: $(-9,-4)$

3. Substitution:

$$y=4\left(\frac{1}{2}y-\frac{1}{2}\right)+1$$
$$y=2y-2+1$$
$$y=2y-1$$
$$y-2y=2y-1-2y$$
$$-y=-1$$
$$\frac{-y}{-1}=\frac{-1}{-1}$$
$$y=1$$

$$x=\frac{1}{2}y-\frac{1}{2}$$
$$x=\frac{1}{2}(1)-\frac{1}{2}$$
$$x=\frac{1}{2}-\frac{1}{2}$$
$$x=0$$

Solution: $(0,1)$

4. Elimination:

$$3x-7y=5$$
$$\underline{2x+7y=15}$$
$$5x+0y=20$$
$$5x=20$$
$$\frac{5x}{5}=\frac{20}{5}$$
$$x=4$$

$$3(4)-7y=5$$
$$12-7y=5$$
$$12-7y-12=5-12$$
$$-7y=-7$$
$$\frac{-7y}{-7}=\frac{-7}{-7}$$
$$y=1$$

Solution: $(4,1)$

5. Multiply the top equation by –3:

$$-3\bullet(x+2y)=1\bullet(-3)$$
$$-3x-6y=-3$$

Elimination:

$$\begin{array}{r} -3x-6y=-3 \\ 3x+6y=3 \\ \hline 0x+0y=0 \\ 0=0 \end{array}$$

Solution: infinite

6. Multiply the top equation by 3:

$$3\bullet(4x-6y)=-12\bullet 3$$
$$12x-18y=-36$$

Multiply the bottom equation by 2:

$$2\bullet(-6x-9y)=18\bullet 2$$
$$-12x-18y=36$$

Elimination:

$$\begin{array}{r} 12x-18y=-36 \\ -12x-18y=36 \\ \hline 0x-36y=0 \\ -36y=0 \\ \frac{-36y}{-36}=\frac{0}{-36} \\ y=0 \end{array}$$

$$12x-18(0)=-36$$
$$12x=-36$$
$$\frac{12x}{12}=\frac{-36}{12}$$
$$x=-3$$

Solution: $(-3,0)$

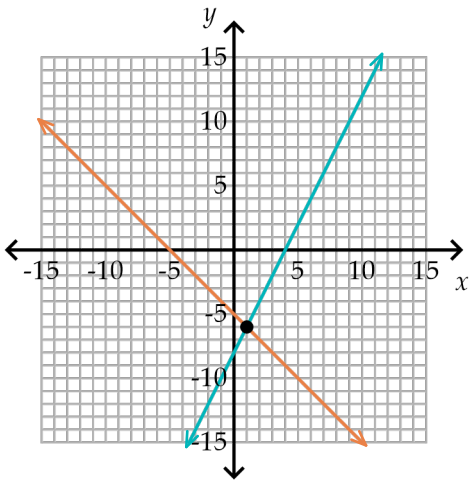
7. Graphing:

$y=-x-5$

Slope: –1 y-intercept: $(0,-5)$

$y=2x-8$

Slope: 2 y-intercept: $(0,-8)$



Solution: $(1,-6)$

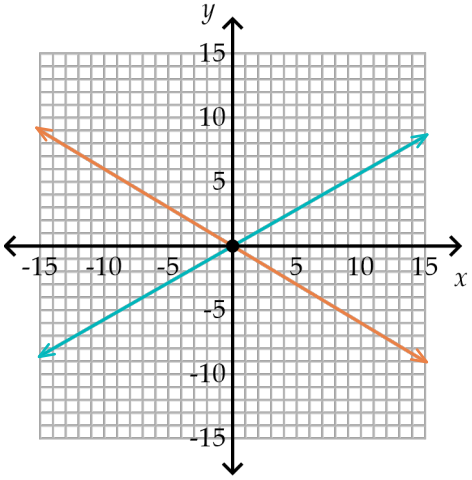
8. Graphing:

$y=-\frac{3}{5}x$

Slope: $-\frac{3}{5}$ y-intercept: $(0,0)$

$y=\frac{4}{7}x$

Slope: $\frac{4}{7}$ y-intercept: $(0,0)$



Solution: $(0,0)$

9. Substitution:

$$3(2x-20)=-2x+4$$
$$6x-60=-2x+4$$
$$6x-60+2x=-2x+4+2x$$
$$8x-60=4$$
$$8x-60+60=4+60$$
$$8x=64$$
$$\frac{8x}{8}=\frac{64}{8}$$
$$x=8$$

$$y=2x-20$$
$$y=2(8)-20$$
$$y=-4$$

Solution: $(8,-4)$

10. Multiply the bottom equation by 3:

$$3\bullet(-x+5y)=-14\bullet 3$$
$$-3x+15y=-42$$

Elimination:

$$\begin{array}{r} 3x-4y=20 \\ -3x+15y=-42 \\ \hline 0x+11y=-22 \end{array}$$
$$11y=-22$$
$$\frac{11y}{11}=\frac{-22}{11}$$
$$y=-2$$

$$3x-4(-2)=20$$
$$3x+8=20$$
$$3x+8-8=20-8$$
$$3x=12$$
$$\frac{3x}{3}=\frac{12}{3}$$
$$x=4$$

Solution: $(4,-2)$

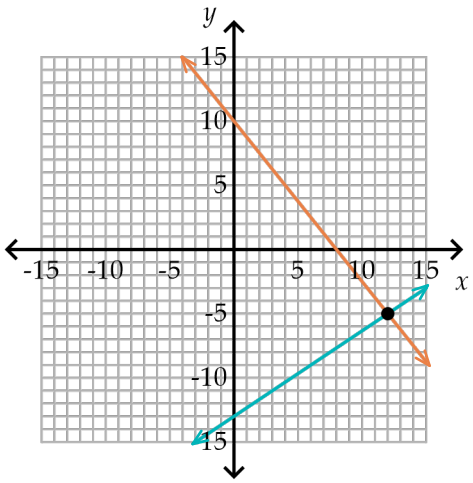
11. Graphing:

$$y=-\frac{5}{4}x+10$$

Slope: $-\frac{5}{4}$ y-intercept: $(0,10)$

$$y=\frac{2}{3}x-13$$

Slope: $\frac{2}{3}$ y-intercept: $(0,-13)$



Solution: $(12,-5)$

12. Substitution:

$$-2x+(x+8)=11$$
$$-x+8=11$$
$$-x+8-8=11-8$$
$$-x=3$$
$$\frac{-x}{-1}=\frac{3}{-1}$$
$$x=-3$$

$$y=x+8$$
$$y=-3+8$$
$$y=5$$

Solution: $(-3,5)$

13. Multiply the top equation by –2:

$$-2\cdot(2x+5y)=12\cdot(-2)$$
$$-4x-10y=-24$$

Elimination:

$$\begin{array}{r} -4x-10y=-24 \\ \underline{4x-3y=-2} \\ 0x-13y=-26 \\ -13y=-26 \\ \frac{-13y}{-13}=\frac{-26}{-13} \\ y=2 \end{array}$$

$$\begin{array}{r} 2x+5(2)=12 \\ 2x+10=12 \\ 2x+10-10=12-10 \\ 2x=2 \\ \frac{2x}{2}=\frac{2}{2} \\ x=1 \end{array}$$

Solution: $(1,2)$

14. Substitution:

$$2x-3\left(\frac{2}{3}x+4\right)=26$$
$$2x-2x-12=26$$
$$-12\neq 26$$

Solution: none

15. Graphing:

Intercepts for $3x+2y=6$:

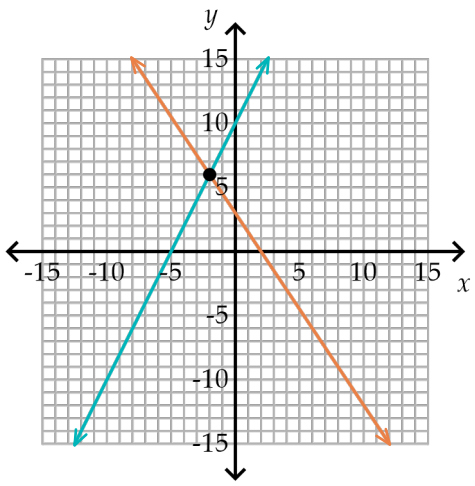
$$\begin{array}{rr} 3x+2(0)=6 & 3(0)+2y=6 \\ 3x=6 & 2y=6 \\ \frac{3x}{3}=\frac{6}{3} & \frac{2y}{2}=\frac{6}{2} \\ x=2 & y=3 \end{array}$$

x-intercept: $(2,0)$ y-intercept: $(0,3)$

Intercepts for $-4x+2y=20$:

$$\begin{array}{rr} -4x+2(0)=20 & -4(0)+2y=20 \\ -4x=20 & 2y=20 \\ \frac{-4x}{-4}=\frac{20}{-4} & \frac{2y}{2}=\frac{20}{2} \\ x=-5 & y=10 \end{array}$$

x-intercept: $(-5,0)$ y-intercept: $(0,10)$



Solution: $(-2,6)$

Secret Message:
Cryptography is the practice and study of hiding information.

Translations on the Coordinate Plane

WARM-UP

Note: There are many ways to solve systems of equations. Work may vary, but the solution should be the same.

Substitution:

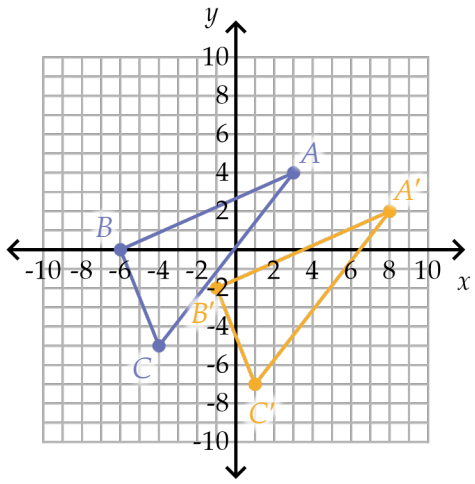
$$\begin{aligned} 3x - y &= 24 \\ 3x - (-x + 16) &= 24 \\ 3x + x - 16 &= 24 \\ 4x - 16 &= 24 \\ 4x - 16 + 16 &= 24 + 16 \\ 4x &= 40 \\ \frac{4x}{4} &= \frac{40}{4} \\ x &= 10 \end{aligned}$$

$$\begin{aligned} y &= -x + 16 \\ y &= -10 + 16 \\ y &= 6 \end{aligned}$$

Solution: $(10,6)$

PRACTICE

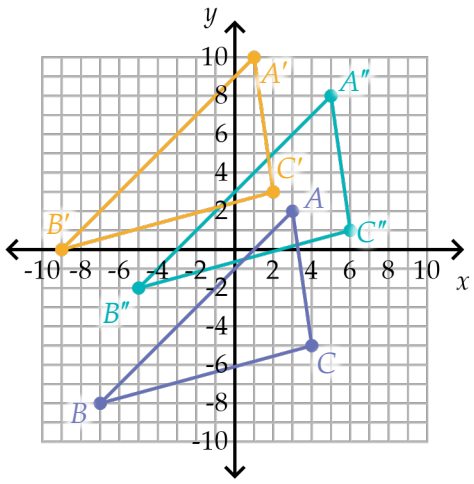
1. a. Image shown in orange on the graph.



b.

ABC	$(3,4)$	$(-6,0)$	$(-4,-5)$
$A'B'C'$	$(8,2)$	$(-1,-2)$	$(1,-7)$

2. a. First image shown in orange on the graph. Second image shown in aqua on the graph.



b.

ABC	$(3,2)$	$(-7,-8)$	$(4,-5)$
$A'B'C'$	$(1,10)$	$(-9,0)$	$(2,3)$
$A''B''C''$	$(5,8)$	$(-5,-2)$	$(6,1)$

3. a. Rule: $(x,y)\rightarrow(x+2,y+5)$

ABC	$(-9,5)$	$(-5,1)$	$(-8,-2)$
$A'B'C'$	$(-9+2,5+5)$ $(-7,10)$	$(-5+2,1+5)$ $(-3,6)$	$(-8+2,-2+5)$ $(-6,3)$

Image shown in aqua on the graph.

b. Rule: $(x,y)\rightarrow(x-6,y-3)$

ABC	$(13,13)$	$(12,6)$	$(9,9)$
$A'B'C'$	$(13-6,13-3)$ $(7,10)$	$(12-6,6-3)$ $(6,3)$	$(9-6,9-3)$ $(3,6)$

Image shown in aqua on the graph.

c. Rule: $(x,y)\rightarrow(x+1,y-2)$

$ABCD$	$(-2,3)$	$(-4,4)$	$(-3,6)$	$(-2,5)$
$A'B'C'D'$	$(-2+1,3-2)$ $(-1,1)$	$(-4+1,4-2)$ $(-3,2)$	$(-3+1,6-2)$ $(-2,4)$	$(-2+1,5-2)$ $(-1,3)$

Image shown in orange on the graph.

d. Rule: $(x,y)\rightarrow(x-3,y+1)$

$ABCD$	$(4,2)$	$(5,3)$	$(6,1)$	$(4,0)$
$A'B'C'D'$	$(4-3,2+1)$ $(1,3)$	$(5-3,3+1)$ $(2,4)$	$(6-3,1+1)$ $(3,2)$	$(4-3,0+1)$ $(1,1)$

Image shown in orange on the graph.

e. Rule: $(x,y)\rightarrow(x+8,y+4)$

ABC	$(-9,-3)$	$(-7,-3)$	$(-8,-4)$
$A'B'C'$	$(-9+8,-3+4)$ $(-1,1)$	$(-7+8,-3+4)$ $(1,1)$	$(-8+8,-4+4)$ $(0,0)$

Image shown in orange on the graph.

f. Rule: $(x,y)\rightarrow(x-5,y+3)$

AB	$(-5,-3)$	$(3,-4)$
$A'B'$	$(-5-5,-3+3)$ $(-10,0)$	$(3-5,-4+3)$ $(-2,-1)$

Image shown in purple on the graph.

g. Rule: $(x,y)\rightarrow(x-2,y-4)$

AB	$(0,3)$	$(-8,3)$
$A'B'$	$(0-2,3-4)$ $(-2,-1)$	$(-8-2,3-4)$ $(-10,-1)$

Image shown in purple on the graph.

h. Rule: $(x,y)\rightarrow(x+6,y+1)$

AB	$(-16,-3)$	$(-8,-2)$
$A'B'$	$(-16+6,-3+1)$ $(-10,-2)$	$(-8+6,-2+1)$ $(-2,-1)$

Image shown in purple on the graph.

i. Rule: $(x,y)\rightarrow(x-4,y-4+1)\rightarrow(x-4,y-3)$

AB	$(6,2)$	$(14,3)$
$A'B'$	$(6-4,2-3)$ $(2,-1)$	$(14-4,3-3)$ $(10,0)$

Image shown in purple on the graph.

j. Rule: $(x,y)\rightarrow(x+1-1,y+1+5)\rightarrow(x,y+6)$

AB	$(2,-7)$	$(10,-7)$
$A'B'$	$(2,-7+6)$ $(2,-1)$	$(10,-7+6)$ $(10,-1)$

Image shown in purple on the graph.

k. Rule: $(x,y)\rightarrow(x-2-4,y-4+2)\rightarrow(x-6,y-2)$

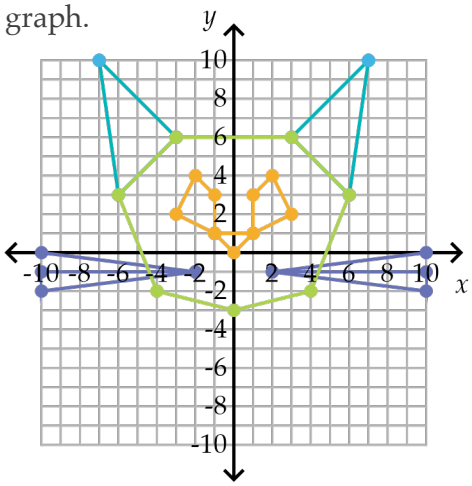
AB	$(8,1)$	$(16,0)$
$A'B'$	$(8-6,1-2)$ $(2,-1)$	$(16-6,0-2)$ $(10,-2)$

Image shown in purple on the graph.

l. Rule: $(x,y)\rightarrow(x+6,y+7)$

$ABCDEFG$	$(-9,-1)$	$(-3,-1)$	$(0,-4)$	$(-2,-9)$	$(-6,-10)$	$(-10,-9)$	$(-12,-4)$
$A'B'C'D'E'F'G'$	$(-9+6,-1+7)$ $(-3,6)$	$(-3+6,-1+7)$ $(3,6)$	$(0+6,-4+7)$ $(6,3)$	$(-2+6,-9+7)$ $(4,-2)$	$(-6+6,-10+7)$ $(0,-3)$	$(-10+6,-9+7)$ $(-4,-2)$	$(-12+6,-4+7)$ $(-6,3)$

Image shown in green on the graph.



REVIEW

1. $-8(n-6)+13=19-5(6n-9)$

$-8n+48+13=19-30n+45$

$-8n+61=64-30n$

$-8n+61+30n=64-30n+30n$

$22n+61=64$

$22n+61-61=64-61$

$22n=3$

$\frac{22n}{22}=\frac{3}{22}$

$n=\frac{3}{22}$

2. a. radius of circular base: 11 dm

$a^2+b^2=c^2$

$60^2+11^2=c^2$

$3600+121=c^2$

$3721=c^2$

$\sqrt{3721}=\sqrt{c^2}$

$61=c$

61 dm

b. $SA=\pi rl+\pi r^2$

$SA=\pi(11)(61)+\pi(11)^2$

$SA=671\pi+121\pi$

$SA\approx 2488$

2488 dm^2

3. 90 problems ÷ 5 minutes = 18 problems per minute

4. a. $8+6+6=20$

$\frac{8}{20}=\frac{40}{100}=40\%$

b. $P(\text{black first and pinto second})$

$=P(\text{black first})\bullet P(\text{pinto second}\,|\,\text{black first})$

$=\frac{8}{20}\bullet\frac{6}{19}$

$=\frac{48}{380}=\frac{12}{95}\approx 0.126=12.6\%$

Reflections on the Coordinate Plane

WARM-UP

Preimage	$(2,2)$	$(5,2)$	$(7,5)$	$(4,5)$
Image	**A** $(-5,5)$	**B** $(-2,5)$	**C** $(0,8)$	**D** $(-3,8)$

Detailed work for each coordinate is shown below.

A $(2,2) \rightarrow (2-7, 2+3) \rightarrow (-5,5)$

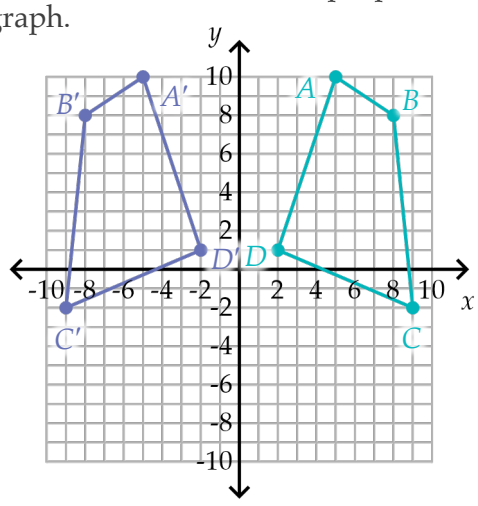
B $(5,2) \rightarrow (5-7, 2+3) \rightarrow (-2,5)$

C $(7,5) \rightarrow (7-7, 5+3) \rightarrow (0,8)$

D $(4,5) \rightarrow (4-7, 5+3) \rightarrow (-3,8)$

PRACTICE

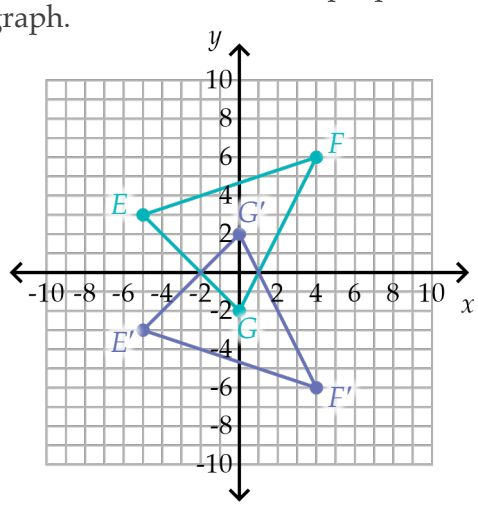
1. a. The reflection is shown in purple on the graph.



b.

$ABCD$	$(5,10)$	$(8,8)$	$(9,-2)$	$(2,1)$
$A'B'C'D'$	$(-5,10)$	$(-8,8)$	$(-9,-2)$	$(-2,1)$

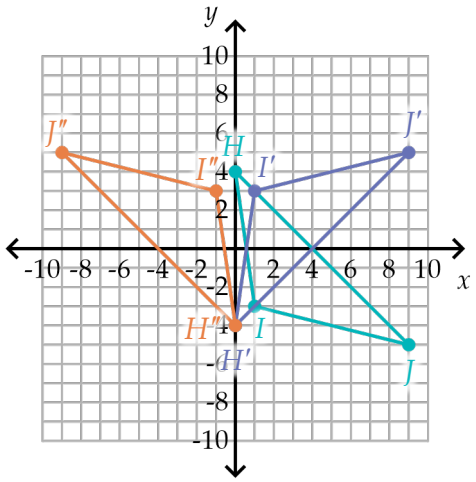
2. a. The reflection is shown in purple on the graph.



b.

ΔEFG	$(-5,3)$	$(4,6)$	$(0,-2)$
$\Delta E'F'G'$	$(-5,-3)$	$(4,-6)$	$(0,2)$

3. a. The reflections are shown in purple and orange on the graph.



b.

$\triangle HIJ$	$(0,4)$	$(1,-3)$	$(9,-5)$
$\triangle H'I'J'$	$(0,-4)$	$(1,3)$	$(9,5)$
$\triangle H''I''J''$	$(0,-4)$	$(-1,3)$	$(-9,5)$

4.

$KLMN$	$(0,4)$	$(5,9)$	$(-10,8)$	$(-7,-1)$
$K'L'M'N'$	$(0,4)$	$(-5,9)$	$(10,8)$	$(7,-1)$

5.

$OPQR$	$(-5,-5)$	$(-3,3)$	$(0,0)$	$(4,-7)$
$O'P'Q'R'$	$(-5,5)$	$(-3,-3)$	$(0,0)$	$(4,7)$

6.

$\triangle STU$	$(2,-1)$	$(4,3)$	$(2,7)$
$\triangle S'T'U'$	$(2,1)$	$(4,-3)$	$(2,-7)$
$\triangle S''T''U''$	$(-2,1)$	$(-4,-3)$	$(-2,-7)$

7.

$WXYZ$	$(-10,-4)$	$(-8,5)$	$(-1,0)$	$(6,6)$
$W'X'Y'Z'$	$(10,-4)$	$(8,5)$	$(1,0)$	$(-6,6)$
$W''X''Y''Z''$	$(10,4)$	$(8,-5)$	$(1,0)$	$(-6,-6)$

REVIEW

1. Note: There are many ways to solve systems of equations. Work may vary, but the solution should be the same.

Multiply bottom equation by 2:

$$2 \bullet (-x + 2y) = -21 \bullet 2$$
$$-2x + 4y = -42$$

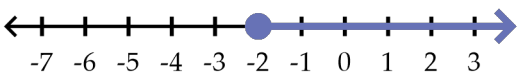
Elimination:

$$\begin{array}{r} 6x - 4y = 30 \\ -2x + 4y = -42 \\ \hline 4x + 0y = -12 \end{array}$$
$$4x = -12$$
$$\frac{4x}{4} = \frac{-12}{4}$$
$$x = -3$$

$$6(-3) - 4y = 30$$
$$-18 - 4y = 30$$
$$-18 - 4y + 18 = 30 + 18$$
$$-4y = 48$$
$$\frac{-4y}{-4} = \frac{48}{-4}$$
$$y = -12$$

Solution: $(-3, -12)$

2. $$-8x \le 6x + 28$$
$$-8x - 6x \le 6x + 28 - 6x$$
$$-14x \le 28$$
$$\frac{-14x}{-14} \le \frac{28}{-14}$$
$$x \ge -2$$



3. $$15x - 3y = 23$$
$$15x - 3y - 15x = 23 - 15x$$
$$-3y = 23 - 15x$$
$$\frac{-3y}{-3} = \frac{23 - 15x}{-3}$$
$$y = -\frac{23}{3} + 5x$$
$$y = 5x - \frac{23}{3}$$
$$y = 5x - 7\frac{2}{3}$$

Slope: 5 y-intercept: $\left(0, -7\frac{2}{3}\right)$

4. 3.72×10^{13}

5. $$I = Prt$$
$$180 = P \bullet 0.005 \bullet 18$$
$$180 = P \bullet 0.09$$
$$\frac{180}{0.09} = \frac{P \bullet 0.09}{0.09}$$
$$2000 = P$$

$2000

Rotations and Symmetry

WARM-UP

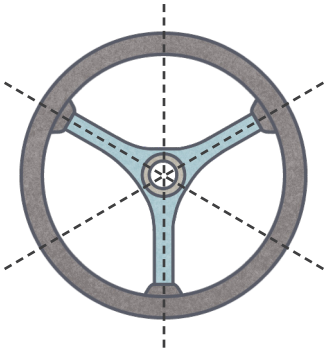
a. 12.5%

b. 0.08%

c. 145%

PRACTICE

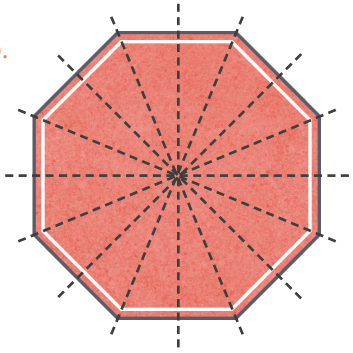
1. a.



Lines of symmetry: 3

Order: 3

b.



Lines of symmetry: 8

Order: 8

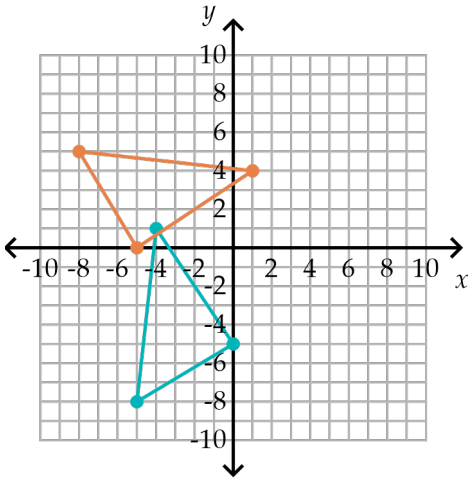
c.

Lines of symmetry: 0

Order: 1

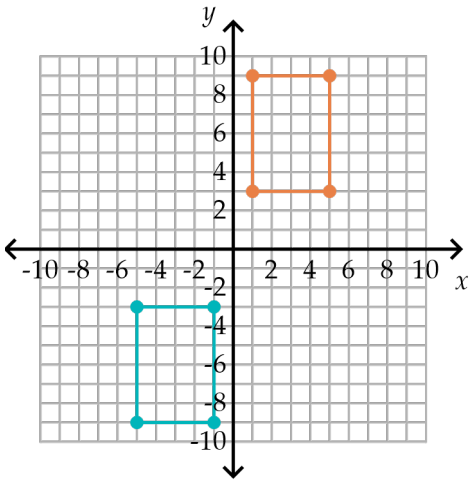
2. a. Rule: $(x,y) \rightarrow (-y,x)$

Rotate 90° Counterclockwise			
Preimage	$(-8,5)$	$(-5,0)$	$(1,4)$
Image	$(-5,-8)$	$(0,-5)$	$(-4,1)$



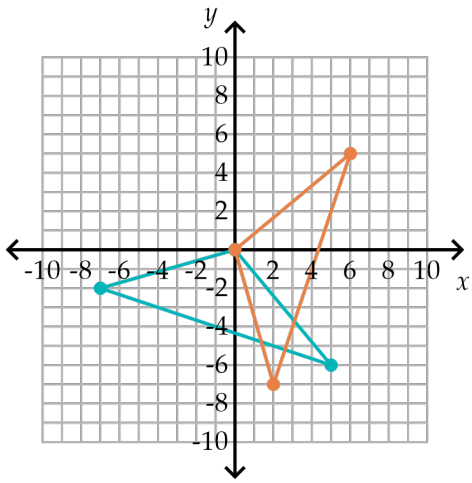
b. Rule: $(x,y) \rightarrow (-x,-y)$

Rotate 180° Clockwise				
Preimage	$(1,9)$	$(5,9)$	$(5,3)$	$(1,3)$
Image	$(-1,-9)$	$(-5,-9)$	$(-5,-3)$	$(-1,-3)$



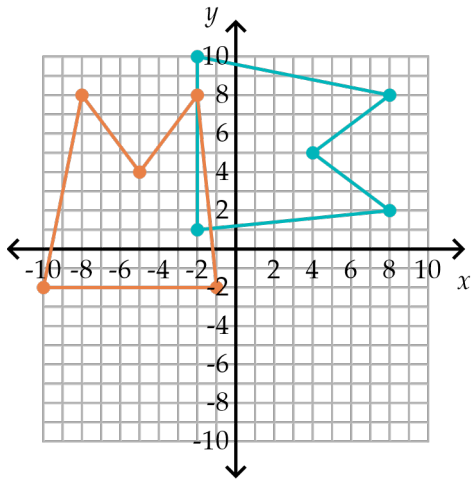
c. Rule: $(x,y) \rightarrow (y,-x)$

Rotate 90° Clockwise			
Preimage	$(6,5)$	$(0,0)$	$(2,-7)$
Image	$(5,-6)$	$(0,0)$	$(-7,-2)$



d. Rule: $(x,y) \rightarrow (y,-x)$

Rotate 270° Counterclockwise					
Preimage	$(-2,8)$	$(-5,4)$	$(-8,8)$	$(-10,-2)$	$(-1,-2)$
Image	$(8,2)$	$(4,5)$	$(8,8)$	$(-2,10)$	$(-2,1)$



REVIEW

1. Rule: $(x,y)\rightarrow(x+9,y-6.5)$

HUG	$(-12.5,8.5)$	$(4,7)$	$(-6,-1.5)$
H'U'G'	$(-12.5+9,8.5-6.5)$ $(-3.5,2)$	$(4+9,7-6.5)$ $(13,0.5)$	$(-6+9,-1.5-6.5)$ $(3,-8)$

2. $y=-4x-5.5$

Slope: -4

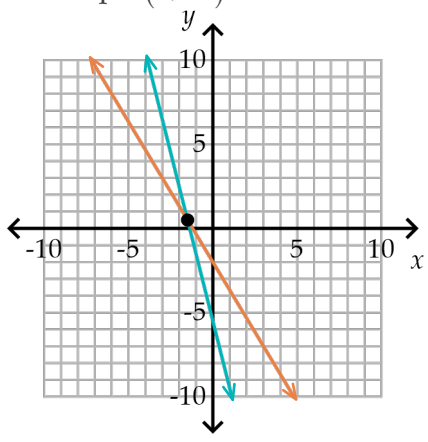
y-intercept: -5.5

$$\begin{aligned}10x+6y&=-12\\10x+6(0)&=-12\\10x&=-12\\\frac{10x}{10}&=\frac{-12}{10}\\x&=-1.2\end{aligned}$$

x-intercept: $(-1.2,0)$

$$\begin{aligned}10x+6y&=-12\\10(0)+6y&=-12\\6y&=-12\\\frac{6y}{6}&=\frac{-12}{6}\\y&=-2\end{aligned}$$

y-intercept: $(0,-2)$



Estimated solution from graph: Answers may vary.

Substitution:

$$\begin{aligned}10x+6y&=-12\\10x+6(-4x-5.5)&=-12\\10x-24x-33&=-12\\-14x-33&=-12\\-14x-33+33&=-12+33\\-14x&=21\\\frac{-14x}{-14}&=\frac{21}{-14}\\x&=-1.5\end{aligned}$$

$$\begin{aligned}y&=-4x-5.5\\y&=-4(-1.5)-5.5\\y&=6-5.5\\y&=0.5\end{aligned}$$

Solution: $(-1.5,0.5)$

3. a.

$$\begin{aligned}a^2+b^2&=c^2\\4.2^2+b^2&=7^2\\17.64+b^2&=49\\17.64+b^2-17.64&=49-17.64\\b^2&=31.36\\\sqrt{b^2}&=\sqrt{31.36}\\b&=5.6\end{aligned}$$

5.6 in

b. Triangular Prisms (2):

$$V_{prism}=\frac{1}{2}bhl$$

$$V_{prism}=\frac{1}{2}(5.6)(4.2)(4.2)$$

$$V_{prism}\approx 49.39$$

$49.39\ \text{in}^3$

Cube:

$V_{cube} = s^3$

$V_{cube} = 4.2^3$

$V_{cube} \approx 74.09$

74.09 in^3

Total Volume:

$2 \bullet 49.39 \text{ in}^3 + 74.09 \text{ in}^3 = 172.87 \text{ in}^3$

4. Ratio of sides: $\frac{17}{13.6} = \frac{5}{4}$

Ratio of areas: $\left(\frac{5}{4}\right)^2 = \frac{25}{16}$

$\frac{25}{16} = \frac{120}{x}$

$25x = 16 \bullet 120$

$25x = 1920$

$\frac{25x}{25} = \frac{1920}{25}$

$x = 76.8$

76.8 cm^2

Dilations

WARM-UP

Rule: $(x,y)\rightarrow(-x,y)$

Preimage	$(1,1)$	$(3,2)$	$(2,5)$
Image	$(-1,1)$	$(-3,2)$	$(-2,5)$

PRACTICE

1. a. $\frac{A'B'}{AB}=\frac{6}{2}=3$

Scale factor: 3 Compression: no

b. $\frac{B'C'}{BC}=\frac{4}{20}=\frac{1}{5}$

Scale factor: $\frac{1}{5}$ Compression: yes

c. $\frac{A'B'}{AB}=\frac{4}{8}=\frac{1}{2}$

Scale factor: $\frac{1}{2}$ Compression: yes

2. a. Each coordinate of the image is two times the value of the corresponding coordinate of the preimage.

Scale factor: 2 Compression: no

b. Each coordinate of the image is one-fourth of the corresponding coordinate of the preimage.

Scale factor: $\frac{1}{4}$ Compression: yes

3. a.

ABC	$(2,5)$	$(4,6)$	$(-5,8)$
$A'B'C'$	$(2\cdot 2,2\cdot 5)$ $(4,10)$	$(2\cdot 4,2\cdot 6)$ $(8,12)$	$(2\cdot(-5),2\cdot 8)$ $(-10,16)$

b.

$ABCD$	$(-1,0)$	$(-3,4)$	$(0,6)$	$(6,-2)$
$A'B'C'D'$	$(5\cdot(-1),5\cdot 0)$ $(-5,0)$	$(5\cdot(-3),5\cdot 4)$ $(-15,20)$	$(5\cdot 0,5\cdot 6)$ $(0,30)$	$(5\cdot 6,5\cdot(-2))$ $(30,-10)$

c.

ABC	$(6,12)$	$(-3,0)$	$(3,-9)$
$A'B'C'$	$\left(\frac{1}{3}\cdot 6,\frac{1}{3}\cdot 12\right)$ $(2,4)$	$\left(\frac{1}{3}\cdot(-3),\frac{1}{3}\cdot 0\right)$ $(-1,0)$	$\left(\frac{1}{3}\cdot 3,\frac{1}{3}\cdot(-9)\right)$ $(1,-3)$

REVIEW

1. a. obtuse, isosceles

b. $x + x + 8x + 5 = 180$

$10x + 5 = 180$

$10x + 5 - 5 = 180 - 5$

$10x = 175$

$\frac{10x}{10} = \frac{175}{10}$

$x = 17.5$

$17.5°$

2. $m = -\frac{1}{2}$

$y = mx + b$

$0 = -\frac{1}{2}(24) + b$

$0 = -12 + b$

$0 + 12 = -12 + b + 12$

$12 = b$

Equation: $y = -\frac{1}{2}x + 12$

3.

QUAD	$(4,-4)$	$(0,0)$	$(2,11)$	$(19,-2)$
Q'U'A'D'	$(4,4)$	$(0,0)$	$(2,-11)$	$(19,2)$

4. $-46 + 8.8x \geq -3.5x + 77$

$-46 + 8.8x + 3.5x \geq -3.5x + 77 + 3.5x$

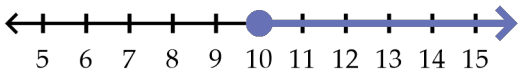
$-46 + 12.3x \geq 77$

$-46 + 12.3x + 46 \geq 77 + 46$

$12.3x \geq 123$

$\frac{12.3x}{12.3} \geq \frac{123}{12.3}$

$x \geq 10$



5. $\frac{3\sqrt[3]{4w-12}}{-2} = 6$

$\left(-\frac{2}{3}\right) \bullet \frac{3\sqrt[3]{4w-12}}{-2} = 6 \bullet \left(-\frac{2}{3}\right)$

$\sqrt[3]{4w-12} = -4$

$\left(\sqrt[3]{4w-12}\right)^3 = (-4)^3$

$4w - 12 = -64$

$4w - 12 + 12 = -64 + 12$

$4w = -52$

$\frac{4w}{4} = \frac{-52}{4}$

$w = -13$

Transformations

WARM-UP

Rule: $(x,y)\rightarrow(-x,-y)$

Preimage	$(0,3)$	$(2,5)$	$(0,8)$	$(-2,5)$
Image	$(0,-3)$	$(-2,-5)$	$(0,-8)$	$(2,-5)$

PRACTICE

1. Green: reflection or rotation

   Purple: dilation and rotation

   Blue: dilation and translation

2. a. reflection across y-axis

   b. rotation 270° clockwise

   c. dilation with scale factor of 5

   d. rotation 90° clockwise

   e. translation left 5 units and down 3 units

   f. dilation with scale factor of $\frac{1}{2}$

3. a. Rule: $(x,y)\rightarrow(x,-y)$
   reflection across x-axis

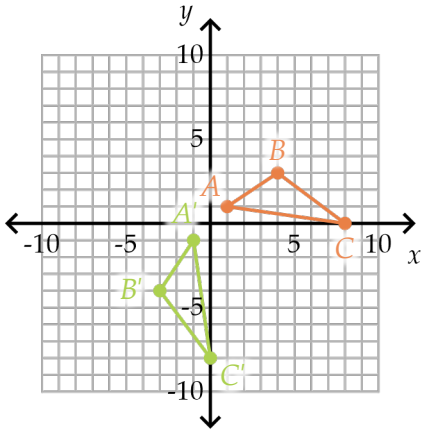
   b. Rule: $(x,y)\rightarrow(-x,-y)$
   rotation 180° clockwise

   c. Rule: $(x,y)\rightarrow(x-1,y+2)$
   translation left 1 unit and up 2 units

   d. Rule: $(x,y)\rightarrow(4x,4y)$
   dilation with scale factor of 4

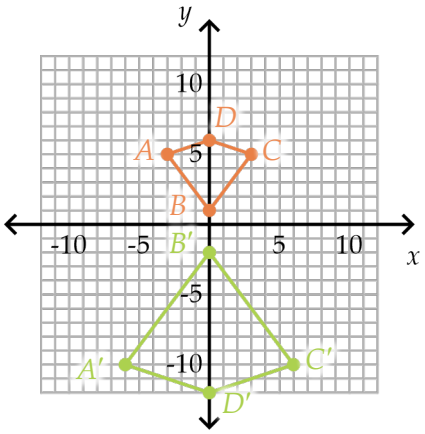
4. a.

ABC	Transformation 1 $(x,y)\rightarrow(y,-x)$	Transformation 2 $(x,y)\rightarrow(-x,y)$
$(1,1)$	$(1,-1)$	$(-1,-1)$
$(4,3)$	$(3,-4)$	$(-3,-4)$
$(8,0)$	$(0,-8)$	$(0,-8)$



b.

$ABCD$	Transformation 1 $(x,y)\to(x,-y)$	Transformation 2 $(x,y)\to(2x,2y)$
$(-3,5)$	$(-3,-5)$	$(-6,-10)$
$(0,1)$	$(0,-1)$	$(0,-2)$
$(3,5)$	$(3,-5)$	$(6,-10)$
$(0,6)$	$(0,-6)$	$(0,-12)$



REVIEW

1. $-14x+10(0)=70$

$-14x=70$

$\frac{-14x}{-14}=\frac{70}{-14}$

$x=-5$

$(-5,0)$

$-14(0)+10y=70$

$10y=70$

$\frac{10y}{10}=\frac{70}{10}$

$y=7$

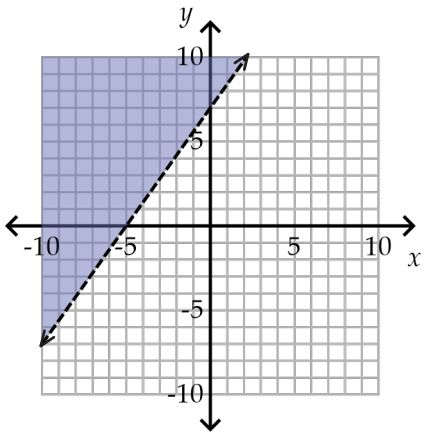
$(0,7)$

Test $(0,0)$:

$-14x+10y \stackrel{?}{>} 70$

$-14(0)+10(0) \stackrel{?}{>} 70$

$0 \stackrel{?}{>} 70$ ✗



2. a. alternate interior angles

b. $16x-18=-x+67$

$16x-18+x=-x+67+x$

$17x-18=67$

$17x-18+18=67+18$

$17x=85$

$\frac{17x}{17}=\frac{85}{17}$

$x=5$

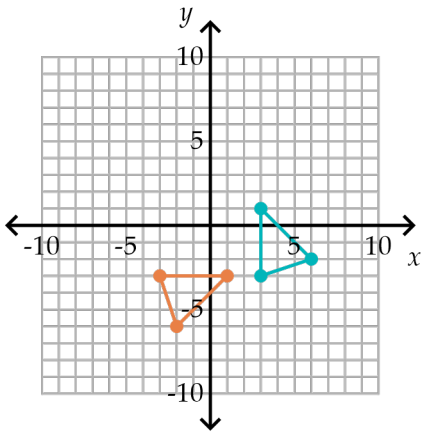
$16(5)-18=62$

62°

3. Rule: $(x,y) \rightarrow (-y,x)$

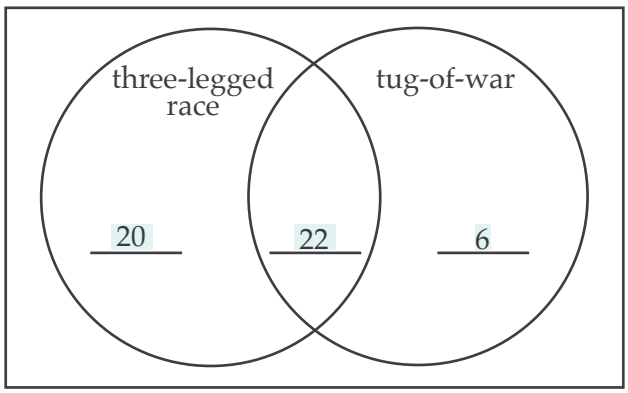
Rotate 270° Clockwise			
Preimage	$(-2,-6)$	$(-3,-3)$	$(1,-3)$
Image	$(6,-2)$	$(3,-3)$	$(3,1)$

The preimage is graphed in orange, and the image is graphed in blue.



4. a. three-legged race only: $42 - 22 = 20$

tug-of-war only: $28 - 22 = 6$



b. $20 + 6 = 26$

Polynomials

WARM-UP

Preimage	$(3,-2)$	$(7,-2)$	$(7,-4)$	$(3,-4)$
Image	$(3\cdot3,3\cdot(-2))$ $(9,-6)$	$(3\cdot7,3\cdot(-2))$ $(21,-6)$	$(3\cdot7,3\cdot(-4))$ $(21,-12)$	$(3\cdot3,3\cdot(-4))$ $(9,-12)$

PRACTICE

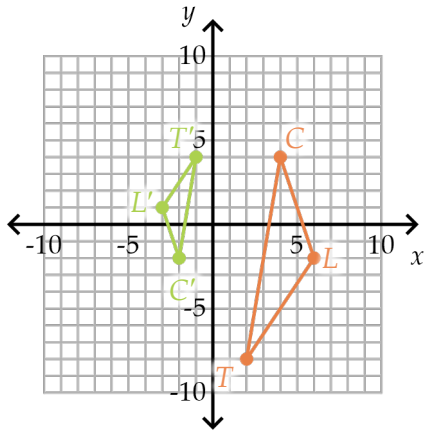
Polynomials	***A* + *B*** Add the polynomials.	***A* – *B*** Subtract polynomial ***B*** from polynomial ***A***.
A: $2a+3a^2+1$ **B:** $-a^2-a$	$2a+3a^2+1+(-a^2)-a$ $=2a-a+3a^2-a^2+1$ $=a+2a^2+1$	$2a+3a^2+1-(-a^2-a)$ $=2a+3a^2+1+a^2+a$ $=2a+a+3a^2+a^2+1$ $=3a+4a^2+1$
A: $5ba-b^2$ **B:** $b+a^2+b^2$	$5ba-b^2+b+a^2+b^2$ $=5ba-b^2+b^2+b+a^2$ $=5ba+b+a^2$	$5ba-b^2-(b+a^2+b^2)$ $=5ba-b^2-b-a^2-b^2$ $=5ba-b^2-b^2-b-a^2$ $=5ba-2b^2-b-a^2$
A: $-4a^2-ab+b^2a$ **B:** a^2b-3a^2+ba	$-4a^2-ab+b^2a+a^2b-3a^2+ba$ $=-4a^2-3a^2-ab+ba+b^2a+a^2b$ $=-7a^2+b^2a+a^2b$	$-4a^2-ab+b^2a-(a^2b-3a^2+ba)$ $=-4a^2-ab+b^2a-a^2b+3a^2-ba$ $=-4a^2+3a^2-ab-ba+b^2a-a^2b$ $=-a^2-2ab+b^2a-a^2b$
A: $-a^3+a^2-a+1$ **B:** a^3-a^2+a-1	$-a^3+a^2-a+1+a^3-a^2+a-1$ $=-a^3+a^3+a^2-a^2-a+a+1-1$ $=0$	$-a^3+a^2-a+1-(a^3-a^2+a-1)$ $=-a^3+a^2-a+1-a^3+a^2-a+1$ $=-a^3-a^3+a^2+a^2-a-a+1+1$ $=-2a^3+2a^2-2a+2$
A: $10b+4b^2-5$ **B:** $-7b^2-2+3b$	$10b+4b^2-5+(-7b^2)-2+3b$ $=10b+3b+4b^2-7b^2-5-2$ $=13b-3b^2-7$	$10b+4b^2-5-(-7b^2-2+3b)$ $=10b+4b^2-5+7b^2+2-3b$ $=10b-3b+4b^2+7b^2-5+2$ $=7b+11b^2-3$

A: $-2a^3+ab-3ab^2$ **B:** $2b^2+4a^3+5ab^2$	$-2a^3+ab-3ab^2+2b^2+4a^3+5ab^2$ $=-2a^3+4a^3+ab-3ab^2+5ab^2+2b^2$ $=2a^3+ab+2ab^2+2b^2$	$-2a^3+ab-3ab^2-\left(2b^2+4a^3+5ab^2\right)$ $=-2a^3+ab-3ab^2-2b^2-4a^3-5ab^2$ $=-2a^3-4a^3+ab-3ab^2-5ab^2-2b^2$ $=-6a^3+ab-8ab^2-2b^2$
A: $b^2a+ab-b^2+3a$ **B:** $-2a-2ab^2+3ab$	$b^2a+ab-b^2+3a+\left(-2a\right)-2ab^2+3ab$ $=b^2a-2ab^2+ab+3ab-b^2+3a-2a$ $=-ab^2+4ab-b^2+a$	$b^2a+ab-b^2+3a-\left(-2a-2ab^2+3ab\right)$ $=b^2a+ab-b^2+3a+2a+2ab^2-3ab$ $=b^2a+2ab^2+ab-3ab-b^2+3a+2a$ $=3ab^2-2ab-b^2+5a$
A: $-a^2-4b+3ab-5$ **B:** $2ab-3a^2-a^3+1$	$-a^2-4b+3ab-5+2ab-3a^2-a^3+1$ $=-a^2-3a^2-4b+3ab+2ab-5+1-a^3$ $=-4a^2-4b+5ab-4-a^3$	$-a^2-4b+3ab-5-\left(2ab-3a^2-a^3+1\right)$ $=-a^2-4b+3ab-5-2ab+3a^2+a^3-1$ $=-a^2+3a^2-4b+3ab-2ab-5-1+a^3$ $=2a^2-4b+ab-6+a^3$
A: $4a^2+1-3a$ **B:** $-a+a^2-4$	$4a^2+1-3a+\left(-a\right)+a^2-4$ $=4a^2+a^2+1-4-3a-a$ $=5a^2-3-4a$	$4a^2+1-3a-\left(-a+a^2-4\right)$ $=4a^2+1-3a+a-a^2+4$ $=4a^2-a^2+1+4-3a+a$ $=3a^2+5-2a$
A: $-2b^2a+b^2$ **B:** $2b^2+2a^2+ab^2$	$-2b^2a+b^2+2b^2+2a^2+ab^2$ $=-2b^2a+ab^2+b^2+2b^2+2a^2$ $=-ab^2+3b^2+2a^2$	$-2b^2a+b^2-\left(2b^2+2a^2+ab^2\right)$ $=-2b^2a+b^2-2b^2-2a^2-ab^2$ $=-2b^2a-ab^2+b^2-2b^2-2a^2$ $=-3ab^2-b^2-2a^2$
A: $3a^2+3ab-5ab^2$ **B:** $-a^2b+2a^2+ba$	$3a^2+3ab-5ab^2+\left(-a^2b\right)+2a^2+ba$ $=3a^2+2a^2+3ab+ba-5ab^2-a^2b$ $=5a^2+4ab-5ab^2-a^2b$	$3a^2+3ab-5ab^2-\left(-a^2b+2a^2+ba\right)$ $=3a^2+3ab-5ab^2+a^2b-2a^2-ba$ $=3a^2-2a^2+3ab-ba-5ab^2+a^2b$ $=a^2+2ab-5ab^2+a^2b$
A: $2b^3-6b^2+4a+2$ **B:** $-b^2+3b^3-2a-6$	$2b^3-6b^2+4a+2+\left(-b^2\right)+3b^3-2a-6$ $=2b^3+3b^3-6b^2-b^2+4a-2a+2-6$ $=5b^3-7b^2+2a-4$	$2b^3-6b^2+4a+2-\left(-b^2+3b^3-2a-6\right)$ $=2b^3-6b^2+4a+2+b^2-3b^3+2a+6$ $=2b^3-3b^3-6b^2+b^2+4a+2a+2+6$ $=-b^3-5b^2+6a+8$

REVIEW

1.

TLC	Transformation 1 $(x,y)\rightarrow(-x,-y)$	Transformation 2 $(x,y)\rightarrow\left(\frac{1}{2}x,\frac{1}{2}y\right)$
$(2,-8)$	$(-2,8)$	$(-1,4)$
$(6,-2)$	$(-6,2)$	$(-3,1)$
$(4,4)$	$(-4,-4)$	$(-2,-2)$



2. $100\% - 25\% = 75\%$

$$0.75 \bullet x = 123$$
$$\frac{0.75 \bullet x}{0.75} = \frac{123}{0.75}$$
$$x = 164$$

164 books

3. $\frac{800}{1450} \approx 0.55 = 55\%$

4. $$4x - 3y = 6$$
$$4x - 3(0) = 6$$
$$4x = 6$$
$$\frac{4x}{4} = \frac{6}{4}$$
$$x = 1.5$$

x-intercept: $(1.5,0)$

$$4x - 3y = 6$$
$$4(0) - 3y = 6$$
$$-3y = 6$$
$$\frac{-3y}{-3} = \frac{6}{-3}$$
$$y = -2$$

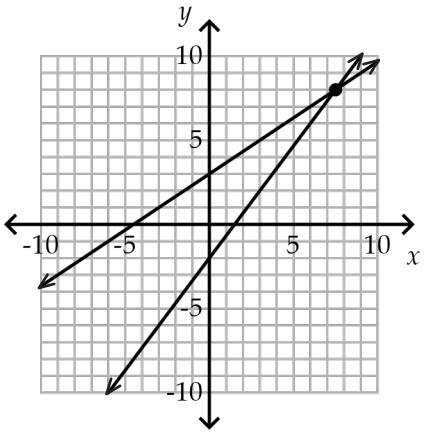
y-intercept: $(0,-2)$

$$-2x + 3y = 9$$
$$-2x + 3(0) = 9$$
$$-2x = 9$$
$$\frac{-2x}{-2} = \frac{9}{-2}$$
$$x = -4.5$$

x-intercept: $(-4.5,0)$

$$-2x + 3y = 9$$
$$-2(0) + 3y = 9$$
$$3y = 9$$
$$\frac{3y}{3} = \frac{9}{3}$$
$$y = 3$$

y-intercept: $(0,3)$



Estimated solution from graph: Answers may vary.

Elimination:

$$\begin{array}{r} 4x-3y=6 \\ -2x+3y=9 \\ \hline 2x+0y=15 \\ 2x=15 \\ \frac{2x}{2}=\frac{15}{2} \\ x=7.5 \end{array}$$

$$\begin{array}{r} 4(7.5)-3y=6 \\ 30-3y=6 \\ 30-3y-30=6-30 \\ -3y=-24 \\ \frac{-3y}{-3}=\frac{-24}{-3} \\ y=8 \end{array}$$

Solution: $(7.5,8)$

5. $56.7 \bullet 10^2 = 5670$

$56.7 \text{ m} = 5670 \text{ cm}$

$$\begin{array}{r} 5670 \bullet x = 21 \\ \frac{5670 \bullet x}{5670} = \frac{21}{5670} \\ x = \frac{21}{5670} = \frac{1}{270} \end{array}$$

Multiplying Polynomials

WARM-UP

$$4q^3r + 14q - 7 + 11q^3r - 5q + 23$$
$$= 4q^3r + 11q^3r + 14q - 5q - 7 + 23$$
$$= 15q^3r + 9q + 16$$

PRACTICE

1. $3a^2b \cdot 5ab^3$
$= 3 \cdot 5 \cdot a^2 \cdot a \cdot b \cdot b^3$
$= 15a^{2+1}b^{1+3}$
$= 15a^3b^4$

2. $pq^2 \cdot 2p^2q^2$
$= 2 \cdot p \cdot p^2 \cdot q^2 \cdot q^2$
$= 2p^{1+2}q^{2+2}$
$= 2p^3q^4$

3. $8c^2de^5 \cdot 4d^4e^2$
$= 8 \cdot 4 \cdot c^2 \cdot d \cdot d^4 \cdot e^5 \cdot e^2$
$= 32c^2d^{1+4}e^{5+2}$
$= 32c^2d^5e^7$

4. $4x^2yz \cdot 4x^3z^2$
$= 4 \cdot 4 \cdot x^2 \cdot x^3 \cdot y \cdot z \cdot z^2$
$= 16x^{2+3}yz^{1+2}$
$= 16x^5yz^3$

5. $2f^2g^3h^5 \cdot 7f^3gh^4$
$= 2 \cdot 7 \cdot f^2 \cdot f^3 \cdot g^3 \cdot g \cdot h^5 \cdot h^4$
$= 14f^{2+3}g^{3+1}h^{5+4}$
$= 14f^5g^4h^9$

6. $3m(2 + 4m)$
$= 3m \cdot 2 + 3m \cdot 4m$
$= 6m + 12m^2$

7. $j^2(-3i^4 + 5ij)$
$= j^2 \cdot (-3i^4) + j^2 \cdot 5ij$
$= -3i^4j^2 + 5ij^{2+1}$
$= -3i^4j^2 + 5ij^3$

8. $-5u^2(2u^3 - 3v^2)$
$= -5u^2 \cdot 2u^3 - 5u^2 \cdot (-3v^2)$
$= -10u^{2+3} + 15u^2v^2$
$= -10u^5 + 15u^2v^2$

9. $10k^4(3ak-5)$

$= 10k^4 \bullet 3ak + 10k^4 \bullet (-5)$

$= 30ak^{4+1} - 50k^4$

$= 30ak^5 - 50k^4$

10. $-b^3(-2b^2-5q^3)$

$= -b^3 \bullet (-2b^2) - b^3 \bullet (-5q^3)$

$= 2b^{3+2} + 5b^3q^3$

$= 2b^5 + 5b^3q^3$

11. $(z+4)(z+2)$

$= z \bullet z + z \bullet 2 + 4 \bullet z + 4 \bullet 2$

$= z^2 + 2z + 4z + 8$

$= z^2 + 6z + 8$

12. $(w-3)(1+w)$

$= w \bullet 1 + w \bullet w + (-3) \bullet 1 + (-3) \bullet w$

$= w + w^2 - 3 - 3w$

$= w^2 - 2w - 3$

13. $(3x+2)(x-1)$

$= 3x \bullet x + 3x \bullet (-1) + 2 \bullet x + 2 \bullet (-1)$

$= 3x^2 - 3x + 2x - 2$

$= 3x^2 - x - 2$

14. $(2n-3)(-5n+1)$

$= 2n \bullet (-5n) + 2n \bullet 1 + (-3) \bullet (-5n) + (-3) \bullet 1$

$= -10n^2 + 2n + 15n - 3$

$= -10n^2 + 17n - 3$

REVIEW

1. Answers may vary.

Sample answer: Because $15 = 10 + 5$, multiply $12 \bullet 10$ to get 120 and $12 \bullet 5 = 60$. Then add $120 + 60$ to get 180.

2. Each coordinate of the image is one-fifth of the corresponding coordinate of the preimage.

Scale factor: $\frac{1}{5}$ Compression: yes

3. $100\% - 40\% = 60\%$

$0.6 \bullet x = 10.71$

$\frac{0.6 \bullet x}{0.6} = \frac{10.71}{0.6}$

$x = 17.85$

$17.85

4. $\frac{6}{7.5} = \frac{10}{x}$

$6x = 7.5 \bullet 10$

$6x = 75$

$\frac{6x}{6} = \frac{75}{6}$

$x = 12.5$

5. $9x^2 + 4xy + 10y^2 - (-17xy + 6x^2 - 5y)$

$= 9x^2 + 4xy + 10y^2 + 17xy - 6x^2 + 5y$

$= 9x^2 - 6x^2 + 4xy + 17xy + 10y^2 + 5y$

$= 3x^2 + 21xy + 10y^2 + 5y$

Logic Lesson 4

Logic puzzles can be approached in many different ways. The solutions here may not represent all possible methods or answers.

One Hundred Five

34, 35, and 36

105 divided by 3 is 35. Because 35 + 35 + 35 is 105, 34 + 35 + 36 will have the same sum.

Family Feast

There were only three people who split the bill: a son, his father, and his grandfather. The two sons are the son and his father. The two fathers are the father and the grandfather. Each person paid $11.

Bike-Shop Blocks

Numbers on one block: 0, 1, 2, 6/9, 7, 8

Numbers on the other block: 0, 1, 2, 3, 4, 5

There are six faces on each block. The dates 11 and 22 require each block to have a 1 and a 2 on it. In order to make the numbers 01 through 09, the digits 1, 2, 3, 4, 5, 6/9, 7, and 8 must all be on blocks opposite 0. Since a cube only has six faces, 0 also needs to be on both blocks. Because 0, 1, and 2 need to be on both blocks, that leaves three blank faces on each block and six remaining digits. Any three of the six remaining digits can go on either block.

Fastest Finishers

The fastest swimmer was Jack.

The fastest cyclist was Don.

The fastest runner was John.

Assume one person was the fastest at one event and see if the statements can be true.

Assume Jack was the fastest cyclist. Since the fastest cyclist was correct, that would mean he was correct in saying that John was the fastest cyclist, which cannot be true because there was only one fastest cyclist. Therefore, Jack cannot be the fastest cyclist.

Assume Don was the fastest cyclist. That would mean his statement that John was the fastest runner is correct and would leave Jack as the fastest swimmer. The fastest swimmer was wrong, and Jack's statement *is* wrong in this scenario (John was not the fastest cyclist). This scenario is possible.

Assume that John was the fastest cyclist. The race organizer said the fastest cyclist was correct, but John said he wasn't the fastest cyclist. Therefore, John cannot be the fastest cyclist.

The second scenario is the only possible answer.

Careers & Coaches

Logic puzzles can be completed in different ways. Information that can be gathered from each clue is shown below.

1. Christian is not the physician or the running coach. The physician is not the running coach because they are two different people.

2. Flora is not the engineer.

3. The physician is not the cycling coach. Therefore, the physician is the swimming coach, and the teacher and engineer do not coach swimming.

4. Paula is not the physician. Therefore, Flora is the physician and the swimming coach. Once the other Xs are filled in, Christian is left as the cycling coach, and Paula is left as the running coach.

5. Paula is not the teacher. Christian is the teacher, and Paula is the engineer.

		Career			Volunteer Coach		
		Physician	Teacher	Engineer	Swimming	Cycling	Running
Friends	Paula	X	X	✓	X	X	✓
	Flora	✓	X	X	✓	X	X
	Christian	X	✓	X	X	✓	X
Volunteer Coach	Swimming	✓	X	X			
	Cycling	X	✓	X			
	Running	X	X	✓			

a. Paula is the engineer and coaches running.

b. Flora is the physician and coaches swimming.

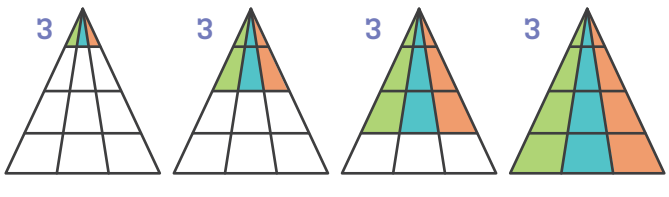
c. Christian is the teacher and coaches cycling.

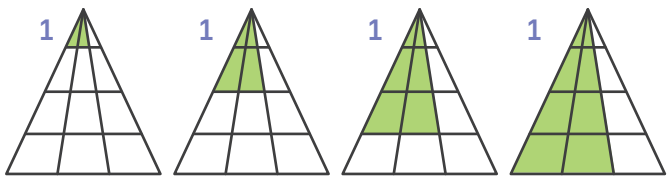
Triathlons, Triangles, & Timers

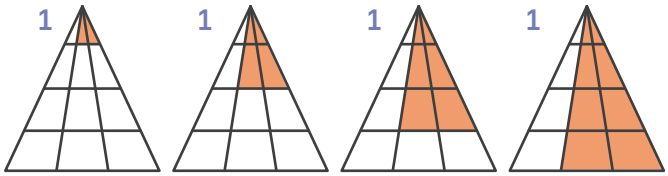
Turn both timers over to start them. When the 7-minute timer is empty, turn it over to restart it. There are 4 minutes remaining on the 11-minute timer. When the 11-minute timer is empty, turn over the 7-minute timer to use the 4 minutes of sand that has fallen into the bottom of it. When the 7-minute timer is empty, 15 minutes have passed.

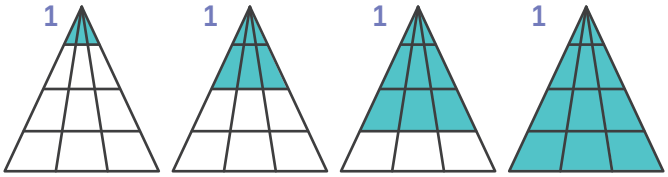
24 triangles

Sketches of the triangles that can be formed are shown below. Each triangle is in a different color or in a different sketch. The total number of triangles that can be sketched is 24.









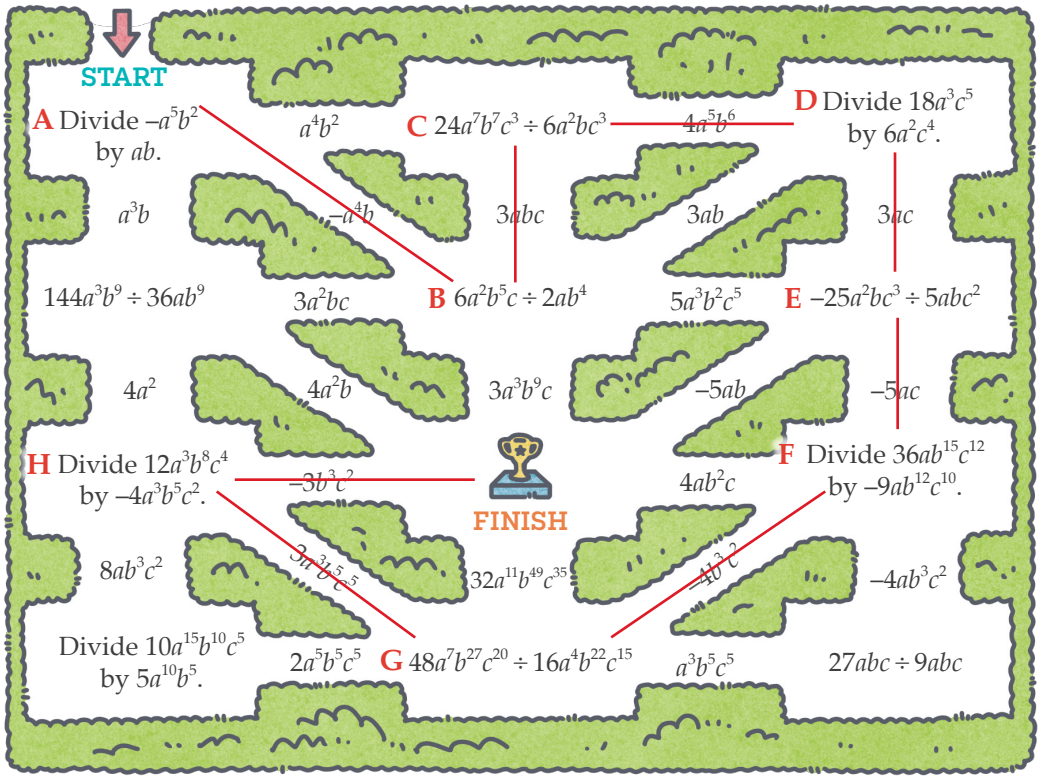
Dividing Polynomials

WARM-UP

$$(7x-2)(3x+5)$$
$$=7x\bullet 3x+7x\bullet 5+(-2)\bullet 3x+(-2)\bullet 5$$
$$=21x^2+35x-6x-10$$
$$=21x^2+29x-10$$

PRACTICE

1.



Detailed work for each problem is shown below.

A $-a^5b^2 \div ab$

$$=\frac{-a^5b^2}{ab}$$
$$=-a^{5-1}b^{2-1}$$
$$=-a^4b$$

B $6a^2b^5c \div 2ab^4$

$$=\frac{6a^2b^5c}{2ab^4}$$
$$=3a^{2-1}b^{5-4}c$$
$$=3abc$$

C $24a^7b^7c^3 \div 6a^2bc^3$

$$= \frac{24a^7b^7c^3}{6a^2bc^3}$$
$$= 4a^{7-2}b^{7-1}c^{3-3}$$
$$= 4a^5b^6$$

D $18a^3c^5 \div 6a^2c^4$

$$= \frac{18a^3c^5}{6a^2c^4}$$
$$= 3a^{3-2}c^{5-4}$$
$$= 3ac$$

E $-25a^2bc^3 \div 5abc^2$

$$= \frac{-25a^2bc^3}{5abc^2}$$
$$= -5a^{2-1}b^{1-1}c^{3-2}$$
$$= -5ac$$

F $36ab^{15}c^{12} \div \left(-9ab^{12}c^{10}\right)$

$$= \frac{36ab^{15}c^{12}}{-9ab^{12}c^{10}}$$
$$= -4a^{1-1}b^{15-12}c^{12-10}$$
$$= -4b^3c^2$$

G $48a^7b^{27}c^{20} \div 16a^4b^{22}c^{15}$

$$= \frac{48a^7b^{27}c^{20}}{16a^4b^{22}c^{15}}$$
$$= 3a^{7-4}b^{27-22}c^{20-15}$$
$$= 3a^3b^5c^5$$

H $12a^3b^8c^4 \div \left(-4a^3b^5c^2\right)$

$$= \frac{12a^3b^8c^4}{-4a^3b^5c^2}$$
$$= -3a^{3-3}b^{8-5}c^{4-2}$$
$$= -3b^3c^2$$

2. a. $\left(6x^2y^5z - 9xyz\right) \div \left(-3xz\right)$

$$= \frac{6x^2y^5z - 9xyz}{-3xz}$$
$$= \frac{6x^2y^5z}{-3xz} - \frac{9xyz}{-3xz}$$
$$= -2x^{2-1}y^5z^{1-1} - \left(-3x^{1-1}yz^{1-1}\right)$$
$$= -2xy^5 + 3y$$

b. $\left(18f^5g^4h^2 + 15f^6g^3h\right) \div 3f^2g^2h$

$$= \frac{18f^5g^4h^2 + 15f^6g^3h}{3f^2g^2h}$$
$$= \frac{18f^5g^4h^2}{3f^2g^2h} + \frac{15f^6g^3h}{3f^2g^2h}$$
$$= 6f^{5-2}g^{4-2}h^{2-1} + 5f^{6-2}g^{3-2}h^{1-1}$$
$$= 6f^3g^2h + 5f^4g$$

c. $\left(16p^8q^2r^5 + 24p^2qr\right) \div 8p^2qr$

$$= \frac{16p^8q^2r^5 + 24p^2qr}{8p^2qr}$$
$$= \frac{16p^8q^2r^5}{8p^2qr} + \frac{24p^2qr}{8p^2qr}$$
$$= 2p^{8-2}q^{2-1}r^{5-1} + 3p^{2-2}q^{1-1}r^{1-1}$$
$$= 2p^6qr^4 + 3$$

d. $\left(-36d^4e^7 + 30d^8e^5\right) \div 6d^2e^2$

$$= \frac{-36d^4e^7 + 30d^8e^5}{6d^2e^2}$$
$$= \frac{-36d^4e^7}{6d^2e^2} + \frac{30d^8e^5}{6d^2e^2}$$
$$= -6d^{4-2}e^{7-2} + 5d^{8-2}e^{5-2}$$
$$= -6d^2e^5 + 5d^6e^3$$

REVIEW

1. $(-b+6)(7b-8)$

$= -b \cdot 7b + (-b) \cdot (-8) + 6 \cdot 7b + 6 \cdot (-8)$

$= -7b^2 + 8b + 42b - 48$

$= -7b^2 + 50b - 48$

2. 25 seconds + 5 seconds + 30 seconds = 60 seconds

$P(\text{green}) = \frac{25}{60} = 0.4166... \approx 41.7\%$

3. a. $C = 2\pi r$

$11 = 2\pi r$

$\frac{11}{2\pi} = \frac{2\pi r}{2\pi}$

$1.75 \approx r$

1.75 in

b. $V = \pi r^2 h$

$V = \pi(1.75)^2(8.5)$

$V = 26.03125\pi$

$V \approx 81.78$

81.78 in^3

c. $C = 2\pi r$

$8.5 = 2\pi r$

$\frac{8.5}{2\pi} = \frac{2\pi r}{2\pi}$

$1.35 \approx r$

1.35 in

d. $V = \pi r^2 h$

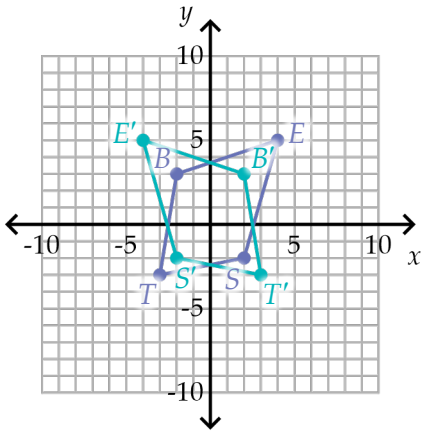
$V = \pi(1.35)^2(11)$

$V = 20.0475\pi$

$V \approx 62.98$

62.98 in^3

4. a. The aqua quadrilateral is the reflected image.



b.

BEST	$(-2,3)$	$(4,5)$	$(2,-2)$	$(-3,-3)$
B'E'S'T'	$(2,3)$	$(-4,5)$	$(-2,-2)$	$(3,-3)$

Factoring

WARM-UP

$$\left(12x^8+15x^3\right)\div 3x^2$$
$$=\frac{12x^8+15x^3}{3x^2}$$
$$=\frac{12x^8}{3x^2}+\frac{15x^3}{3x^2}$$
$$=4x^{8-2}+5x^{3-2}$$
$$=4x^6+5x$$

PRACTICE

1. a. $36a^2bc^5=2\cdot 2\cdot 3\cdot 3\cdot a\cdot a\cdot b\cdot c\cdot c\cdot c\cdot c\cdot c$

   $15a^5b^4c^2=3\cdot 5\cdot a\cdot a\cdot a\cdot a\cdot a\cdot b\cdot b\cdot b\cdot b\cdot c\cdot c$

   b. $2\cdot 2\cdot 3\cdot 3\cdot 5\cdot a\cdot a\cdot a\cdot a\cdot a\cdot b\cdot b\cdot b\cdot b\cdot c\cdot c\cdot c\cdot c\cdot c=180a^5b^4c^5$

   c. $36a^2bc^5=2\cdot 2\cdot (3)\cdot 3\cdot (a)\cdot (a)\cdot (b)\cdot (c)\cdot (c)\cdot c\cdot c\cdot c$

   $15a^5b^4c^2=(3)\cdot 5\cdot (a)\cdot (a)\cdot a\cdot a\cdot a\cdot (b)\cdot b\cdot b\cdot b\cdot (c)\cdot (c)$

   d. $3\cdot a\cdot a\cdot b\cdot c\cdot c=3a^2bc^2$

2. a. $12t^3uv^5=2\cdot 2\cdot 3\cdot t\cdot t\cdot t\cdot u\cdot v\cdot v\cdot v\cdot v\cdot v$

   $5tu^4v^3=5\cdot t\cdot u\cdot u\cdot u\cdot u\cdot v\cdot v\cdot v$

   b. $2\cdot 2\cdot 3\cdot 5\cdot t\cdot t\cdot t\cdot u\cdot u\cdot u\cdot u\cdot v\cdot v\cdot v\cdot v\cdot v=60t^3u^4v^5$

   c. $12t^3uv^5=2\cdot 2\cdot 3\cdot (t)\cdot t\cdot t\cdot (u)\cdot (v)\cdot (v)\cdot (v)\cdot v\cdot v$

   $5tu^4v^3=5\cdot (t)\cdot (u)\cdot u\cdot u\cdot u\cdot (v)\cdot (v)\cdot (v)$

   d. $t\cdot u\cdot v\cdot v\cdot v=tuv^3$

3.

Monomials	LCM	GCF
$16h^3i^4j$ $22h^5j^5$	$16 = 2 \cdot 2 \cdot 2 \cdot 2$ $22 = 2 \cdot 11$ LCM of coefficients: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 11 = 176$ Highest powers: h^5, i^4, j^5 $176h^5i^4j^5$	$16 = 2 \cdot 2 \cdot 2 \cdot 2$ $22 = 2 \cdot 11$ GCF of coefficients: 2 Lowest powers: h^3, j $2h^3j$
$8m^5n^3$ $50m^7n^2$	$8 = 2 \cdot 2 \cdot 2$ $50 = 2 \cdot 5 \cdot 5$ LCM of coefficients: $2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 = 200$ Highest powers: m^7, n^3 $200m^7n^3$	$8 = 2 \cdot 2 \cdot 2$ $50 = 2 \cdot 5 \cdot 5$ GCF of coefficients: 2 Lowest powers: m^5, n^2 $2m^5n^2$
$14p^4qr^7$ $52p^3q^{15}r^8$	$14 = 2 \cdot 7$ $52 = 2 \cdot 2 \cdot 13$ LCM of coefficients: $2 \cdot 2 \cdot 7 \cdot 13 = 364$ Highest powers: p^4, q^{15}, r^8 $364p^4q^{15}r^8$	$14 = 2 \cdot 7$ $52 = 2 \cdot 2 \cdot 13$ GCF of coefficients: 2 Lowest powers: p^3, q, r^7 $2p^3qr^7$

4. a. GCF: $3a^3b^2$

$3a^3b^5 \div 3a^3b^2 = b^3$

$6a^5b^2 \div 3a^3b^2 = 2a^2$

$3a^3b^2\left(b^3 + 2a^2\right)$

b. GCF: $4cd^3$

$12cd^5 \div 4cd^3 = 3d^2$

$-20c^2d^3 \div 4cd^3 = -5c$

$4cd^3\left(3d^2 - 5c\right)$

c. GCF: $9e^4f^2g^2$

$45e^4f^5g^2 \div 9e^4f^2g^2 = 5f^3$

$63e^4f^2g^2 \div 9e^4f^2g^2 = 7$

$9e^4f^2g^2\left(5f^3 + 7\right)$

d. GCF: $13hi^2j^3$

$91h^2i^3j^4 \div 13hi^2j^3 = 7hij$

$-13hi^2j^3 \div 13hi^2j^3 = -1$

$13hi^2j^3\left(7hij - 1\right)$

REVIEW

1. $-10v^2 - 5w^2 + 16 + (-7) - 6vw + 11w^2$

$= -10v^2 - 5w^2 + 11w^2 + 16 - 7 - 6vw$

$= -10v^2 + 6w^2 + 9 - 6vw$

2. $(-42x^9 - 56x^4) \div (-14x^4)$

$= \dfrac{-42x^9 - 56x^4}{-14x^4}$

$= \dfrac{-42x^9}{-14x^4} - \dfrac{56x^4}{-14x^4}$

$= 3x^{9-4} - (-4x^{4-4})$

$= 3x^5 - (-4)$

$= 3x^5 + 4$

3. $-6(3t + 4) = 4t - 2(11t + 12)$

$-18t - 24 = 4t - 22t - 24$

$-18t - 24 = -18t - 24$

$-18t - 24 + 18t = -18t - 24 + 18t$

$-24 = -24$

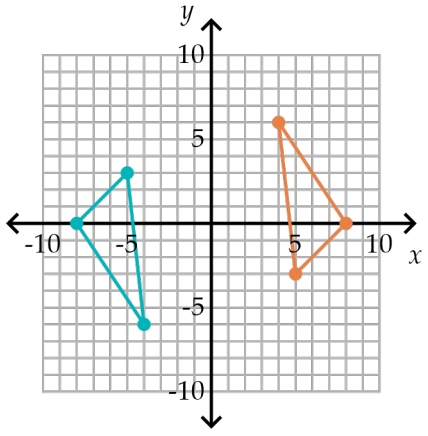
all real numbers

one / (infinite) / zero

4. In a leap year, February has 29 days.
3 weeks = 21 days. 18 days before March 18th is February 29th, so 21 days before March 18th is February 26th.

5. Rule: $(x, y) \rightarrow (-x, -y)$

Rotation 180° Counterclockwise			
Preimage	$(4,6)$	$(8,0)$	$(5,-3)$
Image	$(-4,-6)$	$(-8,0)$	$(-5,3)$



Visual Representations of Data: Part 1

WARM-UP

GCF: $12a$

$24a \div 12a = 2$

$12ab^2 \div 12a = b^2$

$12a(2 + b^2)$

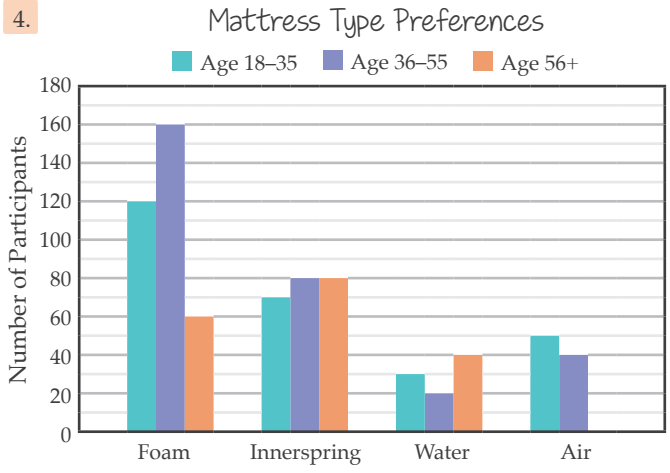
PRACTICE

1. a. Men: $160 + 130 + 80 + 10 = 380$
   Women: $200 + 240 + 150 + 30 = 620$
   $620 - 380 = 240$
   b. ecological impact

2. a. $12\% + 8\% + 15\% = 35\%$
   b. $8\% + 27\% = 35\% = 0.35$
   $0.35 \bullet 1000 = 350$

3. a. 2000, 2005, 2010
   b. 2005, 2010, 2015, 2020, 2025
   c. 2000–2005
   d. $41\% - 33\% = 8\%$

4.



5. Total number of participants: $200 + 100 + 300 + 50 + 350 = 1000$

Degrees in sectors:

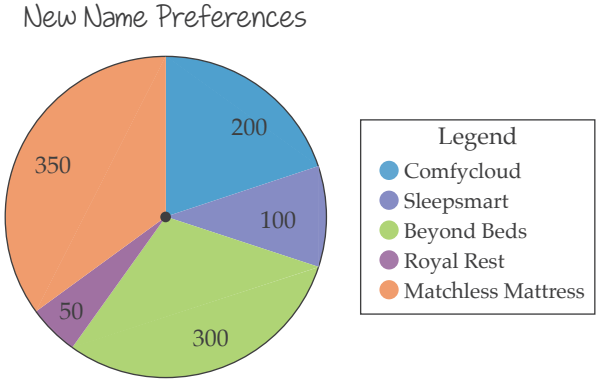
Comfycloud: $\frac{200}{1000} \bullet 360° = 72°$

Sleepsmart: $\frac{100}{1000} \bullet 360° = 36°$

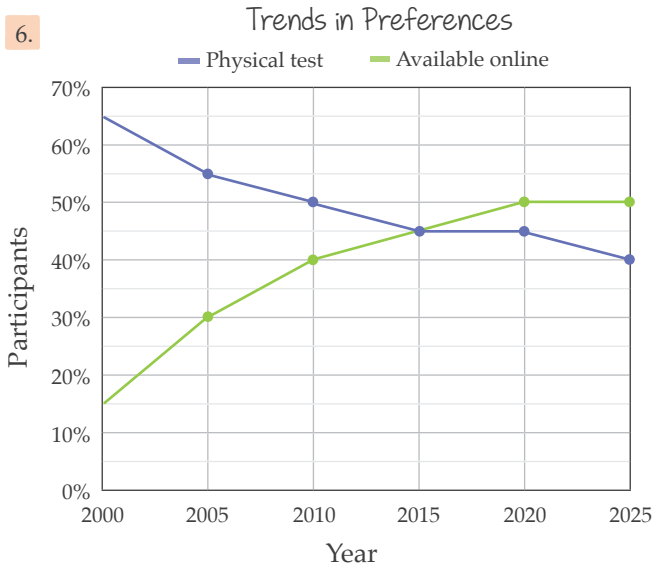
Beyond Beds: $\frac{300}{1000} \bullet 360° = 108°$

Royal Rest: $\frac{50}{1000} \bullet 360° = 18°$

Matchless Mattress: $\frac{350}{1000} \bullet 360° = 126°$



6.



REVIEW

1. GCF: $3r^2m^4$

$21r^2m^4 \div 3r^2m^4 = 7$

$-39r^5m^7 \div 3r^2m^4 = -13r^3m^3$

$18r^3m^9 \div 3r^2m^4 = 6rm^5$

$3r^2m^4\left(7 - 13r^3m^3 + 6rm^5\right)$

2.

ART	$(-10,10)$	$(5,-2)$	$(-15,-25)$
$A'R'T'$	$\left(\frac{2}{5}\bullet(-10),\frac{2}{5}\bullet 10\right)$ $(-4,4)$	$\left(\frac{2}{5}\bullet 5,\frac{2}{5}\bullet(-2)\right)$ $\left(2,-\frac{4}{5}\right)$	$\left(\frac{2}{5}\bullet(-15),\frac{2}{5}\bullet(-25)\right)$ $(-6,-10)$

3. Substitution:

$$\begin{aligned} -5x - 6y &= 43 \\ -5x - 6(-3x + 8) &= 43 \\ -5x + 18x - 48 &= 43 \\ 13x - 48 &= 43 \\ 13x - 48 + 48 &= 43 + 48 \\ 13x &= 91 \\ \frac{13x}{13} &= \frac{91}{13} \\ x &= 7 \end{aligned}$$

$y = -3x + 8$

$y = -3(7) + 8$

$y = -13$

Solution: $(7, -13)$

4. $(k-8)(-2k+9)$

$= k \bullet (-2k) + k \bullet 9 + (-8) \bullet (-2k) + (-8) \bullet 9$

$= -2k^2 + 9k + 16k - 72$

$= -2k^2 + 25k - 72$

5. a. $A = \pi r^2$

$A = \pi(3)^2$

$A = 9\pi$

$9\pi \text{ in}^2$

b. $360° - 108° = 252°$

$\frac{252°}{360°} = \frac{7}{10}$

$\frac{7}{10} \bullet 9\pi = \frac{63}{10}\pi \approx 19.8$

19.8 in^2

Visual Representations of Data: Part 2

WARM-UP

$10\% + 7\% + 24\% + 15\% + 8\% + 12\% + 21\% = 97\%$

$100\% - 97\% = 3\%$

PRACTICE

1. a. 1 to 2

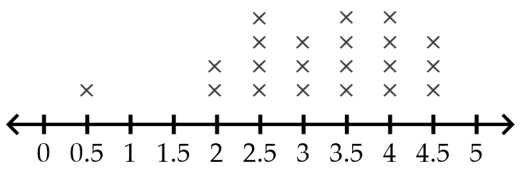
   b. 3

   c. 1.5 and 2

   d. With outlier: $3 - 1 = 2$
   Without outlier: $2 - 1 = 1$

2. Numerical order: 0.5, 2, 2, 2.5, 2.5, 2.5, 2.5, 3, 3, 3, 3.5, 3.5, 3.5, 3.5, 4, 4, 4, 4, 4.5, 4.5, 4.5

Ages of Children



3. a. 19 to 31

   b. 44

   c. With outlier: $44 - 19 = 25$
   Without outlier: $31 - 19 = 12$

4. Numerical order: 100, 110, 110, 115, 120, 125, 125, 140, 150, 200, 220, 225, 250, 250

Program Cost (dollars)

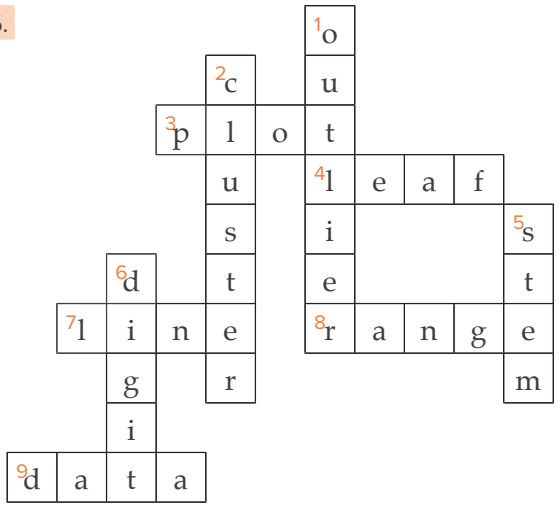
10	0
11	0 0 5
12	0 5 5
13	
14	0
15	0
16	
17	
18	
19	
20	0
21	
22	0 5
23	
24	
25	0 0

5. Numerical order: 3.0, 3.5, 3.8, 3.9, 4.1, 4.4, 4.5, 4.5, 4.6, 5.0, 5.2, 5.5, 6.0, 6.0

Childcare Cost (dollars/hour)

3	0 5 8 9
4	1 4 5 5 6
5	0 2 5
6	0 0

6.



REVIEW

1. Total number of youth: $12+24+16+20+8=80$

Degrees in sectors:

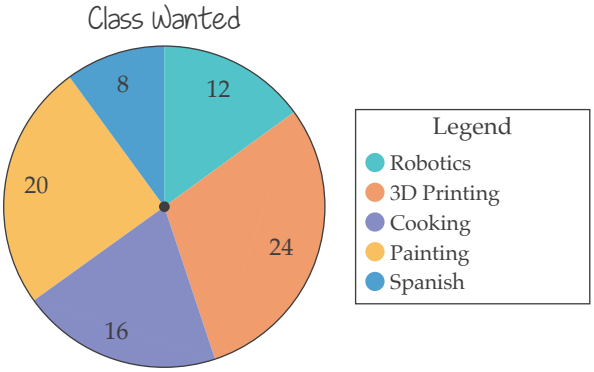
Robotics: $\frac{12}{80}\bullet 360°=54°$

3D Printing: $\frac{24}{80}\bullet 360°=108°$

Cooking: $\frac{16}{80}\bullet 360°=72°$

Painting: $\frac{20}{80}\bullet 360°=90°$

Spanish: $\frac{8}{80}\bullet 360°=36°$



2. GCF: $32pi^7$

$32p^3i^7 \div 32pi^7 = p^2$

$-96pi^{12}e^4 \div 32pi^7 = -3i^5e^4$

$32pi^7\left(p^2-3i^5e^4\right)$

3. a. dilation with scale factor of $\frac{3}{4}$

b. rotation 180°

4. Multiply the top equation by –3:

$-3\bullet(-3x-7y)=-28\bullet(-3)$

$9x+21y=84$

Elimination:

$9x+21y=84$

$-9x-21y=-28$

$0x+0y=56$

$0\neq 56$

no solution

5. $A=P(1+r)^t$

$A=3600(1+0.0125)^{22}$

$A\approx 4731.44$

$4731.44

Measures of Central Tendency

WARM-UP

a. $16 \bullet 2 = 32$
$16 \bullet 0.2 = 3.2$

b. $30 \bullet 5 = 150$
$30 \bullet 0.5 = 15$

c. $40 \bullet 3 = 120$
$40 \bullet 0.3 = 12$

PRACTICE

1. Numerical order: 41, 78, 80, 85, 87, 89, 92, 95, 96, 98

a. 41

b. none

c.

	With Outlier	Without Outlier
Mean	A 84.1	B 88.9
Median	C 88	D 89
Range	E 57	F 20

Detailed work is shown below.

A

$41 + 78 + 80 + 85 + 87 + 89 + 92 + 95 + 96 + 98 = 841$

$841 \div 10 = 84.1$

B

$78 + 80 + 85 + 87 + 89 + 92 + 95 + 96 + 98 = 800$

$800 \div 9 \approx 88.9$

C

~~41~~, ~~78~~, ~~80~~, ~~85~~, (87, 89), ~~92~~, ~~95~~, ~~96~~, ~~98~~

$87 + 89 = 178$

$178 \div 2 = 88$

D

~~78~~, ~~80~~, ~~85~~, ~~87~~, (89), ~~92~~, ~~95~~, ~~96~~, ~~98~~

E

$98 - 41 = 57$

F

$98 - 78 = 20$

2. Numerical order: 6, 7, 8, 8, 8, 8, 8.5, 9, 9.5, 10

a. none

b. 8

c.

	With Outlier	Without Outlier
Mean	A 8.2	no outlier
Median	B 8	no outlier
Range	C 4	no outlier

Detailed work is shown below.

A

$6 + 7 + 8 + 8 + 8 + 8 + 8.5 + 9 + 9.5 + 10 = 82$

$82 \div 10 = 8.2$

B

~~6~~, ~~7~~, ~~8~~, ~~8~~, (8, 8), ~~8~~, ~~5~~, ~~9~~, ~~5~~, ~~10~~

$8 + 8 = 16$

$16 \div 2 = 8$

C

$10 - 6 = 4$

3. $(85+93+88+95+98+x)\div 6=90$

$(85+93+88+95+98+x)\div 6\bullet 6=90\bullet 6$

$85+93+88+95+98+x=540$

$459+x=540$

$459+x-459=540-459$

$x=81$

4. $(9+8+8+9+7.5+8+9.5+9+8.5+8.5+9.5+x)\div 12=8.5$

$(9+8+8+9+7.5+8+9.5+9+8.5+8.5+9.5+x)\div 12\bullet 12=8.5\bullet 12$

$9+8+8+9+7.5+8+9.5+9+8.5+8.5+9.5+x=102$

$94.5+x=102$

$94.5+x-94.5=102-94.5$

$x=7.5$

REVIEW

1. $\left(-154s^8t^{15}u^{12}-70s^9t^3u^{11}\right)\div\left(14s^6t^3u^{10}\right)$

$=\dfrac{-154s^8t^{15}u^{12}-70s^9t^3u^{11}}{14s^6t^3u^{10}}$

$=\dfrac{-154s^8t^{15}u^{12}}{14s^6t^3u^{10}}-\dfrac{70s^9t^3u^{11}}{14s^6t^3u^{10}}$

$=-11s^{8-6}t^{15-3}u^{12-10}-5s^{9-6}t^{3-3}u^{11-10}$

$=-11s^2t^{12}u^2-5s^3u$

2. Slope: -2

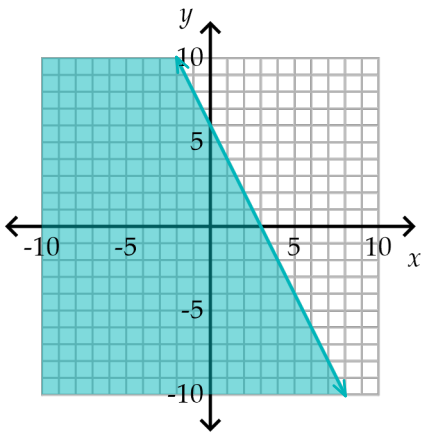
y-intercept: $(0,6)$

Test: $(0,0)$

$y\le -2x+6$

$0\stackrel{?}{\le}-2(0)+6$

$0\stackrel{?}{\le}6$ ✓



3. 8:45 PM

4. a. F

b. T

5. a. $m = \dfrac{6-4.5}{8-5}$

$= \dfrac{1.5}{3}$

$= 0.5$

$y = 0.5x + b$

$6 = 0.5(8) + b$

$6 = 4 + b$

$6 - 4 = 4 + b - 4$

$2 = b$

Equation: $y = 0.5x + 2$

b. y-intercept: $(0, 2)$

The parking garage charges an initial entrance fee of $2.

c. Slope: 0.5

The parking garage charges $0.50 per hour.

d. $7.5 = 0.5x + 2$

$7.5 - 2 = 0.5x + 2 - 2$

$5.5 = 0.5x$

$\dfrac{5.5}{0.5} = \dfrac{0.5x}{0.5}$

$11 = x$

11 hours

Box Plots

WARM-UP

Numerical order: 11, 11, 12, 15, 16, 17, 18, 18, 18, 18, 21, 22, 23, 25

a. $11 + 11 + 12 + 15 + 16 + 17 + 18 + 18 + 18 + 18 + 21 + 22 + 23 + 25 = 245$

$245 \div 14 = 17.5$

b. 11, 11, 12, 15, 16, 17, (18, 18,) 18, 18, 21, 22, 23, 25

18

c. 18

PRACTICE

1. a. 20 minutes

b. 2–5 minutes

c. 9–20 minutes

d. IQR: $9 - 3 = 6$

6 minutes

Meaning: The middle 50% of calls have an officer arrive on site within a range of 6 minutes.

2.

T/F	Statement
A F	The range of Fred's call lengths is larger than the range of Suzanne's.
B T	Suzanne has a smaller interquartile range than Fred.
C F	Fred's median call length is less than Suzanne's.
D T	Suzanne's third quartile is less than Fred's third quartile.
E T	There is more variability in Suzanne's longest 50% of calls than in Fred's longest 50% of calls.
F F	There is more variability in Suzanne's second 25% of calls than in Fred's second 25% of calls.
G F	50% of Fred's calls are between 3 minutes and 6 minutes.
H T	50% of Suzanne's calls are between 2 minutes and 6 minutes.
I T	Both dispatchers have a maximum call length that is more than twice their median call length.

Detailed work for each statement is shown below.

A

Fred's range: 14 – 2 = 12

Suzanne's range: 16 – 2 = 14

B

Suzanne's IQR: 9 – 4 = 5

Fred's IQR: 10 – 3 = 7

C

Fred's median: 6

Suzanne's median: 6

D

Suzanne's Q3: 9

Fred's Q3: 10

E

Suzanne's longest 50% of calls: 6 minutes to 16 minutes (10-minute range)

Fred's longest 50% of calls: 6 minutes to 14 minutes (8-minute range)

F

Q1 to Q2 for Suzanne: 4 minutes to 6 minutes (2-minute range)

Q1 to Q2 for Fred: 3 minutes to 6 minutes (3-minute range)

G

Fred's Q1 is at 3 minutes, and his Q2 is at 6 minutes. 25% of the data lies between Q1 and Q2, not 50%.

H

Suzanne's minimum is at 2 minutes, and her median is at 6 minutes. 50% of the data lies between the minimum and median.

I

Fred's median: 6 minutes

Fred's max: 14 minutes (greater than 6 • 2)

Suzanne's median: 6 minutes

Suzanne's max: 16 minutes (greater than 6 • 2)

3. Numerical order: 5, 12, 15, 18, 20, 21, 21, 21, 22, 23, 24, 25, 28, 35

Minimum: 5

Maximum: 35

Median: 5, 12, 15, 18, 20, 21, (21, 21), 22, 23, 24, 25, 28, 35

Q2: 21

Lower half of data:

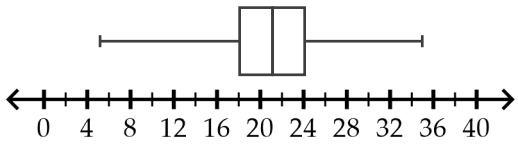
5, 12, 15, (18), 20, 21, 21

Q1: 18

Upper half of data:

21, 22, 23, (24), 25, 28, 35

Q3: 24



IQR: 24 – 18 = 6

4. Numerical order: 8, 8.2, 8.4, 8.5, 8.6, 8.6, 8.7, 8.7, 8.9, 9, 9.1, 9.1, 9.2, 9.4, 9.7, 10.3

Minimum: 8

Maximum: 10.3

Median: 8, 8.2, 8.4, 8.5, 8.6, 8.6, 8.7, (8.7, 8.9), 9, 9.1, 9.1, 9.2, 9.4, 9.7, 10.3

8.7 + 8.9 = 17.6

17.6 ÷ 2 = 8.8

Q2: 8.8

Lower half of data:

8, 8.2, 8.4, (8.5, 8.6), 8.6, 8.7, 8.7

8.5 + 8.6 = 17.1

17.1 ÷ 2 = 8.55

Q1: 8.55

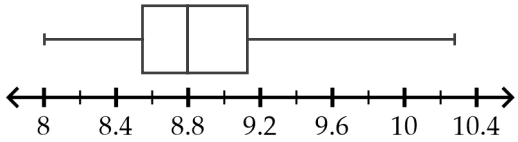
Upper half of data:

8, 8, 9, 9.1, 9.2, 9, 9, 10, 10

$9.1 + 9.2 = 18.3$

$18.3 \div 2 = 9.15$

Q3: 9.15

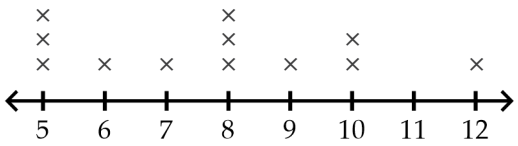


IQR: $9.15 - 8.55 = 0.6$

REVIEW

1. a. Numerical order: 5, 5, 5, 6, 7, 8, 8, 8, 9, 10, 10, 12

Hours Spent Practicing Martial Arts



b. Mean: $5 + 5 + 5 + 6 + 7 + 8 + 8 + 8 + 9 + 10 + 10 + 12 = 93$

$93 \div 12 = 7.75$

Median : 5, 5, 5, 6, 7, 8, 8, 8, 9, 10, 10, 12

$8 + 8 = 16$

$16 \div 2 = 8$

Range: $12 - 5 = 7$

2. $m = -\frac{4}{7}$

$b = 8$

Equation: $y = -\frac{4}{7}x + 8$

3. $6.5 \times 10^{13} = 0.65 \times 10^{14}$

$8.75 + 0.65 = 9.4$

$\left(8.75 \times 10^{14}\right) + \left(6.5 \times 10^{13}\right) = 9.4 \times 10^{14}$

4. $1 \text{ mi} \bullet \text{mi} \bullet \frac{5280 \text{ ft}}{1 \text{ mi}} \bullet \frac{5280 \text{ ft}}{1 \text{ mi}} = \frac{5280 \bullet 5280 \text{ ft} \bullet \text{ft}}{1}$

$= 27{,}878{,}400 \text{ ft}^2$

$27{,}878{,}400 \text{ ft}^2 \bullet \frac{1 \text{ acre}}{43{,}560 \text{ ft}^2} = \frac{27{,}878{,}400 \text{ acres}}{43{,}560}$

$= 640$ acres

5. a. $18 + \sqrt{2} \bullet \sqrt{8}$

$= 18 + \sqrt{2 \bullet 8}$

$= 18 + \sqrt{16}$

$= 18 + 4$

$= 22$

b. $5\sqrt{3}\left(2\sqrt{3} - 4\sqrt{2}\right)$

$= 5\sqrt{3} \bullet 2\sqrt{3} - 5\sqrt{3} \bullet 4\sqrt{2}$

$= 10\sqrt{3 \bullet 3} - 20\sqrt{3 \bullet 2}$

$= 10\sqrt{3^2} - 20\sqrt{6}$

$= 10 \bullet 3 - 20\sqrt{6}$

$= 30 - 20\sqrt{6}$

Scatter Plots

WARM-UP

Q1: 3
Q3: 13

IQR: Q3 – Q1 = 13 – 3 = 10

PRACTICE

1. C
2. H
3. V
4. O
5. D
6. S
7. W
8. a. R
   b. In general, more candy results in more cavities; it is a weak relationship.
9. a. P
   b. Some people may get few cavities even without brushing, while others may get many cavities, despite brushing often.
10. A
11. T
12. I
13. a. E
    b. The more a person flosses, the better his or her oral hygiene is.
14. L

Riddle answer:

It will spread it all over the place!

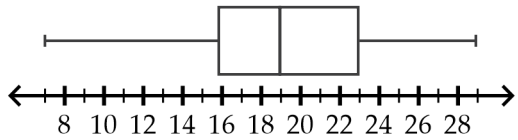
REVIEW

1. Numerical order: 7, 16, 19, 19, 20, 23, 29

Minimum: 7
Maximum: 29
Median: ~~7~~, ~~16~~, ~~19~~, (19), ~~20~~, ~~23~~, ~~29~~
Q2: 19

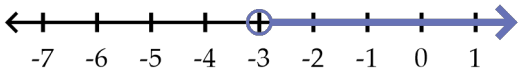
Lower half of data: ~~7~~, (16), ~~19~~
Q1: 16

Upper half of data: ~~20~~, (23), ~~29~~
Q3: 23



IQR: $23 - 16 = 7$

2. $$\frac{3}{4}(8x-24) < \frac{15x-27}{2}$$
$$6x-18 < \frac{15x-27}{2}$$
$$2 \cdot (6x-18) < \frac{15x-27}{2} \cdot 2$$
$$12x-36 < 15x-27$$
$$12x-36-12x < 15x-27-12x$$
$$-36 < 3x-27$$
$$-36+27 < 3x-27+27$$
$$-9 < 3x$$
$$\frac{-9}{3} < \frac{3x}{3}$$
$$-3 < x$$
$$x > -3$$



3. $$(22+15+18+20+23+x) \div 6 = 20$$
$$(22+15+18+20+23+x) \div 6 \cdot 6 = 20 \cdot 6$$
$$22+15+18+20+23+x = 120$$
$$98+x = 120$$
$$98+x-98 = 120-98$$
$$x = 22$$

22 minutes

4. Area of a semicircle:

$$A_{semi} = \frac{1}{2}\pi r^2$$
$$A_{semi} = \frac{1}{2}\pi(3)^2$$
$$A_{semi} = \frac{1}{2}\pi(9)$$
$$A_{semi} = 4.5\pi$$
$$A_{semi} \approx 14.14$$

14.14 in^2

Area of the trapezoid:

height: 4 in
base_1: 6 in
base_2: 1 in

$$A_{trap} = \frac{1}{2}h(b_1+b_2)$$
$$A_{trap} = \frac{1}{2}(4)(6+1)$$
$$A_{trap} = \frac{1}{2}(4)(7)$$
$$A_{trap} = 14$$

14 in^2

Total area: $14.14 \text{ in}^2 + 14 \text{ in}^2 = 28.14 \text{ in}^2$

Line of Best Fit

WARM-UP

strong, negative, nonlinear

PRACTICE

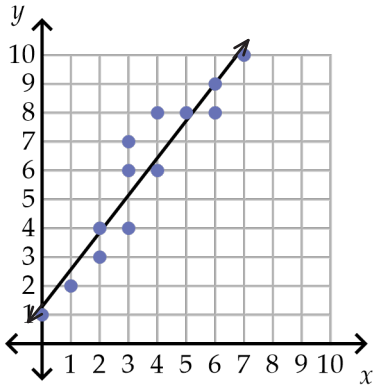
1. Answers may vary.

   a. The line does not follow the general trend in data. It is too steep.

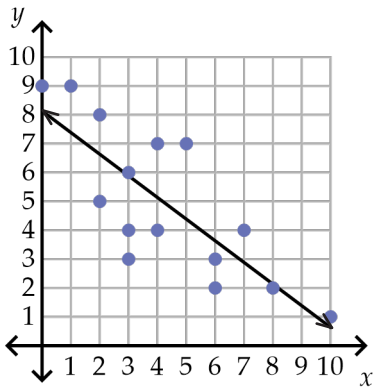
   b. There are too many points below the line. It is not balanced.

2. Answers may vary. Lines may not match exactly, but they should follow the general trend in data (roughly the same slope) and be balanced (roughly the same number of points on either side).

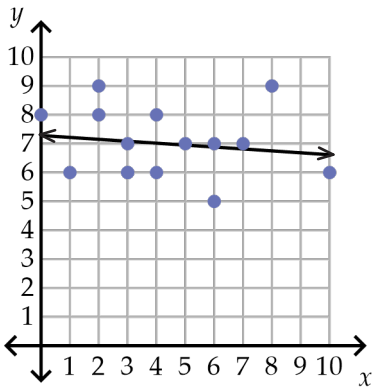
   a.



   b.



   c.



3. Answers may vary depending on the points chosen.

   a. $(6,6)$ and $(10,9)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{9-6}{10-6}$$

$$m = \frac{3}{4}$$

$$y = mx + b$$

$$6 = \frac{3}{4}(6) + b$$

$$6 = \frac{9}{2} + b$$

$$6 - \frac{9}{2} = \frac{9}{2} + b - \frac{9}{2}$$

$$1\frac{1}{2} = b$$

$y = \frac{3}{4}x + 1\frac{1}{2}$

b. $(0,16)$ and $(15,1)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$m = \frac{1-16}{15-0}$$
$$m = -1$$

The y-intercept is $(0,16)$. $b = 16$

$y = -x + 16$

c. $(10,35)$ and $(40,25)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$m = \frac{25-35}{40-10}$$
$$m = -\frac{1}{3}$$

$$y = mx + b$$
$$35 = -\frac{1}{3}(10) + b$$
$$35 = -3\frac{1}{3} + b$$
$$35 + 3\frac{1}{3} = -3\frac{1}{3} + b + 3\frac{1}{3}$$
$$38\frac{1}{3} = b$$

$y = -\frac{1}{3}x + 38\frac{1}{3}$

4. a. 0 hours after waking, Anna has walked $1\frac{1}{2}$ thousand steps. This does not make sense because Anna cannot have taken any steps right when she wakes up.

b. Every hour, Anna takes approximately 500 steps.

c. $y = \frac{1}{2}x + 1\frac{1}{2}$

$$y = \frac{1}{2}(12) + 1\frac{1}{2}$$
$$y = 6 + 1\frac{1}{2}$$
$$y = 7\frac{1}{2}$$

$7\frac{1}{2}$ thousand steps

d. $y = \frac{1}{2}x + 1\frac{1}{2}$

$$y = \frac{1}{2}(25) + 1\frac{1}{2}$$
$$y = 12\frac{1}{2} + 1\frac{1}{2}$$
$$y = 14$$

14 thousand steps

e. No, 25 hours after waking would be the next day, so she would have slept again.

REVIEW

1. a. weak, positive, linear

   b. The more time Jessica spent birdwatching each week, the more species of birds she saw.

2. $(2x-5)(x+8)$

$= 2x \bullet x + 2x \bullet 8 + (-5) \bullet x + (-5) \bullet 8$

$= 2x^2 + 16x - 5x - 40$

$= 2x^2 + 11x - 40$

3. Rule: $(x, y) \rightarrow (x - 3.5, y + 7)$

ODE	$(-4, -4.5)$	$(-2.5, 9)$	$(1.5, 6)$
O'D'E'	$(-4 - 3.5, -4.5 + 7)$ $(-7.5, 2.5)$	$(-2.5 - 3.5, 9 + 7)$ $(-6, 16)$	$(1.5 - 3.5, 6 + 7)$ $(-2, 13)$

4. $10s + 3 = 13 + 5p$

$10s + 3 - 3 = 13 + 5p - 3$

$10s = 10 + 5p$

$\frac{10s}{10} = \frac{10 + 5p}{10}$

$s = \frac{10}{10} + \frac{5p}{10}$

$s = 1 + \frac{1}{2}p$

5. $A_{rect} = bh$

$A_{rect} = \left(\frac{9}{5}\right)\left(\frac{4}{5}\right)$

$A_{rect} = \frac{36}{25}$

$A_{square} = s^2$

$\frac{36}{25} = s^2$

$\sqrt{\frac{36}{25}} = \sqrt{s^2}$

$\frac{6}{5} = s$

$\frac{6}{5}$ m

Frequency Tables and Histograms

WARM-UP

$(0,1)$ and $(4,4)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-1}{4-0} = \frac{3}{4}$

y-intercept: $(0,1)$ $\quad b = 1$

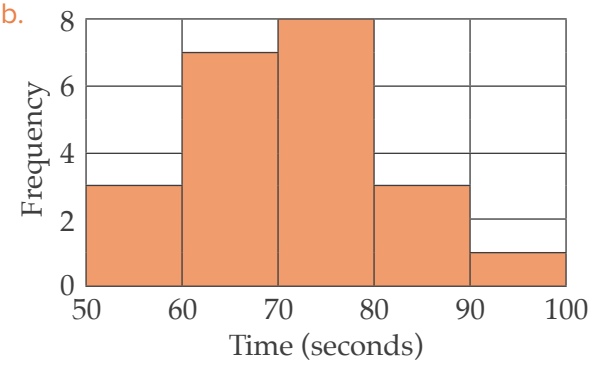
$y = \frac{3}{4}x + 1$

PRACTICE

1. a.

Time (seconds)	Frequency
50–60	III
60–70	𝍸 II
70–80	𝍸 III
80–90	III
90–100	I

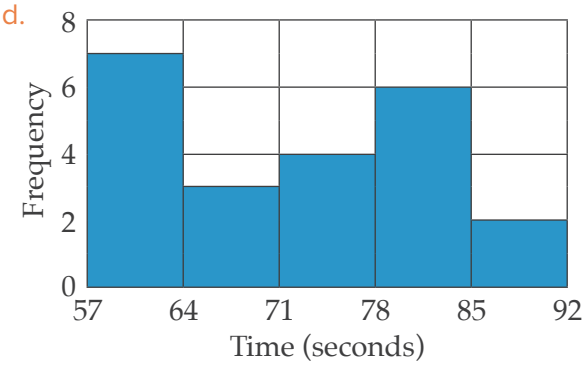
b.



c.

Time (seconds)	Frequency
57–64	𝍸 II
64–71	III
71–78	IIII
78–85	𝍸 I
85–92	II

d.



e. Part D

Explanations may vary. Sample explanation is shown below.

Intervals in Part B are too large to show the data well. For example, the minimum data value is 57, but the range of 50–60 could imply there are lower data values in the 50s.

f.

Time (sec)	Tally	Frequency	Product
57	I	1	57
59	II	2	118
61	II	2	122
63	II	2	126
65	II	2	130
67	I	1	67
73	I	1	73
74	II	2	148
76	I	1	76
78	III	3	234
79	I	1	79
81	II	2	162
85	I	1	85
91	I	1	91
Total		22	1568

Mean: $1568 \div 22 \approx 71.27$

Median: $73 + 74 = 147$

$147 \div 2 = 73.5$

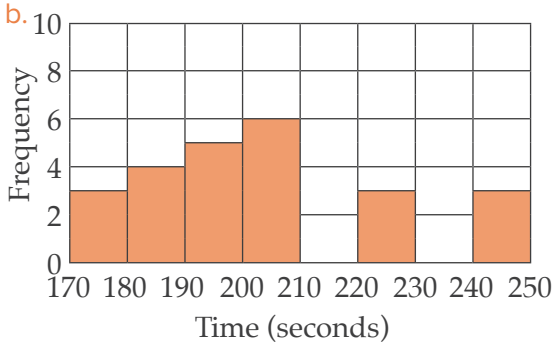
Mode: 78

Range: $91 - 57 = 34$

2. a.

Time (seconds)	Frequency
170–180	III
180–190	IIII
190–200	𝍸
200–210	𝍸 I
210–220	
220–230	III
230–240	
240–250	III

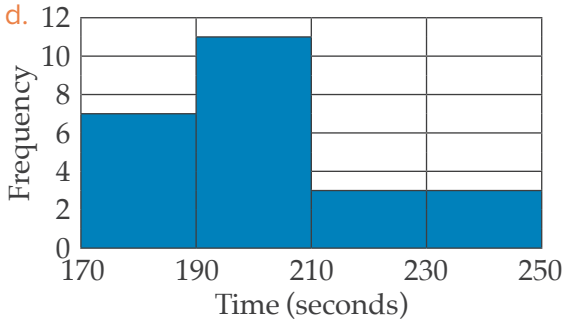
b.



c.

Time (seconds)	Frequency
170–190	𝍸 II
190–210	𝍸 𝍸 I
210–230	III
230–250	III

d.



e. Part B

Explanations may vary. Sample explanation is shown below.

The intervals in Part D are too large, so important details, like gaps in data values, are not shown.

3. a. symmetric

b. right-skewed

c. left-skewed

d. symmetric

REVIEW

1. a. Points on line: $(150,145)$ and $(177,170)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$m = \frac{170 - 145}{177 - 150}$$
$$m = \frac{25}{27}$$

$$y = mx + b$$
$$145 = \frac{25}{27}(150) + b$$
$$145 = 138\frac{8}{9} + b$$
$$145 - 138\frac{8}{9} = 138\frac{8}{9} + b - 138\frac{8}{9}$$
$$6\frac{1}{9} = b$$

$y = \frac{25}{27}x + 6\frac{1}{9}$

b.
$$180 = \frac{25}{27}x + 6\frac{1}{9}$$
$$180 - 6\frac{1}{9} = \frac{25}{27}x + 6\frac{1}{9} - 6\frac{1}{9}$$
$$173\frac{8}{9} = \frac{25}{27}x$$
$$\frac{27}{25} \cdot 173\frac{8}{9} = \frac{25}{27}x \cdot \frac{27}{25}$$
$$187.8 = x$$

187.8 cm

2. Interior angle sum: $6 \cdot 180° = 1080°$

$1080° \div 8 = 135°$

3. a. Tickets: $\$3200 + \$4400 + \$2900 = \$10{,}500$

Concessions: $\$2750 + \$3600 + \$3100 = \$9450$

Donations: $\$1000 + \$650 + \$800 = \$2450$

b. August

c. Answers may vary. Sample answer is given below.

More tickets sold means more people attended the show, so there are more potential customers for concessions.

4.
$$2x^3 - 3456 = 938$$
$$2x^3 - 3456 + 3456 = 938 + 3456$$
$$2x^3 = 4394$$
$$\frac{2x^3}{2} = \frac{4394}{2}$$
$$x^3 = 2197$$
$$\sqrt[3]{x^3} = \sqrt[3]{2197}$$
$$x = 13$$

Two-Way Tables

WARM-UP

a. 27 b. –49 c. $\frac{1}{16}$ d. 1

PRACTICE

1. a.

	Children	Adults	Total
Male	478	825	478 + 825 = 1303
Female	615	936	615 + 936 = 1551
Total	478 + 615 = 1093	825 + 936 = 1761	1303 + 1551 = 2854

b.

i. $1093 < 1761$
false

ii. 936 is larger than 478, 825, and 615.
true

iii. true

iv. false

v. $825 < 1093$
true

c.

	Children	Adults	Total
Male	$\frac{478}{1303} \approx 36.68\%$	$\frac{825}{1303} \approx 63.32\%$	$\frac{1303}{1303} = 100\%$
Female	$\frac{615}{1551} \approx 39.65\%$	$\frac{936}{1551} \approx 60.35\%$	$\frac{1551}{1551} = 100\%$

2. a.

	Children	Adults	Total
Road	1093 – 650 – 312 = 131	789	131 + 789 = 920
Mountain	650	1171 – 650 = 521	1171
Hybrid	312	451	312 + 451 = 763
Total	1093	2854 – 1093 = 1761	2854

b.

i. $650 > 521$
true

ii. false

iii. 763 is the smallest marginal frequency.
true

iv. $521 > 451$
true

c.

	Children	Adults
Road	$\frac{131}{1093} \approx 11.99\%$	$\frac{789}{1761} \approx 44.80\%$
Mountain	$\frac{650}{1093} \approx 59.47\%$	$\frac{521}{1761} \approx 29.59\%$
Hybrid	$\frac{312}{1093} \approx 28.55\%$	$\frac{451}{1761} \approx 25.61\%$
Total	$\frac{1093}{1093} = 100\%$	$\frac{1761}{1761} = 100\%$

3. a.

	Disc	Rim	Total
18-25	225	87	$225+87=312$
26-35	321	275	$321+275=596$
36-45	254	213	$254+213=467$
46+	204	182	$204+182=386$
Total	$225+321+254+204=1004$	$87+275+213+182=757$	$1004+757=1761$

b.

i. $1004 > 757$
true

ii. $225 > 87$
$321 > 275$
$254 > 213$
$204 > 182$
true

iii. false

iv. true

v. $467 < 596$
false

c.

	Disc	Rim	Total
18-25	$\frac{225}{1761} \approx 12.78\%$	$\frac{87}{1761} \approx 4.94\%$	$\frac{312}{1761} \approx 17.72\%$
26-35	$\frac{321}{1761} \approx 18.23\%$	$\frac{275}{1761} \approx 15.62\%$	$\frac{596}{1761} \approx 33.84\%$
36-45	$\frac{254}{1761} \approx 14.42\%$	$\frac{213}{1761} \approx 12.10\%$	$\frac{467}{1761} \approx 26.52\%$
46+	$\frac{204}{1761} \approx 11.58\%$	$\frac{182}{1761} \approx 10.34\%$	$\frac{386}{1761} \approx 21.92\%$
Total	$\frac{1004}{1761} \approx 57.01\%$	$\frac{757}{1761} \approx 42.99\%$	$\frac{1761}{1761} = 100\%$

REVIEW

1. a. $$\frac{0.5 \text{ oz water}}{1 \text{ lb}} = \frac{x \text{ oz water}}{166 \text{ lb}}$$

$$\frac{0.5}{1} = \frac{x}{166}$$

$$0.5 \cdot 166 = 1 \cdot x$$

$$83 = x$$

83 oz

b. Area of Kara's lawn:

$$A = bh$$

$$A = (50)(24)$$

$$A = 1200$$

1200 ft^2

$$\frac{8 \text{ lb seed}}{1000 \text{ ft}^2} = \frac{x \text{ lb seed}}{1200 \text{ ft}^2}$$

$$\frac{8}{1000} = \frac{x}{1200}$$

$$8 \cdot 1200 = 1000 \cdot x$$

$$9600 = 1000x$$

$$\frac{9600}{1000} = \frac{1000x}{1000}$$

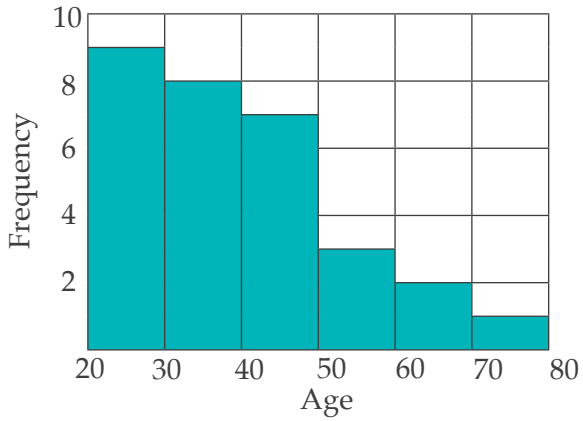
$$9.6 = x$$

9.6 lb

2. a.

Age	Frequency
20–30	𝍸 ||||
30–40	𝍸 |||
40–50	𝍸 ||
50–60	|||
60–70	||
70–80	|

b.



c. symmetric / right-skewed / left-skewed

3. a. $m = \frac{1}{3}$

$$y = mx + b$$

$$-3 = \frac{1}{3}(15) + b$$

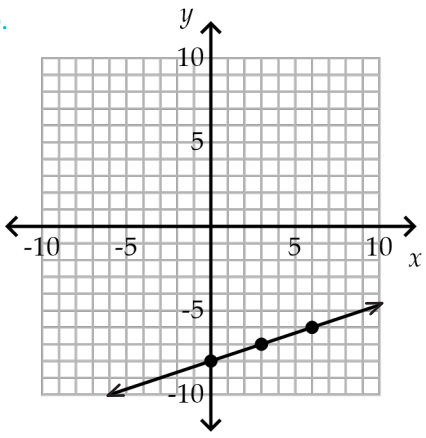
$$-3 = 5 + b$$

$$-3 - 5 = 5 + b - 5$$

$$-8 = b$$

$$y = \frac{1}{3}x - 8$$

b.



Data and Surveys

WARM-UP

	Glasses	No Glasses	Total
Male	57	23	C 80
Female	34	62	D 96
Total	A 91	B 85	E 176

Detailed work is shown below.

A $57 + 34 = 91$

B $23 + 62 = 85$

C $57 + 23 = 80$

D $34 + 62 = 96$

E $80 + 96 = 176$ or $91 + 85 = 176$

PRACTICE

1. Population: athletes in the organization

   Sample: 50 athletes in the organization

   Sample size: 50

   Sample bias? no

   Question bias? yes
   The question favors the blue uniforms.

   Sampling method: simple

2. Population: community

   Sample: 30 households from each quarter of the community

   Sample size: $30 \bullet 4 = 120$

   Sample bias? no

   Question bias? no

   Sampling method: stratified

3. Population: students in a school

   Sample: 100 marching band students

   Sample size: 100

   Sample bias? yes
   Marching band students may not be representative of all students at the school.

   Question bias? no

   Sampling method: N/A

4. Population: bus drivers

   Sample: every 10th bus driver on a list

   Sample size: $300 \div 10 = 30$

   Sample bias? no

   Question bias? no

   Sampling method: systematic

5. Population: congregation members

Sample: 30 children aged five and under

Sample size: 30

Sample bias? yes
Children aged five and under are not representative of the entire congregation, and choosing the first 30 is not random.

Question bias? yes
The question favors pizza.

Sampling method: N/A

6. Population: community

Sample: 200 male and 200 female library patrons

Sample size: $200 + 200 = 400$

Sample bias? no

Question bias? no

Sampling method: stratified

REVIEW

1. a.

	Girls	Boys	Total
Build a Marble Run	5	$11 - 5 = 6$	11
Create a Scale Model of a Tree House	7	2	$7 + 2 = 9$
Program a Robot	$12 - 9 = 3$	9	12
Build a Mousetrap Car	4	4	$4 + 4 = 8$
Total	$5 + 7 + 3 + 4 = 19$	$6 + 2 + 9 + 4 = 21$	$19 + 21 = 40$

b. $\frac{9}{12} = 0.75 = 75\%$

c. $\frac{8}{40} = 0.2 = 20\%$

2. Trapezoid bases (2):

$$A_{trap} = \frac{1}{2}(b_1 + b_2)h$$
$$A_{trap} = \frac{1}{2}(13 + 3)(12)$$
$$A_{trap} = \frac{1}{2}(16)(12)$$
$$A_{trap} = \frac{1}{2}(192)$$
$$A_{trap} = 96$$

96 in^2

Left and right rectangular faces (2):

$$A_{rect1} = bh$$
$$A_{rect1} = (13)(3)$$
$$A_{rect1} = 39$$

39 in^2

Front rectangular face (1):

$A_{rect\,2} = bh$
$A_{rect\,2} = (3)(3)$
$A_{rect\,2} = 9$

$9\ \text{in}^2$

Back rectangular face (1):

$A_{rect\,3} = bh$
$A_{rect\,3} = (13)(3)$
$A_{rect\,3} = 39$

$39\ \text{in}^2$

Surface Area:

$2 \bullet 96\ \text{in}^2 + 2 \bullet 39\ \text{in}^2 + 9\ \text{in}^2 + 39\ \text{in}^2 = 318\ \text{in}^2$

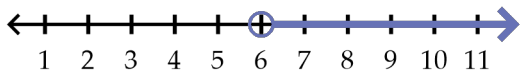
3. a. 110 minutes

b. 90 minutes

c. IQR: $95 - 85 = 10$

Meaning: 50% of the times between eruptions were within a range of 10 minutes.

4.
$$\begin{aligned} -27 - 6t &< -63 \\ -27 - 6t + 27 &< -63 + 27 \\ -6t &< -36 \\ \frac{-6t}{-6} &< \frac{-36}{-6} \\ t &> 6 \end{aligned}$$



5.
$$\begin{aligned} & 7\left(5 \bullet \left|\sqrt[3]{-64}\right| \div \frac{1}{4} - 3^4\right) \\ &= 7\left(5 \bullet |-4| \div \frac{1}{4} - 81\right) \\ &= 7\left(5 \bullet 4 \div \frac{1}{4} - 81\right) \\ &= 7\left(20 \div \frac{1}{4} - 81\right) \\ &= 7(20 \bullet 4 - 81) \\ &= 7(80 - 81) \\ &= 7(-1) \\ &= -7 \end{aligned}$$

Unit 4 Review

1. $3x+2\le 4-3x$

$3x+2+3x\le 4-3x+3x$

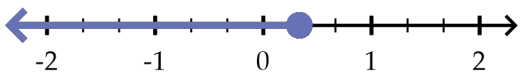
$6x+2\le 4$

$6x+2-2\le 4-2$

$6x\le 2$

$\frac{6x}{6}\le\frac{2}{6}$

$x\le\frac{1}{3}$



2. a. $5(0)+2y=20$

$2y=20$

$\frac{2y}{2}=\frac{20}{2}$

$y=10$

$(0,10)$

$5x+2(0)=20$

$5x=20$

$\frac{5x}{5}=\frac{20}{5}$

$x=4$

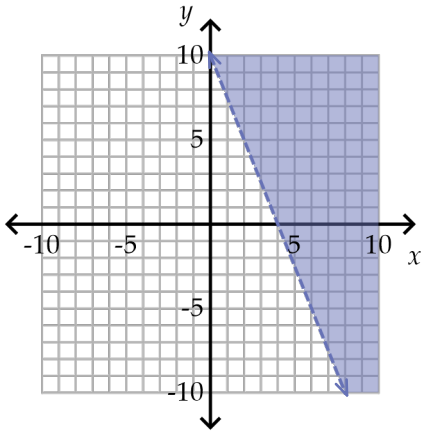
$(4,0)$

Test $(0,0)$:

$5x+2y>20$

$5(0)+2(0)\stackrel{?}{>}20$

$0\stackrel{?}{>}20$ ✗



b. $(6,1)$

3. $\frac{2a}{3}-1=5$

$\frac{2a}{3}-1+1=5+1$

$\frac{2a}{3}=6$

$\frac{3}{2}\cdot\frac{2a}{3}=6\cdot\frac{3}{2}$

$a=9$

$2b=4b+12$

$2b-4b=4b+12-4b$

$-2b=12$

$\frac{-2b}{-2}=\frac{12}{-2}$

$b=-6$

$2(4a+b)-1$

$2(4\cdot 9+(-6))-1$

$=2(36+(-6))-1$

$=2(30)-1$

$=59$

4. a. $5+3(2u-4)=-7-(-6u)$

$5+6u-12=-7+6u$

$-7+6u=-7+6u$

$-7+6u-6u=-7+6u-6u$

$-7=-7$

infinitely many

b. $2v+3=-3(4-v)-v$

$2v+3=-12+3v-v$

$2v+3=-12+2v$

$2v+3-2v=-12+2v-2v$

$3\neq -12$

none

c. $2(3y+1)-4y=6$

$6y+2-4y=6$

$2y+2=6$

$2y+2-2=6-2$

$2y=4$

$\frac{2y}{2}=\frac{4}{2}$

$y=2$

$x=3(2)+1=7$

$(7,2)$

d. Multiply top equation by 3:

$3\bullet(6x+2y)=8\bullet 3$

$18x+6y=24$

Multiply bottom equation by 2:

$2\bullet(-9x-3y)=-12\bullet 2$

$-18x-6y=-24$

Elimination:

$18x+6y=24$

$-18x-6y=-24$

$0+0=0$

$0=0$

infinitely many

5. a. Rule: $(x,y)\to(x+7-3,y+3+1)=(x+4,y+4)$

ABC	$(2,-4)$	$(3,6)$	$(-5,0)$
$A'B'C'$	$(2+4,-4+4)$ $(6,0)$	$(3+4,6+4)$ $(7,10)$	$(-5+4,0+4)$ $(-1,4)$

b. Rule: $(x,y)\to(y,-x)$

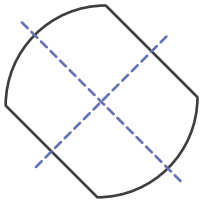
ABC	$(2,-4)$	$(3,6)$	$(-5,0)$
$A'B'C'$	$(-4,-2)$	$(6,-3)$	$(0,5)$

c. Rule: $(x,y)\to\left(\frac{2}{3}x,\frac{2}{3}y\right)$

ABC	$(2,-4)$	$(3,6)$	$(-5,0)$
$A'B'C'$	$\left(\frac{2}{3}\bullet 2,\frac{2}{3}(-4)\right)$ $\left(1\frac{1}{3},-2\frac{2}{3}\right)$	$\left(\frac{2}{3}\bullet 3,\frac{2}{3}\bullet 6\right)$ $(2,4)$	$\left(\frac{2}{3}(-5),\frac{2}{3}\bullet 0\right)$ $\left(-3\frac{1}{3},0\right)$

6. Transformation 1: reflect across y-axis

Transformation 2: translate left 4, down 2

7. 

Order: 2

Lines of symmetry: 2

8. $3a^2b-5+2a-ab^3-\left(ab^3+a^2b-4\right)$

$=3a^2b-5+2a-ab^3-ab^3-a^2b+4$

$=3a^2b-a^2b-5+4+2a-ab^3-ab^3$

$=2a^2b-1+2a-2ab^3$

9. a. $c^2d\left(4+c-cd^2\right)$

$=c^2d\bullet 4+c^2d\bullet c+c^2d\bullet\left(-cd^2\right)$

$=4c^2d+c^{2+1}d-c^{2+1}d^{1+2}$

$=4c^2d+c^3d-c^3d^3$

b. $(e+1)(2e-3)$

$=e\bullet 2e+e\bullet(-3)+1\bullet 2e+1\bullet(-3)$

$=2e^2-3e+2e-3$

$=2e^2-e-3$

10. $\left(8f^4g^5h+12f^2g^6h^2\right)\div 4f^2g^3h$

$=\frac{8f^4g^5h+12f^2g^6h^2}{4f^2g^3h}$

$=\frac{8f^4g^5h}{4f^2g^3h}+\frac{12f^2g^6h^2}{4f^2g^3h}$

$=2f^{4-2}g^{5-3}h^{1-1}+3f^{2-2}g^{6-3}h^{2-1}$

$=2f^2g^2+3g^3h$

11. a. $18 = 2 \bullet 3 \bullet 3$
$8 = 2 \bullet 2 \bullet 2$
$10 = 2 \bullet 5$
LCM of coefficients:
$2 \bullet 2 \bullet 2 \bullet 3 \bullet 3 \bullet 5 = 360$
Highest powers: j^2, k^3, l^3

$360j^2k^3l^3$

b. $18 = 2 \bullet 3 \bullet 3$
$8 = 2 \bullet 2 \bullet 2$
$10 = 2 \bullet 5$
GCF of coefficients: 2
Lowest powers: k, l

$2kl$

c. $18j^2k^3l^2 \div 2kl = 9j^2k^2l$
$8jk^3l \div 2kl = 4jk^2$
$-10kl^3 \div 2kl = -5l^2$

$2kl\left(9j^2k^2l + 4jk^2 - 5l^2\right)$

12. a.

	With Outlier	Without Outlier
Mean	**A** 7.36	**B** 6.9
Median	**C** 7.05	**D** 6.9
Mode	6.7	6.7
Range	**E** 9	**F** 3.1

Detailed work for the chart is shown below.
The outlier is 14.2.

A Mean with outlier:

$5.5 + 6.7 + 5.4 + 6.2 + 7.5 + 8.3 + 6.7 + 7.2 + 7.4 + 8.1 + 6.9 + 5.2 + 6.4 + 14.2 + 7.8 + 8.2 = 117.7$

$117.7 \div 16 \approx 7.36$

B Mean without outlier:

$5.5 + 6.7 + 5.4 + 6.2 + 7.5 + 8.3 + 6.7 + 7.2 + 7.4 + 8.1 + 6.9 + 5.2 + 6.4 + 7.8 + 8.2 = 103.5$

$103.5 \div 15 = 6.9$

C Median with outlier:

5/2, 5/4, 5/5, 6/2, 6/4, 6/7, 6/7, (6.9, 7.2) 7/4, 7/5, 7/8, 8/1, 8/2, 8/3, 14/2

$6.9 + 7.2 = 14.1$

$14.1 \div 2 = 7.05$

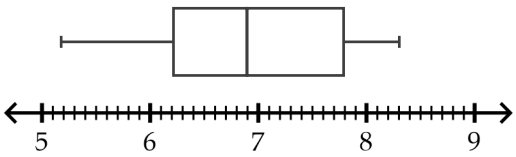
D Median without outlier:

5/2, 5/4, 5/5, 6/2, 6/4, 6/7, 6/7, (6.9,) 7/2, 7/4, 7/5, 7/8, 8/1, 8/2, 8/3

E Range with outlier: $14.2 - 5.2 = 9$

F Range without outlier: $8.3 - 5.2 = 3.1$

b. Minimum: 5.2
Maximum 8.3
Q2: 6.9 (work in Part A)
Q1: 5/2, 5/4, 5/5, (6.2,) 6/4, 6/7, 6/7
Q3: 7/2, 7/4, 7/5, (7.8,) 8/1, 8/2, 8/3



c.

5	2 4 5
6	2 4 7 7 9
7	2 4 5 8
8	1 2 3
9	
10	
11	
12	
13	
14	2

13. a. Graph A: strong, positive, linear

Graph B: strong, positive, nonlinear

b. Line l

c. $(2,3)$ and $(-2,-2)$

$$m = \frac{-2-3}{-2-2} = \frac{-5}{-4} = \frac{5}{4}$$

$$y = mx + b$$

$$3 = \frac{5}{4} \bullet 2 + b$$

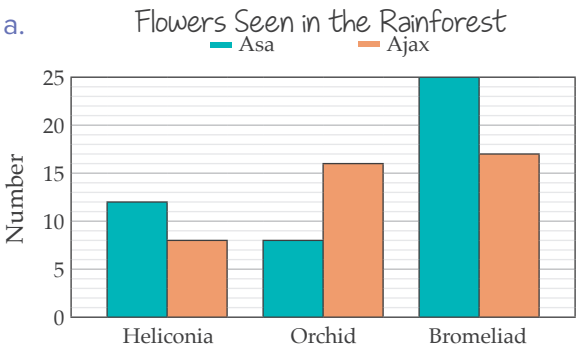
$$3 = \frac{5}{2} + b$$

$$3 - \frac{5}{2} = \frac{5}{2} + b - \frac{5}{2}$$

$$\frac{1}{2} = b$$

$$y = \frac{5}{4}x + \frac{1}{2}$$

14. a.



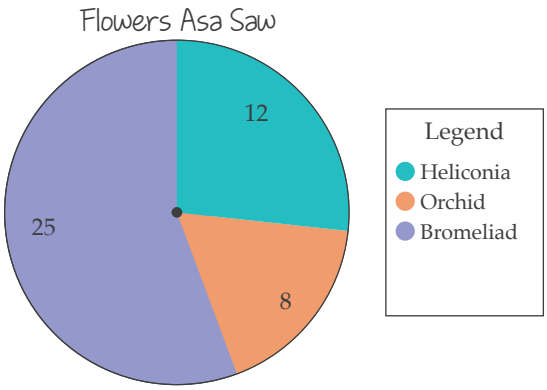
b. Total flowers seen: $12 + 8 + 25 = 45$

Degrees in sectors:

Heliconia: $\frac{12}{45} \bullet 360° = 96°$

Orchid: $\frac{8}{45} \bullet 360° = 64°$

Bromeliad: $\frac{25}{45} \bullet 360° = 200°$



Note: Segments may be rotated or in a different order, but central angles should be the same.

c. $(12 + 8 + 25 + x) \div 4 = 12$

$$(12 + 8 + 25 + x) \div 4 \bullet 4 = 12 \bullet 4$$

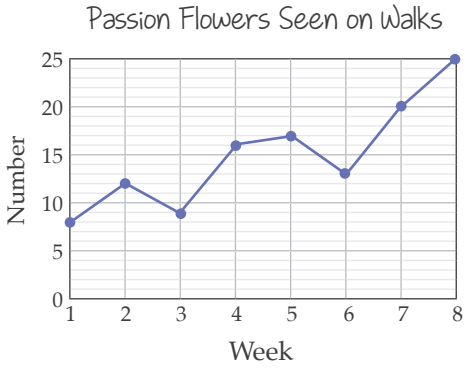
$$12 + 8 + 25 + x = 48$$

$$45 + x = 48$$

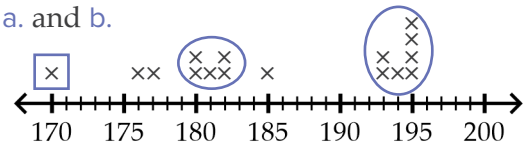
$$45 + x - 45 = 48 - 45$$

$$x = 3$$

d.

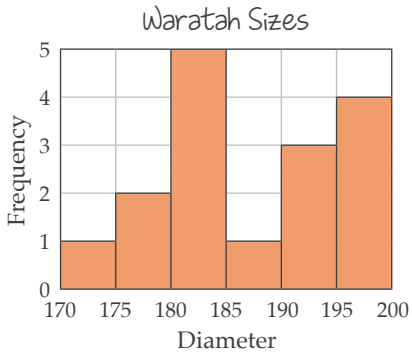


15. a. and b.



c.

Range	Frequency
170–175	I
175–180	II
180–185	𝍸
185–190	I
190–195	III
195–200	IIII



16. a.

	Male	Female	Total
0–5 Years	6	8	14
6–10 Years	12	14	26
11–17 Years	16	12	28
18+ Years	4	4	8
Total	38	38	76

b. $14 + 26 = 40$

c. $16 + 4 = 20$

d.

	Male	Female	Total
0–5 Years	$\frac{6}{76} \approx 7.89\%$	$\frac{8}{76} \approx 10.53\%$	$\frac{14}{76} \approx 18.42\%$
6–10 Years	$\frac{12}{76} \approx 15.79\%$	$\frac{14}{76} \approx 18.42\%$	$\frac{26}{76} \approx 34.21\%$
11–17 Years	$\frac{16}{76} \approx 21.05\%$	$\frac{12}{76} \approx 15.79\%$	$\frac{28}{76} \approx 36.84\%$
18+ Years	$\frac{4}{76} \approx 5.26\%$	$\frac{4}{76} \approx 5.26\%$	$\frac{8}{76} \approx 10.53\%$
Total	$\frac{38}{76} = 50\%$	$\frac{38}{76} = 50\%$	$\frac{76}{76} = 100\%$

e. $10.53\% + 18.42\% + 15.79\% = 44.74\%$

17. Population: homeschool families in the community

Sample: half the people in each age group at the field trip

Sample size: $76 \div 2 = 38$

Sample bias? yes
People on the field trip may not be representative of the homeschool families in the community in general.

Question bias? yes
The question favors outdoor adventures.

Rainforest Facts:

1. Roughly 6% of the earth's surface is rainforest.

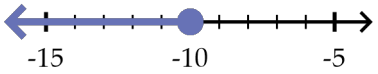
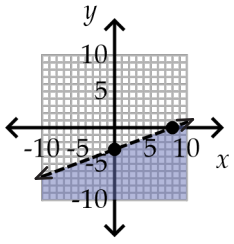
2. A falling raindrop can take as long as 10 minutes to fall from the upper canopy of a rainforest all the way to the ground.

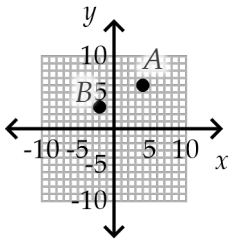
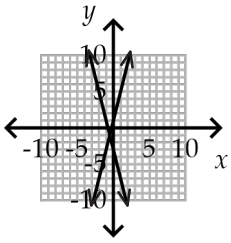
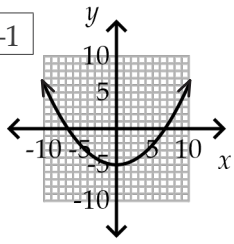
3. During years of heavy rainfall, a rainforest might receive as many as 400 inches of rain in a single year.

4. About 25% of modern medicines originate from plants in the rainforest. The National Cancer Institute in the United States estimates that as many as two-thirds of cancer-fighting medicines originate from rainforest plants.

Course Review

The final answers for each problem on the game boards are shown on this page and the following page. Detailed solutions are given after the game board and are labeled with the category and point value.

	Numbers and Miscellaneous	Exponents and Roots	Expressions, Equations, and Inequalities
20 points	a. 1.23 b. $\frac{4}{7} > \frac{5}{9}$	$(2 \cdot 10^2) + (4 \cdot 10^1) + (1 \cdot 10^{-1})$	$\frac{1}{3}(n^2 + 6)$
40 points	a. $-\frac{7}{24}$ b. –9.45 c. $-2\frac{4}{5}$ d. –0.516	a. s^2 b. $\frac{y^3}{w^6 z^9}$	a. no solution b. infinitely many solutions
60 points	a. true b. false c. false d. true e. false	a. 35 b. $\frac{27}{125}$ c. 22	a. no solution b. $r = 3$ and $r = -7$
80 points	a. 40 b. 112 c. 215%, $2\frac{3}{20}$	between –4 and –3 –3.71	$a \leq -10$ 
100 points	$750	a. $3t^3u + 2t^2u^3$ b. $3ac - a^2b^2$	a. $\frac{2}{9}$ b. $r = \sqrt{\frac{A}{\pi}}$
120 points	a. 25% b. 22.22%	$2c^3d(2d - 5)$	a.  b. no

	Coordinate Planes	Relations and Functions	Geometry, Graphs, and Data
20 points	 Point A: quadrant I Point B: quadrant II	a. $y = 3$ b. $x = 4$	$x = 6$
40 points	$y = -9x + 23$	Domain: $\{0,1,2,3\}$ Range: $\{10,9,8,7,6,5\}$ not a function	Arc length: 11.78 cm Sector area: 17.67 cm^2
60 points	a. $y - 4 = \frac{3}{2}(x - 2)$ or $y + 2 = \frac{3}{2}(x + 2)$ b. $y = \frac{3}{2}x + 1$	Rule: Multiply the input by 2 and add 1. Equation: $y = 2x + 1$	5.25 m
80 points	 neither	y: –4, –5, –4, –1 Function: yes Linear: no 	mean > median
100 points	$y = \frac{3}{4}x + 1\frac{1}{4}$ Slope: $\frac{3}{4}$ y-intercept: $\left(0, 1\frac{1}{4}\right)$	Constant rate of change: yes Linear function: yes	2
120 points	$A'B'$: $(8,0)$, $(6,5)$	a. yes b. no c. graph m d. graph m	Volume: 1696.46 ft^3 Surface area: 791.68 ft^2

Numbers and Miscellaneous
20 points

a. $13\overline{)3.0000}\ 0.2307$

-26

40

-39

10

-0

100

-91

9

$1\frac{3}{13} \approx 1.23$

b. $\frac{4}{7} = \frac{36}{63}$

$\frac{5}{9} = \frac{35}{63}$

$\frac{4}{7} > \frac{5}{9}$

Numbers and Miscellaneous
40 points

a. $-\frac{2}{3} + \frac{3}{8} = -\frac{16}{24} + \frac{9}{24} = -\frac{7}{24}$

b. $-2.1(-3)(-1.5)$

$= 6.3(-1.5)$

$= -9.45$

c. $\frac{2\frac{1}{3}}{-\frac{5}{6}} = \frac{\frac{7}{3}}{-\frac{5}{6}} = \frac{7}{\cancel{3}_{1}} \bullet \left(-\frac{\cancel{6}^{2}}{5}\right) = -\frac{14}{5} = -2\frac{4}{5}$

d. $2\cancel{4}^{3}.{}^{1}016$

-23.500

0.516

$|-24.016| > |23.5|$

Answer is negative: -0.516

Numbers and Miscellaneous
60 points

a. true

b. false

c. false

d. true

e. false

Numbers and Miscellaneous
80 points

a. $\frac{2}{5} \bullet x = 16$

$\frac{5}{2} \bullet \frac{2}{5} \bullet x = 16 \bullet \frac{5}{2}$

$x = 40$

b. $1.4 \bullet 80 = 112$

c. $2.15 = 215\%$

$2.15 = 2\frac{15}{100} = 2\frac{3}{20}$

Numbers and Miscellaneous
100 points

$1 - 0.72 = 0.28$

$0.28 \bullet x = 210$

$\frac{0.28 \bullet x}{0.28} = \frac{210}{0.28}$

$x = 750$

$750

Numbers and Miscellaneous
120 points

a. $5+2+3=10$

$$P(\text{blue}) \bullet P(\text{blue}) = \frac{5}{10} \bullet \frac{5}{10} = \frac{25}{100} = \frac{1}{4} = 25\%$$

b. $P(\text{blue first, blue second})$

$$= P(\text{blue first}) \bullet P(\text{blue second} \mid \text{blue first})$$

$$= \frac{5}{10} \bullet \frac{4}{9}$$

$$= \frac{20}{90}$$

$$= \frac{2}{9}$$

$$\approx 22.22\%$$

Exponents and Roots
20 points

$$240.1 = \left(2 \bullet 10^2\right) + \left(4 \bullet 10^1\right) + \left(1 \bullet 10^{-1}\right)$$

Exponents and Roots
40 points

a. $s^6 \bullet s^3 \div s^7 = s^{6+3-7} = s^2$

b. $\left(\frac{w^{-2}y}{z^3}\right)^3 = \frac{w^{-2\bullet 3}y^{1\bullet 3}}{z^{3\bullet 3}} = \frac{w^{-6}y^3}{z^9} = \frac{y^3}{w^6 z^9}$

Exponents and Roots
60 points

a. $3\sqrt{81} - 2\sqrt[3]{-64}$

$$= 3 \bullet 9 - 2(-4)$$

$$= 27 + 8$$

$$= 35$$

b. $\left(\frac{5}{3}\right)^{-3} = \frac{5^{-3}}{3^{-3}} = \frac{3^3}{5^3} = \frac{27}{125}$

c. $\sqrt{3} \bullet \sqrt{75} + \sqrt{\frac{16^2 - 2 \bullet 30}{3 \bullet 5 - 11}}$

$$= \sqrt{225} + \sqrt{\frac{256 - 2 \bullet 30}{3 \bullet 5 - 11}}$$

$$= 15 + \sqrt{\frac{256 - 60}{15 - 11}}$$

$$= 15 + \sqrt{\frac{196}{4}}$$

$$= 15 + \sqrt{49}$$

$$= 15 + 7$$

$$= 22$$

Exponents and Roots
80 points

–51 is between –64 and –27.

$$\sqrt[3]{-64} < \sqrt[3]{-51} < \sqrt[3]{-27}$$

$$-4 < \sqrt[3]{-51} < -3$$

between –4 and –3

$\sqrt[3]{-51} \approx -3.71$

Exponents and Roots
100 points

a. $t^2u\left(3t - 4u^2\right) + 6t^2u^3$

$$= t^2u \bullet 3t + t^2u \bullet \left(-4u^2\right) + 6t^2u^3$$

$$= 3t^{2+1}u - 4t^2u^{1+2} + 6t^2u^3$$

$$= 3t^3u - 4t^2u^3 + 6t^2u^3$$

$$= 3t^3u + 2t^2u^3$$

b. $\frac{3a^3bc^2 - a^4b^3c}{a^2bc}$

$$= \frac{3a^3bc^2}{a^2bc} - \frac{a^4b^3c}{a^2bc}$$

$$= 3a^{3-2}b^{1-1}c^{2-1} - a^{4-2}b^{3-1}c^{1-1}$$

$$= 3ac - a^2b^2$$

Exponents and Roots
120 points

$4 = 2 \bullet 2$

$10 = 2 \bullet 5$

GCF of coefficients: 2

Lowest powers: c^3, d

GCF of the binomial: $2c^3d$

$4c^3d^2 \div 2c^3d = 2d$

$-10c^3d \div 2c^3d = -5$

$4c^3d^2 - 10c^3d = 2c^3d(2d - 5)$

Expressions, Equations, and Inequalities
20 points

$\frac{1}{3}(n^2 + 6)$

Expressions, Equations, and Inequalities
40 points

a. $2(3 - x) + 1 = x + 4 - 3x$

$6 - 2x + 1 = -2x + 4$

$7 - 2x = -2x + 4$

$7 - 2x + 2x = -2x + 4 + 2x$

$7 \neq 4$

no solution

b. Multiply top equation by –2:

$-2 \bullet (3x + 4y) = 24 \bullet (-2)$

$-6x - 8y = -48$

Elimination:

$$\begin{array}{r} -6x - 8y = -48 \\ 6x + 8y = 48 \\ \hline 0x + 0y = 0 \end{array}$$

$0 = 0$

infinitely many solutions

Expressions, Equations, and Inequalities
60 points

a. $5 + \sqrt{2z + 1} = 2$

$5 + \sqrt{2z + 1} - 5 = 2 - 5$

$\sqrt{2z + 1} = -3$

$\left(\sqrt{2z + 1}\right)^2 = (-3)^2$

$2z + 1 = 9$

$2z + 1 - 1 = 9 - 1$

$2z = 8$

$\frac{2z}{2} = \frac{8}{2}$

$z = 4$

Check:

$5 + \sqrt{2 \bullet 4 + 1} \stackrel{?}{=} 2$

$5 + \sqrt{8 + 1} \stackrel{?}{=} 2$

$5 + \sqrt{9} \stackrel{?}{=} 2$

$5 + 3 \stackrel{?}{=} 2$

$8 \neq 2$

no solution

b. $(r + 2)^2 - 12 = 13$

$(r + 2)^2 - 12 + 12 = 13 + 12$

$(r + 2)^2 = 25$

$\sqrt{(r + 2)^2} = \pm\sqrt{25}$

$r + 2 = \pm 5$

$r + 2 = 5$ and $r + 2 = -5$

$r + 2 - 2 = 5 - 2$ and $r + 2 - 2 = -5 - 2$

$r = 3$ and $r = -7$

Check:

$(3 + 2)^2 - 12 \stackrel{?}{=} 13$

$(5)^2 - 12 \stackrel{?}{=} 13$

$25 - 12 \stackrel{?}{=} 13$

$13 = 13$ ✓

$((-7) + 2)^2 - 12 \stackrel{?}{=} 13$

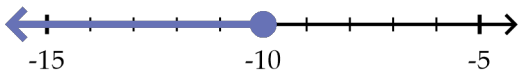
$(-5)^2 - 12 \stackrel{?}{=} 13$

$25 - 12 \stackrel{?}{=} 13$

$13 = 13$ ✓

Expressions, Equations, and Inequalities
80 points

$$
\begin{aligned}
3(a-4) &\geq 5a+8 \\
3a-12 &\geq 5a+8 \\
3a-12-5a &\geq 5a+8-5a \\
-2a-12 &\geq 8 \\
-2a-12+12 &\geq 8+12 \\
-2a &\geq 20 \\
\frac{-2a}{-2} &\geq \frac{20}{-2} \\
a &\leq -10
\end{aligned}
$$



Expressions, Equations, and Inequalities
100 points

a.
$$
\begin{aligned}
\frac{e+3}{2} &= -4e \\
2 \bullet \frac{e+3}{2} &= -4e \bullet 2 \\
e+3 &= -8e \\
e+3-e &= -8e-e \\
3 &= -9e \\
\frac{3}{-9} &= \frac{-9e}{-9} \\
-\frac{1}{3} &= e
\end{aligned}
$$

$$
\begin{aligned}
&2e^2 \\
&= 2\left(-\frac{1}{3}\right)^2 \\
&= 2\left(\frac{1}{9}\right) \\
&= \frac{2}{9}
\end{aligned}
$$

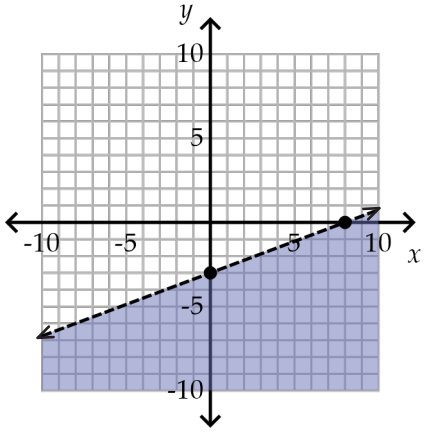
b.
$$
\begin{aligned}
A &= \pi r^2 \\
\frac{A}{\pi} &= \frac{\pi r^2}{\pi} \\
\frac{A}{\pi} &= r^2 \\
\sqrt{\frac{A}{\pi}} &= \sqrt{r^2} \\
\sqrt{\frac{A}{\pi}} &= r
\end{aligned}
$$

Expressions, Equations, and Inequalities
120 points

a.
$$
\begin{aligned}
3(0)-8y &= 24 \\
-8y &= 24 \\
\frac{-8y}{-8} &= \frac{24}{-8} \\
y &= -3 \\
&(0,-3)
\end{aligned}
\qquad
\begin{aligned}
3x-8(0) &= 24 \\
3x &= 24 \\
\frac{3x}{3} &= \frac{24}{3} \\
x &= 8 \\
&(8,0)
\end{aligned}
$$

Test $(0,0)$:

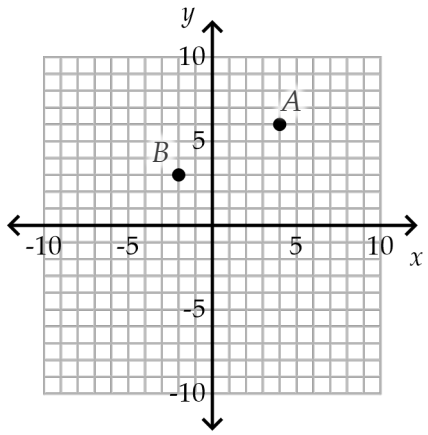
$$
\begin{aligned}
3x-8y &> 24 \\
3(0)-8(0) &\stackrel{?}{>} 24 \\
0 &\stackrel{?}{>} 24 \ \text{✗}
\end{aligned}
$$



b.
$$
\begin{aligned}
3(2)-8(5) &\stackrel{?}{>} 24 \\
6-40 &\stackrel{?}{>} 24 \\
-34 &\stackrel{?}{<} 24
\end{aligned}
$$

no

Coordinate Planes
20 points



Point A: quadrant I

Point B: quadrant II

Coordinate Planes
40 points

$$m=\frac{-4-5}{3-2}=\frac{-9}{1}=-9$$

$$\begin{aligned} y&=mx+b\\ y&=-9x+b\\ 5&=-9(2)+b\\ 5&=-18+b\\ 5+18&=-18+b+18\\ 23&=b \end{aligned}$$

$y=-9x+23$

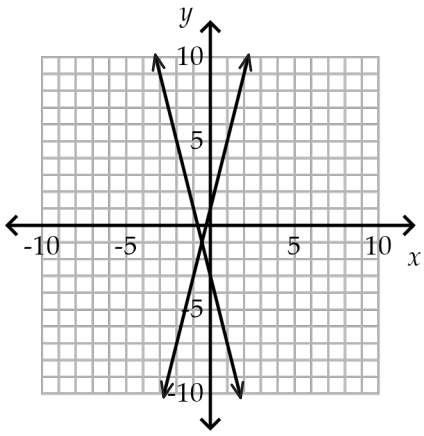
Coordinate Planes
60 points

a. $m=\frac{-2-4}{-2-2}=\frac{-6}{-4}=\frac{3}{2}$

$y-4=\frac{3}{2}(x-2)$ or $y+2=\frac{3}{2}(x+2)$

b. $$\begin{aligned} y-4&=\frac{3}{2}(x-2)\\ y-4+4&=\frac{3}{2}(x-2)+4\\ y&=\frac{3}{2}(x-2)+4\\ y&=\frac{3}{2}x-3+4\\ y&=\frac{3}{2}x+1 \end{aligned}$$

Coordinate Planes
80 points



neither

Coordinate Planes
100 points

$$\begin{aligned} -3x+4y&=5\\ -3x+4y+3x&=5+3x\\ 4y&=5+3x\\ \frac{4y}{4}&=\frac{5+3x}{4}\\ y&=\frac{5}{4}+\frac{3}{4}x\\ y&=\frac{3}{4}x+1\frac{1}{4} \end{aligned}$$

Slope: $\frac{3}{4}$ y-intercept: $\left(0,1\frac{1}{4}\right)$

Coordinate Planes
120 points

$(x,y)\rightarrow(y,-x)$

AB	$(0,8)$	$(-5,6)$
$A'B'$	$(8,0)$	$(6,5)$

Relations and Functions
20 points

a. $m=\dfrac{3-3}{5-(-1)}=\dfrac{0}{6}=0$

Horizontal line: $y=3$

b. $m=\dfrac{-2-6}{4-4}=\dfrac{-8}{0}=$ undefined

Vertical line: $x=4$

Relations and Functions
40 points

Domain: $\{0,1,2,3\}$

Range: $\{10,9,8,7,6,5\}$

not a function

Relations and Functions
60 points

Rule: Multiply the input by 2 and add 1.

Equation: $y=2x+1$

Relations and Functions
80 points

x	-3	0	3	6
y	**A** -4	**B** -5	**C** -4	**D** -1

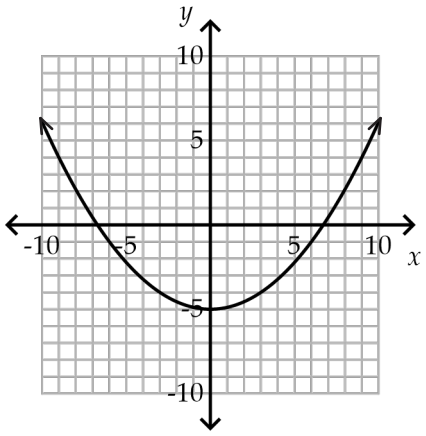
Detailed work is shown below.

A $y=\dfrac{1}{9}(-3)^2-5=\dfrac{1}{9}(9)-5=1-5=-4$

B $y=\dfrac{1}{9}(0)^2-5=\dfrac{1}{9}(0)-5=0-5=-5$

C $y=\dfrac{1}{9}(3)^2-5=\dfrac{1}{9}(9)-5=1-5=-4$

D $y=\dfrac{1}{9}(6)^2-5=\dfrac{1}{9}(36)-5=4-5=-1$



Yes, it is a function.
No, it is not linear.

Relations and Functions
100 points

	-3	-2	-1	
x	5	2	0	-1
y	12	6	2	0
	-6	-4	-2	

$\dfrac{-6}{-3}=\dfrac{-4}{-2}=\dfrac{-2}{-1}=2$

The rate of change is constant.
It represents a linear function.

Relations and Functions
120 points

a. yes

b. no

c. graph m

d. graph m

Geometry, Graphs, and Data
20 points

$$a^2 + b^2 = c^2$$
$$8^2 + x^2 = 10^2$$
$$64 + x^2 = 100$$
$$64 + x^2 - 64 = 100 - 64$$
$$x^2 = 36$$
$$\sqrt{x^2} = \sqrt{36}$$
$$x = 6$$

Geometry, Graphs, and Data
40 points

$$\frac{225}{360} = \frac{5}{8}$$

Arc length:

$$C = 2\pi r = 2\pi \bullet 3 = 6\pi \approx 18.85$$

$$\frac{5}{8}(18.85) \approx 11.78$$

11.78 cm

Sector area:

$$A = \pi r^2 = \pi \bullet 3^2 = 9\pi \approx 28.27$$

$$\frac{5}{8}(28.27) \approx 17.67$$

17.67 cm^2

Geometry, Graphs, and Data
60 points

$$\frac{1.5}{4} = \frac{x}{14}$$
$$1.5 \bullet 14 = 4x$$
$$21 = 4x$$
$$\frac{21}{4} = \frac{4x}{4}$$
$$5.25 = x$$

5.25 m

Geometry, Graphs, and Data
80 points

mean > median

Geometry, Graphs, and Data
100 points

$$(8 + 6 + 9 + 5 + x) \div 5 = 6$$
$$(8 + 6 + 9 + 5 + x) \div 5 \bullet 5 = 6 \bullet 5$$
$$8 + 6 + 9 + 5 + x = 30$$
$$28 + x = 30$$
$$28 + x - 28 = 30 - 28$$
$$x = 2$$

Geometry, Graphs, and Data
120 points

Volume:

$$V = \pi r^2 h$$
$$V = \pi \bullet 6^2 \bullet 15$$
$$V = 540\pi$$
$$V \approx 1696.46$$

1696.46 ft^3

Surface Area:

$$SA = 2\pi r^2 + 2\pi rh$$
$$SA = 2\pi \bullet 6^2 + 2\pi \bullet 6 \bullet 15$$
$$SA = 72\pi + 180\pi$$
$$SA = 252\pi$$
$$SA \approx 791.68$$

791.68 ft^2

Course Assessment

1. a. 7

b. 8

c. $\frac{1}{2^3} = \frac{1}{8}$

d. $\sqrt{2} \bullet \sqrt{8}$

$= \sqrt{2 \bullet 8}$

$= \sqrt{16}$

$= 4$

e. $5\sqrt{3} - 2\sqrt{3}$

$= 3\sqrt{3}$

f. $\sqrt[3]{\frac{1000 - 2 \bullet 68}{8^2 - 4 \bullet 15}}$

$= \sqrt[3]{\frac{1000 - 136}{64 - 60}}$

$= \sqrt[3]{\frac{864}{4}}$

$= \sqrt[3]{216}$

$= 6$

2.

x	y
–2	–8
–1	–1
0	0
1	1
2	8

Rule: Cube each input value.

Equation: $y = x^3$

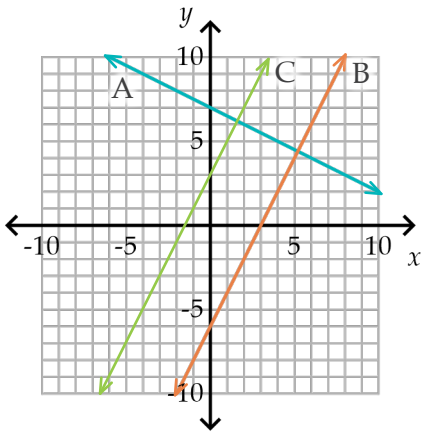
3. a.

Change in x	x	y	Change in y
	–2	3	
+1	–1	4	+1
+1	0	5	+1
+1	1	6	+1
+1	2	7	+1

b. yes

c. yes

4.



Parallel lines: B and C

Perpendicular lines: A and B or A and C

5. $a^2 + b^2 = c^2$

$5^2 + 7^2 = \left(\sqrt{10x + 4}\right)^2$

$25 + 49 = 10x + 4$

$74 = 10x + 4$

$74 - 4 = 10x + 4 - 4$

$70 = 10x$

$\frac{70}{10} = \frac{10x}{10}$

$7 = x$

6. $42{,}250 - 32{,}110 = 10{,}140$

$$x \bullet 42{,}250 = 10{,}140$$
$$\frac{x \bullet 42{,}250}{42{,}250} = \frac{10{,}140}{42{,}250}$$
$$x = 0.24$$

24%

7. a. $8 + 6 + 7 + 4 = 25$

$$\frac{7}{25} = 28\%$$

b. $P(\text{square first, star second})$

$$= P(\text{square first}) \bullet P(\text{star second} \mid \text{square first})$$
$$= \frac{6}{25} \bullet \frac{4}{24}$$
$$= \frac{24}{600}$$
$$= 0.04$$

4%

8. $$\frac{SP}{RS} = \frac{DA}{CD}$$
$$\frac{10}{8} = \frac{p}{4}$$
$$10 \bullet 4 = 8p$$
$$40 = 8p$$
$$\frac{40}{8} = \frac{8p}{8}$$
$$5 = p$$

9. $$\frac{135°}{360°} = \frac{3}{8}$$

$$C = 2\pi r$$
$$C = 2\pi \bullet 3$$
$$C = 6\pi$$

$$\frac{3}{8} \bullet 6\pi = \frac{9}{4}\pi \approx 7.07$$

Arc length: 7.07 cm

$$A = \pi r^2$$
$$A = \pi(3)^2$$
$$A = 9\pi$$

$$\frac{3}{8} \bullet 9\pi = \frac{27}{8}\pi \approx 10.6$$

Sector area: $10.6\ \text{cm}^2$

10. Surface area:

$$SA_{cyl} = \pi r^2 + 2\pi rh$$
$$SA_{cyl} = \pi(3)^2 + 2\pi(3)(12)$$
$$SA_{cyl} = 9\pi + 72\pi$$
$$SA_{cyl} = 81\pi$$
$$SA_{cyl} \approx 254.47$$

$254.47\ \text{in}^2$

$$SA_{hemi} = \frac{1}{2} \bullet 4\pi r^2$$
$$SA_{hemi} = 2\pi(3)^2$$
$$SA_{hemi} = 18\pi$$
$$SA_{hemi} \approx 56.55$$

$56.55\ \text{in}^2$

Surface Area: $254.47\ \text{in}^2 + 56.55\ \text{in}^2 = 311.02\ \text{in}^2$

Volume:

$$V_{cyl} = \pi r^2 h$$
$$V_{cyl} = \pi(3)^2(12)$$
$$V_{cyl} = 108\pi$$
$$V_{cyl} \approx 339.29$$

$339.29\ \text{in}^3$

$$V_{hemi} = \frac{1}{2} \bullet \frac{4}{3}\pi r^3$$
$$V_{hemi} = \frac{2}{3}\pi(3)^3$$
$$V_{hemi} = 18\pi$$
$$V_{hemi} \approx 56.55$$

$56.55\ \text{in}^3$

Volume: $339.29\ \text{in}^3 + 56.55\ \text{in}^3 = 395.84\ \text{in}^3$

11. $\frac{4}{3}x-5\geq 13-\frac{2}{3}x$

$\frac{4}{3}x-5+5\geq 13-\frac{2}{3}x+5$

$\frac{4}{3}x\geq 18-\frac{2}{3}x$

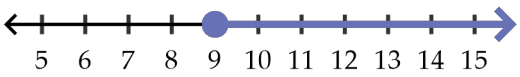
$\frac{4}{3}x+\frac{2}{3}x\geq 18-\frac{2}{3}x+\frac{2}{3}x$

$\frac{6}{3}x\geq 18$

$2x\geq 18$

$\frac{2x}{2}\geq\frac{18}{2}$

$x\geq 9$



12. a. Slope: -2

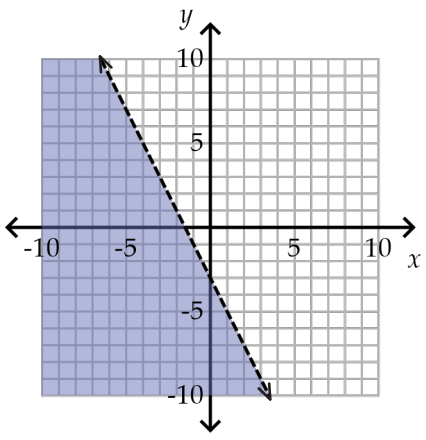
y-intercept: $(0,-3)$

Test: $(0,0)$

$y<-2x-3$

$0\overset{?}{<}-2(0)-3$

$0\overset{?}{<}-3$ X



b.

ordered pair	$(3,-2)$	$(-1,-4)$	$(5,9)$	$(-6,-6)$
yes or no	no	yes	no	yes

13. a. $3p-8=-11p+62$

$3p-8+8=-11p+62+8$

$3p=-11p+70$

$3p+11p=-11p+70+11p$

$14p=70$

$\frac{14p}{14}=\frac{70}{14}$

$p=5$

one / infinite / zero

b. $2(12k+23)=24k+46$

$24k+46=24k+46$

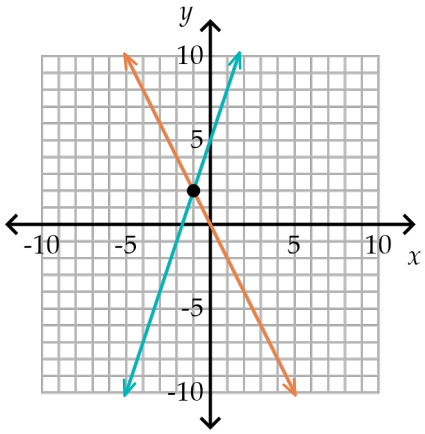
$24k+46-24k=24k+46-24k$

$46=46$

all real numbers

one / infinite / zero

14.



Solution: $(-1,2)$

15. $3x+7=-5x+3$

$3x+7-7=-5x+3-7$

$3x=-5x-4$

$3x+5x=-5x-4+5x$

$8x=-4$

$\frac{8x}{8}=\frac{-4}{8}$

$x=-\frac{1}{2}$

Substitution:

$$y = 3x + 7$$
$$y = 3\left(-\frac{1}{2}\right) + 7$$
$$y = -\frac{3}{2} + 7$$
$$y = -\frac{3}{2} + \frac{14}{2}$$
$$y = \frac{11}{2} = 5\frac{1}{2}$$

Solution: $\left(-\frac{1}{2}, 5\frac{1}{2}\right)$

16. Multiply bottom equation by 2:

$$2 \bullet (-4x + 5y) = 42 \bullet 2$$
$$-8x + 10y = 84$$

Elimination:

$$\begin{array}{r} 8x + 2y = -12 \\ -8x + 10y = 84 \\ \hline 0x + 12y = 72 \end{array}$$
$$12y = 72$$
$$\frac{12y}{12} = \frac{72}{12}$$
$$y = 6$$

$$8x + 2(6) = -12$$
$$8x + 12 = -12$$
$$8x + 12 - 12 = -12 - 12$$
$$8x = -24$$
$$\frac{8x}{8} = \frac{-24}{8}$$
$$x = -3$$

Solution: $(-3, 6)$

17.

Translate left 4 units and up 6 units. Then rotate 90° clockwise.			
ordered pair	$(2,5)$	$(4,7)$	$(6,4)$
translation	$(2-4, 5+6)$ $(-2,11)$	$(4-4, 7+6)$ $(0,13)$	$(6-4, 4+6)$ $(2,10)$
rotation	$(11,2)$	$(13,0)$	$(10,-2)$

Reflect across the x-axis. Then dilate by a scale factor of $\frac{1}{2}$.			
ordered pair	$(3,-4)$	$(5,-1)$	$(6,-6)$
reflection	$(3,4)$	$(5,1)$	$(6,6)$
dilation	$\left(\frac{1}{2} \bullet 3, \frac{1}{2} \bullet 4\right)$ $\left(\frac{3}{2}, 2\right)$	$\left(\frac{1}{2} \bullet 5, \frac{1}{2} \bullet 1\right)$ $\left(\frac{5}{2}, \frac{1}{2}\right)$	$\left(\frac{1}{2} \bullet 6, \frac{1}{2} \bullet 6\right)$ $(3,3)$

18. a. $42p^5q^2 + 12q^4 - 15 + 25p^5q^2 - 7q^4 + 20$
$= 42p^5q^2 + 25p^5q^2 + 12q^4 - 7q^4 - 15 + 20$
$= 67p^5q^2 + 5q^4 + 5$

b. $18x^4y^2 + 23x - (5x^4y^2 + 12x)$
$= 18x^4y^2 + 23x - 5x^4y^2 - 12x$
$= 18x^4y^2 - 5x^4y^2 + 23x - 12x$
$= 13x^4y^2 + 11x$

c. $3z(7z + 5)$
$= 3z \bullet 7z + 3z \bullet 5$
$= 21z^2 + 15z$

d. $(56a^7b + 49a^4b^3) \div 7a^2b$
$= \frac{56a^7b + 49a^4b^3}{7a^2b}$
$= \frac{56a^7b}{7a^2b} + \frac{49a^4b^3}{7a^2b}$
$= 8a^{7-2}b^{1-1} + 7a^{4-2}b^{3-1}$
$= 8a^5 + 7a^2b^2$

19. GCF $= 5a^3c^2$

$15a^5c^2 \div 5a^3c^2 = 3a^2$

$-5a^3c^4 \div 5a^3c^2 = -c^2$

$5a^3c^2\left(3a^2 - c^2\right)$

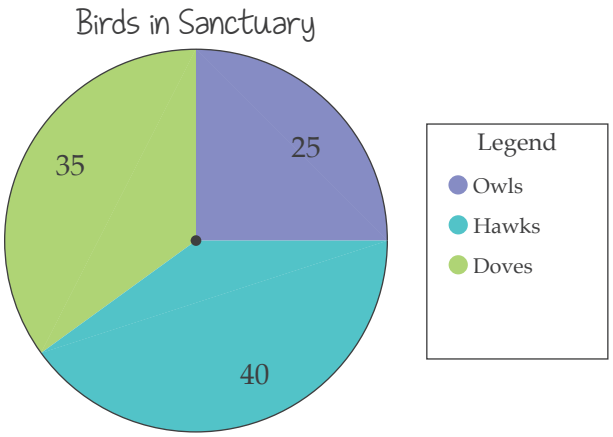
20. Total number of birds: $25 + 40 + 35 = 100$

Degrees in sectors:

Owls: $\frac{25}{100} \bullet 360° = 90°$

Hawks: $\frac{40}{100} \bullet 360° = 144°$

Doves: $\frac{35}{100} \bullet 360° = 126°$



21.

9	1
10	
11	2 5 5
12	3 5 7
13	5 6
14	
15	0 3 4

a. 112 to 136

b. 91

c. With outlier: $154 - 91 = 63$

Without outlier: $154 - 112 = 42$

22. 15, 18, 19, 21, 22, 24, 28, 32, 35, 36, 46

a. Minimum: 15

Maximum: 46

Median: 15, 18, 19, 21, 22, (24), 28, 32, 35, 36, 46

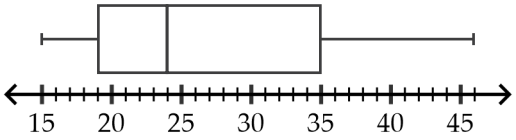
Q2: 24

Lower half of data: 15, 18, (19), 21, 22

Q1: 19

Upper half of data: 28, 32, (35), 36, 46

Q3: 35



b. IQR: $35 - 19 = 16$

c. $15 + 18 + 19 + 21 + 22 + 24 + 28 + 32 + 35 + 36 + 46 = 296$

$296 \div 11 \approx 26.9$

Mean: 26.9

23. a. $(0,2)$ and $(7,8)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{8-2}{7-0}$$

$$m = \frac{6}{7}$$

The y-intercept is $(0,2)$. $b = 2$

$$y = \frac{6}{7}x + 2$$

b.

linear	nonlinear
positive	negative
strong	weak

24. a. left-skewed

b. symmetric

c. right-skewed

25. $\frac{95}{500} = 0.19$

19%

26. a. unbiased

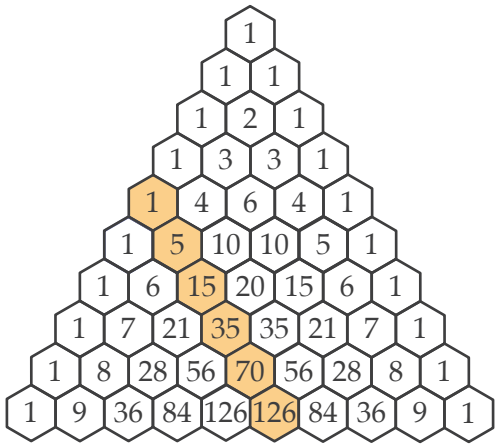
b. unbiased

c. biased

Enrichment: Pascal's Triangle

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1.



2. Answers may vary. Some observations that can be made include the following:

   The second diagonal on each side contains the counting numbers.

   The rows are symmetric.

3. a. 1
   b. 3
   c. 6
   d. 10
   e. 15
   f. 21

4. a. 3
   b. 6
   c. 10
   d. 15

5. a. $1 + 4 + 10 + 20 = 35$
   Sum: 35
   Value on curve: 35
   b. $1 + 6 + 21 + 56 + 126 = 210$
   Sum: 210
   Value on curve: 210
   c. $1 + 7 + 28 = 36$
   Sum: 36
   Value on curve: 36

6. a. 1
   b. 2
   c. 4
   d. 8
   e. 16
   f. 32

7. a. 1
   no toppings
   b. 4
   cheese or lettuce or tomato or pickles
   c. 6
   cheese and lettuce
   cheese and tomato
   cheese and pickles
   lettuce and tomato
   lettuce and pickles
   tomato and pickles
   d. 4
   cheese, lettuce, and tomato
   cheese, lettuce, and pickles
   cheese, tomato, and pickles
   lettuce, tomato, and pickles
   e. 1
   cheese, lettuce, tomato, and pickles
   f. $1 + 4 + 6 + 4 + 1 = 16$

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