UNITS
1-4

Simply Good and Beautiful

MATH 7

ANSWERS & SOLUTIONS

The Good and the Beautiful
CURRICULUM

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Note to Parents

Math 7 Answers and Solutions **includes detailed solutions for all problems in the course book. Final answers are boxed for easy reference. Solutions are not included for the Video Notes section of each lesson. Parents do not need to check this section. Students complete notes along with the video instructor and try problems on their own that are then checked in the video. Student answers may not be correct in this section, and that is OK. Mastery is not expected in the Video Notes section.**

Table of Contents

Writing Decimals, Estimating, and Rounding

WARM-UP

a. $45 \div 15 = 3$

b. $16 \bullet 4 = 64$

c. $56 \div 8 = 7$

PRACTICE

1. a. 19 is close to 20.
Estimate: $20 \div 5 = 4$

b. 47 is close to 45.
Estimate: $45 \div 15 = 3$

2.

Problem	Answer Terminates	Answer Repeats
$8.52 \bullet 4.09$	✓	
$103 \div 3$		✓
$39 \div 3$	✓	
$68.6868 \bullet 4.44$	✓	
$56 \div 3$		✓

3. a. $33 \div 13 = 2.\overline{538461}$
$33 \div 13 \approx 2.5385$

b. $4.56 \bullet 2.6398 = 12.037488$
$4.56 \bullet 2.6398 \approx 12.0375$

c. $8.623 \bullet 5.01 = 43.20123$
$8.623 \bullet 5.01 \approx 43.2012$

4. a. $98 \div 15 = 6.53333\ldots = 6.5\overline{3}$

b. $65 \div 12 = 5.4166\ldots = 5.41\overline{6}$

c. $134 \div 11 = 12.181818\ldots = 12.\overline{18}$

5. a. 34 is close to 35.
Estimate: $35 \div 5 = 7$

b. Since $34 < 35$,
the quotient will be less than the estimate.

6. $\$34 \div 5$

$$\begin{array}{r} 6.8 \\ 5\overline{)34.0} \\ -30 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

$\$6.80$

7. $34 \text{ cm} \div 5$

$$\begin{array}{r} 6.8 \\ 5\overline{)34.0} \\ -30 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

6.8 cm

8. 34 students ÷ 5

$$
\begin{array}{r}
6.8 \\
5\overline{)34.0} \\
-30 \\
\hline
40 \\
-40 \\
\hline
0
\end{array}
$$

Since there cannot be 0.8 of a car, 7 cars are needed.

7 cars

9.

$65 \div 6$	$11.\overline{5}$	12.6
$63 \div 5$	$115 \div 10$	$38 \div 3$
$10.8\overline{3}$	$1266 \div 100$	$10.\overline{83}$
$11.\overline{56}$	12.66	12.7
$254 \div 20$	11.5	$1145 \div 99$
$104 \div 9$	$12.\overline{6}$	$1073 \div 99$

REVIEW

1. O = 30

5	×	6	=	30
6	×	5	=	30
30	÷	5	=	6
30	÷	6	=	5

2. T = 4, R = 24

4	×	6	=	24
6	×	4	=	24
24	÷	4	=	6
24	÷	6	=	4

3. S = 54, E = 9

6	×	9	=	54
9	×	6	=	54
54	÷	6	=	9
54	÷	9	=	6

4. D = 7, I = 63

7	×	9	=	63
9	×	7	=	63
63	÷	7	=	9
63	÷	9	=	7

5. M = 36

3	×	12	=	36
12	×	3	=	36
36	÷	3	=	12
36	÷	12	=	3

6. H = 22

2	×	11	=	22
11	×	2	=	22
22	÷	2	=	11
22	÷	11	=	2

7. C = 72

8	×	9	=	72
9	×	8	=	72
72	÷	8	=	9
72	÷	9	=	8

8. N = 70

7	×	10	=	70
10	×	7	=	70
70	÷	7	=	10
70	÷	10	=	7

Why didn't the dime roll down the mountain with the nickel?

Because IT HAD MORE CENTS!

Upside Down Division and Prime Factorization

WARM-UP

a. $12 = 1 \cdot 12$
$12 = 2 \cdot 6$
$12 = 3 \cdot 4$

Factors: 1, 2, 3, 4, 6, 12

b. $20 = 1 \cdot 20$
$20 = 2 \cdot 10$
$20 = 4 \cdot 5$

Factors: 1, 2, 4, 5, 10, 20

PRACTICE

1. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

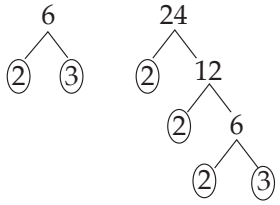
2. (650) (882) (1234) (162) 67 135 (98)

3. 0 or 5

4. 12 is even.
2

5. 35 ends in 5.
5

6. a.



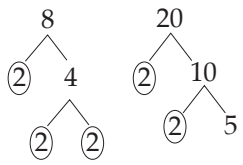
$6 = 2 \cdot 3$
$24 = 2 \cdot 2 \cdot 2 \cdot 3$
LCM: $2 \cdot 2 \cdot 2 \cdot 3 = 24$

b. $2|\underline{36}$
$2|\underline{18}$
$3|\underline{9}$
3

$2|\underline{162}$
$3|\underline{81}$
$3|\underline{27}$
$3|\underline{9}$
3

$36 = 2 \cdot 2 \cdot 3 \cdot 3$
$162 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
GCF: $2 \cdot 3 \cdot 3 = 18$

c.



$8 = 2 \cdot 2 \cdot 2$
$20 = 2 \cdot 2 \cdot 5$
LCM: $2 \cdot 2 \cdot 2 \cdot 5 = 40$

d. $5|\underline{45}$
$3|\underline{9}$
3

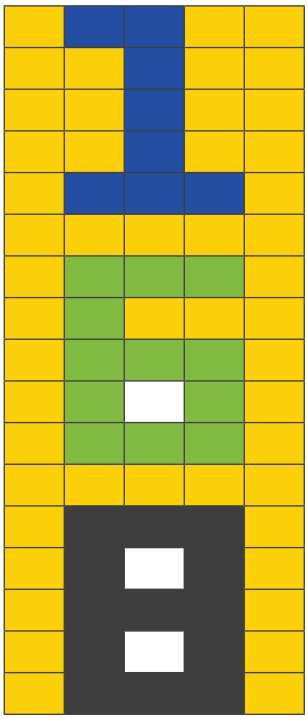
$3|\underline{117}$
$3|\underline{39}$
13

$45 = 3 \cdot 3 \cdot 5$
$117 = 3 \cdot 3 \cdot 13$
GCF: $3 \cdot 3 = 9$

e. $2|\underline{26}$
13

$5|\underline{65}$
13

$26 = 2 \cdot 13$
$65 = 5 \cdot 13$
GCF: 13



Total prime numbers between one and 1,000: 168

REVIEW

1. $20.00 - $16.52

$$\begin{array}{r} {}^{1}\cancel{2}\,{}^{9}\cancel{0}\,{}^{9}\cancel{.}\,{}^{1}\cancel{0}\,{}^{1}\cancel{0} \\ -\ 1\ 6\ .\ 5\ 2 \\ \hline 3\ .\ 4\ 8 \end{array}$$

$3.48

2. $20 + ? = 40$
$40 - 20 = 20$
The pattern is to add 20 in the y-column.

x	y
1	20
2	40
3	60
4	80

$17 + ? = 18$
$18 - 17 = 1$
The pattern is to add 1 in the y-column.

x	y
0	17
1	18
2	19
3	20

3. a. 55 is close to 54.
Estimate: $54 \div 6 = 9$

b. The answer will be greater than the estimate because 55 is greater than 54.

c. $55 \div 6 = 9.1667...$

$55 \div 6 = 9.1\overline{6}$

4. a. Round up because the hundredths place is 5 or greater.

854.0

b. Round down because the thousandths place is less than 5.

43.75

c. Round up because the tens place is 5 or greater.

1800

5. a.
$$\begin{array}{r} {\scriptstyle 1} \\ 658 \\ +\ 324 \\ \hline 982 \end{array}$$

b.
$$\begin{array}{r} 658 \\ -\ 324 \\ \hline 334 \end{array}$$

c.
$$\begin{array}{r} {\scriptstyle 1\,2} \\ {\scriptstyle \cancel{1}\,\cancel{7}} \\ {\scriptstyle \cancel{2}\,\cancel{3}} \\ 658 \\ \times\ 324 \\ \hline 2632 \\ 13160 \\ +\ 197400 \\ \hline 213192 \end{array}$$

6. $3 \bullet 2 = 6$

6 baby calves

Simplifying Fractions with Prime Factors

WARM-UP

a. $2|\underline{110}$
$5|\underline{55}$
11
$110 = 2 \cdot 5 \cdot 11$

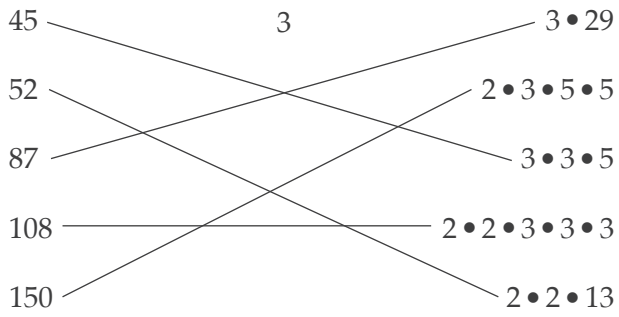
b. $3|\underline{225}$
$3|\underline{75}$
$5|\underline{25}$
5
$225 = 3 \cdot 3 \cdot 5 \cdot 5$

c. $2|\underline{84}$
$2|\underline{42}$
$3|\underline{21}$
7
$84 = 2 \cdot 2 \cdot 3 \cdot 7$

d. $2|\underline{126}$
$3|\underline{63}$
$3|\underline{21}$
7
$126 = 2 \cdot 3 \cdot 3 \cdot 7$

PRACTICE

1. $3|\underline{45}$ $3|\underline{15}$ 5 | $2|\underline{52}$ $2|\underline{26}$ 13 | $3|\underline{87}$ 29 | $2|\underline{108}$ $2|\underline{54}$ $3|\underline{27}$ $3|\underline{9}$ 3 | $2|\underline{150}$ $3|\underline{75}$ $5|\underline{25}$ 5



2. a. $2|\underline{38}$
19
$38 = 2 \cdot 19$

b. $2|\underline{48}$
$2|\underline{24}$
$2|\underline{12}$
$2|\underline{6}$
3
$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$

c. $2|\underline{72}$
$2|\underline{36}$
$2|\underline{18}$
$3|\underline{9}$
3
$72 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

d. $3|\underline{135}$
$3|\underline{45}$
$3|\underline{15}$
5
$135 = 3 \cdot 3 \cdot 3 \cdot 5$

3. a. $\frac{38}{48} = \frac{\cancel{2} \cdot 19}{\cancel{2} \cdot 2 \cdot 2 \cdot 2 \cdot 3} = \frac{19}{2 \cdot 2 \cdot 2 \cdot 3} = \frac{19}{24}$

b. $\frac{72}{135} = \frac{2 \cdot 2 \cdot 2 \cdot \cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot 3 \cdot 5} = \frac{2 \cdot 2 \cdot 2}{3 \cdot 5} = \frac{8}{15}$

4. a. 2

b. $\frac{18}{72} = \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{3}}{2 \cdot 2 \cdot \cancel{2} \cdot \cancel{3} \cdot \cancel{3}} = \frac{1}{2 \cdot 2} = \frac{1}{4}$

Denominator: 4

c. $2|\underline{24}$
$2|\underline{12}$
$2|\underline{6}$
3

$24 = 2 \cdot 2 \cdot 2 \cdot 3$

$2|\underline{40}$
$2|\underline{20}$
$2|\underline{10}$
5

$40 = 2 \cdot 2 \cdot 2 \cdot 5$

GCF: $2 \cdot 2 \cdot 2 = 8$

d. $2|\underline{78}$
$3|\underline{39}$
13

$7|\underline{91}$
13

$\frac{78}{91} = \frac{2 \cdot 3 \cdot \cancel{13}}{7 \cdot \cancel{13}} = \frac{2 \cdot 3}{7} = \frac{6}{7}$

Numerator: 6

e. 2

f. 0

g. $2|\underline{34}$
17

$2|\underline{136}$
$2|\underline{68}$
$2|\underline{34}$
17

$\frac{34}{136} = \frac{\cancel{2} \cdot \cancel{17}}{2 \cdot 2 \cdot \cancel{2} \cdot \cancel{17}} = \frac{1}{2 \cdot 2} = \frac{1}{4}$

Denominator: 4

h. $2|\underline{96}$
$2|\underline{48}$
$2|\underline{24}$
$2|\underline{12}$
$2|\underline{6}$
3

$2|\underline{156}$
$2|\underline{78}$
$3|\underline{39}$
13

$\frac{96}{156} = \frac{2 \cdot 2 \cdot 2 \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{3}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{3} \cdot 13} = \frac{2 \cdot 2 \cdot 2}{13} = \frac{8}{13}$

Numerator: 8

The largest known prime number has this many digits:
24,862,048

REVIEW

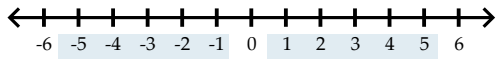
1. $2|\underline{44}$
$2|\underline{22}$
11

$44 = 2 \cdot 2 \cdot 11$

$2|\underline{110}$
$5|\underline{55}$
11

$110 = 2 \cdot 5 \cdot 11$

GCF: $2 \cdot 11 = 22$

2. 

3. Point *A*: –3.5
Point *B*: –0.5
Point *C*: 4.5

4. 84 inches ÷ 12 inches / foot = 7 feet

5. 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96

6. a. $16 \div 8 = 2$
$2 \cdot 7 = 14$

b. $32 \div 8 = 4$
$4 \cdot 7 = 28$

c. $56 \div 8 = 7$
$7 \cdot 7 = 49$

7. a. 3.86 rounds to 4.
8.94 rounds to 9.
$4 \cdot 9 = 36$
$3.86 \cdot 8.94 \approx 36$

b. The exact answer will be less than 36 because each number was rounded up to the estimates.

Multi-Digit Division

WARM-UP

$29 \div 4$

$$
\begin{array}{r}
7.25 \\
4\overline{)29.00} \\
-28 \\
\hline
10 \\
-\ 8 \\
\hline
20 \\
-20 \\
\hline
0
\end{array}
$$

7.25 and $7\frac{1}{4}$

PRACTICE

1. 1,680 can be rounded to 1,600.
$1600 \div 400 = 4$
$1680 \div 400 \approx 4$

2. $1680 \div 400 \rightarrow 168 \div 40$

$$
\begin{array}{r}
4 \\
40\overline{)168} \\
-160 \\
\hline
8
\end{array}
$$

$1680 \div 400 = 4\frac{8}{40} = 4\frac{1}{5}$

3. a. 2,720 can be rounded to 2,500.
$2500 \div 500 = 25 \div 5 = 5$
$2750 \div 500 \approx 5$

b. The quotient will be greater than the estimate because $2{,}720 > 2{,}500$.

c. $2720 \div 500 \rightarrow 272 \div 50$

$$
\begin{array}{r}
5 \\
50\overline{)272} \\
-250 \\
\hline
22
\end{array}
$$

$2720 \div 500 = 5\frac{22}{50} = 5\frac{11}{25}$

4. E $2600 \div 200 \rightarrow 26 \div 2$

$$
\begin{array}{r}
13 \\
2\overline{)26} \\
-2 \\
\hline
06 \\
-\ 6 \\
\hline
0
\end{array}
$$

$2600 \div 200 = 13$

R $2550 \div 300 \rightarrow 255 \div 30$

$$
\begin{array}{r}
8.5 \\
30\overline{)255.0} \\
-240 \\
\hline
150 \\
-150 \\
\hline
0
\end{array}
$$

$2550 \div 300 = 8.5$

T $4680 \div 660 \rightarrow 468 \div 66$

$$
\begin{array}{r}
7.09\ldots \\
66\overline{)468.00\ldots} \\
-462 \\
\hline
60 \\
-\ 0 \\
\hline
600 \\
-594 \\
\hline
6
\end{array}
$$

$4680 \div 660 = 7.0\overline{9}$

M $8800 \div 750 \rightarrow 880 \div 75$

$$
\begin{array}{r}
11.73\ldots \\
75\overline{)880.00\ldots} \\
-75 \\
\hline
130 \\
-\ 75 \\
\hline
550 \\
-525 \\
\hline
250 \\
-225 \\
\hline
25
\end{array}
$$

$8800 \div 750 = 11.7\overline{3}$

H $0 \div 1234 = 0$

F $1234 \div 0 =$ undefined

A $6960 \div 480 \rightarrow 696 \div 48$

$$
\begin{array}{r}
14.5 \\
48\overline{)696.00} \\
-48 \\
\hline
216 \\
-192 \\
\hline
240 \\
-240 \\
\hline
0
\end{array}
$$

$6960 \div 480 = 14.5$

THE AFTERMATH

REVIEW

1. $2\overline{)24}$ $2\overline{)12}$ $2\overline{)6}$ 3 and $2\overline{)112}$ $2\overline{)56}$ $2\overline{)28}$ $2\overline{)14}$ 7

GCF: $2 \cdot 2 \cdot 2 = 8$

LCM: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 7 = 336$

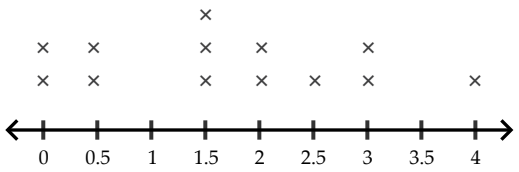
2. $\frac{99}{154} = \frac{3 \cdot 3 \cdot \cancel{11}}{2 \cdot 7 \cdot \cancel{11}} = \frac{3 \cdot 3}{2 \cdot 7} = \frac{9}{14}$

3. 

12 flowers $\div 3 = 4$ flowers

4 flowers $\cdot 2 = 8$ flowers

4. 31, 37, 41, 43, 47

5. 

6. a. 4 hours

b. 1.5 hours

Converting Between Fractions and Decimals

WARM-UP

1. a. $6^2 = 6 \bullet 6 = 36$
   b. $7^2 = 7 \bullet 7 = 49$
   c. $\sqrt{100} = 10$
   d. $\sqrt{9} = 3$

2. a. $3 \bullet 9 = 27$ $27 \bullet 10 = 270$
   $30 \bullet 9 = 270$
   b. $32 \bullet 3 = 96$ $96 \bullet 10 = 960$
   $32 \bullet 30 = 960$

PRACTICE

1. a. $15\overline{)7.00...}$ = 0.46...
   $-6\,0$
   $1\,00$
   $-\ 90$
   10

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

   b. $15\overline{)6.0}$ = 0.4
   $-6\,0$
   0

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

   c. $14\overline{)21.0}$ = 1.5
   -14
   $7\,0$
   $-7\,0$
   0

   $\frac{21}{14} = 1.5$

2. a. $2 \bullet 5 = 10$
   $10 + 1 = 11$

   $2\frac{1}{5} = \frac{11}{5}$

   b. $5\overline{)11.0}$ = 2.2
   -10
   $1\,0$
   $-1\,0$
   0

   $\frac{11}{5} = 2.2$

3. a. 0.23 ends in the hundredths place.
   $0.23 = \frac{23}{100}$

   b. 1.76 ends in the hundredths place.
   $1.76 = 1\frac{76}{100} = 1\frac{19}{25}$

   c. 8.56 ends in the hundredths place.
   $8.56 = 8\frac{56}{100} = 8\frac{14}{25}$

4. 5.224 ends in the thousandths place.

$$\begin{array}{r|l} 2 & 224 \\ 2 & 112 \\ 2 & 56 \\ 2 & 28 \\ 2 & 14 \\ & 7 \end{array} \qquad \begin{array}{r|l} 2 & 1000 \\ 2 & 500 \\ 2 & 250 \\ 5 & 125 \\ 5 & 25 \\ & 5 \end{array}$$

$$5.224 = 5\frac{224}{1000} = 5\frac{\cancel{2}\cdot\cancel{2}\cdot\cancel{2}\cdot 2\cdot 2\cdot 7}{\cancel{2}\cdot\cancel{2}\cdot\cancel{2}\cdot 5\cdot 5\cdot 5} = 5\frac{28}{125}$$

5. 3.522 ends in the thousandths place.

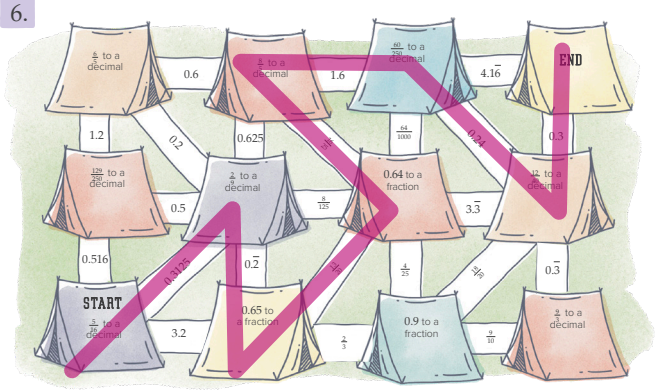
$$3.522 = 3\frac{522}{1000} = 3\frac{261}{500}$$

$$3 \cdot 500 = 1500$$

$$\begin{array}{r} 1500 \\ +\ 261 \\ \hline 1761 \end{array}$$

$$3.522 = \frac{1761}{500}$$

6.



A
$$\begin{array}{r} 0.3125 \\ 16\overline{)5.0000} \\ -4\,8 \\ \hline 20 \\ -16 \\ \hline 40 \\ -32 \\ \hline 80 \\ -80 \\ \hline 0 \end{array} \qquad \frac{5}{16} = 0.3125$$

B
$$\begin{array}{r} 0.22\ldots \\ 9\overline{)2.0\ldots} \\ -1\,8 \\ \hline 2 \end{array} \qquad \frac{2}{9} = 0.\overline{2}$$

C 0.65 ends in the hundredths place.

$$\frac{65}{100} = \frac{13}{20}$$

D 0.64 ends in the hundredths place.

$$\frac{64}{100} = \frac{16}{25}$$

E
$$\begin{array}{r} 1.6 \\ 5\overline{)8.0} \\ -5 \\ \hline 3\,0 \\ -3\,0 \\ \hline 0 \end{array} \qquad \frac{8}{5} = 1.6$$

F
$$\begin{array}{r} 0.24 \\ 25\overline{)6.00} \\ -5\,0 \\ \hline 1\,00 \\ -1\,00 \\ \hline 0 \end{array} \qquad \frac{60}{250} = \frac{6}{25} = 0.24$$

G
$$\begin{array}{r} 0.3 \\ 10\overline{)3.0} \\ -3\,0 \\ \hline 0 \end{array} \qquad \frac{12}{40} = \frac{3}{10} = 0.3$$

REVIEW

1. $132 \div 12 = 11$
   11 feet

2. a. $133 \div 99 = 1.3434\ldots = 1.\overline{34}$
   b. $233 \div 99 = 2.3535\ldots = 2.\overline{35}$
   c. $333 \div 99 = 3.3636\ldots = 3.\overline{36}$
   d. $433 \div 99 = 4.3737\ldots = 4.\overline{37}$

3. a. Answers may vary.
   b. $533 \div 99 = 5.3838\ldots = 5.\overline{38}$

4. a.
   $2\overline{)162}$
   $3\overline{)81}$
   $3\overline{)27}$
   $3\overline{)9}$
   3
   $162 = 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

   b.
   $2\overline{)800}$
   $2\overline{)400}$
   $2\overline{)200}$
   $2\overline{)100}$
   $2\overline{)50}$
   $5\overline{)25}$
   5
   $800 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5$

   c.
   $3\overline{)525}$
   $5\overline{)175}$
   $5\overline{)35}$
   7
   $525 = 3 \cdot 5 \cdot 5 \cdot 7$

   d.
   $3\overline{)735}$
   $5\overline{)245}$
   $7\overline{)49}$
   7
   $735 = 3 \cdot 5 \cdot 7 \cdot 7$

5. a. $\frac{162}{800} = \frac{\cancel{2} \cdot 3 \cdot 3 \cdot 3 \cdot 3}{\cancel{2} \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5} = \frac{81}{400}$

   b. $\frac{525}{735} = \frac{\cancel{3} \cdot \cancel{5} \cdot 5 \cdot \cancel{7}}{\cancel{3} \cdot \cancel{5} \cdot 7 \cdot \cancel{7}} = \frac{5}{7}$

6.
$$\begin{array}{r} 12.6\ldots \\ 15\overline{)190.0\ldots} \\ -15 \\ \hline 40 \\ -30 \\ \hline 100 \\ -90 \\ \hline 10 \end{array}$$

   $190 \div 15 = 12.\overline{6} \approx 13$

7. a. $9400 \div 450 \rightarrow 940 \div 45$

$$\begin{array}{r} 20.8\ldots \\ 45\overline{)940.0\ldots} \\ -90 \\ \hline 400 \\ -360 \\ \hline 40 \end{array}$$

   $9400 \div 450 = 20.\overline{8}$

   b. $5320 \div 160 \rightarrow 532 \div 16$

$$\begin{array}{r} 33.25 \\ 16\overline{)532.00} \\ -48 \\ \hline 52 \\ -48 \\ \hline 40 \\ -32 \\ \hline 80 \\ -80 \\ \hline 0 \end{array}$$

   $5320 \div 160 = 33.25$

Adding and Subtracting Integers

WARM-UP

a. $\begin{array}{r} {}^{8}\not{9}\,{}^{1}7 \\ -\,6\,9 \\ \hline 2\,8 \end{array}$

b. $\begin{array}{r} {}^{1}\,4\,8 \\ +\,7\,6 \\ \hline 1\,2\,4 \end{array}$

c. $29 - 29 = 0$

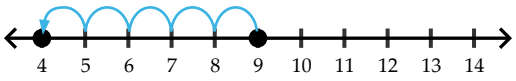
d. $60 - 57 = 3$

PRACTICE

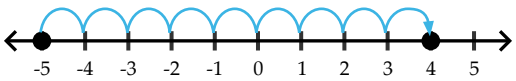
1.

	Answer Is Positive	Answer Is Negative	Answer Is Zero
$-8 + 10$ *Opposite signs,* $\lvert 10 \rvert > \lvert -8 \rvert$	✓		
$-4 + (-2)$ *Same signs, negative*		✓	
$36 + (-36)$ *Opposites*			✓
$-50 + 23$ *Opposite signs,* $\lvert -50 \rvert > \lvert 23 \rvert$		✓	
$\lvert -5 \rvert$ *Absolute values are positive or zero.*	✓		
$\lvert 0 \rvert$ *Zero is not positive or negative.*			✓
the opposite of 9 *Opposite of positive is negative.*		✓	
the opposite of –7 *Opposite of negative is positive.*	✓		

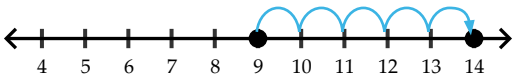
2. a. 4



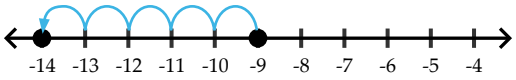
b. 4



c. 14



d. –14



3. $-1 + 12 = 11$
Level 11

4. $11 - (-6) = 11 + 6 = 17$

5. a. $63 - 86 = 63 + (-86)$

Different signs, subtract absolute values.

$$\begin{array}{r} 86 \\ -\ 63 \\ \hline 23 \end{array}$$

$|-86| > |63|$

Answer is negative.

$63 - 86 = -23$

b. $-25 - 41 = -25 + (-41)$

Same sign, add absolute values. Answer is negative.

$$\begin{array}{r} 25 \\ +\ 41 \\ \hline 66 \end{array}$$

$-25 - 41 = -66$

c. $-57 + 95$

Different signs, subtract absolute values.

$$\begin{array}{r} {}^{8}\not{9}\,{}^{1}5 \\ -\ 5\,7 \\ \hline 3\,8 \end{array}$$

$|95| > |-57|$

Answer is positive.

$-57 + 95 = 38$

6. $530 - (-220) = 530 + 220$

$$\begin{array}{r} 530 \\ +\ 220 \\ \hline 750 \end{array}$$

$530 - (-220) = 750$

7. GREEN: $-23 + 23 = 0$

WHITE: $-42 + 50 = 50 - 42 = 8$

ORANGE: $16 - 29 = 16 + (-29)$

$29 - 16 = 13$

$|-29| > |16|$

$16 - 29 = -13$

YELLOW: $14 - (-4) = 14 + 4 = 18$

TAN: $-11 + 14 = 14 - 11 = 3$

PURPLE: $3 + 3 = 6$

$-3 + (-3) = -6$

BLUE: $-21 - (-18) = -21 + 18$

$21 - 18 = 3$

$|-21| > |18|$

$-21 - (-18) = -3$

RED: $-5 - 3 = -5 + (-3) = -8$

8	8	–8	–8	–8	–8	8	8
8	–8	–8	–8	–8	–8	–8	8
–8	–8	–8	–8	–8	–8	–8	–8
–8	–8	–8	–8	–8	–8	–8	–8
–13	–13	–13	–13	–13	–13	–13	–13
–13	–13	–13	–13	–13	–13	–13	–13
–6	–6	–6	–6	–6	–6	–6	–6
–6	–6	–6	–6	–6	–6	–6	–6
–3	–3	–3	–3	–3	–3	–3	–3
–3	–3	–3	–3	–3	–3	–3	–3
18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
8	8	8	3	3	8	8	8
8	8	8	3	3	8	8	8
8	8	8	3	3	8	8	8

REVIEW

1. a.
$$8\overline{)5.000}\quad 0.625$$
$$-48$$
$$20$$
$$-16$$
$$40$$
$$-40$$
$$0$$

$\frac{5}{8} = 0.625$

b.
$$60\overline{)52.00\ldots}\quad 0.86\ldots$$
$$-480$$
$$400$$
$$-360$$
$$40$$

$\frac{52}{60} = 0.8\overline{6}$

c.
$$120\overline{)72.0}\quad 0.6$$
$$-720$$
$$0$$

$\frac{72}{120} = 0.6$

2. a.
$$10\overline{)438}\quad 43$$
$$-40$$
$$38$$
$$-30$$
$$8$$

$43\frac{8}{10} = 43\frac{4}{5}$

b.
$$30\overline{)8885}\quad 296$$
$$-60$$
$$288$$
$$-270$$
$$185$$
$$-180$$
$$5$$

$296\frac{5}{30} = 296\frac{1}{6}$

3. a. 50% of 10 is one half of 10. Half of 10 is 5.

b. 10% of 50 is one tenth of 50. One tenth of 50 is 50 divided by 10, which is 5.

4.
$$\begin{array}{r} {}^{1}65 \\ \times\ 3 \\ \hline 195 \end{array}$$

195 miles

5. a. January

b. $200

c.
$$5\overline{)200}\quad 40$$
$$-20$$
$$00$$
$$-00$$
$$0$$

$200 \div 5 = 40$

d. Answers may vary. Sample answer: There was more snowfall in January than in February.

Multiplying and Dividing Integers

WARM-UP

a. $-5+(-5)+(-5)=-10+(-5)=-15$

b. $-3+(-3)+(-3)+(-3)=-6+(-3)+(-3)=-9+(-3)=-12$

c. $12 \bullet 8 = 96$

d. $56 \div 7 = 8$

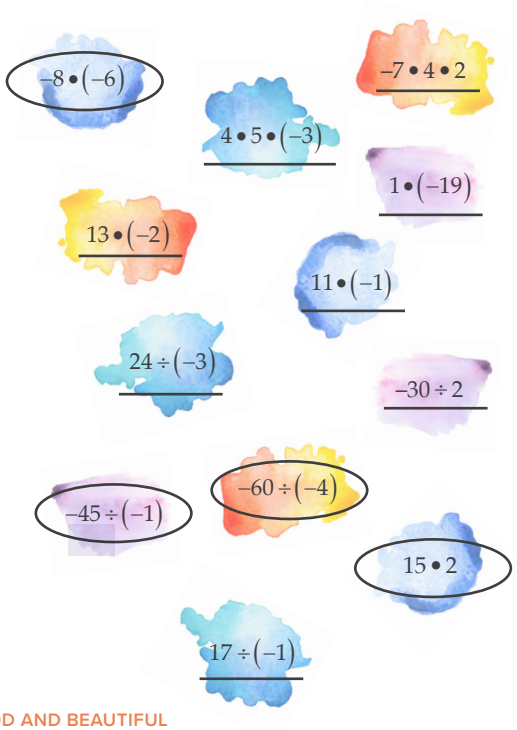
e. $2 \bullet 6 \bullet 7 = 12 \bullet 7 = 84$

PRACTICE

1.

	Repeated Addition	Answer
$-4 \bullet 3$	$-4+(-4)+(-4)$	-12
$-6 \bullet 4$	$-6+(-6)+(-6)+(-6)$	-24
$-2 \bullet 5$	$-2+(-2)+(-2)+(-2)+(-2)$	-10
$-9 \bullet 5$	$-9+(-9)+(-9)+(-9)+(-9)$	-45

2.



3. $4 \bullet (-3) = -12$

4. a. -4

b. -1

c. 2

d. -6

5. The student should have completed and colored in at least five squares in a row.

5	-90	-10	-2	-630
-76	-8	12	108	-56
0	-10	10	-4	-11
-8	6	132	1	-121
-9	-49	150	0	-11

REVIEW

1. a.
$$25\overline{)1835}\quad 73$$
$$-175$$
$$85$$
$$-75$$
$$10$$
$$73\frac{10}{25}=73\frac{2}{5}$$

b. $2210\div 40\rightarrow 221\div 4$
$$4\overline{)221}\quad 55$$
$$-20$$
$$21$$
$$-20$$
$$1$$
$$2210\div 40=55\frac{1}{4}$$

2. a. $456\div 7=65.14285714\ldots\approx 65.1429$

b. $1654\div 17=97.29411764\ldots\approx 97.2941$

3. a.
$$3\overline{)165}$$
$$5\overline{)55}$$
$$11$$
$$165=3\cdot 5\cdot 11$$

b.
$$2\overline{)440}$$
$$2\overline{)220}$$
$$2\overline{)110}$$
$$5\overline{)55}$$
$$11$$
$$440=2\cdot 2\cdot 2\cdot 5\cdot 11$$

4. $$\frac{165}{440}=\frac{3\cdot \cancel{5}\cdot \cancel{11}}{2\cdot 2\cdot 2\cdot \cancel{5}\cdot \cancel{11}}=\frac{3}{8}$$

5. a. $2.017=2\frac{17}{1000}$

b. $5.175=5\frac{175}{1000}=5\frac{7}{40}$

6. $150-400=150+(-400)$

$$\begin{array}{r} {}^{3}\cancel{4}{}^{1}00 \\ -\ 150 \\ \hline 250 \end{array}$$

$|-400|>|150|$

$150-400=-250$

150 points – 400 points = –250 points

Multiplying and Dividing Fractions

WARM-UP

a. $-5 \bullet 2 \bullet (-12) = -10 \bullet (-12) = 120$

b. $24 \div (-4) = -6$

c. $20 \div (-2) \div 5 = -10 \div 5 = -2$

PRACTICE

1. a. 3

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

c. $\frac{9}{6} = \frac{3}{2}$

d. $\frac{1}{11}$

e. $7\frac{1}{2} = \frac{15}{2}$

$\frac{2}{15}$

2. a. $\frac{7}{8} < 1$, $<$

b. $\frac{5}{3} > 1$, $>$

c. $\frac{7}{6} > 1$, $>$

3. a. $-\frac{\cancel{9}^{3}}{\cancel{16}_{8}} \bullet \frac{\cancel{2}^{1}}{\cancel{3}_{1}} = -\frac{3}{8}$

b. $-\frac{\cancel{15}^{3}}{\cancel{21}_{7}} \bullet \left(-\frac{\cancel{9}^{3}}{\cancel{5}_{1}}\right) = \frac{9}{7} = 1\frac{2}{7}$

4. a. $2\frac{3}{4} \bullet 6 = \frac{11}{\cancel{4}_{2}} \bullet \frac{\cancel{6}^{3}}{1} = \frac{33}{2} = 16\frac{1}{2}$

b. $4\frac{1}{6} \bullet 1\frac{1}{5} = \frac{\cancel{25}^{5}}{\cancel{6}_{1}} \bullet \frac{\cancel{6}^{1}}{\cancel{5}_{1}} = 5$

5. a. $\frac{7}{\cancel{3}_{1}} \bullet \frac{1}{2} \bullet \frac{\cancel{3}^{1}}{5} = \frac{7}{10}$

b. $\frac{5}{7} \bullet \frac{1}{3} \bullet \frac{4}{3} = \frac{20}{63}$

6. $4 \div \frac{1}{4} = 4 \bullet 4 = 16$

16 bowls

7. $10 \div \frac{1}{2} = 10 \bullet 2 = 20$

20 boards

8. a. $\frac{11}{18} \div \frac{11}{18} = \frac{\cancel{11}^{1}}{\cancel{18}_{1}} \bullet \frac{\cancel{18}^{1}}{\cancel{11}_{1}} = 1$

b. $\frac{1}{\cancel{12}_{4}} \bullet \frac{\cancel{3}^{1}}{7} = \frac{1}{28}$

c. $-\frac{\cancel{4}^{1}}{9} \bullet \left(-\frac{13}{\cancel{20}_{5}}\right) = \frac{13}{45}$

d. $-\frac{5}{11} \div \frac{10}{33} = -\frac{\cancel{5}^{1}}{\cancel{11}_{1}} \bullet \frac{\cancel{33}^{3}}{\cancel{10}_{2}} = -\frac{3}{2} = -1\frac{1}{2}$

e. $-2 \div \frac{1}{5} = -2 \bullet 5 = -10$

f. $9 \bullet \left(-\frac{4}{15}\right) = \frac{\cancel{9}^{3}}{1} \bullet \left(-\frac{4}{\cancel{15}_{5}}\right) = -\frac{12}{5} = -2\frac{2}{5}$

g. $\frac{7}{8} \bullet \frac{3}{2} = \frac{21}{16} = 1\frac{5}{16}$

REVIEW

1. a. $9 \bullet (-9) = -81$
   b. $-12 \bullet (-12) = 144$

2. a. $-72 \div 12 = -6$
   b. $56 \div (-8) = -7$

3. a. $92 - 108 = 92 + (-108)$

$$\begin{array}{r} 108 \\ -\ 92 \\ \hline 16 \end{array}$$

$|-108| > |92|$

$92 - 108 = -16$

   b. $-7 - (-18) = -7 + 18$

$18 - 7 = 11$

$|18| > |-7|$

$18 - 7 = 11$

4.

$$\begin{array}{r|l} 2 & 52 \\ \hline 2 & 26 \\ \hline 13 & \end{array} \qquad \begin{array}{r|l} 2 & 234 \\ \hline 3 & 117 \\ \hline 3 & 39 \\ \hline 13 & \end{array}$$

$52 = 2 \bullet 2 \bullet 13$
$234 = 2 \bullet 3 \bullet 3 \bullet 13$

GCF: $2 \bullet 13 = 26$
LCM: $2 \bullet 2 \bullet 3 \bullet 3 \bullet 13 = 468$

5. $16 = 12 + 4$
6:30 PM + 12 hours = 6:30 AM on December 2
6:30 AM + 4 hours = 10:30 AM
Date: December 2
Time: 10:30 AM

6. a. $940 \div 30 = 94 \div 3$

$$\begin{array}{r} 31.3\ldots \\ 3\overline{)94.0\ldots} \\ -9 \\ \hline 04 \\ -\ 3 \\ \hline 10 \\ -9 \\ \hline 1 \end{array}$$

$940 \div 30 = 31.\overline{3}$

   b. $1260 \div 90 = 126 \div 9$

$$\begin{array}{r} 14 \\ 9\overline{)126} \\ -\ 9 \\ \hline 36 \\ -36 \\ \hline 0 \end{array}$$

$1260 \div 90 = 14$

7. 1.55

Complex Fractions

WARM-UP

a. $-\frac{6}{11} \div \frac{3}{4}$

$= -\frac{\cancel{6}^{2}}{11} \bullet \frac{4}{\cancel{3}_{1}}$

$= \boxed{-\frac{8}{11}}$

b. $-2\frac{1}{2} \div 10$

$= -\frac{5}{2} \div 10$

$= -\frac{\cancel{5}^{1}}{2} \bullet \frac{1}{\cancel{10}_{2}}$

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

PRACTICE

1. a. $\boxed{-\frac{4}{11} \div \left(-\frac{3}{5}\right)}$

b. $\boxed{\frac{9}{10} \div 3}$

c. $\boxed{-6 \div \frac{7}{12}}$

d. $\boxed{\frac{5}{3} \div \frac{1}{9}}$

2. a. $\boxed{\dfrac{10\frac{1}{2}}{\frac{3}{4}}}$

b. $10\frac{1}{2} \div \frac{3}{4}$

$= \frac{21}{2} \div \frac{3}{4}$

$= \frac{\cancel{21}^{7}}{\cancel{2}_{1}} \bullet \frac{\cancel{4}^{2}}{\cancel{3}_{1}}$

$= 14$

$\boxed{14 \text{ bags}}$

3. a. $\frac{14}{15} \div 2\frac{1}{3}$

$= \frac{14}{15} \div \frac{7}{3}$

$= \frac{\cancel{14}^{2}}{\cancel{15}_{5}} \bullet \frac{\cancel{3}^{1}}{\cancel{7}_{1}}$

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

b. $\frac{9}{8} \div \left(-\frac{7}{2}\right)$

$= \frac{9}{\cancel{8}_{4}} \bullet \left(-\frac{\cancel{2}^{1}}{7}\right)$

$= \boxed{-\frac{9}{28}}$

c. $-\frac{15}{2} \div 3$

$= -\frac{\cancel{15}^{5}}{2} \bullet \frac{1}{\cancel{3}_{1}}$

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

$= \boxed{-2\frac{1}{2}}$

d. $\frac{5}{11} \div (-5)$

$= \frac{\overset{1}{\cancel{5}}}{11} \bullet \left(-\frac{1}{\underset{1}{\cancel{5}}}\right)$

$= -\frac{1}{11}$

e. $-\frac{8}{25} \div \left(-\frac{1}{3}\right)$

$= -\frac{8}{25} \bullet \left(-\frac{3}{1}\right)$

$= \frac{24}{25}$

f. $12 \div \frac{3}{4}$

$= \frac{\overset{4}{\cancel{12}}}{1} \bullet \frac{4}{\underset{1}{\cancel{3}}}$

$= 16$

g. $-\frac{6}{7} \div \frac{12}{5}$

$= -\frac{\overset{1}{\cancel{6}}}{7} \bullet \frac{5}{\underset{2}{\cancel{12}}}$

$= -\frac{5}{14}$

h. $3\frac{5}{9} \div \frac{8}{3}$

$= \frac{32}{9} \div \frac{8}{3}$

$= \frac{\overset{4}{\cancel{32}}}{\underset{3}{\cancel{9}}} \bullet \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{8}}}$

$= \frac{4}{3}$

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

i. $96 \div 1\frac{1}{3}$

$= 96 \div \frac{4}{3}$

$= \frac{96}{1} \div \frac{4}{3}$

$= \frac{\overset{24}{\cancel{96}}}{1} \bullet \frac{3}{\underset{1}{\cancel{4}}}$

$= 72$

j. $22\frac{1}{2} \div \frac{1}{2}$

$= \frac{45}{2} \div \frac{1}{2}$

$= \frac{45}{\underset{1}{\cancel{2}}} \bullet \frac{\overset{1}{\cancel{2}}}{1}$

$= 45$

Destination	Accommodation	Adventures
~~Hawaii~~ 45	luxury yurt $\frac{1}{11}$	~~amusement park~~ $1\frac{1}{3}$
Australia $2\frac{1}{2}$	~~hotel suite~~ $\frac{2}{5}$	~~zip-lining~~ $-\frac{1}{11}$
~~Florida~~ $-\frac{9}{28}$	~~cruise ship~~ 16	museum 22
~~Alaska~~ $-\frac{5}{14}$	~~private cabin~~ 72	helicopter tour $\frac{2}{3}$
~~Jamaica~~ $\frac{24}{25}$	~~family resort~~ $-2\frac{1}{2}$	scuba diving $-\frac{24}{25}$

REVIEW

1. $4\frac{5}{6} \cdot 1\frac{3}{4}$

$= \frac{29}{6} \cdot \frac{7}{4}$

$= \frac{203}{24}$

$= 8\frac{11}{24}$

2. a. -28

b. -28

3. a. $15 + (-32)$

$32 - 15 = 17$

$|-32| > |15|$

$15 + (-32) = -17$

b. $-15 + 32$

$32 - 15 = 17$

$|32| > |-15|$

$-15 + 32 = 17$

4. $80\overline{)1888}$ quotient 23

-160

288

-240

48

$1888 \div 80 = 23\frac{48}{80} = 23\frac{3}{5}$

5. a. $2\frac{54}{100} = 2\frac{27}{50} = \frac{127}{50}$

b. $3\frac{14}{100} = 3\frac{7}{50} = \frac{157}{50}$

6. $150 \text{ gallons} \div 2 = 75 \text{ gallons}$

$75 \text{ gallons} \div 3 \text{ gallons/minute} = 25 \text{ minutes}$

7. a. $3\overline{)63}$

$3\overline{)21}$

7

$63 = 3 \cdot 3 \cdot 7$

b. $3\overline{)117}$

$3\overline{)39}$

13

$117 = 3 \cdot 3 \cdot 13$

8. $\frac{63}{117} = \frac{\cancel{3} \cdot \cancel{3} \cdot 7}{\cancel{3} \cdot \cancel{3} \cdot 13} = \frac{7}{13}$

Adding and Subtracting Fractions

WARM-UP

1. a. 5
   b. –56
   c. 109
   d. –1493

2. a. $2+(-3)+3+(-1)$
   $=-1+3+(-1)$
   $=2+(-1)$
   $=1$

   b. $-4+5+3+(-6)$
   $=1+3+(-6)$
   $=4+(-6)$
   $=-2$

PRACTICE

1. a. 60 is the smallest common multiple of 20 and 12.

   60 is the least common denominator.

   b. 54 is the smallest common multiple of 6 and 27.

   54 is the least common denominator.

   c. 121 is the smallest common multiple of 11 and 121.

   121 is the least common denominator.

2. a. $\frac{2}{3}-\frac{3}{5}$
   $=\frac{10}{15}-\frac{9}{15}$
   $=\frac{1}{15}$

   b. $\frac{3}{5}-\frac{2}{3}$
   $=\frac{9}{15}-\frac{10}{15}$
   $=-\frac{1}{15}$

   c. $\frac{11}{16}-\frac{1}{4}$
   $=\frac{11}{16}-\frac{4}{16}$
   $=\frac{7}{16}$

   d. $\frac{1}{4}-\frac{11}{16}$
   $=\frac{4}{16}-\frac{11}{16}$
   $=-\frac{7}{16}$

3. a. $3\frac{1}{3}+5\frac{5}{18}$
   $=\frac{10}{3}+\frac{95}{18}$
   $=\frac{60}{18}+\frac{95}{18}$
   $=\frac{155}{18}$
   $=8\frac{11}{18}$

b. $-3\frac{1}{3}+\left(-5\frac{5}{18}\right)$

$=-\frac{10}{3}+\left(-\frac{95}{18}\right)$

$=-\frac{60}{18}+\left(-\frac{95}{18}\right)$

$=-\frac{155}{18}=-8\frac{11}{18}$

4. a. $\frac{21}{25}+\left(-\frac{3}{5}\right)$

$=\frac{21}{25}+\left(-\frac{15}{25}\right)$

$=\frac{6}{25}$

b. $\frac{3}{5}+\left(-\frac{21}{25}\right)$

$=\frac{15}{25}+\left(-\frac{21}{25}\right)$

$=-\frac{6}{25}$

5. a. $10\frac{1}{6}-8\frac{2}{3}$

$=\frac{61}{6}-\frac{26}{3}$

$=\frac{61}{6}-\frac{52}{6}$

$=\frac{9}{6}$

$=\frac{3}{2}$

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

b. $-3\frac{8}{9}+4\frac{24}{27}$

$=-\frac{35}{9}+\frac{132}{27}$

$=-\frac{105}{27}+\frac{132}{27}$

$=\frac{27}{27}$

$=1$

c. $\frac{10}{4}+\frac{8}{16}$

$=\frac{40}{16}+\frac{8}{16}$

$=\frac{48}{16}$

$=3$

d. $6\frac{2}{5}+\left(-4\frac{9}{10}\right)$

$=\frac{32}{5}+\left(-\frac{49}{10}\right)$

$=\frac{64}{10}+\left(-\frac{49}{10}\right)$

$=\frac{15}{10}$

$=\frac{3}{2}$

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

e. $\frac{1}{6}-\left(-1\frac{1}{3}\right)$

$=\frac{1}{6}+1\frac{1}{3}$

$=\frac{1}{6}+\frac{4}{3}$

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

$=\frac{9}{6}$

$=\frac{3}{2}$

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

f. $-\frac{3}{10}+\frac{11}{20}$

$=-\frac{6}{20}+\frac{11}{20}$

$=\frac{5}{20}$

$=\frac{1}{4}$

g. $7\frac{5}{6}-\frac{49}{12}$

$=\frac{47}{6}-\frac{49}{12}$

$=\frac{94}{12}-\frac{49}{12}$

$=\frac{45}{12}$

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

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

h. $-\frac{3}{7}+2\frac{3}{7}$

$=-\frac{3}{7}+\frac{17}{7}$

$=\frac{14}{7}$

$=2$

REVIEW

1. Round 48 to 50.

$3500 \div 50 = 350 \div 5 = 70$

$3540 \div 48 \approx 70$

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

$=\frac{15}{4} \bullet \frac{3}{1}$

$=\frac{45}{4}$

$=11\frac{1}{4}$

$11\frac{1}{4}$ cups

3. a. $\frac{9}{4} \div \frac{1}{2}$

$=\frac{9}{\cancel{4}_{2}} \bullet \frac{\overset{1}{\cancel{2}}}{1}$

$=\frac{9}{2}$

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

b. $\frac{3}{7} \div \frac{1}{14}$

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

$=6$

4. a. 2,000 hours • \$11 per hour ≈ \$22,000 per year

b. 2,000 hours • \$18 per hour ≈ \$36,000 per year

5. a. $365 \bullet 6 = 2190$

2,190 gallons

b. $2190 \div 18 = 121.66...$

121 people

(She doesn't produce enough for 122 people.)

6. a. $75 - 111 = 75 + (-111)$

$111 - 75 = 36$

$|-111| > |75|$

$75 - 111 = -36$

b. $-111 + 75$

$111 - 75 = 36$

$|-111| > |75|$

$-111 + 75 = -36$

c. $-75 + 111$

$111 - 75 = 36$

$|111| > |-75|$

$-75 + 111 = 36$

Adding and Subtracting Decimals

WARM-UP

a. $\$11.50 + \$5.75$

$$\begin{array}{r} {\scriptstyle 1} \\ 11.50 \\ +\ 5.75 \\ \hline 17.25 \end{array}$$

$\$11.50 + \$5.75 = \$17.25$

b. $$\begin{array}{r} {\scriptstyle 2\ 9\ 9} \\ 3\,\not{0}.\not{0}\,{}^{1}0 \\ -\ 1\ 7.2\ 5 \\ \hline 1\ 2.7\ 5 \end{array}$$

$\$30.00 - \$17.25 = \$12.75$

PRACTICE

1.

	Positive	Negative	Zero
$-7.2 + (-7.2)$ *Both numbers are negative.*		✓	
$-4.3 - (-4.3)$ $= -4.3 + 4.3$ *The values are opposites.*			✓
$-2.5 + 5.2$ *The greater absolute value is positive.*	✓		
$6.1 - 8.6$ $= 6.1 + (-8.6)$ *The greater absolute value is negative.*		✓	

2. a. $29 + 8.3$ b. $27.4 + (-36.2)$

3. a. $$\begin{array}{r} {\scriptstyle 7} \\ \not{8}.{}^{1}1 \\ -5.6 \\ \hline 2.5 \end{array}$$

b. $$\begin{array}{r} {\scriptstyle 7} \\ \not{8}.{}^{1}0 \\ -4.6 \\ \hline 3.4 \end{array}$$

c. $$\begin{array}{r} {\scriptstyle 0\ 9} \\ \not{1}\,\not{0}.{}^{1}2 \\ -\ 3.3 \\ \hline 6.9 \end{array}$$

4. a. $$\begin{array}{r} {\scriptstyle 1\ 1} \\ 42.58 \\ +\ 63.98 \\ \hline 106.56 \end{array}$$

b. $$\begin{array}{r} {\scriptstyle 1} \\ 9.23 \\ +\ 17.18 \\ \hline 26.41 \end{array}$$

5. $-12.6\ °F + 20.4\ °F$

$$\begin{array}{r} {\scriptstyle 1\ 9} \\ \not{2}\,\not{0}.{}^{1}4 \\ -\ 1\ 2.\ 6 \\ \hline 7.\ 8 \end{array}$$

$|20.4| > |-12.6|$

$-12.6\ °F + 20.4\ °F = 7.8\ °F$

6. $15 - 72.8 = 15 + (-72.8)$

$$\begin{array}{r} {\scriptstyle 6} \\ \not{7}{}^{1}2.8 \\ -\ 1\ 5.0 \\ \hline 5\ 7.8 \end{array}$$

$|-72.8| > |15|$

15 feet $- 72.8$ feet $= -57.8$ feet

7. $190 - 309.2 = 190 + (-309.2)$

$$\begin{array}{r} {}^{2}\not{3}{}^{1}09.2 \\ -\ 1\,90.0 \\ \hline 1\,19.2 \end{array}$$

$|-309.2| > |190|$

190 calories – 309.2 calories = –119.2 calories

8. a. $17.52 - 38.6 = 17.52 + (-38.6)$

$$\begin{array}{r} {}^{5}38.\not{6}{}^{1}0 \\ -\ 17.5\ 2 \\ \hline 21.0\ 8 \end{array}$$

$|-38.6| > |17.52|$

$17.52 - 38.6 = -21.08$

b. $48.24 - (-20.1) = 48.24 + 20.1$

$$\begin{array}{r} 48.24 \\ +\ 20.10 \\ \hline 68.34 \end{array}$$

$48.24 - (-20.1) = 68.34$

c. $-15.9 + 8.37$

$$\begin{array}{r} {}^{8}15.\not{9}{}^{1}0 \\ -\ 8.3\ 7 \\ \hline 7.5\ 3 \end{array}$$

$|-15.9| > |8.37|$

$-15.9 + 8.37 = -7.53$

d. $-18.77 - 10.4 = -18.77 + (-10.4)$

$$\begin{array}{r} {}^{1}18.77 \\ +\ 10.40 \\ \hline 29.17 \end{array}$$

$-18.77 - 10.4 = -29.17$

e. $-3.81 + 9.02$

$$\begin{array}{r} {}^{8}\not{9}{}^{1}.02 \\ -\ 3.\ 81 \\ \hline 5.\ 21 \end{array}$$

$|9.02| > |-3.81|$

$-3.81 + 9.02 = 5.21$

f. $-3.8 - 14.1 = -3.8 + (-14.1)$

$$\begin{array}{r} 3.8 \\ +\ 14.1 \\ \hline 17.9 \end{array}$$

$-3.8 - 14.1 = -17.9$

g. $13.5 - (-11.25) = 13.5 + 11.25$

$$\begin{array}{r} 13.50 \\ +\ 11.25 \\ \hline 24.75 \end{array}$$

$13.5 - (-11.25) = 24.75$

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

REVIEW

1. a. $\frac{7}{16} \div \frac{3}{4} = \frac{7}{\cancel{16}_{4}} \bullet \frac{\overset{1}{\cancel{4}}}{3} = \frac{7}{12}$

b. $\frac{6}{11} \div 9 = \frac{\overset{2}{\cancel{6}}}{11} \bullet \frac{1}{\cancel{9}_{3}} = \frac{2}{33}$

c. $8 \div \frac{2}{13} = \frac{\overset{4}{\cancel{8}}}{1} \bullet \frac{13}{\cancel{2}_{1}} = 52$

2. a. $-2\frac{9}{10} + \left(-5\frac{4}{5}\right)$

$= -\frac{29}{10} + \left(-\frac{29}{5}\right)$

$= -\frac{29}{10} + \left(-\frac{58}{10}\right)$

$= -\frac{87}{10}$

$= -8\frac{7}{10}$

b. $\frac{16}{3} - 7\frac{5}{6}$

$= \frac{16}{3} + \left(-\frac{47}{6}\right)$

$= \frac{32}{6} + \left(-\frac{47}{6}\right)$

$= -\frac{15}{6}$

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

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

3. a. $-18 + 60$

$\begin{array}{r} \overset{5}{\cancel{6}}\overset{1}{0} \\ -\ 1\ 8 \\ \hline 4\ 2 \end{array}$

$|60| > |-18|$

$-18 + 60 = 42$

b. $25 - 34 = 25 + (-34)$

$\begin{array}{r} \overset{2}{\cancel{3}}\overset{1}{4} \\ -\ 2\ 5 \\ \hline 9 \end{array}$

$|-34| > |25|$

$25 - 34 = -9$

c. $-12 - 27 = -12 + (-27)$

$\begin{array}{r} 12 \\ +\ 27 \\ \hline 39 \end{array}$

$-12 - 27 = -39$

4. a. $-23 \bullet 10 = -230$

b. $-11 \bullet (-4) = 44$

c. $156 \bullet (-1) = -156$

5. $365 \text{ days} \bullet 4 = 1{,}460 \text{ days}$

$1{,}460 \text{ days} + 1 \text{ day (leap year)} = 1{,}461 \text{ days}$

6. a. $3000 \div 60 = 300 \div 6$

$\begin{array}{r} 50 \\ 6\overline{)300} \\ -30 \\ \hline 00 \\ -\ 00 \\ \hline 0 \end{array}$

50 minutes

b. $3000 \div 50 = 300 \div 5$

$\begin{array}{r} 60 \\ 5\overline{)300} \\ -30 \\ \hline 00 \\ -\ 00 \\ \hline 0 \end{array}$

$60 \text{ minutes} - 50 \text{ minutes} = 10 \text{ minutes}$

Multiplying and Dividing Decimals

WARM-UP

a.
$$\begin{array}{r} {\scriptstyle 6\ 3} \\ 784 \\ \times\ \ 8 \\ \hline 6272 \end{array}$$

b.
$$\begin{array}{r} 75 \\ 12\overline{)900} \\ -84 \\ \hline 60 \\ -\ 60 \\ \hline 0 \end{array}$$

PRACTICE

1.

same sign $-3.12 \bullet (-5.9)$	different signs $-2.1 \bullet 8.8$	different signs $42 \div (-9.7)$
same sign $-8.5 \div (-4.25)$	same sign $6.98 \div 14$	different signs $6.9 \bullet (-6.9)$
different signs $-19.32 \div 1$	same sign $-12.1 \div (-1)$	different signs $-5.02 \div 10$

2.
$$\begin{array}{r} 5.69 \\ 6\overline{)34.14} \\ -30 \\ \hline 41 \\ -\ 36 \\ \hline 54 \\ -54 \\ \hline 0 \end{array}$$

$\$34.14 \div 6 = \$5.69$

3.
$$\begin{array}{r} {\scriptstyle 3\ 1} \\ 26.2 \\ \times\ \ 5 \\ \hline 131.0 \end{array}$$

$26.2 \text{ miles} \bullet 5 = 131 \text{ miles}$

4.
$$\begin{array}{r} {\scriptstyle 1\ 1\ 1} \\ 37.85 \\ \times\ \ 12 \\ \hline 7570 \\ +\ 37850 \\ \hline 454.20 \end{array}$$

$\$37.85 \bullet 12 = \$454.20$

5. a.
$$\begin{array}{r} {\scriptstyle 3\ 1} \\ 15.2 \\ \times\ \ 7.65 \\ \hline 760 \\ 9120 \\ +\ 106400 \\ \hline 116.280 \end{array}$$

$-15.2 \bullet (-7.65) = 116.28$

b. $8.8\overline{)67.32} \rightarrow 88\overline{)673.20}$
$$\begin{array}{r} 7.65 \\ -616 \\ \hline 572 \\ -\ 528 \\ \hline 440 \\ -440 \\ \hline 0 \end{array}$$

$67.32 \div (-8.8) = -7.65$

c.
$$\begin{array}{r} {\scriptstyle 1}\not{1}\quad {\scriptstyle 1}\not{1} \\ 162.25 \\ \times \quad 3.2 \\ \hline 32450 \\ +\ 486750 \\ \hline 519.200 \end{array}$$

$-162.25 \bullet 3.2 = -519.2$

d. $36.2\overline{)5390.18} \rightarrow 362\overline{)53901.8}$

$$\begin{array}{r} 148.9 \\ -362 \\ \hline 1770 \\ -1448 \\ \hline 3221 \\ -2896 \\ \hline 3258 \\ -3258 \\ \hline 0 \end{array}$$

$-5390.18 \div 36.2 = -148.9$

e. $55.5\overline{)1365.3} \rightarrow 555\overline{)13653.0}$

$$\begin{array}{r} 24.6 \\ -1110 \\ \hline 2553 \\ -2220 \\ \hline 3330 \\ -3330 \\ \hline 0 \end{array}$$

$1365.3 \div 55.5 = 24.6$

f.
$$\begin{array}{r} {\scriptstyle 2}\not{2}\ {\scriptstyle 1}\not{1}\ {\scriptstyle 1}\not{1} \\ 152.2 \\ \times \quad 5.5 \\ \hline 7610 \\ +\ 76100 \\ \hline 837.10 \end{array}$$

$152.2 \bullet (-5.5) = -837.1$

			e 2			
	d −		4		f −	
a 1	1	6	.	2	8	
	4		6		3	
	8			b −	7	. 6 5
	.				.	
	9		c −	5	1	9 . 2

REVIEW

1. a. $2.7 - 5.8 = 2.7 + (-5.8)$

$$\begin{array}{r} 5.8 \\ -\ 2.7 \\ \hline 3.1 \end{array}$$

$|-5.8| > |2.7|$

$2.7 - 5.8 = -3.1$

b. $-9.2 + (-12.8)$

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 12.8 \\ +\ 9.2 \\ \hline 22.0 \end{array}$$

$-9.2 + (-12.8) = -22$

2. a. $\frac{7}{9} + 3\frac{2}{3} + 4\frac{5}{12}$

$= \frac{7}{9} + \frac{11}{3} + \frac{53}{12}$

$= \frac{28}{36} + \frac{132}{36} + \frac{159}{36}$

$= \frac{319}{36}$

$= 8\frac{31}{36}$

b. $\frac{23}{5} + 1\frac{7}{15} + 8\frac{3}{10}$

$= \frac{23}{5} + \frac{22}{15} + \frac{83}{10}$

$= \frac{138}{30} + \frac{44}{30} + \frac{249}{30}$

$= \frac{431}{30}$

$= 14\frac{11}{30}$

3. a. $-\frac{3}{5} \bullet 4 = -\frac{3}{5} \bullet \frac{4}{1} = -\frac{12}{5} = -2\frac{2}{5}$

b. $2\frac{1}{5} \div \left(-\frac{3}{8}\right)$

$= \frac{11}{5} \div \left(-\frac{3}{8}\right)$

$= \frac{11}{5} \bullet \left(-\frac{8}{3}\right)$

$= -\frac{88}{15}$

$= -5\frac{13}{15}$

4. a. $56 + (-29)$

$$\begin{array}{r} {\scriptstyle 4} \\ 5\not{6}^{1}6 \\ -\ 2\ 9 \\ \hline 2\ 7 \end{array}$$

$|56| > |-29|$

$56 + (-29) = 27$

b. $-283 + (-146)$

$$\begin{array}{r} {\scriptstyle 1} \\ 283 \\ +\ 146 \\ \hline 429 \end{array}$$

$-283 + (-146) = -429$

5. a. 97

b. 47

6. The least common multiple of 30 and 50 is 150.
150 minutes is 2 hours 30 minutes.
They will next launch at the same time at 9:30 AM.

Positive Exponents

WARM-UP

a. $3+3+3+3=6+3+3=9+3=12$

b. $3\cdot3\cdot3\cdot3=9\cdot3\cdot3=27\cdot3=81$

c. $5+5+5=10+5=15$

d. $5\cdot5\cdot5=25\cdot5=125$

PRACTICE

1. ☑ 3^4 ☐ 4^3 ☑ $3\cdot3\cdot3\cdot3$
   ☐ $3\cdot4$ ☐ $4\cdot4\cdot4$ ☐ 12
   ☑ 81 ☐ 64 ☑ $3^3\cdot3$

2. a. 6^3
   b. $(-5)^4$

3. a.
$$-2\cdot(-2)\cdot(-2)\cdot(-2)=4\cdot(-2)\cdot(-2)=-8\cdot(-2)=16$$
$$-2^4=-(2\cdot2\cdot2\cdot2)=-16$$
$$-2\cdot(-2)\cdot(-2)\cdot(-2)\neq-2^4$$

   b. $-3^3=-(3\cdot3\cdot3)=-27$
$$(-3)^3=(-3)\cdot(-3)\cdot(-3)=9\cdot(-3)=-27$$
$$-3^3=(-3)^3$$

   c. $-5^2=-(5\cdot5)=-25$
$$(-5)^2=-5\cdot(-5)=25$$
$$-5^2\neq(-5)^2$$

   d. $4^2\cdot4^2=4\cdot4\cdot4\cdot4=196$
$$4^4=4\cdot4\cdot4\cdot4=196$$
$$4^2\cdot4^2=4^4$$

   e. $\left(\frac{1}{3}\right)^5=\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}=\frac{1}{243}$
$$\frac{1^5}{3^5}=\frac{1\cdot1\cdot1\cdot1\cdot1}{3\cdot3\cdot3\cdot3\cdot3}=\frac{1}{243}$$
$$\left(\frac{1}{3}\right)^5=\frac{1^5}{3^5}$$

4. Answers may vary.
   Sample answer: The expression 2^2 means $2\cdot2$, but 5^2 means $5\cdot5$, not $5\cdot2$.

5. a. $-8^4=-(8\cdot8\cdot8\cdot8)$
   Evaluate the exponent before applying the negative. The answer is negative.

   b. $(-10)^3=-10\cdot(-10)\cdot(-10)$
   Multiplying three negatives results in a negative.

   c. $\left(-\frac{1}{4}\right)^5=\left(-\frac{1}{4}\right)\cdot\left(-\frac{1}{4}\right)\cdot\left(-\frac{1}{4}\right)\cdot\left(-\frac{1}{4}\right)\cdot\left(-\frac{1}{4}\right)$
   Multiplying five negatives results in a negative.

d.

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

Multiplying six negatives results in a positive.

e. $-12^2 = -(12 \bullet 12)$

Evaluate the exponent before applying the negative. The answer is negative.

f. $(-11)^2 = -11 \bullet (-11)$

Multiplying two negatives results in a positive.

g. $\left(\frac{1}{7}\right)^3 = \frac{1}{7} \bullet \frac{1}{7} \bullet \frac{1}{7}$

Multiplying positive numbers always results in a positive.

Negative	Positive
a b c e	d f g

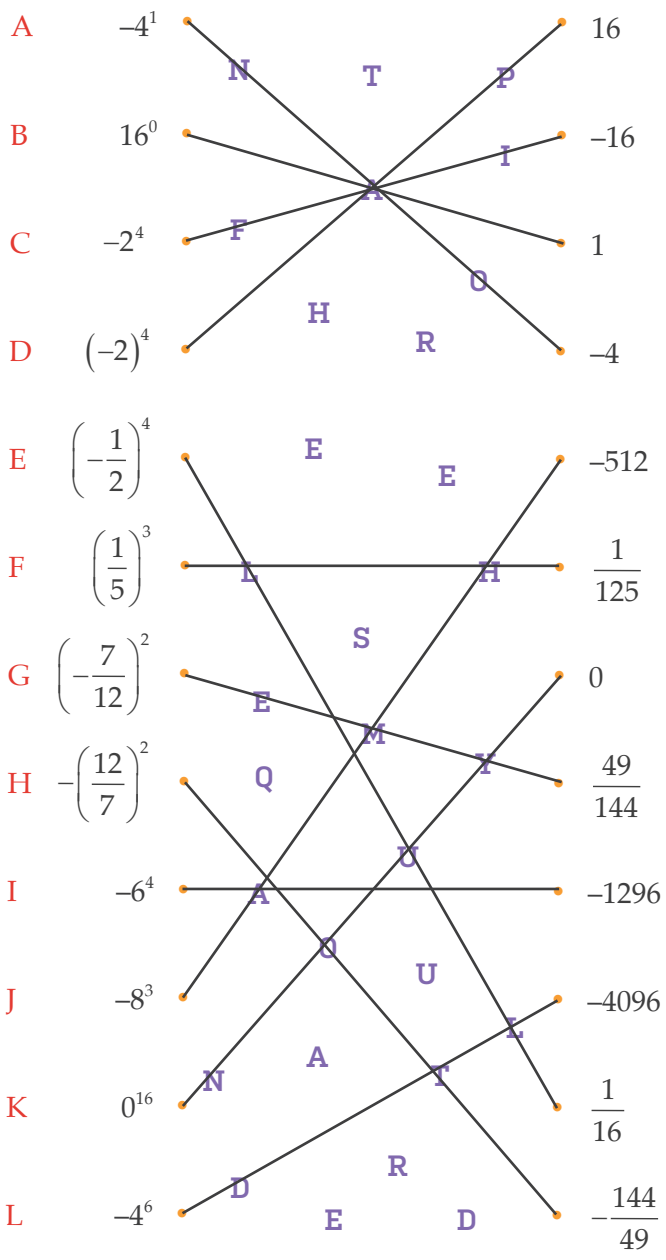
6. a. 60,466,176

b. –614,656

7. a. $2\overline{)72}$
$2\overline{)36}$
$2\overline{)18}$
$3\overline{)9}$
3
$72 = 2 \bullet 2 \bullet 2 \bullet 3 \bullet 3 = 2^3 \bullet 3^2$

b. $3\overline{)135}$
$3\overline{)45}$
$3\overline{)15}$
5
$135 = 3 \bullet 3 \bullet 3 \bullet 5 = 3^3 \bullet 5$

8.



Because his mom told him to eat

THREE SQUARED

meals every day.

Work for the previous problem is shown below.

A $-4^1 = -4$

B $16^0 = 1$

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

D $(-2)^4$

$= -2 \bullet (-2) \bullet (-2) \bullet (-2)$

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

$= -8 \bullet (-2)$

$= 16$

E $\left(-\frac{1}{2}\right)^4$

$= -\frac{1}{2} \bullet \left(-\frac{1}{2}\right) \bullet \left(-\frac{1}{2}\right) \bullet \left(-\frac{1}{2}\right)$

$= \frac{1}{4} \bullet \left(-\frac{1}{2}\right) \bullet \left(-\frac{1}{2}\right)$

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

$= \frac{1}{16}$

F $\left(\frac{1}{5}\right)^3 = \frac{1}{5} \bullet \frac{1}{5} \bullet \frac{1}{5} = \frac{1}{25} \bullet \frac{1}{5} = \frac{1}{125}$

G $\left(-\frac{7}{12}\right)^2 = -\frac{7}{12} \bullet \left(-\frac{7}{12}\right) = \frac{49}{144}$

H $-\left(\frac{12}{7}\right)^2 = -\left(\frac{12}{7} \bullet \frac{12}{7}\right) = -\frac{144}{49}$

I $-6^4 = -(6 \bullet 6 \bullet 6 \bullet 6) = -1296$

J $-8^3 = -(8 \bullet 8 \bullet 8) = -512$

K $0^{16} = 0$

L $-4^6 = -(4 \bullet 4 \bullet 4 \bullet 4 \bullet 4 \bullet 4) = -4096$

REVIEW

1. a.
$$\begin{array}{r} {\scriptstyle 3\ 2\ 1} \\ 14.3 \\ \times\ \ 7.5 \\ \hline 715 \\ +\ 10010 \\ \hline 107.25 \end{array}$$

$-14.3 \bullet (-7.5) = 107.25$

b.
$$\begin{array}{r} {\scriptstyle 4\ 4} \\ 46.8 \\ \times\ \ 16 \\ \hline 2808 \\ +\ 4680 \\ \hline 748.8 \end{array}$$

$-46.8 \bullet 16 = -748.8$

2. a. $180 \div 60 = 18 \div 6 = 3$

$180 \div (-60) = -3$

b.
$$\begin{array}{r} 30 \\ 11\overline{)330} \\ -33 \\ \hline 00 \\ -\ 0 \\ \hline 0 \end{array}$$

$-330 \div 11 = -30$

3. a. $-8\frac{5}{16} + 7\frac{3}{4} - 3\frac{1}{2}$

$= -\frac{133}{16} + \frac{31}{4} - \frac{7}{2}$

$= -\frac{133}{16} + \frac{124}{16} - \frac{56}{16}$

$= -\frac{9}{16} - \frac{56}{16}$

$= -\frac{65}{16}$

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

b. $\frac{7}{2}-\frac{10}{11}=\frac{77}{22}-\frac{20}{22}=\frac{57}{22}=2\frac{13}{22}$

4. a. $-98.7+71.8$

$$\begin{array}{r} {}^{7}\not{9}{}^{1}\not{8}.{}^{1}7 \\ -\ 7\,1.\,8 \\ \hline 2\,6.\,9 \end{array}$$

$|-98.7|>|71.8|$

$-98.7+71.8=-26.9$

b. $-7.2-2.8=-7.2+(-2.8)$

$$\begin{array}{r} {}^{1} \\ 7.2 \\ +\ 2.8 \\ \hline 10.0 \end{array}$$

$-7.2-2.8=-10$

5. a. $-2\cdot 5\cdot 12=-10\cdot 12=-120$

b. $-2\cdot(-5)\cdot(-12)=10\cdot(-12)=-120$

6. $2\frac{3}{4}\cdot 3=\frac{11}{4}\cdot\frac{3}{1}=\frac{33}{4}=8\frac{1}{4}$

$2\frac{3}{4}\text{ cups}\cdot 3=8\frac{1}{4}\text{ cups}$

Negative Exponents

WARM-UP

a. $3^3 = 3 \bullet 3 \bullet 3 = 27$

b. $\frac{1}{3^3} = \frac{1}{3 \bullet 3 \bullet 3} = \frac{1}{27}$

PRACTICE

1.

Power	Fraction	Factored Form	Value
2^7		$2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2$	128
2^6		$2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2$	64
2^5		$2 \bullet 2 \bullet 2 \bullet 2 \bullet 2$	32
2^4		$2 \bullet 2 \bullet 2 \bullet 2$	16
2^3		$2 \bullet 2 \bullet 2$	8
2^2		$2 \bullet 2$	4
2^1		2	2
2^0		1	1

Power	Fraction	Factored Form	Value
2^{-1}	$\frac{1}{2^1}$	$\frac{1}{2}$	$\frac{1}{2}$
2^{-2}	$\frac{1}{2^2}$	$\frac{1}{2 \bullet 2}$	$\frac{1}{4}$
2^{-3}	$\frac{1}{2^3}$	$\frac{1}{2 \bullet 2 \bullet 2}$	$\frac{1}{8}$
2^{-4}	$\frac{1}{2^4}$	$\frac{1}{2 \bullet 2 \bullet 2 \bullet 2}$	$\frac{1}{16}$
2^{-5}	$\frac{1}{2^5}$	$\frac{1}{2 \bullet 2 \bullet 2 \bullet 2 \bullet 2}$	$\frac{1}{32}$
2^{-6}	$\frac{1}{2^6}$	$\frac{1}{2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2}$	$\frac{1}{64}$
2^{-7}	$\frac{1}{2^7}$	$\frac{1}{2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2}$	$\frac{1}{128}$

2. a. $\frac{1}{5^{13}}$ b. $\frac{1}{8^9}$ c. $\frac{1}{11^{10}}$

d. $\frac{1}{(-6)^3}$ e. $-\frac{1}{12^{10}}$ f. $\frac{1}{(-7)^4}$

3. a. $(-2)^{-6}$

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

$= \frac{1}{(-2) \bullet (-2) \bullet (-2) \bullet (-2) \bullet (-2) \bullet (-2)}$

$= \frac{1}{64}$

b. $12^{-2} = \frac{1}{12^2} = \frac{1}{144}$

c. $-4^{-4} = -\frac{1}{4^4} = -\frac{1}{4 \bullet 4 \bullet 4 \bullet 4} = -\frac{1}{256}$

d. $(-10)^{-3}$

$= \frac{1}{(-10)^3}$

$= \frac{1}{(-10) \bullet (-10) \bullet (-10)}$

$= -\frac{1}{1000}$

4. a. $10^{-1} \longrightarrow$ 1 place

$10^{-1} = 0.1$

b. $10^{-2} \longrightarrow$ 2 places

$10^{-2} = 0.01$

c. $10^{-8} \longrightarrow$ 8 places

$10^{-8} = 0.00000001$

5. a. $0.00001 = 10^{-5}$

b. $0.001 = 10^{-3}$

c. $0.0000000001 = 10^{-10}$

6. Students only need to complete one problem in each pair. Both may be completed for extra practice.

a. Vanilla pudding:

$\frac{1}{10000} = \frac{1}{10 \bullet 10 \bullet 10 \bullet 10} = \frac{1}{10^4} = 10^{-4}$

Root beer:

$\frac{1}{100000} = \frac{1}{10 \bullet 10 \bullet 10 \bullet 10 \bullet 10} = \frac{1}{10^5} = 10^{-5}$

b. Sand:

$5^{-3} = \frac{1}{5^3} = \frac{1}{5 \bullet 5 \bullet 5} = \frac{1}{125}$

Harmless snakes:

$2^{-5} = \frac{1}{2^5} = \frac{1}{2 \bullet 2 \bullet 2 \bullet 2 \bullet 2} = \frac{1}{32}$

c. Potato: $0.1 = 10^{-1}$

Onion: $0.000001 = 10^{-6}$

d. Arms:

$\frac{1}{27} = \frac{1}{3 \bullet 3 \bullet 3} = \frac{1}{3^3} = 3^{-3}$

Legs:

$\frac{1}{36} = \frac{1}{6 \bullet 6} = \frac{1}{6^2} = 6^{-2}$

e. Past:

$7^{-3} = \frac{1}{7^3} = \frac{1}{7 \bullet 7 \bullet 7} = \frac{1}{343}$

Future:

$4^{-3} = \frac{1}{4^3} = \frac{1}{4 \bullet 4 \bullet 4} = \frac{1}{64}$

f. Nose like a platypus:

$\frac{1}{16} = \frac{1}{2 \bullet 2 \bullet 2 \bullet 2} = \frac{1}{2^4} = 2^{-4}$

Neck like a giraffe:

$\frac{1}{81} = \frac{1}{3 \bullet 3 \bullet 3 \bullet 3} = \frac{1}{3^4} = 3^{-4}$

REVIEW

1. a. $-\frac{2}{9} \div \frac{12}{5} = -\frac{\cancel{2}^{1}}{9} \bullet \frac{5}{\cancel{12}_{6}} = -\frac{5}{54}$

   b. $3\frac{3}{11} \div \left(-\frac{6}{10}\right) = \frac{\cancel{36}^{6}}{11} \bullet \left(-\frac{10}{\cancel{6}_{1}}\right) = -\frac{60}{11} = -5\frac{5}{11}$

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

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

   c. $\left(-\frac{7}{8}\right)^2 = -\frac{7}{8} \bullet \left(-\frac{7}{8}\right) = \frac{49}{64}$

3. a. 1616.508

   b. $-78.\overline{51}$

4. a. $-15 > -60$

   b. $|-15| < |-60|$

   c. $|-15| > -60$

5. a. $\frac{3}{4} + \frac{1}{8} + \frac{1}{8} = \frac{6}{8} + \frac{1}{8} + \frac{1}{8} = \frac{8}{8} = 1$

   1 cup

   b. $1 \div \frac{1}{16} = \frac{1}{1} \bullet \frac{16}{1} = 16$

   16 servings

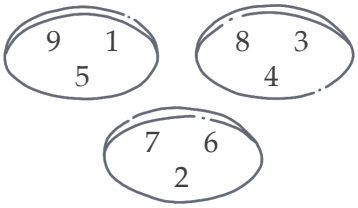
Logic Lesson 1

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

Hole 1: Answers may vary. An example is given.

$9+8+7+65+4+3+2+1$

Hole 2: Answers may vary. An example is given.



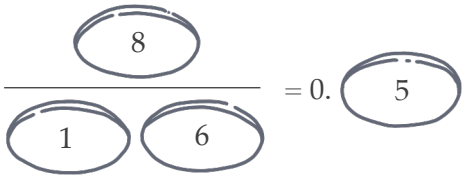
Sum of each hole: 15

Hole 3:

$99 \div 5\frac{1}{2} = 99 \div 5.5 = 18$

18 years old

Hole 4: Answers may vary. An example is given.



8 divided by 16 is 0.5.

Hole 5:

Person A: 8 handshakes

Person B: 7 handshakes (already counted handshake with Person A)

Person C: 6 handshakes (already counted handshakes with Person A and Person B)

Person D: 5 handshakes

Person E: 4 handshakes

Person F: 3 handshakes

Person G: 2 handshakes

Person H: 1 handshake

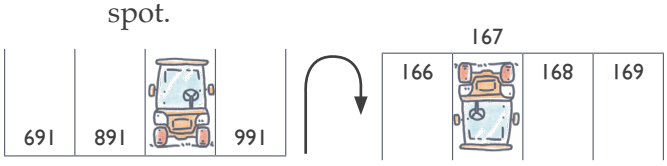
Person I: 0 handshakes (already shook hands with everyone else)

36 handshakes

Hole 6: Answers may vary. An example is given.

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ } \\ 147 \\ 263 \\ +\ 589 \\ \hline 999 \end{array}$$

Hole 7: 167 The numbers are upside down. They are viewed as if pulling into the parking spot.



Hole 8:

1. $9 = 9 \bullet 1$

   $1 \_\_ \_\_ 9$

2. $\frac{2}{\cancel{3}_{1}} \bullet \frac{\overset{3}{\cancel{9}}}{1} = 6$

   $1 \_\_ 6\ 9$

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

Mystery number: 1469

Hole 9: Information that can be gathered from each clue is shown below. A check is placed in a box when the answer is known for certain, and an X is placed in a box if it cannot be the answer. When a check is placed in a box, Xs can be placed in the rest of the boxes in the row and column for that section.

		Course				Number of Holes Played			
		Greenfield Golf	Putter's Paradise	Par for the Course	The Cart Club	9	18	27	36
Family	Stewart	X	✓	X	X	✓	X	X	X
	Lin	X	X	X	✓	X	X	X	✓
	Miller	✓	X	X	X	X	✓	X	X
	O'Brien	X	X	✓	X	X	X	✓	X
Number of Holes Played	9	X	✓	X	X				
	18	✓	X	X	X				
	27	X	X	✓	X				
	36	X	X	X	✓				

1. The Millers cannot have played 9 holes because they played more than the Stewarts, and they cannot have played 36 holes because they played less than the O'Briens. The Stewarts cannot have played 36 holes because the Millers played more than them, and the O'Briens did not play 9 holes because the Millers played fewer than them.
2. The family who played Putter's Paradise course cannot have played 36 holes.
3. A check mark can be placed in the box for playing 27 holes at Par for the Course.
4. The O'Briens played 27 or 36 holes.
5. 36 is the only value that is four times another, so the Lins played 36 holes, and the Stewarts played 9 holes. This information, along with Clue 4, means that the Millers played 18 holes and the O'Briens played 27 holes. This means that the O'Briens played Par for the Course (Clue 3).
6. Since the Millers did not play at Putter's Paradise, the Stewarts or Lins must have played this course. However, the family who played Putter's Paradise played 9 or 18 holes. The Lins played 36 holes, so they could not have played Putter's Paradise. The Stewarts played 9 holes, so they played Putter's Paradise.
7. The only options left for Greenfield Golf are 18 or 36 holes. Since the family who played this course played 9 or 18 holes, they must have played 18 holes. Therefore the family who played The Cart Club played 36 holes. The rest of the answers can now be found based on the available options, but two additional clues are given.
8. The Lin family played 36 holes at The Cart Club.
9. The Miller family played at Greenfield Golf.

Properties of Real Numbers

WARM-UP

a. $12 \cdot (4 \cdot 10) = 12 \cdot 40 = 480$

b. $(12 \cdot 4) \cdot 10 = 48 \cdot 10 = 480$

c. $12 + (4 + 10) = 12 + 14 = 26$

d. $(12 + 4) + 10 = 16 + 10 = 26$

PRACTICE

1. addition and multiplication

2. a. associative property of multiplication
   b. distributive property
   c. identity property of multiplication
   d. identity property of addition

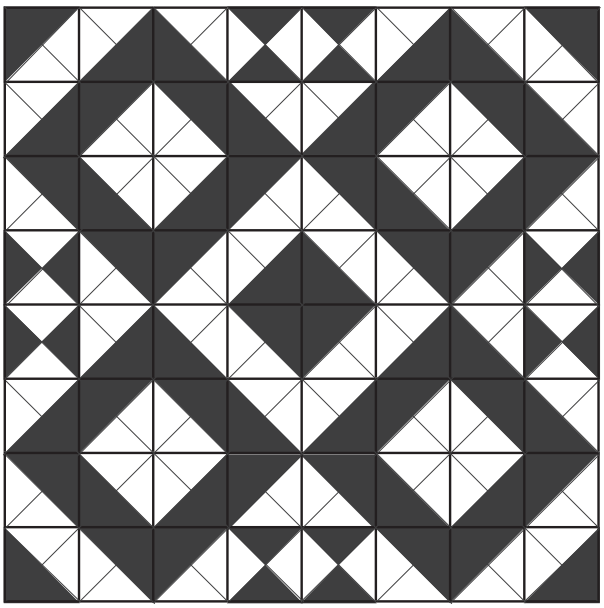
3. a. $-4(10 + 3) = -4(10) + (-4)(3) = -40 + (-12) = -52$
   b. $-7(-3 - 5) = -7(-3) - (-7)(5) = 21 + 35 = 56$
   c. $-2(1 - 6) = -2(1) - (-2)(6) = -2 + 12 = 10$

4. a. $3(\_\_ + 5) = 3(\_\_) + 3(5) = 3(\_\_) + 15 = -9 + 15$
   Since 3 times –3 is –9, the missing value is –3.
   b. $\_\_(-1 - 7) = \_\_(-1) - \_\_(7) = 8 + 56$
   –8 times –1 is 8.
   –8 times 7 is –56, and subtracting –56 is the same as adding 56.
   The missing value is –8.

5. a. $(-9 + 7) + 3 = -2 + 3 = 1$
   b. $-9 + (7 + 3) = -9 + 10 = 1$
   c. $(18 - 7) - 4 = 11 - 4 = 7$
   d. $18 - (7 - 4) = 18 - 3 = 15$

6. a. $(2 \cdot 5) \cdot 6 = 10 \cdot 6 = 60$
   b. $2 \cdot (5 \cdot 6) = 2 \cdot 30 = 60$
   c. $(24 \div 12) \div 2 = 2 \div 2 = 1$
   d. $24 \div (12 \div 2) = 24 \div 6 = 4$

7. a. $11 \cdot 8 = 8 \cdot 11$
   b. $\frac{1}{23} \cdot \frac{23}{1} = \frac{1}{23} \cdot 23 = 1$
   c. $28 + (-28) = 0$
   d. $7(40 - 1) = 7 \cdot 39 = 273$
   e. $7 \cdot (4 \cdot 3) = 7 \cdot 12 = 84$
   f. $3(80 + 1) = 3 \cdot 81 = 243$



REVIEW

1. a. $11^{-2} = \frac{1}{11^2} = \frac{1}{11 \bullet 11} = \frac{1}{121}$

   b. $8^{-2} = \frac{1}{8^2} = \frac{1}{8 \bullet 8} = \frac{1}{64}$

   c. $\left(\frac{5}{9}\right)^2 = \frac{5}{9} \bullet \frac{5}{9} = \frac{25}{81}$

   d. $\left(\frac{3}{4}\right)^4 = \frac{3}{4} \bullet \frac{3}{4} \bullet \frac{3}{4} \bullet \frac{3}{4} = \frac{81}{256}$

2. a.
$$2\frac{3}{16} - 7\frac{5}{6} = \frac{35}{16} - \frac{47}{6} = \frac{105}{48} - \frac{376}{48} = -\frac{271}{48} = -5\frac{31}{48}$$

   b.
$$9\frac{1}{27} + \left(-8\frac{2}{9}\right) = \frac{244}{27} + \left(-\frac{74}{9}\right) = \frac{244}{27} + \left(-\frac{222}{27}\right) = \frac{22}{27}$$

3. a.
$$\begin{array}{r} {\scriptstyle 3\ 5}\\ 15.9\\ \times\ \ 6.1\\ \hline 159\\ +9540\\ \hline 96.99 \end{array}$$
   $15.9 \bullet (-6.1) = -96.99$

   b. $3.6\overline{)20} \longrightarrow 36\overline{)200.0\ldots}$

   $5.5\ldots$

   -180

   20

   $-20 \div (-3.6) = 5.\overline{5}$

4. a. Multiplying by a number greater than one results in a greater number.

   $49.5 < 49.5 \bullet 1.09$

   b. Dividing by a number greater than one results in a smaller number.

   $49.5 > 49.5 \div 1.09$

5. $\$13.70 \div \$0.05$

   $0.05\overline{)13.70} \longrightarrow 5\overline{)1370}$

   274

   -10

   37

   -35

   20

   -20

   0

   274 nickels

6. From 10:35 AM to 1:35 PM is 3 hours.

   From 1:35 PM to 2:00 PM is 25 minutes.

   From 2:00 PM to 2:10 PM is 10 minutes.

   3 hours + 25 minutes + 10 minutes = 3 hours 35 minutes

Expanded Notation with Exponents

WARM-UP

a. $15873 = 5873 + 10000$

b. $300 = 3 \bullet 100$

c. $0.0001 = 10^{-4}$

PRACTICE

1. a. 70,000

   b. 0.07

   c. 0.0007

2. 5.7401
$= 5 + 0.7 + 0.04 + 0.0001$
$= (5 \bullet 1) + (7 \bullet 0.1) + (4 \bullet 0.01) + (1 \bullet 0.0001)$
$= (5 \bullet 10^{0}) + (7 \bullet 10^{-1}) + (4 \bullet 10^{-2}) + (1 \bullet 10^{-4})$

   57.401
$= 50 + 7 + 0.4 + 0.001$
$= (5 \bullet 10) + (7 \bullet 1) + (4 \bullet 0.1) + (1 \bullet 0.001)$
$= (5 \bullet 10^{1}) + (7 \bullet 10^{0}) + (4 \bullet 10^{-1}) + (1 \bullet 10^{-3})$

   0.57401
$= 0.5 + 0.07 + 0.004 + 0.00001$
$= (5 \bullet 0.1) + (7 \bullet 0.01) + (4 \bullet 0.001) + (1 \bullet 0.00001)$
$= (5 \bullet 10^{-1}) + (7 \bullet 10^{-2}) + (4 \bullet 10^{-3}) + (1 \bullet 10^{-5})$

   574.01
$= 500 + 70 + 4 + 0.01$
$= (5 \bullet 100) + (7 \bullet 10) + (4 \bullet 1) + (1 \bullet 0.01)$
$= (5 \bullet 10^{2}) + (7 \bullet 10^{1}) + (4 \bullet 10^{0}) + (1 \bullet 10^{-2})$

   57401
$= 50000 + 7000 + 400 + 1$
$= (5 \bullet 10000) + (7 \bullet 1000) + (4 \bullet 100) + (1 \bullet 1)$
$= (5 \bullet 10^{4}) + (7 \bullet 10^{3}) + (4 \bullet 10^{2}) + (1 \bullet 10^{0})$

   5740.1
$= 5000 + 700 + 40 + 0.1$
$= (5 \bullet 1000) + (7 \bullet 100) + (4 \bullet 10) + (1 \bullet 0.1)$
$= (5 \bullet 10^{3}) + (7 \bullet 10^{2}) + (4 \bullet 10^{1}) + (1 \bullet 10^{-1})$

5.7401	$(5 \bullet 10^{-1}) + (7 \bullet 10^{-2}) + (4 \bullet 10^{-3}) + (1 \bullet 10^{-5})$
57.401	$(5 \bullet 10^{4}) + (7 \bullet 10^{3}) + (4 \bullet 10^{2}) + (1 \bullet 10^{0})$
0.57401	$(5 \bullet 10^{1}) + (7 \bullet 10^{0}) + (4 \bullet 10^{-1}) + (1 \bullet 10^{-3})$
574.01	$(5 \bullet 10^{2}) + (7 \bullet 10^{1}) + (4 \bullet 10^{0}) + (1 \bullet 10^{-2})$
57401	$(5 \bullet 10^{3}) + (7 \bullet 10^{2}) + (4 \bullet 10^{1}) + (1 \bullet 10^{-1})$
5740.1	$(5 \bullet 10^{0}) + (7 \bullet 10^{-1}) + (4 \bullet 10^{-2}) + (1 \bullet 10^{-4})$

3. b. Expanded form:
$8 + 0.8 + 0.005 + 0.0008$

Expanded notation:
$(8 \bullet 1) + (8 \bullet 0.1) + (5 \bullet 0.001) + (8 \bullet 0.0001)$

Expanded notation with exponents:
$(8 \bullet 10^{0}) + (8 \bullet 10^{-1}) + (5 \bullet 10^{-3}) + (8 \bullet 10^{-4})$

c. Expanded form:
$0.1 + 0.03 + 0.002 + 0.0009 + 0.00003$

Expanded notation:
$(1 \bullet 0.1) + (3 \bullet 0.01) + (2 \bullet 0.001) + (9 \bullet 0.0001) + (3 \bullet 0.00001)$

Expanded notation with exponents:
$(1 \bullet 10^{-1}) + (3 \bullet 10^{-2}) + (2 \bullet 10^{-3}) + (9 \bullet 10^{-4}) + (3 \bullet 10^{-5})$

d. Expanded form:
$50 + 0.7 + 0.04$

Expanded notation:
$(5 \bullet 10) + (7 \bullet 0.1) + (4 \bullet 0.01)$

Expanded notation with exponents:
$(5 \bullet 10^{1}) + (7 \bullet 10^{-1}) + (4 \bullet 10^{-2})$

4. a. $50265 = 50000 + 2000 + 60 + 5$
Correction(s): 200

b. $9166.3 = 9100 + 60 + 6 + 0.3$
Correction(s): $9000 + 100$

c. $0.97 = (9 \bullet 10^{1}) + (7 \bullet 10^{2})$
Correction(s): $(9 \bullet 10^{-1}) + (7 \bullet 10^{-2})$

d. $0.15 = (1 \bullet 10^{0}) + (5 \bullet 10^{-1})$
Correction(s): $(1 \bullet 10^{-1}) + (5 \bullet 10^{-2})$

e. $26.039 = (2 \bullet 10) + (6 \bullet 1) + (3 \bullet 0.1) + (9 \bullet 0.01)$
Correction(s): $(3 \bullet 0.01) + (9 \bullet 0.001)$

f. $7.602 = (7 \bullet 1) + (6 \bullet 0.1) + (0.01) + (2 \bullet 0.001)$
Correction(s): Delete this term.

g. $64.78 = (6 \bullet 10^{2}) + (4 \bullet 10^{1}) + (7 \bullet 10^{-1}) + (8 \bullet 10^{-2})$
Correction(s): $(6 \bullet 10^{1}) + (4 \bullet 10^{0})$

h. $0.409 = (4^{-1}) + (9^{-3})$
Correction(s): $(4 \bullet 10^{-1}) + (9 \bullet 10^{-3})$

REVIEW

1. a. 10,000 has four zeros. Move the decimal point four places to the right (multiplication).

7.64

$7.64 \bullet 10000 = 76400$

b. 1,000 has three zeros. Move the decimal point three places to the left (division).

8.23

$8.23 \div 1000 = 0.00823$

2. a. $-6(7x-9) = (-6)(7x) - (-6)(9) = -42x + 54$

b. $18(-2y-1) = 18(-2y) - 18(1) = -36y - 18$

3. a. 15,625

b. –20,736

4. a. $3 \overline{)147}$

$7 \overline{)49}$

7

$147 = 3 \bullet 7 \bullet 7 = 3 \bullet 7^2$

b. $2 \overline{)216}$

$2 \overline{)108}$

$2 \overline{)54}$

$3 \overline{)27}$

$3 \overline{)9}$

3

$216 = 2 \bullet 2 \bullet 2 \bullet 3 \bullet 3 \bullet 3 = 2^3 \bullet 3^3$

5. a. $0.1 = \frac{1}{10^1} = 10^{-1}$

b. $0.00000001 = \frac{1}{10^8} = 10^{-8}$

6. a. $12.7 - 29.08 = 12.7 + (-29.08)$

$$\begin{array}{r} {}^{8}\not{2}\not{9}{}^{1}.08 \\ -\ 12.70 \\ \hline 16.38 \end{array}$$

$|-29.08| > |12.7|$

$12.7 - 29.08 = -16.38$

b. $-17.95 - 37.1 = -17.95 + (-37.1)$

$$\begin{array}{r} {}^{1}37{}^{1}.10 \\ +\ 17.95 \\ \hline 55.05 \end{array}$$

$-17.95 - 37.1 = -55.05$

7. \$16 teaching + \$20 babysitting = \$36 earned / week

4 weeks • \$36 / week = \$144

8. $64\frac{5}{16} + \frac{3}{4} = \frac{1029}{16} + \frac{12}{16} = \frac{1041}{16} = 65\frac{1}{16}$

$64\frac{5}{16}\text{ in} + \frac{3}{4}\text{ in} = 65\frac{1}{16}\text{ in}$

Scientific Notation

WARM-UP

a. 10,000 has four zeros. Move the decimal point four places to the right (multiplication).

7.42

$7.42 \bullet 10000 = 74200$

b. 10,000 has four zeros. Move the decimal point four places to the left (division).

7.42

$7.42 \div 10000 = 0.000742$

PRACTICE

1.

5,200,000,000	5.2 billion
5,020,000,000	52 billion
5,200,000	520 billion
5,020,000	5.02 billion
52,000,000,000	5.02 million
520,000,000,000	5.2 million

2. a. $1.38 \times 10^9 \rightarrow 1.38$

1,380,000,000

b. $2.96 \times 10^6 \rightarrow 2.96$

2,960,000

c. $3.37 \times 10^4 \rightarrow 3.37$

33,700

3. a. $1{,}440{,}000{,}000 = 1.44 \times 10^9$

b. $331{,}000{,}000 = 3.31 \times 10^8$

c. $10{,}380{,}000 = 1.038 \times 10^7$

4. $1.4 \times 10^{-10} \rightarrow 14$

0.00000000014

5. $0.000000000023 = 2.3 \times 10^{-11}$

6. a. $11{,}200{,}000 = 1.12 \times 10^7$

b. $1{,}300{,}000{,}000 = 1.3 \times 10^9$

c. $6.88 \times 10^{-7} \rightarrow 6.88$

0.000000688

d. $6.88 \times 10^{-9} \rightarrow 6.88$

0.00000000688

e. 3,240,000,000 → 3 is in the billions place

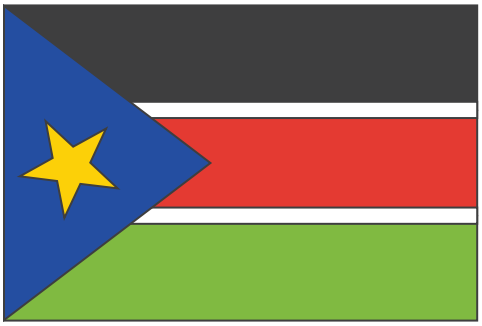
3.24 billion

f. 32,400,000 → 2 is in the millions place

32.4 million

g. $0.000039 = 3.9 \times 10^{-5}$

h. $0.0000039 = 3.9 \times 10^{-6}$



REVIEW

1. a. 3.872
$= 3 + 0.8 + 0.07 + 0.002$
$= (3 \bullet 1) + (8 \bullet 0.1) + (7 \bullet 0.01) + (2 \bullet 0.001)$
$= (3 \bullet 10^{0}) + (8 \bullet 10^{-1}) + (7 \bullet 10^{-2}) + (2 \bullet 10^{-3})$

b.
154.39
$= 100 + 50 + 4 + 0.3 + 0.09$
$= (1 \bullet 100) + (5 \bullet 10) + (4 \bullet 1) + (3 \bullet 0.1) + (9 \bullet 0.01)$
$= (1 \bullet 10^{2}) + (5 \bullet 10^{1}) + (4 \bullet 10^{0}) + (3 \bullet 10^{-1}) + (9 \bullet 10^{-2})$

2. a. $-(21 - 6y)$
$= -1(21 - 6y)$
$= (-1)(21) - (-1)(6y)$
$= -21 + 6y$
$= 6y - 21$

b. $7(-8z + 12)$
$= 7(-8z) + (7)(12)$
$= -56z + 84$

3. a. $24 \div 11 = 2.1818\ldots = 2.\overline{18}$

b. $856 \div 45 = 19.022\ldots = 19.0\overline{2}$

4. a. $\left(\frac{3}{8}\right)^{2} = \frac{3}{8} \bullet \frac{3}{8} = \frac{9}{64}$

b. $(-0.2)^{3} = (-0.2) \bullet (-0.2) \bullet (-0.2) = -0.008$

5. $11\,°\text{C} - (-12\,°\text{C}) = 11\,°\text{C} + 12\,°\text{C} = 23\,°\text{C}$

6. a. $\$10 \div \$3.80$

$3.8\overline{)10} \longrightarrow 38\overline{)100.000\ldots}$

$2.631\ldots$
$-\ 76$
240
$-\ 228$
120
$-\ 114$
60
-38
22

2 gallons (There isn't enough for 3 gallons.)

b. $2 \bullet \$3.80 = \$7.60$

$\cancel{10}^{9}\cancel{0}^{1}.00$
$-\ 7.60$
2.40

$\$10 - \$7.60 = \$2.40$

Operations with Numbers in Scientific Notation

WARM-UP

a.
$$\begin{array}{r} {\scriptstyle 1}\\ 2.3\\ \times\ 1.6\\ \hline 138\\ +\ 230\\ \hline 3.68 \end{array}$$

b.
$$\begin{array}{r} {\scriptstyle 4}\\ 2.8\\ \times\ 6.5\\ \hline 140\\ +1680\\ \hline 18.20 \end{array}$$

c. $4.6\overline{)9.2} \rightarrow 46\overline{)92}$

$$\begin{array}{r} 2\\ \hline 92\\ -92\\ \hline 0 \end{array}$$

$9.2 \div 4.6 = 2$

PRACTICE

1.

✗	10×10^{12}
✗	0.91×10^{3}
✓	6.7×10^{-10}
✗	2.4^{10}
✓	8.005×10^{-9}
✗	14×10^{-15}
✗	$1.6 \div 10^{6}$

2. a. 54×10^{5}

The decimal point must move one place to the left, so the exponent must increase by one.

5.4×10^{6}

b. 0.03×10^{-7}

The decimal point must move two places to the right, so the exponent must decrease by two.

3×10^{-9}

c. 200×10^{-10}

The decimal point must move two places to the left, so the exponent must increase by two.

2×10^{-8}

3. a. $\left(2.3 \times 10^{2}\right) \bullet \left(4 \times 10^{4}\right)$

$2.3 \bullet 4 = 9.2$

$10^{2} \bullet 10^{4}$

$= 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$

$= 10^{6}$

$\left(2.3 \times 10^{2}\right) \bullet \left(4 \times 10^{4}\right) = 9.2 \times 10^{6}$

b. $(8\times10^3)\bullet(5\times10^7)$

$8\bullet5=40$

$10^3\bullet10^7$

$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^{10}$

$(8\times10^3)\bullet(5\times10^7)=40\times10^{10}$

The decimal point must move one place to the left, so the exponent must increase by one.

$(8\times10^3)\bullet(5\times10^7)=4\times10^{11}$

c. $(4.1\times10^3)\bullet(2\times10^6)$

$4.1\bullet2=8.2$

$10^3\bullet10^6$

$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^9$

$(4.1\times10^3)\bullet(2\times10^6)=8.2\times10^9$

4. a. $(9.9\times10^{10})\div(3\times10^5)$

$9.9\div3=3.3$

$10^{10}\div10^5$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}}$

$=10^5$

$(9.9\times10^{10})\div(3\times10^5)=3.3\times10^5$

b. $(8.6\times10^9)\div(1\times10^2)$

$8.6\div1=8.6$

$10^9\div10^2$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}}$

$=10^7$

$(8.6\times10^9)\div(1\times10^2)=8.6\times10^7$

c. $(3\times10^{11})\div(6\times10^7)$

$3\div6=0.5$

$10^{11}\div10^7$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}}$

$=10^4$

$(3\times10^{11})\div(6\times10^7)=0.5\times10^4$

The decimal point must move one place to the right, so the exponent must decrease by one.

$(3\times10^{11})\div(6\times10^7)=5\times10^3$

5. a. $(8\times10^4)\bullet(6\times10^4)$

$8\bullet6=48$

$10^4\bullet10^4$

$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^8$

$(8\times10^4)\bullet(6\times10^4)=48\times10^8$

The decimal point must move one place to the left, so the exponent must increase by one.

$(8\times10^4)\bullet(6\times10^4)=4.8\times10^9$

b. $(1.5\times10^5)\bullet(5.2\times10^9)$

$1.5\bullet5.2=7.8$

$10^5\bullet10^9$

$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^{14}$

$(1.5\times10^5)\bullet(5.2\times10^9)=7.8\times10^{14}$

c. $(8.4\times10^7)\div(4.2\times10^2)$

$8.4\div4.2=2$

$10^7\div10^2$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}}$

$=10^5$

$(8.4\times10^7)\div(4.2\times10^2)=2\times10^5$

d. $(3\times10^{10})\div(4\times10^3)$

$3\div4=0.75$

$10^{10}\div10^3$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}}$

$=10^7$

$(3\times10^{10})\div(4\times10^3)=0.75\times10^7$

The decimal point must move one place to the right, so the exponent must decrease by one.

$(3\times10^{10})\div(4\times10^3)=7.5\times10^6$

e. $(3\times10^5)\bullet(7\times10^5)$

$3\bullet7=21$

$10^5\bullet10^5$

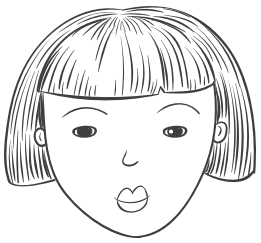
$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^{10}$

$(3\times10^5)\bullet(7\times10^5)=21\bullet10^{10}$

The decimal point must move one place to the left, so the exponent must increase by one.

$(3\times10^5)\bullet(7\times10^5)=2.1\bullet10^{11}$



REVIEW

1. a. 47.085

$=40+7+0.08+0.005$

$=(4\bullet10)+(7\bullet1)+(8\bullet0.01)+(5\bullet0.001)$

$=(4\bullet10^1)+(7\bullet10^0)+(8\bullet10^{-2})+(5\bullet10^{-3})$

b.

600.09021

$=600+0.09+0.0002+0.00001$

$=(6\bullet100)+(9\bullet0.01)+(2\bullet0.0001)+(1\bullet0.00001)$

$=(6\bullet10^2)+(9\bullet10^{-2})+(2\bullet10^{-4})+(1\bullet10^{-5})$

2. ~~0.3×10^8~~ 1.125×10^{-6} ~~10.5×10^3~~ ~~10×10^4~~ 9×10^{-7} ~~6.5^4~~

3. a. $-4^{-3}=-\dfrac{1}{4^3}=-\dfrac{1}{4\bullet4\bullet4}=-\dfrac{1}{64}$

b. $15^{-2}=\dfrac{1}{15^2}=\dfrac{1}{15\bullet15}=\dfrac{1}{225}$

4. a. $-6(9+\_\_)$

$=-6(9)+(-6)(\_\_)$

$=-54+48$

-6 times -8 is 48.

The missing value is -8.

b. $\_(6-9)$

$=\_(6)-(\_)(9)$

$=42-63$

7 times 6 is 42.

7 times 9 is 63.

The missing value is 7.

5. $100 = 1 \cdot 100$
$100 = 2 \cdot 50$
$100 = 4 \cdot 25$
$100 = 5 \cdot 20$
$100 = 10 \cdot 10$

Factors: 1, 2, 4, 5, 10, 20, 25, 50, 100

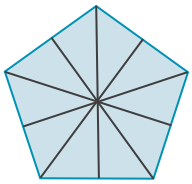
6. a. $\frac{23}{25} \cdot \frac{25}{23} = 1$

b. $-5\frac{7}{8} + 5\frac{7}{8} = 0$

7. $8.4 \text{ cm} \cdot 6 = 50.4 \text{ cm}$

8. a. 5 lines of symmetry

b.



9.

Books Read During Fall Break	
Charles	
Jane	
Laura	

Absolute Value and Coordinate Planes

WARM-UP

1. a. $\frac{1}{5} = \frac{2}{10} = 0.2$

   b. $\frac{3}{4} = \frac{75}{100} = 0.75$

   c. $\frac{9}{10} = 0.9$

2. a. $5 - \frac{1}{5} = 4\frac{4}{5}$

   b. $5 - 1\frac{1}{5}$

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

   $= 4\frac{4}{5} - 1$

   $= 3\frac{4}{5}$

   c. $5 - 2\frac{1}{5}$

   $= 5 - \frac{1}{5} - 2$

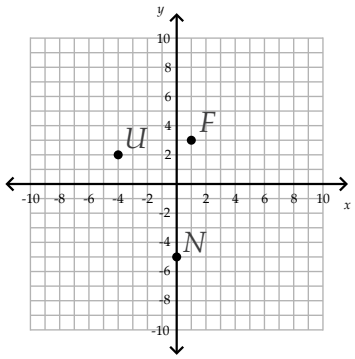
   $= 4\frac{4}{5} - 2$

   $= 2\frac{4}{5}$

PRACTICE

1. a. Quadrant IV (move right and down)
   b. *x*-axis (right of the origin)
   c. Quadrant III (left and down)
   d. origin
   e. Quadrant I (right and up)
   f. *y*-axis (above the origin)
   g. Quadrant II (left and up)
   h. Quadrant III (left and down)
   i. *x*-axis (left of the origin)

2. a. Point *F* is 1 unit to the right of the origin and 3 units above the origin.
   b. Point *U* is 4 units to the left of the origin and 2 units above the origin.
   c. Point *N* is 5 units below the origin.



3. A: $(-7,7)$ B: $(0,5)$ C: $(6,3)$
D: $(0,0)$ E: $(8,0)$ F: $(-5,-5)$
G: $(7,-5)$

4. a. $|5|=5$

b. $|-7|=7$

c. $\left|-\frac{5}{9}\right|=\frac{5}{9}$

d. $|12.7|=12.7$

e. $|0|=0$

5. a. $(1,4)$ and $(7,4)$

The y-coordinate is the same.

$7-1=6$

$|6|=6$

6 units

b. $(-2,3)$ and $(-2,-7)$

The x-coordinate is the same.

$3-(-7)=3+7=10$

$|10|=10$

10 units

c. $(0,0)$ and $(-5,0)$

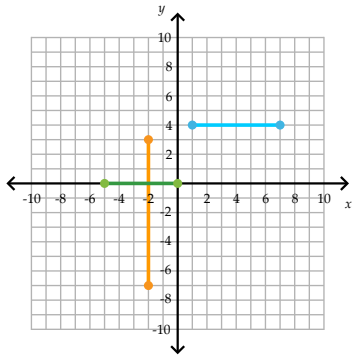
The y-coordinate is the same.

$0-(-5)=0+5=5$

$|5|=5$

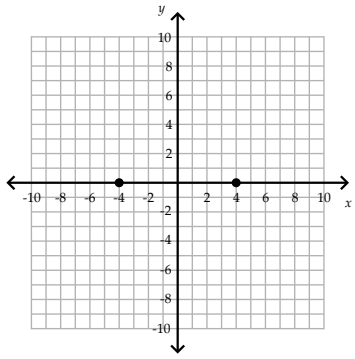
5 units

6.



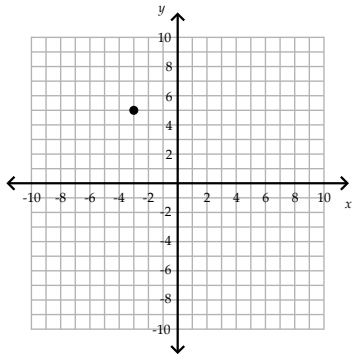
The blue line is 6 units long.
The orange line is 10 units long.
The green line is 5 units long.

7. $(4,0)$ and $(-4,0)$



Any point on the x-axis has a y–coordinate of zero.

8. $(-3,5)$



The point $(0,5)$ is on the y-axis. Points to the left of the y-axis and above the x-axis are in Quadrant II.

REVIEW

1. a. $(4\times10^8)\bullet(7\times10^3)$

$4\bullet7=28$

$10^8\bullet10^3$

$=10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10$

$=10^{11}$

$(4\times10^8)\bullet(7\times10^3)=28\times10^{11}$

The decimal point must move one place to the left, so the exponent must increase by one.

$(4\times10^8)\bullet(7\times10^3)=2.8\times10^{12}$

b. $(8\times10^9)\div(4\times10^5)$

$8\div4=2$

$10^9\div10^5$

$=\dfrac{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}}$

$=10^4$

$(8\times10^9)\div(4\times10^5)=2\times10^4$

2. a. $3^{-3}=\dfrac{1}{3^3}=\dfrac{1}{3\bullet3\bullet3}=\dfrac{1}{27}$

b. $12^{-2}=\dfrac{1}{12^2}=\dfrac{1}{12\bullet12}=\dfrac{1}{144}$

c. $10^{-4}=\dfrac{1}{10^4}=\dfrac{1}{10\bullet10\bullet10\bullet10}=\dfrac{1}{10000}$

3. a. $0.000062=6.2\times10^{-5}$

b. $0.0000000108=1.08\times10^{-8}$

c. $4030000=4.03\times10^6$

4. $\$1.29\div11\text{ oz}\approx\$0.12$ per ounce

$\$1.89\div15\text{ oz}\approx\$0.13$ per ounce

The 11-oz can has the better value.

5.
$$\begin{array}{r} 348.48 \\ 125\overline{)43560.00} \\ -375 \\ \hline 606 \\ -500 \\ \hline 1060 \\ -1000 \\ \hline 600 \\ -500 \\ \hline 1000 \\ -1000 \\ \hline 0 \end{array}$$

$43560\div125=348.48$

6. a. 23500.0900

b. 0.1998

7. a. $3^4=3\bullet3\bullet3\bullet3=81$

$4^3=4\bullet4\bullet4=64$

$3^4>4^3$

b. $-7^2=-7\bullet7=-49$

$-7^{-2}=-\dfrac{1}{7^2}=-\dfrac{1}{49}$

$-49<-\dfrac{1}{49}$

8. $131-27=104$

$104\div2=52$

$27+52=79$

Order of Operations: Part 1

WARM-UP

a. $6^3 - 2^4$
$= (6 \cdot 6 \cdot 6) - (2 \cdot 2 \cdot 2 \cdot 2)$
$= 216 - 16$
$= 200$

b. $2^5 \cdot 10$
$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 10$
$= 32 \cdot 10$
$= 320$

PRACTICE

1.

a. Multiplication is performed before division.	SOMETIMES
b. Addition is performed before subtraction.	SOMETIMES
c. Exponents are evaluated before subtracting.	ALWAYS
d. Operations in parentheses are performed first.	ALWAYS

2. a. $2 + 3 \cdot 4$
$= 2 + 12$
$= 14$

b. $3 - 5 + 7$
$= -2 + 7$
$= 5$

c. $(10 - 1) \div (2 + 1)$
$= 9 \div 3$
$= 3$

d. $3(25 - 5(3 + 1))$
$= 3(25 - 5(4))$
$= 3(25 - 20)$
$= 3(5)$
$= 15$

3. R: $5 + 10 \div 2$
$= 5 + 5$
$= 10$

F: $3 - [2 + (4 - 7)]$
$= 3 - [2 + (-3)]$
$= 3 - [-1]$
$= 3 + 1$
$= 4$

A: $2 \cdot 6 + 1$
$= 12 + 1$
$= 13$

P: $0 \cdot 5 - (-3)$
$= 0 - (-3)$
$= 0 + 3$
$= 3$

I: $3 \cdot (2 + 2 \cdot 5)$
$= 3(2 + 10)$
$= 3(12)$
$= 36$

S: $25 \div 5 + 2$

$= 5 + 2$

$= 7$

L: $3 - 4 \div (1 + 3)$

$= 3 - 4 \div 4$

$= 3 - 1$

$= 2$

E: $6 \div (2 - 1)$

$= 6 \div 1$

$= 6$

O: $3^2 \bullet 2 - 1 = 9 \bullet 2 - 1 = 18 - 1 = 17$

T: $6 \div 3 \bullet 2^2 = 6 \div 3 \bullet 4 = 2 \bullet 4 = 8$

"Simple; follow the order of operations."

REVIEW

1. a. $(3,6)$ and $(3,-5)$

$6 - (-5)$

$= 6 + 5$

$= 11$

$|11| = 11$

11 units

b. $(-5,4)$ and $(3,4)$

$-5 - 3 = -8$

$|-8| = 8$

8 units

2. a. $(2 \times 10^{13}) \div (8 \times 10^5)$

$2 \div 8 = 0.25$

$10^{13} \div 10^5$

$= \dfrac{\cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10}{\cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10}}$

$= 10^8$

$(2 \times 10^{13}) \div (8 \times 10^5) = 0.25 \times 10^8$

The decimal point must move one place to the right, so the exponent must decrease by one.

$(2 \times 10^{13}) \div (8 \times 10^5) = 2.5 \times 10^7$

b. $(9 \times 10^6) \bullet (4 \times 10^4)$

$9 \bullet 4 = 36$

$10^6 \bullet 10^4$

$= 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$

$= 10^{10}$

$(9 \times 10^6) \bullet (4 \times 10^4) = 36 \times 10^{10}$

The decimal point must move one place to the left, so the exponent must increase by one.

$(9 \times 10^6) \bullet (4 \times 10^4) = 3.6 \times 10^{11}$

3. a. $9.02 \times 10^{-8} \rightarrow$ 9.02

$9.02 \times 10^{-8} = 0.0000000902$

b. $6.7 \times 10^6 \rightarrow 6.7$

$6.7 \times 10^6 = 6{,}700{,}000$

4. a. $\dfrac{185}{225} = \dfrac{\cancel{5} \bullet 37}{3 \bullet 3 \bullet 5 \bullet \cancel{5}} = \dfrac{37}{45}$

b. $\dfrac{180}{216} = \dfrac{\cancel{2} \bullet \cancel{2} \bullet \cancel{3} \bullet \cancel{3} \bullet 5}{\cancel{2} \bullet \cancel{2} \bullet 2 \bullet \cancel{3} \bullet \cancel{3} \bullet 3} = \dfrac{5}{6}$

5. a. $>$ Because $\frac{1}{4}$ is less than 1, the result will be less than the original number.

b. $<$ Because 1.05 is greater than 1, the result will be greater than the original number.

c. $<$ Because 0.5 is less than 1, when dividing the result will be greater than the original number.

d. $>$ Because 1.5 is greater than 1, when dividing the result will be less than the original number.

6. 1 yard = 36 inches

$3 \cdot 36$ inches = 108 inches

$$\begin{array}{r} 27 \\ 4\overline{)108} \\ -\ 8 \\ \hline 28 \\ -28 \\ \hline 0 \end{array}$$

108 inches ÷ 4-inch strips = 27 strips

7. a. $-468 \div 26$

$$\begin{array}{r} 18 \\ 26\overline{)468} \\ -26 \\ \hline 208 \\ -208 \\ \hline 0 \end{array}$$

$-468 \div 26 = -18$

b. $-210 \div (-10) = 21$

Order of Operations: Part 2

WARM-UP

a. $19 - 6 \bullet 2$
$= 19 - 12$
$= 7$

b. $(3-10)5^2$
$= (-7)5^2$
$= (-7)25$
$= -175$

PRACTICE

1. a. true b. true c. true

2. a. $\frac{1}{3} + \left(1 - \frac{1}{5}\right)^4$ b. $\frac{1}{90 \div 2 \bullet 3}$

c. $\sqrt[3]{27} - 11 \bullet 2$ d. $1 - \sqrt{16} \div 2$

3. a. He should have evaluated the exponents before adding.
$3 + 5(4^2 + 3^2)$
$= 3 + 5(16 + 9)$
$= 3 + 5(25)$
$= 3 + 125$
$= 128$

b. He should have simplified the numerator and denominator separately before dividing.
$\frac{3+6}{15+30}$
$= \frac{9}{45}$
$= \frac{1}{5}$

4. a. $25 \bullet (1-2)^2$
$= 25 \bullet (-1)^2$
$= 25 \bullet 1$
$= 25$

b. $\frac{\sqrt{144}}{6^2}$
$= \frac{12}{36}$
$= \frac{1}{3}$

c. $\frac{8 + \sqrt[3]{64}}{6-2}$
$= \frac{8+4}{6-2}$
$= \frac{12}{4}$
$= 3$

d. $\frac{3 \bullet 5}{3^2 - 4}$
$= \frac{3 \bullet 5}{9-4}$
$= \frac{15}{5}$
$= 3$

5. a. $2^3 - 4\sqrt{25} = 8 - 4(5)$
To make this expression equal 20, insert the set of parentheses like this:
$(8-4)(5) = (2^3 - 4)\sqrt{25}$

b. $100 - 10 - 9^2 = 100 - 10 - 81$
To make this expression equal 171, insert the set of parentheses like this:
$100 - (10 - 81) = 100 - (10 - 9^2)$

REVIEW

1. a.

742.082

$= 700 + 40 + 2 + 0.08 + 0.002$

$= (7 \bullet 100) + (4 \bullet 10) + (2 \bullet 1) + (8 \bullet 0.01) + (2 \bullet 0.001)$

$= (7 \bullet 10^2) + (4 \bullet 10^1) + (2 \bullet 10^0) + (8 \bullet 10^{-2}) + (2 \bullet 10^{-3})$

b.

8005.4061

$= 8000 + 5 + 0.4 + 0.006 + 0.0001$

$= (8 \bullet 1000) + (5 \bullet 1) + (4 \bullet 0.1) + (6 \bullet 0.001) + (1 \bullet 0.0001)$

$= (8 \bullet 10^3) + (5 \bullet 10^0) + (4 \bullet 10^{-1}) + (6 \bullet 10^{-3}) + (1 \bullet 10^{-4})$

2. $18\frac{1}{2}$ feet $\div \frac{1}{4}$-foot-long pieces

$18\frac{1}{2} \div \frac{1}{4}$

$= \frac{37}{2} \div \frac{1}{4}$

$= \frac{37}{\cancel{2}_{1}} \bullet \frac{\cancel{4}^{2}}{1}$

$= \frac{74}{1}$

$= 74$

74 pieces

3. a. $\left(16\frac{1}{4} - \left(\frac{1}{2}\right)^2\right)\left(\frac{1}{2}\right)^3$

$= \left(16\frac{1}{4} - \frac{1}{4}\right)\left(\frac{1}{8}\right)$

$= (16)\left(\frac{1}{8}\right)$

$= \left(\frac{16}{1}\right)\left(\frac{1}{8}\right)$

$= 2$

b. $-5\left(62 - 4^3\right)$

$= -5(62 - 64)$

$= -5(-2)$

$= 10$

4. a. $273 + 98$

$273 + 100 = 373$

$373 - 2 = 371$

b. $887 + 98$

$887 + 100 = 987$

$987 - 2 = 985$

c. $455 + 98$

$455 + 100 = 555$

$555 - 2 = 553$

5. a. $932 - 98$

$932 - 100 = 832$

$832 + 2 = 834$

b. $561 - 98$

$561 - 100 = 461$

$461 + 2 = 463$

c. $437 - 98$

$437 - 100 = 337$

$337 + 2 = 339$

6. 1 hour = 60 minutes

$20 \div 60 = \frac{1}{3}$

1 hour 20 minutes $= 1\frac{1}{3}$ hours

450 calories per hour $\bullet$ $1\frac{1}{3}$ hours

$450 \bullet 1\frac{1}{3}$

$= \frac{\cancel{450}^{150}}{1} \bullet \frac{4}{\cancel{3}_{1}}$

$= \frac{600}{1}$

$= 600$

600 calories

7. a. $-9 \bullet 2 \bullet (-5) = -18 \bullet (-5) = 90$

b. $(-60) \div (-3) \div (-5) = 20 \div (-5) = -4$

Simplifying Expressions

WARM-UP

a. $40(2+4)$
$=40(2)+40(4)$
$=80+160$
$=240$

b. $5\left(\frac{3}{5}+2\right)$
$=5\left(\frac{3}{5}\right)+5(2)$
$=\frac{\cancel{5}}{1}\left(\frac{3}{\cancel{5}}\right)+10$
$=3+10$
$=13$

c. $6(4-7)$
$=6(4)-6(7)$
$=24-42$
$=-18$

PRACTICE

1. a. yes (no equal sign)
b. yes (no equal sign)
c. no (has an equal sign)
d. yes (no equal sign)
e. no (has an inequality sign)
f. yes (no equal sign)

2. a. 3
b. 5
c. 5
d. 8

3. a. $3x+4-2n$ b. $4-2b+1+\frac{2}{3}c-1d$
c. $5F-\frac{3}{2}G+\frac{7}{2}-1+1G$
d. $1p+1p+1p+1p+1p+0+0+0$

4. a. $2(3+x)=2(3)+2(x)=6+2x$

b. $4(x-1)=4(x)-4(1)=4x-4$

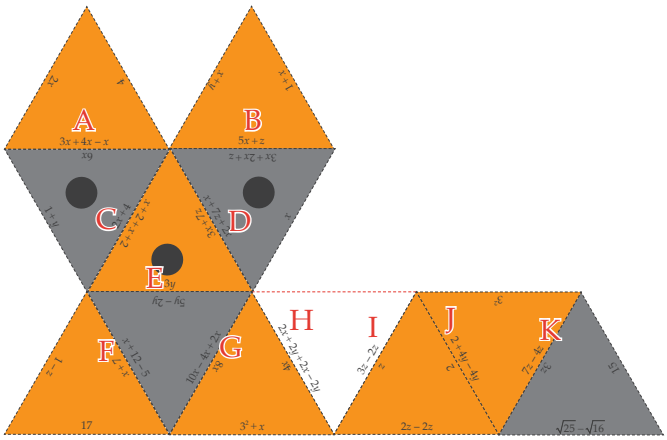
c. $\frac{1}{2}(4+x-y)=\frac{1}{2}(4)+\frac{1}{2}(x)-\frac{1}{2}(y)$
$=2+\frac{1}{2}x-\frac{1}{2}y$

d. $-\left(y+2-\frac{x}{2}\right)=-1(y)+-1(2)-(-1)\left(\frac{x}{2}\right)$
$=-y-2+\frac{x}{2}$

5.

$4y$	$5x$	2.25	$-y$
7	$0.8y$	z	$5y$

6.



Detailed work for the matching expressions is shown below.

A $3x+4x-x=7x-x=6x$

B $3x+2x+z=5x+z$

C $x+2+x+2=2x+4$

D $x+7z+2x=3x+7z$

E $5y-2y=3y$

F $x+12-5=x+7$

G $10x-4x+2x=6x+2x=8x$

H $2x+2y+2x-2y=4x+0=4x$

I $3z-2z=z$

J $2+4y-4y=2+0=2$

K $7z-4z=3z$

REVIEW

1. a. $2\left(1-\frac{5}{8}\bullet\frac{2}{3}\right)$

$=2\left(1-\frac{5}{12}\right)$

$=2\left(\frac{12}{12}-\frac{5}{12}\right)$

$=2\left(\frac{7}{12}\right)$

$=\frac{2}{1}\left(\frac{7}{12}\right)$

$=\frac{7}{6}$ or $1\frac{1}{6}$

b. $\frac{3(5-1)\div 6}{3^2+\sqrt{4}}$

$=\frac{3(4)\div 6}{3^2+\sqrt{4}}$

$=\frac{3(4)\div 6}{9+2}$

$=\frac{12\div 6}{9+2}$

$=\frac{2}{9+2}$

$=\frac{2}{11}$

2. $7.235=7\frac{235}{1000}=7\frac{47}{200}$

3. a. 15 minutes • 6 days = 90 minutes per week

b. 90 minutes per week ÷ 3 days = 30 minutes per day

4. a. $0.0000708 = 7.08 \times 10^{-5}$

b. $60{,}230{,}000{,}000 = 6.023 \times 10^{10}$

5. a. $\left(\frac{2}{5}\right)^3$

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

$= \frac{8}{125}$

b. $-11^2 = -(11 \bullet 11) = -121$

6. Cost: \$24.18 + \$1.37 = \$25.55

Money made: 159 cups • \$0.50 = \$79.50

Profit: \$79.50 – \$25.55 = \$53.95

Evaluating Expressions

WARM-UP

a. $(-8)^2 - 6^2$

$= (-8)(-8) - (6)(6)$

$= 64 - 36$

$= 28$

b. $3 \bullet 3 \bullet 3 = 27$

$\sqrt[3]{27} = 3$

PRACTICE

1. a. $3 - \left(\frac{1}{2}\right)^2$

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

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

b. $9 - \frac{\left((1)^3 - 8\right)}{2(1)}$

$= 9 - \frac{(1-8)}{2}$

$= 9 - \frac{(-7)}{2}$

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

$= \frac{18}{2} + \frac{7}{2}$

$= \frac{25}{2} = 12\frac{1}{2}$

c. Anything to the zero power is 1.

$\left(2 - \frac{4}{7}\right)^0 + 3\left(\frac{4}{7}\right)^0$

$= 1 + 3(1)$

$= 1 + 3$

$= 4$

d. $(9-15)^2 + \sqrt{9}$

$= (-6)^2 + \sqrt{9}$

$= 36 + 3$

$= 39$

e. $2\left[1.5 - \sqrt{16}\left(3 - (1.5)^2\right)\right]$

$= 2\left[1.5 - \sqrt{16}(3 - 2.25)\right]$

$= 2\left[1.5 - \sqrt{16}(0.75)\right]$

$= 2\left[1.5 - 4(0.75)\right]$

$= 2\left[1.5 - 3\right]$

$= 2\left[-1.5\right]$

$= -3$

2.

	$y=0,$ $z=0$	$y=5,$ $z=0$	$y=-10,$ $z=-3$
$\frac{y-5}{y+5}+z$	$\frac{0-5}{0+5}+0$ $=\frac{-5}{5}+0$ $=-1+0$ $=-1$	$\frac{5-5}{5+5}+0$ $=\frac{0}{10}+0$ $=0+0$ $=0$	$\frac{-10-5}{-10+5}+(-3)$ $=\frac{-15}{-5}+(-3)$ $=3+(-3)$ $=0$
$yz-(1+y)$	$(0)(0)-(1+0)$ $=(0)(0)-1$ $=0-1$ $=-1$	$(5)(0)-(1+5)$ $=(5)(0)-6$ $=0-6$ $=-6$	$(-10)(-3)-(1+(-10))$ $=(-10)(-3)-(-9)$ $=30-(-9)$ $=30+9$ $=39$
$(y-z)(y+z)$	$(0-0)(0+0)$ $=(0)(0)$ $=0$	$(5-0)(5+0)$ $=(5)(5)$ $=25$	$(-10-(-3))(-10+(-3))$ $=(-7)(-13)$ $=91$

3. b. Substitute 12 in place of s.

$$\frac{s(-1+\_\_)}{2}=\frac{12(-1+\_\_)}{2}$$

In order for this expression to equal 66 (the output), the numerator must be 132, because $132 \div 2 = 66$.

$$\frac{132}{2}=\frac{12(-1+\_\_)}{2}$$

The expression in parentheses must be 11 because $12 \bullet 11 = 132$.
The missing value must be 12 because $-1+12=11$.

c. Substitute -2 in place of t and 5 in place of r.

$$2t^2+\sqrt[3]{\_\_}-r=2(-2)^2+\sqrt[3]{\_\_}-5$$

Simplify the expression as much as possible.

$$2(-2)^2+\sqrt[3]{\_\_}-5$$
$$=2(4)+\sqrt[3]{\_\_}-5$$
$$=8+\sqrt[3]{\_\_}-5$$
$$=3+\sqrt[3]{\_\_}$$

In order for the expression to equal 5 (the output), the missing value's cube root must be 2, because $3+2=5$.

Since the cube root of 8 is 2, the missing value is 8.

REVIEW

1. a. $2(y-5)+3y$
$=2y-10+3y$
$=5y-10$

b. $5z-2z+19-z-7z=-5z+19$

2. a. $\dfrac{83-14^2}{-16+8\bullet 2}$
$=\dfrac{83-196}{-16+16}$
$=\dfrac{-113}{0}$
undefined

b. $\left(3\bullet 5+3^4\right)\left(\dfrac{1}{4}\right)$
$=\left(3\bullet 5+81\right)\left(\dfrac{1}{4}\right)$
$=\left(15+81\right)\left(\dfrac{1}{4}\right)$
$=\left(96\right)\left(\dfrac{1}{4}\right)$
$=24$

3. a. $(-9,-5)$ b. $(-4,8)$ c. $(0,-3)$
d. $(3,-7)$ e. $(6,2)$

4. a. $9(72)$
$=9(70+2)$
$=630+18$
$=648$

b. $154(6)$
$=(150+4)(6)$
$=6(150+4)$
$=900+24$
$=924$

5. 20 minutes after 4:38 PM is 4:58 PM.
6 minutes after 4:58 PM is 5:04 PM.

6. a. 6,800
b. 210
c. 25,000

7. a. $13^{-2}=\dfrac{1}{13^2}=\dfrac{1}{169}$

b. $(-20)^{-2}=\dfrac{1}{(-20)^2}=\dfrac{1}{400}$

8. $5.154=5\dfrac{154}{1000}=5\dfrac{77}{500}$

Writing Expressions

WARM-UP

1. a. $0.5 = \frac{5}{10} = \frac{1}{2}$

   b. $0.\overline{6} = \frac{2}{3}$

   c. $0.81 = \frac{81}{100}$

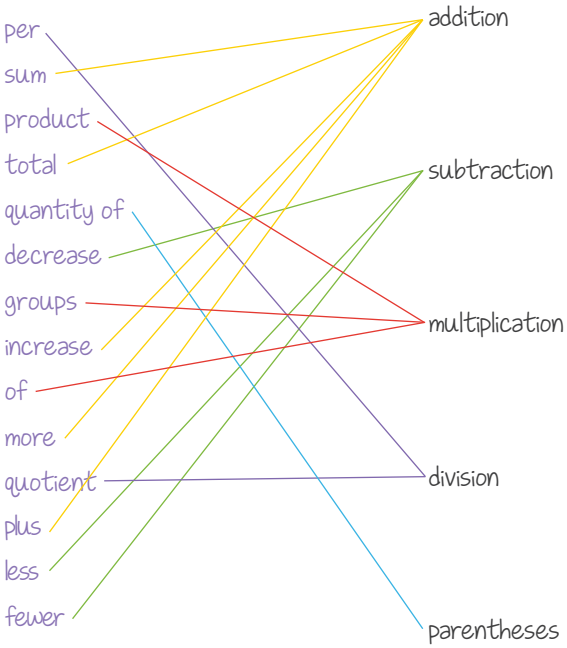
2. a. $12 \cdot 3 = 36$
   $12 \cdot 0.3 = 3.6$

   b. $25 \cdot 5 = 125$
   $25 \cdot 0.5 = 12.5$

   c. $100 \cdot 2 = 200$
   $100 \cdot 0.2 = 20$

PRACTICE

1.



2. a. $2a + 5$

   b. $\frac{1}{2}x - 17$

   c. $a + b + 4$

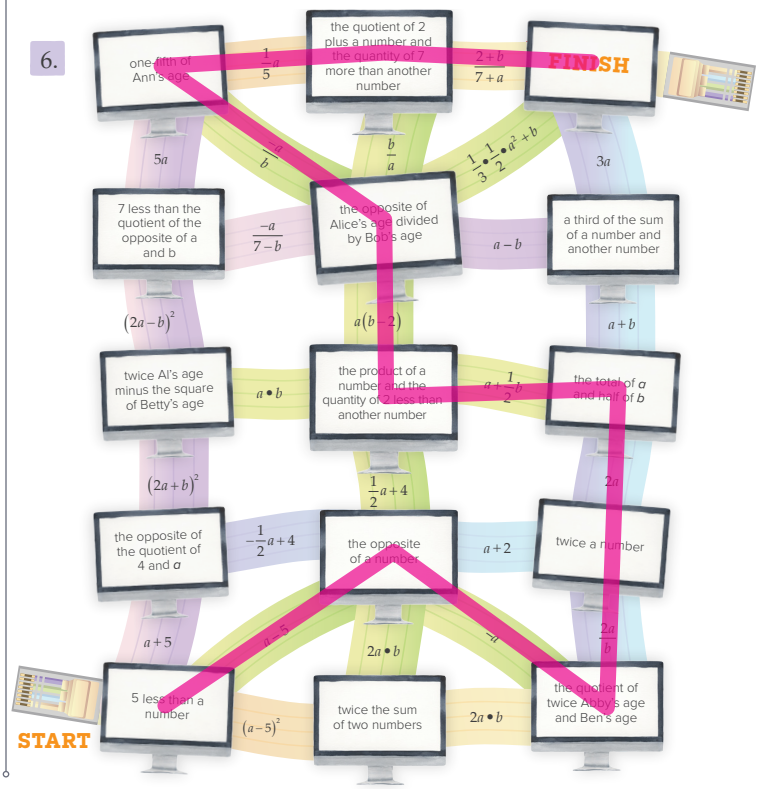
   d. $\frac{x}{2}$ or $x \div 2$

3. Sue's carrots $= c$
   Jim's carrots $= 2c$
   $c + 2c$ or $3c$

4. $\frac{2}{3}x$

5. $30 - 5j$ or $30 - j - j - j - j - j$

6.



REVIEW

1. a. $400000 + 70000 + 9000 + 300 + 5 = 479305$

b.
$$(8 \bullet 100000) + (1 \bullet 10000) + (6 \bullet 100) + (1 \bullet 10) + (2 \bullet 1)$$
$$= 800000 + 10000 + 600 + 10 + 2$$
$$= 810612$$

2.
$$\begin{array}{r} 1\overset{3}{\cancel{4}}\overset{12}{\cancel{3}}.2 \\ -\ 119.8 \\ \hline 23.4 \end{array}$$

23.4 lb

3. a. $3(8d + 9e + 2)$
$= 24d + 27e + 6$

b. $5f + 3g - g - 2f$
$= 3f + 2g$

4. $\dfrac{10+5}{10-5} = \dfrac{15}{5} = 3$

5. a. $3^2 = 3 \bullet 3 = 9$

b. $3^{-2} = \dfrac{1}{3^2} = \dfrac{1}{3 \bullet 3} = \dfrac{1}{9}$

6. a. Use the Distributive Property to expand the expression.

$3(\_\_ + 18) = 3(\_\_) + 3(18) = 3(\_\_) + 54$

In order for this expression to equal 48, 3 times the missing integer must equal –6.

$-6 + 54 = 48$

$3(\_\_) = -6$

The missing integer must be –2.

b. Use the Distributive Property to expand the expression.

$-9(17 + \_\_)$
$= -9(17) + (-9)(\_\_)$
$= -153 + (-9)(\_\_)$

In order for this expression to equal –108, –9 times the missing integer must equal 45.

$-153 + 45 = -108$

$(-9)(\_\_) = 45$

The missing integer must be –5.

Writing Equations

WARM-UP

a. $5+8n$

b. $n \div 3 - 9$ or $\frac{n}{3} - 9$

PRACTICE

1. a. $5+4=9$
$3 \bullet 3 = 9$
$5+4=3 \bullet 3$

b. $4^2+3^2=16+9=25$
$4+3=7$
$4^2+3^2 \neq 4+3$

c. $50-22=28$
$80-52=28$
$50-22=80-52$

d. $5x-4x=x$
$x+2=5x-4x+2$

e. $2p+3p=5p$
$2p+3p \neq 5p+7$

f. $2(x+1)=2x+2$
$2x+1 \neq 2x+2$

2. a. $g=e+10$

b. $\frac{3}{4}e=l+3$

c. $\sqrt[3]{l}=\frac{1}{12}n$

d. $d=n-2$

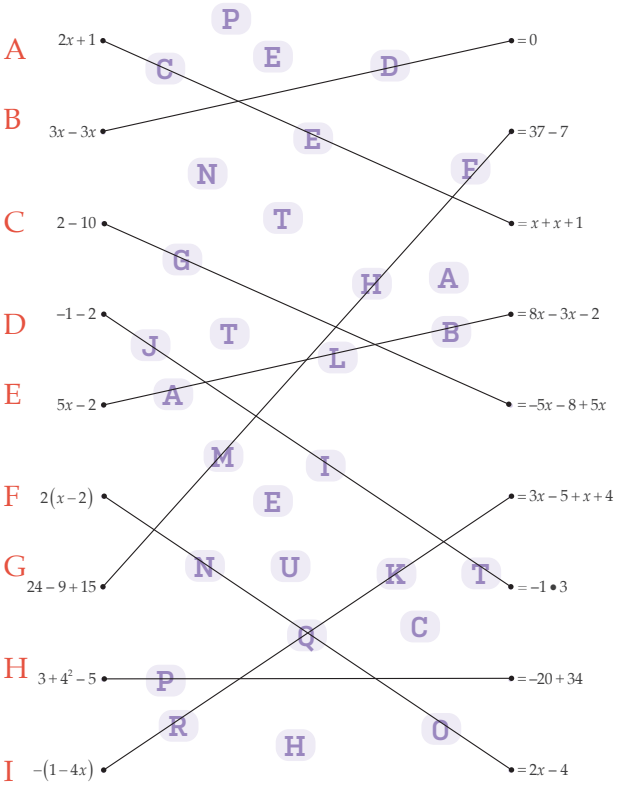
e. $d+6=5j \div 3$

f. $-(u-j)=3$

g. $j=r+u-1$

h. $2r^2=s+1$

3.



PENTATEUCH

Detailed work for the matching expressions is shown below.

A $x+x+1=2x+1$

B $3x-3x=0$

C $2-10=-8$
$-5x-8+5x=-8$
$-5x-8+5x=2-10$

D $-1-2=-3$
$-1 \bullet 3=-3$
$-1-2=-1 \bullet 3$

E $8x-3x-2=5x-2$

F $2(x-2)=2x-4$

G $24-9+15=30$
$37-7=30$
$24-9+15=37-7$

H $3+4^2-5=3+16-5=14$
$-20+34=14$
$3+4^2-5=-20+34$

I $-(1-4x)=-1+4x=4x-1$
$3x-5+x+4=4x-1$
$-(1-4x)=3x-5+x+4$

REVIEW

1. a. $\sqrt{w}+\sqrt[3]{x}$

b. $\frac{1}{2}y-2z$

2. $4(5^2-4^2)$
$=4(25-16)$
$=4(9)$
$=36$

3. $(-16,-20)$ and $(-16,-33)$

The x-coordinate is the same.
$-20-(-33)=-20+33=13$
$|13|=13$

4. a. $\frac{3}{5}-\frac{7}{\cancel{10}_{5}}\bullet\frac{\cancel{2}^{1}}{3}$
$=\frac{3}{5}-\frac{7}{15}$
$=\frac{9}{15}-\frac{7}{15}$
$=\frac{2}{15}$

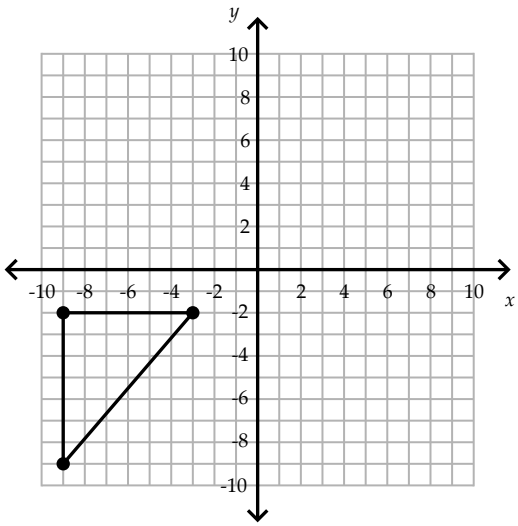
b. $-\frac{4}{9}\div\frac{4}{15}+\frac{11}{3}\bullet\frac{9}{2}$
$=-\frac{\cancel{4}}{\cancel{9}_{3}}\bullet\frac{\cancel{15}^{5}}{\cancel{4}}+\frac{11}{\cancel{3}_{1}}\bullet\frac{\cancel{9}^{3}}{2}$
$=-\frac{5}{3}+\frac{33}{2}$
$=-\frac{10}{6}+\frac{99}{6}$
$=\frac{89}{6}$
$=14\frac{5}{6}$

5. a. $2\overline{)220}$
$2\overline{)110}$
$5\overline{)55}$
11
$220=2\bullet2\bullet5\bullet11$

b. $2\overline{)380}$
$2\overline{)190}$
$5\overline{)95}$
19
$380=2\bullet2\bullet5\bullet19$

c. $\frac{220}{380}=\frac{\cancel{2}\bullet\cancel{2}\bullet\cancel{5}\bullet11}{\cancel{2}\bullet\cancel{2}\bullet\cancel{5}\bullet19}=\frac{11}{19}$

6. a.



b. III

Solving One-Step Equations

WARM-UP

a. $x^2+6=3(x-2)$

b. $2\sqrt{x}=12$

c. $10n=n+18$

PRACTICE

1. $\boxed{2x+3=\frac{4}{2}}$ $\left(x+1=3\right)$

$\boxed{\frac{x}{3}=-\frac{1}{6}}$ $\left(x-1.7=0.3\right)$

Substitutions for each equation are shown below.

$2x+3=\frac{4}{2}$

$2\left(-\frac{1}{2}\right)+3=-1+3=2$

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

$x+1=3$

$2+1=3$

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

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

$x-1.7=0.3$

$2-1.7=0.3$

2. a. $4z=2$

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

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

Check: $4\left(\frac{1}{2}\right)\stackrel{?}{=}2$

$2=2$

b. $2+c=15$

$2+c-2=15-2$

$c=13$

Check: $2+13\stackrel{?}{=}15$

$15=15$

c. $3.4f=0$

$\frac{3.4f}{3.4}=\frac{0}{3.4}$

$f=0$

Check: $3.4(0)\stackrel{?}{=}0$

$0=0$

d. $\frac{x}{3}=4$

$3\bullet\frac{x}{3}=4\bullet3$

$1x=12$

$x=12$

Check: $\frac{12}{3}\stackrel{?}{=}4$

$4=4$

e. $a-15=35$

$a-15+15=35+15$

$a=50$

Check: $50-15\stackrel{?}{=}35$

$35=35$

f. $t\div7=2$

$t\div7\bullet7=2\bullet7$

$1t=14$

$t=14$

Check: $14\div7\stackrel{?}{=}2$

$2=2$

3. Equations may vary, but answers should match.

a. Equation: $40680 = 360 \bullet w$

$$\frac{40680}{360} = \frac{360 \bullet w}{360}$$

$$113 = w$$

Solution: $w = 113$

Answer: 113 ft

b. Equation: $n + 8 = 20$

$$n + 8 - 8 = 20 - 8$$

Solution: $n = 12$

Answer: 12 years

c. Equation: $57 \bullet t = 228$

$$\frac{57 \bullet t}{57} = \frac{228}{57}$$

Solution: $t = 4$

Answer: 4 hours

d. Equation: $3 + w = 12$

$$3 + w - 3 = 12 - 3$$

Solution: $w = 9$

Answer: 9 cups

REVIEW

1. Any variable may be used.

a. $n \div 15 = 5$ or $\frac{n}{15} = 5$

b. $n = 6(m + 8)$

2. a. $2.4(r - 0.5s + 2) + s - 2r$

$= 2.4r - 1.2s + 4.8 + s - 2r$

$= 0.4r - 0.2s + 4.8$

b. $5.8t - (12.2 - 8t)$

$= 5.8t - 12.2 + 8t$

$= 13.8t - 12.2$

3. a. $23^{-5} = \frac{1}{23^5}$

b. $(-14)^{-6} = \frac{1}{(-14)^6}$

c. $-19^{-8} = -\frac{1}{19^8}$

4. 12 hours before 10:20 AM is 10:20 PM.
One hour before 10:20 PM is 9:20 PM.

5. a. $20 \bullet 8 = 160 \rightarrow \$16$

b. $6 \bullet 8 = 48 \rightarrow \$4.80$

c. $60 \bullet 8 = 480 \rightarrow \$48$

6.
$$\begin{array}{r} 96 \\ 324\overline{)31104} \\ \underline{-2916} \\ 1944 \\ \underline{-1944} \\ 0 \end{array}$$

$31104 \div 324 = 96$

7. $\frac{12 \bullet \sqrt[3]{125}}{2^2}$

$= \frac{12 \bullet 5}{4}$

$= \frac{60}{4}$

$= 15$

Unit 1 Review

1. $200 \bullet 4 = 800$
$250 \bullet 4 = 1000$
Estimate: between 800 and 1000

Rounded:
$241 \bullet 3.7412 = 901.6292 \approx 901.629$

2.
$$\begin{array}{r} 13.16\ldots \\ 48\overline{)632.00\ldots} \\ -48 \\ \hline 152 \\ -144 \\ \hline 80 \\ -48 \\ \hline 320 \\ -288 \\ \hline 32 \end{array}$$

$632 \div 48 = 13.1\overline{6}$

3.

Fraction	Decimal
$\frac{3}{5}$	0.6
$\frac{2}{3}$	$0.\overline{6}$
$4\frac{5}{8}$	4.625

Detailed work is shown below.

$0.6 = \frac{6}{10} = \frac{3}{5}$

$\frac{2}{3} \rightarrow$
$$\begin{array}{r} 0.6\ldots \\ 3\overline{)2.0\ldots} \\ -18 \\ \hline 2 \end{array}$$

$4\frac{5}{8} = \frac{37}{8}$

$$\begin{array}{r} 4.625 \\ 8\overline{)37.000} \\ -32 \\ \hline 50 \\ -48 \\ \hline 20 \\ -16 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

4.
$$\begin{array}{r|l} 2 & 420 \\ 2 & 210 \\ 3 & 105 \\ 5 & 35 \\ & 7 \end{array} \qquad \begin{array}{r|l} 2 & 600 \\ 2 & 300 \\ 2 & 150 \\ 3 & 75 \\ 5 & 25 \\ & 5 \end{array}$$

$\frac{420}{600} = \frac{\cancel{2} \bullet \cancel{2} \bullet \cancel{3} \bullet \cancel{5} \bullet 7}{\cancel{2} \bullet \cancel{2} \bullet 2 \bullet \cancel{3} \bullet \cancel{5} \bullet 5} = \frac{7}{10}$

5.
$$\begin{array}{r|l} 2 & 248 \\ 2 & 124 \\ 2 & 62 \\ & 31 \end{array} \qquad \begin{array}{r|l} 2 & 1240 \\ 2 & 620 \\ 2 & 310 \\ 5 & 155 \\ & 31 \end{array}$$

$\frac{248}{1240} = \frac{\cancel{2} \bullet \cancel{2} \bullet \cancel{2} \bullet \cancel{31}}{\cancel{2} \bullet \cancel{2} \bullet \cancel{2} \bullet 5 \bullet \cancel{31}} = \frac{1}{5}$

6.

Expression	Value
$4-10+2+7-1$	2
$-3+5-7+4-2$	-3
$-1+4-2-(-1)$	2

Detailed work is shown below.

$$\begin{aligned}&4-10+2+7-1\\&=-6+2+7-1\\&=-4+7-1\\&=3-1\\&=2\end{aligned}$$

$$\begin{aligned}&-3+5-7+4-2\\&=2-7+4-2\\&=-5+4-2\\&=-1-2\\&=-3\end{aligned}$$

$$\begin{aligned}&-1+4-2-(-1)\\&=3-2-(-1)\\&=1-(-1)\\&=1+1\\&=2\end{aligned}$$

Expression	Value
$\frac{3}{4}-\frac{7}{8}$	$-\frac{1}{8}$
$\frac{1}{2}+\left(-\frac{5}{8}\right)$	$-\frac{1}{8}$
$3-6.5$	-3.5

Detailed work is shown below.

$$\frac{3}{4}-\frac{7}{8}=\frac{6}{8}-\frac{7}{8}=-\frac{1}{8}$$

$$\frac{1}{2}+\left(-\frac{5}{8}\right)=\frac{4}{8}+\left(-\frac{5}{8}\right)=-\frac{1}{8}$$

$$3-6.5=3+(-6.5)$$

$$6.5-3=3.5$$

$$|-6.5|>|3|$$

$$3-6.5=-3.5$$

7. a. same sign, positive answer

$$\begin{array}{r}{}^{1}17\\ \times\ 2\\ \hline 34\end{array}$$

$-17\bullet(-2)=34$

b. different signs, negative answer

$$\begin{array}{r}3.4\\ \times\ 1.2\\ \hline 68\\ +\ 340\\ \hline 4.08\end{array}$$

$1.2\bullet(-3.4)=-4.08$

8. a. different signs, negative answer

$$\begin{array}{r}12\\ 7\overline{)84}\\ \underline{-7}\\ 14\\ \underline{-14}\\ 0\end{array}$$

$84\div(-7)=-12$

b. different signs, negative answer

$$\frac{-3\frac{4}{5}}{\frac{5}{12}}$$

$$=-3\frac{4}{5}\div\frac{5}{12}$$

$$=-\frac{19}{5}\bullet\frac{12}{5}$$

$$=-\frac{228}{25}$$

$$=-9\frac{3}{25}$$

$$\frac{-3\frac{4}{5}}{\frac{5}{12}} = -9\frac{3}{25}$$

9.

Exponent Form	Expansion	Simplified
4^3	$4 \bullet 4 \bullet 4$	64
$(-3)^5$	$-3(-3)(-3)(-3)(-3)$	-243
$\frac{75}{5^4}$	$\frac{75}{5 \bullet 5 \bullet 5 \bullet 5}$	$\frac{3}{25}$
$\left(\frac{4}{5}\right)^4$	$\frac{4}{5} \bullet \frac{4}{5} \bullet \frac{4}{5} \bullet \frac{4}{5}$	$\frac{256}{625}$
3^{-5}	$\frac{1}{3 \bullet 3 \bullet 3 \bullet 3 \bullet 3}$	$\frac{1}{243}$
10^{-6}	$\frac{1}{10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10}$	$\frac{1}{1000000}$

Detailed work is shown below.

$$(-3)^5$$
$$= -3 \bullet (-3) \bullet (-3) \bullet (-3) \bullet (-3)$$
$$= 9 \bullet (-3) \bullet (-3) \bullet (-3)$$
$$= -27 \bullet (-3) \bullet (-3)$$
$$= 81 \bullet (-3)$$
$$= -243$$

$$\frac{75}{5^4} = \frac{75}{5 \bullet 5 \bullet 5 \bullet 5} = \frac{3 \bullet \cancel{5} \bullet \cancel{5}}{\cancel{5} \bullet \cancel{5} \bullet 5 \bullet 5} = \frac{3}{25}$$

$$\left(\frac{4}{5}\right)^4 = \frac{4}{5} \bullet \frac{4}{5} \bullet \frac{4}{5} \bullet \frac{4}{5} = \frac{256}{625}$$

$$10^{-6} = \frac{1}{10^6} = \frac{1}{10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10} = \frac{1}{1000000}$$

10. a. $10^{-2} \rightarrow 1.$
0.01

b. $10^{-5} \rightarrow 1.$
0.00001

11. a.
$$500002014$$
$$= 500000000 + 2000 + 10 + 4$$
$$= (5 \bullet 100000000) + (2 \bullet 1000) + (1 \bullet 10) + (4 \bullet 1)$$
$$= (5 \bullet 10^8) + (2 \bullet 10^3) + (1 \bullet 10^1) + (4 \bullet 10^0)$$

b.
$$6284.203$$
$$= 6000 + 200 + 80 + 4 + 0.2 + 0.003$$
$$= (6 \bullet 1000) + (2 \bullet 100) + (8 \bullet 10) + (4 \bullet 1) + (2 \bullet 0.1) + (3 \bullet 0.001)$$
$$= (6 \bullet 10^3) + (2 \bullet 10^2) + (8 \bullet 10^1) + (4 \bullet 10^0) + (2 \bullet 10^{-1}) + (3 \bullet 10^{-3})$$

12. a. $54{,}382{,}300{,}000 = 5.43823 \times 10^{10}$

b. $0.0000000423 = 4.23 \times 10^{-8}$

13. a. $8.15 \times 10^{-3} \rightarrow 8.15$
0.00815

b. $9.01 \times 10^6 \rightarrow 9.01$
9010000

14. $(1.6\times10^7)\div(3.2\times10^4)$

$1.6\div3.2=0.5$

$10^7\div10^4$

$$=\frac{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}\bullet\cancel{10}\bullet\cancel{10}}$$

$=10^3$

$(1.6\times10^7)\div(3.2\times10^4)=0.5\times10^3$

The decimal point must move one place to the right, so the exponent must decrease by one.

$(1.6\times10^7)\div(3.2\times10^4)=5\times10^2$

$(8.1\times10^2)\bullet(7.23\bullet10^3)$

$8.1\bullet7.23=58.563$

$10^2\bullet10^3$

$=10\bullet10\bullet10\bullet10\bullet10$

$=10^5$

$(8.1\times10^2)\bullet(7.23\bullet10^3)=58.563\times10^5$

The decimal point must move one place to the left, so the exponent must increase by one.

$(8.1\times10^2)\bullet(7.23\bullet10^3)=5.8563\times10^6$

$(1.09\times10^8)\div(2\times10^2)$

$1.09\div2=0.545$

$10^8\div10^2$

$$=\frac{\cancel{10}\bullet\cancel{10}\bullet10\bullet10\bullet10\bullet10\bullet10\bullet10}{\cancel{10}\bullet\cancel{10}}$$

$=10^6$

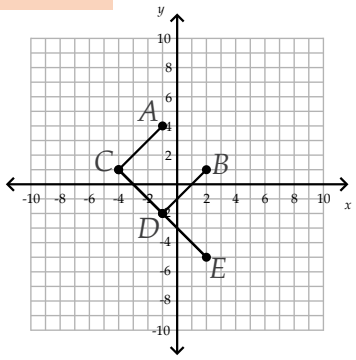
$(1.09\times10^8)\div(2\times10^2)=0.545\times10^6$

The decimal point must move one place to the right, so the exponent must decrease by one.

$(1.09\times10^8)\div(2\times10^2)=5.45\times10^5$

Greatest:	5.8563×10^6
	5.45×10^5
Least:	5×10^2

15. $A\ (-1,4)\quad B\ (2,1)$



16. Distance from A to D:

$(-1,4)$ and $(-1,-2)$

The x-coordinate is the same.

$4-(-2)=4+2=6$

$|6|=6$

6 units

Distance from B to C:

$(2,1)$ and $(-4,1)$

The y-coordinate is the same.

$2-(-4)=2+4=6$

$|6|=6$

6 units

Sum of distances:

6 units + 6 units = 12 units

17. $-3^2(5-3+\sqrt{4})$

$=-3^2(5-3+2)$

$=-3^2(2+2)$

$=-3^2(4)$

$=-9(4)$

$=-36$

18. $\dfrac{10 \div 2 \bullet 3}{3+2}$

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

$= \dfrac{15}{3+2}$

$= \dfrac{15}{5}$

$= 3$

19. $25 - 3 + 18$

$= 22 + 18$

$= 40$

20. a. $3a + 1 - 2b - 0.7 + 1.23a$ 5 terms

b. $3a + 1 - 2b - 0.7 + 1.23a$

$= 4.23a - 2b + 0.3$

21. a. $5(3+n)^2$

b. $\dfrac{\frac{1}{2}x+3}{2}$ or $\left(\dfrac{1}{2}x+3\right) \div y^2$

22. a. $\dfrac{5(10)+5}{5}$

$= \dfrac{50+5}{5}$

$= \dfrac{55}{5}$

$= 11$

b. $\dfrac{5(8)+2}{2}$

$= \dfrac{40+2}{2}$

$= \dfrac{42}{2}$

$= 21$

23. a. $\dfrac{1}{2}(34) = \sqrt[3]{x} + 7$

b. $\dfrac{5}{7+n} = 2(3-n)^2$

24. a. $r + 1.5 = -5$

$r + 1.5 - 1.5 = -5 - 1.5$

$r = -6.5$

b. $6m = 15$

$\dfrac{6m}{6} = \dfrac{15}{6}$

$1m = \dfrac{5}{2}$

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

c. $w - \dfrac{1}{2} = 0$

$w - \dfrac{1}{2} + \dfrac{1}{2} = 0 + \dfrac{1}{2}$

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

d. $\dfrac{c}{8} = 0.25$

$8 \bullet \dfrac{c}{8} = 0.25 \bullet 8$

$1c = 2$

$c = 2$

Riddle solution:

THE ROMAN NUMERAL REPRESENTING THE NUMBER FOUR IS IV, WHICH IS EXACTLY HALF OF THE LETTERS IN THE WORD FIVE.

Unit 1 Assessment

Note to parent/teacher: This assessment covers concepts taught in Unit 1. Problems are designed to assess multiple skills. If a problem is missed, show the student the answer and allow him or her time to find the error. Often, students can correct mistakes when checking their work. If the student still has difficulty, have him or her revisit the corresponding lesson for review. Corresponding lesson numbers are listed in the course book at the end of each problem.

1. a. $7 \cdot 3 = 21$

$8 \cdot 3 = 24$

Estimate: between 21 and 24

Rounded: $7.412 \cdot 3 = 22.236 \approx 22.24$

b. $6 \cdot 4 = 24$

Estimate: 24

Rounded: $5.963 \cdot 4.2 = 25.0446 \approx 25.04$

2. a. $2|342$

$3|171$

$3|57$

19

$342 = 2 \cdot 3^2 \cdot 19$

b. $2|450$

$3|225$

$3|75$

$5|25$

5

$450 = 2 \cdot 3^2 \cdot 5^2$

3. $\frac{342}{450} = \frac{\cancel{2} \cdot \cancel{3} \cdot \cancel{3} \cdot 19}{\cancel{2} \cdot \cancel{3} \cdot \cancel{3} \cdot 5 \cdot 5} = \frac{19}{25}$

4. $420\overline{)70} \longrightarrow 42\overline{)7.00...}$

$0.16...$

-42

280

-252

28

$70 \div 420 = 0.1\overline{6}$

5. a. $5\overline{)4.0}$

0.8

-40

0

$\frac{4}{5} = 0.8$

b. $6\overline{)5.00...}$

$0.83...$

-48

20

-18

2

$\frac{5}{6} = 0.8\overline{3}$

6. a. $0.125 = \frac{125}{1000} = \frac{1}{8}$

b. $5.43 = 5\frac{43}{100}$

7. a. $25 - 38 + 15 = -13 + 15 = 2$

b. $-7 - 33 - 32 = -40 - 32 = -72$

c. $67 - 35 + 12 = 32 + 12 = 44$

8. a. same signs, positive $-14 \cdot (-3) = 42$

b. different signs, negative $-90 \div 10 = -9$

c. different signs, negative $21 \cdot (-5) = -105$

d. same signs, positive $-55 \div (-11) = 5$

9. a. $-\frac{\cancel{7}^{1}}{8} \bullet \left(-\frac{3}{\cancel{14}_{2}}\right) = \frac{3}{16}$

b. $-4\frac{5}{6} \div \frac{2}{9}$

$= -\frac{29}{6} \div \frac{2}{9}$

$= -\frac{29}{\cancel{6}_{2}} \bullet \frac{\cancel{9}^{3}}{2}$

$= -\frac{87}{4}$

$= -21\frac{3}{4}$

10. $\dfrac{\frac{4}{15}}{\frac{8}{45}}$

$= \frac{4}{15} \div \frac{8}{45}$

$= \frac{\cancel{4}^{1}}{\cancel{15}_{1}} \bullet \frac{\cancel{45}^{3}}{\cancel{8}_{2}}$

$= \frac{3}{2}$

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

11. a. $\frac{5}{7} + 3\frac{11}{14} - \frac{25}{28}$

$= \frac{5}{7} + \frac{53}{14} - \frac{25}{28}$

$= \frac{20}{28} + \frac{106}{28} - \frac{25}{28}$

$= \frac{126}{28} - \frac{25}{28}$

$= \frac{101}{28}$

$= 3\frac{17}{28}$

b. $-\frac{3}{2} - \frac{8}{11} + \frac{1}{11}$

$= -\frac{33}{22} - \frac{16}{22} + \frac{2}{22}$

$= -\frac{49}{22} + \frac{2}{22}$

$= -\frac{47}{22}$

$= -2\frac{3}{22}$

12. a.
$$\begin{array}{r} 4.3570 \\ 10.3210 \\ +\ 5.0101 \\ \hline 19.6881 \end{array}$$

b.
$$\begin{array}{r} 12.987 \\ -\ 4.012 \\ \hline 8.975 \end{array} \longrightarrow 8.975 - 9.754$$

Subtract and use the sign of the greater absolute value.

$$\begin{array}{r} \cancel{9}^{8}\,\cancel{.}^{}\,\cancel{7}^{16}\,\cancel{5}^{14}\,\cancel{4}^{1} \\ -\,8.9\,7\,5 \\ \hline 0.7\,7\,9 \end{array}$$

The answer is negative.

$12.987 - 4.012 - 9.754 = -0.779$

13. a.
$$\begin{array}{r} \cancel{1}^{1}2.3 \\ \times\ 4.5 \\ \hline 115 \\ +\ 920 \\ \hline 10.35 \end{array}$$

b. $0.6\overline{)78.91} \longrightarrow 6\overline{)789.100\ldots}$

$$\begin{array}{r} 131.516\ldots \\ 6\overline{)789.100\ldots} \\ -6 \\ \hline 18 \\ -18 \\ \hline 09 \\ -\ 6 \\ \hline 3\,1 \\ -3\,0 \\ \hline 1\,0 \\ -\ 6 \\ \hline 40 \\ -36 \\ \hline 4 \end{array}$$

$78.91 \div 0.6 = \overline{131.516}$

14. a. $(-3)^5$

$= -3 \bullet (-3) \bullet (-3) \bullet (-3) \bullet (-3)$

$= 9 \bullet (-3) \bullet (-3) \bullet (-3)$

$= -27 \bullet (-3) \bullet (-3)$

$= 81 \bullet (-3)$

$= -243$

b. $\left(\frac{3}{4}\right)^2 = \frac{3}{4} \bullet \frac{3}{4} = \frac{9}{16}$

c. $4^{-3} = \frac{1}{4^3} = \frac{1}{4 \bullet 4 \bullet 4} = \frac{1}{64}$

15. $10^{-7} \longrightarrow 0.0000001$

16. 8096502

$= 8000000 + 90000 + 6000 + 500 + 2$

$= (8 \bullet 1000000) + (9 \bullet 10000) + (6 \bullet 1000)$

$+ (5 \bullet 100) + (2 \bullet 1)$

$= (8 \bullet 10^6) + (9 \bullet 10^4) + (6 \bullet 10^3)$

$+ (5 \bullet 10^2) + (2 \bullet 10^0)$

17. a. $3.05 \times 10^5 \longrightarrow 305000$

b. $7.9 \times 10^{-4} \longrightarrow 0.00079$

18. a. $104{,}500{,}000{,}000 = 1.045 \times 10^{11}$

b. $0.000083 = 8.3 \times 10^{-5}$

19. a. $(6.8 \times 10^{12}) \div (2.0 \times 10^8)$

$6.8 \div 2.0 = 3.4$

$$\frac{10^{12}}{10^8}$$

$$= \frac{\cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet 10 \bullet 10 \bullet 10 \bullet 10}{\cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10} \bullet \cancel{10}}$$

$= 10^4$

$(6.8 \times 10^{12}) \div (2.0 \times 10^8) = 3.4 \times 10^4$

b. $(4.5 \times 10^3) \bullet (3.0 \times 10^5)$

$4.5 \bullet 3.0 = 13.5$

$10^3 \bullet 10^5$

$= 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$

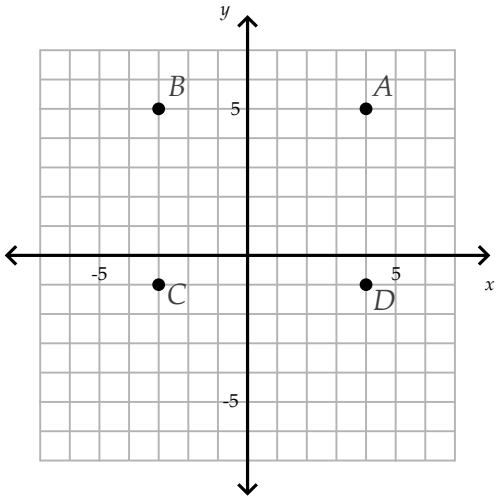
$= 10^8$

$(4.5 \times 10^3) \bullet (3.0 \times 10^5) = 13.5 \times 10^8$

The decimal point must move one place to the left, so the exponent must increase by one.

$(4.5 \times 10^3) \bullet (3.0 \times 10^5) = 1.35 \times 10^9$

20.



Quadrants: A: I B: II C: III D: IV

Distance between A and B:

$(4,5)$ and $(-3,5)$

The y-coordinates are the same.

$4-(-3)=4+3=7$

7 units

21. $(-7,-1)$ and $(-7,-16)$

The x-coordinates are the same.

$-1-(-16)=-1+16=15$

15 units

22. a. $2(40+33)-6^2$

$=2(73)-6^2$

$=2(73)-36$

$=146-36$

$=110$

b. $48\div 12\bullet 3$

$=4\bullet 3$

$=12$

c. $\dfrac{\sqrt{100}\bullet 12}{5^2+55}$

$=\dfrac{10\bullet 12}{25+55}$

$=\dfrac{120}{80}$

$=\dfrac{3}{2}$

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

23. $5.5y+81-3.4z-65$ 4 terms

24. $8x+29-4x-13=4x+16$

25. $\dfrac{7(3)-3(6)}{2(3+15)}$

$=\dfrac{7(3)-3(6)}{2(18)}$

$=\dfrac{21-18}{36}$

$=\dfrac{3}{36}$

$=\dfrac{1}{12}$

26. a. $2a-8$

b. $y(x+25)$

27. a. $28-2t=3r+56$

b. $x+8=6(x+14)$

28. a. $5b=75$

$\dfrac{5b}{5}=\dfrac{75}{5}$

$1b=15$

$b=15$

b. $p - 4 = 86$

$p - 4 + 4 = 86 + 4$

$p = 90$

c. $m + 14 = 94$

$m + 14 - 14 = 94 - 14$

$m = 80$

d. $\frac{x}{3} = 12$

$3 \bullet \frac{x}{3} = 12 \bullet 3$

$1x = 36$

$x = 36$

Enrichment: Sequences and Series

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1.

	Rule	Next Two Terms	A, G, or N	Common Difference or Ratio
a.	+2	14, 16	A	2
b.	perfect squares	49, 64	N	none
c.	–6	70, 64	A	–6
d.	÷2	$\frac{1}{4}, \frac{1}{8}$	G	$\frac{1}{2}$
e.	+2	15, 17	A	2
f.	•1.5	60.75, 91.125	G	1.5
g.	prime numbers	19, 23	N	none
h.	•2	192, 384	G	2

2. a. The sequence is arithmetic with a common difference of 6.

$$\begin{aligned} a_{17} &= 5+(17-1)(6) \\ &= 5+(16)(6) \\ &= 5+(96) \\ &= 101 \end{aligned}$$

b. The sequence is arithmetic with a common difference of –3.

$$\begin{aligned} a_{42} &= 7+(42-1)(-3) \\ &= 7+(41)(-3) \\ &= 7+(-123) \\ &= -116 \end{aligned}$$

c. The sequence is arithmetic with a common difference of 3.5.

$$\begin{aligned} a_{101} &= -10+(101-1)(3.5) \\ &= -10+(100)(3.5) \\ &= -10+(350) \\ &= 340 \end{aligned}$$

3. a. The sequence is geometric with a common ratio of 2.

$$\begin{aligned} b_{11} &= 1 \bullet 2^{11-1} \\ &= 1 \bullet 2^{10} \\ &= 1 \bullet 1024 \\ &= 1024 \end{aligned}$$

b. The sequence is geometric with a common ratio of $\frac{1}{3}$.

$$\begin{aligned} b_9 &= 729 \bullet \left(\frac{1}{3}\right)^{9-1} \\ &= 729 \bullet \left(\frac{1}{3}\right)^{8} \\ &= 729 \bullet \frac{1}{6561} \\ &= \frac{1}{9} \end{aligned}$$

c. This sequence is geometric with a common ratio of $\frac{3}{2}$.

$$\begin{aligned} b_6 &= 18 \bullet \left(\frac{3}{2}\right)^{6-1} \\ &= 18 \bullet \left(\frac{3}{2}\right)^{5} \\ &= 18 \bullet \frac{243}{32} \\ &= 136.6875 \end{aligned}$$

4. a. $b_5 = 1000 \bullet 1.03^{5-1}$

$= 1000 \bullet 1.03^4$

$= 1000 \bullet 1.12550881$

$= 1125.50881$

≈ 1125.51

$1,125.51

b. $b_{18} = 1000 \bullet 1.03^{18-1}$

$= 1000 \bullet 1.03^{17}$

$\approx 1000 \bullet 1.652847632$

≈ 1652.847632

≈ 1652.85

$1,652.85

c. $b_{30} = 1000 \bullet 1.03^{30-1}$

$= 1000 \bullet 1.03^{29}$

$\approx 1000 \bullet 2.356565506$

≈ 2356.565506

≈ 2356.57

$2,356.57

Set Notation

WARM-UP

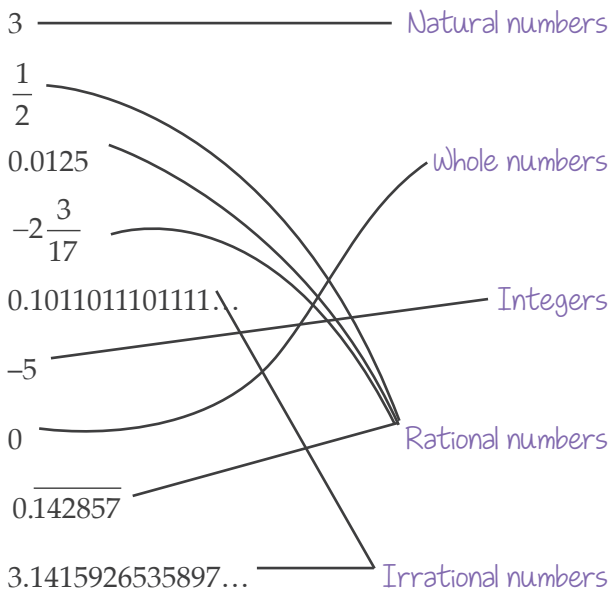
a. $|14-24|$
$=|-10|$
$=10$
$10=|14-24|$

b. $7^2=49$
$14<7^2$

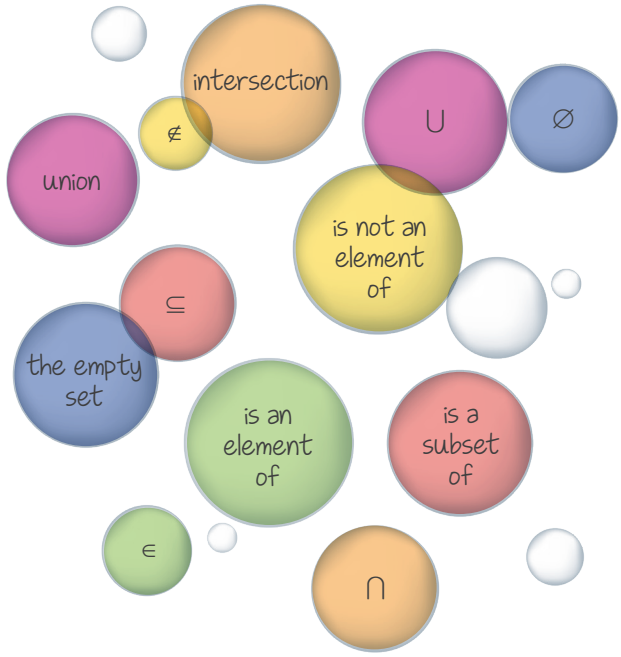
c. $\sqrt{121}=11$
$\sqrt{121}>-15$

PRACTICE

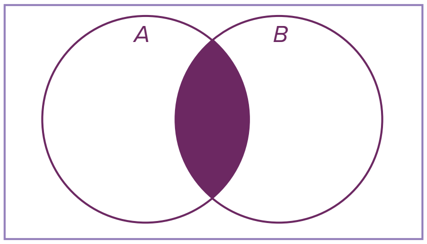
1.



2.

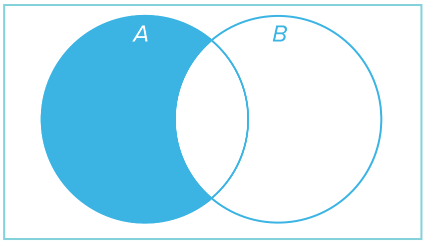


3. a.



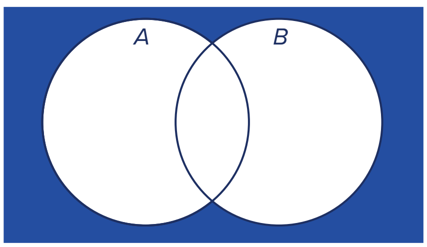
$A \cap B$

b.



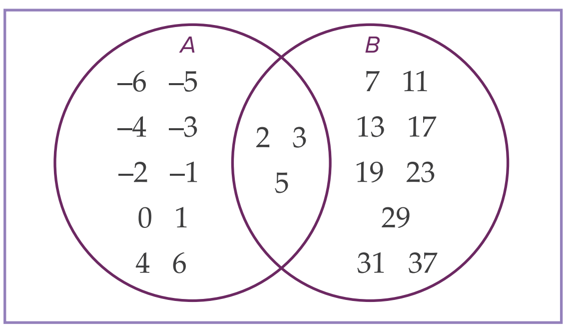
$A \cap B'$

c.



$A' \cap B'$

4.



a. The intersection of *A* and *B*.

$\{2, 3, 5\}$

b. The union of *A* and *B*.

$\{-6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 11, 13, 17, 19, 23, 29, 31, 37\}$

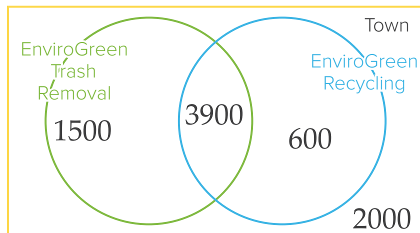
5. The 3,900 people who use EnviroGreen for both trash and recycling go in the overlapping part.

Subtract those who use both from those who use EnviroGreen for trash to see how many use the company for trash only.

$$\begin{array}{r} \overset{4}{\cancel{5}}\overset{1}{4}00 \\ -\ 3900 \\ \hline 1500 \end{array}$$

Subtract those who use both from those who use EnviroGreen for recycling to see how many use the company for recycling only.

$$\begin{array}{r} \overset{3}{\cancel{4}}\overset{1}{5}00 \\ -\ 3900 \\ \hline 600 \end{array}$$



$$\begin{array}{r} \overset{2}{3}900 \\ 1500 \\ +\ 600 \\ \hline 6000 \end{array}$$

The total who use EnviroGreen for trash, recycling, or both is 6,000.

$8000 - 6000 = 2000$

2,000 people do not use EnviroGreen.

REVIEW

1. a. $2.4d = 12$

$$\frac{2.4d}{2.4} = \frac{12}{2.4}$$

$$1d = 5$$

$$d = 5$$

b. $11.9 + f = -49.1$

$$11.9 + f - 11.9 = -49.1 - 11.9$$

$$f = -61$$

2. a. $\frac{1}{8}n - 15 = -p + 4$

b. $qr = 9s$

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

$= -3 - 3$

$= -6$

b. $6(-3) + 27$

$= -18 + 27$

$= 9$

4. a. $0.0002009 = 2.009 \times 10^{-4}$

b. $6{,}530{,}000{,}000 = 6.53 \times 10^{9}$

5. a. $30 \bullet 7 = 210$

$21

b. $12 \bullet 7 = 84$

$8.40

c. $50 \bullet 7 = 350$

$35

6. a. $(-25 + 31) + 8 = -25 + (31 + 8)$

-25 will make this statement true. The Associative Property of Addition says that the sum will be the same no matter how numbers are grouped.

b. $23 \bullet 47 = 47 \bullet 23$

47 will make this statement true. The Commutative Property of Multiplication says that numbers can be multiplied in any order and the product will be the same.

7.

222	554
1,124	3,780
936	826

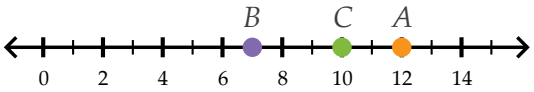
24 is divisible by 4.

80 is divisible by 4.

36 is divisible by 4.

Evaluating Square Roots

WARM-UP



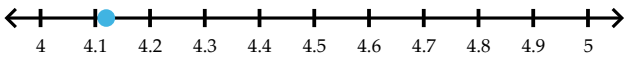
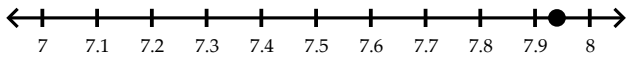
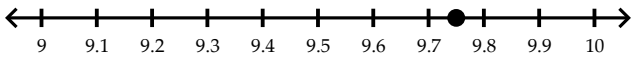
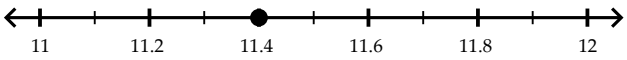
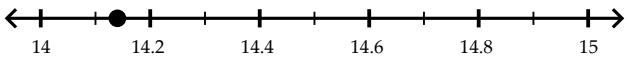
a. $\sqrt{144} = 12$

b. $\sqrt{49} = 7$

c. $\sqrt{100} = 10$

PRACTICE

1.

Square Root	Between Which Two Integers	Approximation	Plot on Number Line
$\sqrt{17}$	$\sqrt{16} = (4)$ and $\sqrt{25} = 5$	4.12	
$\sqrt{63}$	$\sqrt{49} = 7$ and $\sqrt{64} = (8)$	7.94	
$\sqrt{95}$	$\sqrt{81} = 9$ and $\sqrt{100} = (10)$	9.75	
$\sqrt{130}$	$\sqrt{121} = (11)$ and $\sqrt{144} = 12$	11.40	
$\sqrt{200}$	$\sqrt{196} = (14)$ and $\sqrt{225} = 15$	14.14	

2. a. 34 is between the perfect squares 25 and 36.

$\sqrt{25} = 5$

$\sqrt{36} = 6$

The third side is between 5 and 6 meters.

b. $\sqrt{34} = 5.830951895... \approx 5.8$

c. $5 + 3 + 5.8 = 13.8$

3. a. 150 is between the perfect squares 144 and 169.

$\sqrt{144} = 12$

$\sqrt{169} = 13$

The length is between 12 and 13 feet.

b. $\sqrt{150} = 12.24744871... \approx 12.2$

4. a. 500 is between the perfect squares 484 and 529.

$\sqrt{484} = 22$

$\sqrt{529} = 23$

It takes between $\frac{22}{7}$ and $\frac{23}{7}$ seconds to hit the ground.

b. $\frac{\sqrt{500}}{7} = 3.194382825... \approx 3.2$

5. a. 62.5 is between the perfect squares 49 and 64.

$\sqrt{49} = 7$

$\sqrt{64} = 8$

It takes between 7 and 8 seconds to hit the ground.

b. $\sqrt{62.5} = 7.90569415... \approx 7.9$

REVIEW

1. a. $\dfrac{-1\frac{9}{11}}{\frac{5}{8}}$

$= \dfrac{-\frac{20}{11}}{\frac{5}{8}}$

$= -\frac{20}{11} \div \frac{5}{8}$

$= -\frac{\cancel{20}^{4}}{11} \bullet \frac{8}{\cancel{5}_{1}}$

$= -\frac{4}{11} \bullet \frac{8}{1}$

$= -\frac{32}{11}$

$= -2\frac{10}{11}$

b. $\dfrac{3\frac{1}{3}}{-\frac{5}{2}}$

$= \dfrac{\frac{10}{3}}{-\frac{5}{2}}$

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

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

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

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

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

2. a. $4.875 = 4\frac{875}{1000} = 4\frac{7}{8}$

b. $16.232 = 16\frac{232}{1000} = 16\frac{29}{125}$

3. Friday

4. $5 + 14 = 19$

November 19

5. 0.043

6. a. $\frac{j}{4.5} = -8.8$

$4.5 \bullet \frac{j}{4.5} = -8.8 \bullet 4.5$

$j = -39.6$

b. $k - \frac{7}{2} = 8\frac{1}{3}$

$k - \frac{7}{2} + \frac{7}{2} = 8\frac{1}{3} + \frac{7}{2}$

$k = \frac{25}{3} + \frac{7}{2}$

$k = \frac{50}{6} + \frac{21}{6}$

$k = \frac{71}{6}$

$k = 11\frac{5}{6}$

7. a. III

b. IV

c. II

8. Equation: $80 = 0.2n$ or $80 = \frac{2}{10}n$

$80 = 0.2n$

$\frac{80}{0.2} = \frac{0.2n}{0.2}$

$400 = n$

$80 = \frac{2}{10}n$

$\frac{10}{2} \bullet 80 = \frac{2}{10}n \bullet \frac{10}{2}$

$400 = n$

$n = 400$

Solving Two-Step Equations

WARM-UP

a. $6w = 42$

$\frac{6w}{6} = \frac{42}{6}$

$w = 7$

b. $v + 17 = 4$

$v + 17 - 17 = 4 - 17$

$v = -13$

PRACTICE

1. a. $2m + 4 = -10$

$2m + 4 - 4 = -10 - 4$

$2m = -14$

$\frac{2m}{2} = \frac{-14}{2}$

$m = -7$

b. $\frac{1}{2}n - 1 = 23$

$\frac{1}{2}n - 1 + 1 = 23 + 1$

$\frac{1}{2}n = 24$

$2 \cdot \frac{1}{2}n = 24 \cdot 2$

$n = 48$

2. a. $6x + 4 = -2$

$6x + 4 - 4 = -2 - 4$

$6x = -6$

$\frac{6x}{6} = \frac{-6}{6}$

$x = -1$

b. $5 = 4a - 3$

$5 + 3 = 4a - 3 + 3$

$8 = 4a$

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

$2 = a$ or $a = 2$

c. $2.2s - 0.9 = 3.5$

$2.2s - 0.9 + 0.9 = 3.5 + 0.9$

$2.2s = 4.4$

$\frac{2.2s}{2.2} = \frac{4.4}{2.2}$

$s = 2$

d. $3z - 1 = 8$

$3z - 1 + 1 = 8 + 1$

$3z = 9$

$\frac{3z}{3} = \frac{9}{3}$

$z = 3$

3. Any variable may be used in the equations.

a. Equation: $2x - 5 = 11$

$$2x - 5 = 11$$
$$2x - 5 + 5 = 11 + 5$$
$$2x = 16$$
$$\frac{2x}{2} = \frac{16}{2}$$
$$x = 8$$

Solution: $x = 8$

b. Equation: $x + 10 = 21$

$$x + 10 = 21$$
$$x + 10 - 10 = 21 - 10$$
$$x = 11$$

Solution: $x = 11$

c. Equation: $\frac{3}{4}x - 3 = 24$

$$\frac{3}{4}x - 3 = 24$$
$$\frac{3}{4}x - 3 + 3 = 24 + 3$$
$$\frac{3}{4}x = 27$$
$$\frac{4}{3} \bullet \frac{3}{4}x = \frac{\cancel{27}^{9}}{1} \bullet \frac{4}{\cancel{3}_{1}}$$
$$x = \frac{36}{1} = 36$$

Solution: 36 in or 3 ft

d. Equation: $\frac{1}{2}x - 7 = 12$

$$\frac{1}{2}x - 7 = 12$$
$$\frac{1}{2}x - 7 + 7 = 12 + 7$$
$$\frac{1}{2}x = 19$$
$$2 \bullet \frac{1}{2}x = 19 \bullet 2$$
$$x = 38$$

Solution: 38 years

e. Equation: $\frac{1}{3}x + 5 = 13$

$$\frac{1}{3}x + 5 = 13$$
$$\frac{1}{3}x + 5 - 5 = 13 - 5$$
$$\frac{1}{3}x = 8$$
$$3 \bullet \frac{1}{3}x = 8 \bullet 3$$
$$x = 24$$

Solution: 24 squares

f. Equation: $5 + 0.45x = 12.65$

$$0.45x + 5 = 12.65$$
$$0.45x + 5 - 5 = 12.65 - 5$$
$$0.45x = 7.65$$
$$\frac{0.45x}{0.45} = \frac{7.65}{0.45}$$
$$x = 17$$

Solution: 17 newspapers

REVIEW

1. a. T; $\mathbb{Z}$ represents the set of all integers. –8 is an integer.

   b. F; W is the set of all whole numbers. –8 is not a whole number.

   c. T; $\mathbb{R}$ is the set of real numbers. Real numbers include both rational numbers and irrational numbers, such as pi.

2. a. $144 < 146 < 169$

   $\sqrt{144} < \sqrt{146} < \sqrt{169}$

   $12 < \sqrt{146} < 13$

   $\sqrt{146}$ is between 12 & 13 and is closer to 12, since 146 is closer to 144 than 169.

   b. $25 < 35 < 36$

   $\sqrt{25} < \sqrt{35} < \sqrt{36}$

   $5 < \sqrt{35} < 6$

   $\sqrt{35}$ is between 5 & 6 and is closer to 6, since 35 is closer to 36 than 25.

   c. $81 < 90 < 100$

   $\sqrt{81} < \sqrt{90} < \sqrt{100}$

   $9 < \sqrt{90} < 10$

   $\sqrt{90}$ is between 9 & 10 and is closer to 9, since 90 is closer to 81 than 100.

3. a. $52 + 2g$

   b. $\frac{h}{3} - 16$

4. a. $21.7 - 4j - 3.5k + 2.3j - 14.9 - 8.2k$

   $= -4j + 2.3j - 3.5k - 8.2k + 21.7 - 14.9$

   $= -1.7j - 3.5k - 8.2k + 21.7 - 14.9$

   $= -1.7j - 11.7k + 21.7 - 14.9$

   $= -1.7j - 11.7k + 6.8$

   b. $-\frac{1}{3} + \frac{3}{2}m + \frac{1}{9} - \frac{1}{2}m$

   $= \frac{3}{2}m - \frac{1}{2}m - \frac{1}{3} + \frac{1}{9}$

   $= \frac{2}{2}m - \frac{1}{3} + \frac{1}{9}$

   $= m - \frac{3}{9} + \frac{1}{9}$

   $= m + \left(-\frac{2}{9}\right)$

   $= m - \frac{2}{9}$

5. a. $\left(5.3 \times 10^5\right) \bullet \left(4 \times 10^8\right)$

   $5.3 \bullet 4 = 21.2 \qquad 10^5 \bullet 10^8 = 10^{13}$

   $21.2 \bullet 10^{13}$

   The decimal point must move one place to the left, so the exponent must increase by one.

   2.12×10^{14}

   b. $\left(2.8 \times 10^{10}\right) \div \left(2 \times 10^3\right)$

   $2.8 \div 2 = 1.4 \qquad 10^{10} \div 10^3 = 10^7$

   1.4×10^7

6. a. $\frac{1}{2} \bullet \$70 = \$35$

   b. $\frac{1}{2} \bullet \$11 = \$5.50$

   c. $\frac{1}{2} \bullet \$48 = \$24$

Square Roots and Cube Roots

WARM-UP

a. $2^2 = 2 \bullet 2 = 4$

b. $(-2)^2 = -2 \bullet (-2) = 4$

c. $2^3 = 2 \bullet 2 \bullet 2 = 8$

d. $(-2)^3 = -2 \bullet (-2) \bullet (-2) = -8$

PRACTICE

1. a. False

Perfect squares are always positive because they are the product of a number times itself.

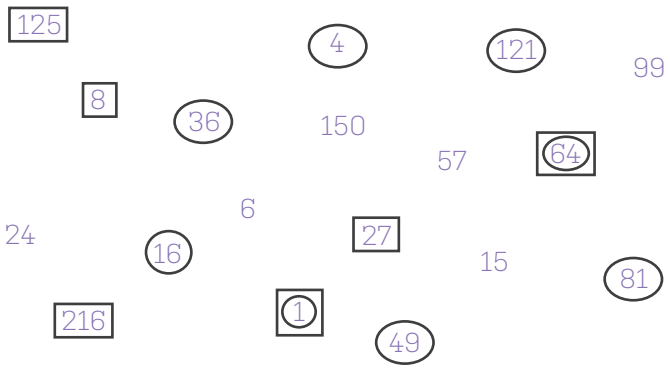
b. True

c. True

d. False

A negative number cubed is a negative number, so the cube root of a negative number exists.

2.



3. a. $10^2 = 10 \bullet 10 = 100$

$\sqrt{100} = 10$

b. $2^2 = 2 \bullet 2 = 4$

$\sqrt{4} = 2$

c. $8^2 = 8 \bullet 8 = 64$

$\sqrt{64} = 8$

d. $5^2 = 5 \bullet 5 = 25$

$\sqrt{25} = 5$

e. $1^2 = 1 \bullet 1 = 1$

$\sqrt{1} = 1$

f. $4^2 = 4 \bullet 4 = 16$

$\sqrt{16} = 4$

4. a. $3^3 = 3 \bullet 3 \bullet 3 = 27$

$\sqrt[3]{27} = 3$

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

$\sqrt[3]{125} = 5$

c. $(-4)^3 = -4 \bullet (-4) \bullet (-4) = -64$

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

d. $1^3 = 1 \bullet 1 \bullet 1 = 1$

$\sqrt[3]{1} = 1$

e. $(-1)^3 = -1 \bullet (-1) \bullet (-1) = -1$

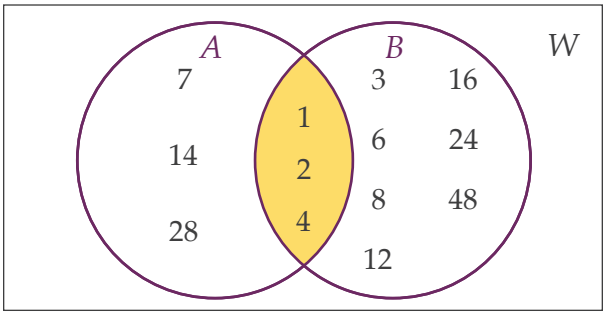
$\sqrt[3]{-1} = -1$

f. $(-2)^3 = -2 \bullet (-2) \bullet (-2) = -8$

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

REVIEW

1. Factors of 28: 1, 2, 4, 7, 14, 28
Factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48



2. a. $-14+10s=-44$
$-14+10s+14=-44+14$
$\frac{10s}{10}=\frac{-30}{10}$
$s=-3$

b. $9t-29=52$
$9t-29+29=52+29$
$9t=81$
$\frac{9t}{9}=\frac{81}{9}$
$t=9$

3. Expanded form: $40+9+0.07+0.007$
Expanded notation:
$(4\bullet 10)+(9\bullet 1)+(7\bullet 0.01)+(7\bullet 0.001)$
Expanded notation with exponents:
$(4\bullet 10^{1})+(9\bullet 10^{0})+(7\bullet 10^{-2})+(7\bullet 10^{-3})$

4. a. $160\div 20=8$
$158\div 19\approx 8$

b. $300\div 30=10$
$295\div 30\approx 10$

5. a. $\frac{\frac{2}{3}}{\frac{1}{3}}+(16-7)\div 3$
$=\frac{\frac{2}{3}}{\frac{1}{3}}+9\div 3$
$=\frac{2}{3}\div\frac{1}{3}+9\div 3$
$=\frac{2}{\cancel{3}_{1}}\bullet\frac{\cancel{3}^{1}}{1}+9\div 3$
$=2+9\div 3$
$=2+3$
$=5$

b. $\frac{\sqrt{64}-11\bullet 3}{-44\div 4+6^{2}}$
$=\frac{8-11\bullet 3}{-44\div 4+36}$
$=\frac{8-33}{-11+36}$
$=\frac{-25}{25}$
$=-1$

6. a.
$$\begin{array}{r} 1.45\ldots \\ 11\overline{)16.00\ldots} \\ \underline{-11} \\ 50 \\ \underline{-44} \\ 60 \\ \underline{-55} \\ 5 \end{array}$$
$\frac{16}{11}=1.\overline{45}$

b.
$$\begin{array}{r} 0.27\ldots \\ 22\overline{)6.00\ldots} \\ \underline{-44} \\ 160 \\ \underline{-154} \\ 6 \end{array}$$
$\frac{6}{22}=0.\overline{27}$

Multi-Step Equations with Negative Coefficients

WARM-UP

1. a. $8^2 = 8 \bullet 8 = 64$
   b. $9^2 = 9 \bullet 9 = 81$
   c. $\sqrt{16} = 4$
   d. $\sqrt{25} = 5$

2. a. $120 \bullet 4 = 480$
   b. $800 \bullet 12 = 9600$

PRACTICE

1. **Blue**

$$-3x + 4 = 20 - x$$
$$-3x + x + 4 = 20 - x + x$$
$$-2x + 4 = 20$$
$$-2x + 4 - 4 = 20 - 4$$
$$-2x = 16$$
$$\frac{-2x}{-2} = \frac{16}{-2}$$
$$x = -8$$

2. **Green**

$$3 - 2a + 5 = -12 + 2a$$
$$3 - 2a + 5 + 2a = -12 + 2a + 2a$$
$$8 = -12 + 4a$$
$$8 + 12 = -12 + 4a + 12$$
$$20 = 4a$$
$$\frac{20}{4} = \frac{4a}{4}$$
$$5 = a$$
$$a = 5$$

3. **Yellow**

$$7 - 2b = 1 + b + 5 - 2b$$
$$7 - 2b = 1 + 5 - b$$
$$7 - 2b = 6 - b$$
$$7 - 2b + b = 6 - b + b$$
$$7 - b = 6$$
$$7 - b - 7 = 6 - 7$$
$$-b = -1$$
$$\frac{-b}{-1} = \frac{-1}{-1}$$
$$b = 1$$

4. **Orange**

$$12 + 14s = 72 - 6s$$
$$12 + 14s + 6s = 72 - 6s + 6s$$
$$12 + 20s = 72$$
$$12 + 20s - 12 = 72 - 12$$
$$20s = 60$$
$$\frac{20s}{20} = \frac{60}{20}$$
$$s = 3$$

5. **Red**

$$3r-1=r+3$$
$$3r-1-r=r+3-r$$
$$2r-1=3$$
$$2r-1+1=3+1$$
$$2r=4$$
$$\frac{2r}{2}=\frac{4}{2}$$
$$r=2$$

6. **Blue**

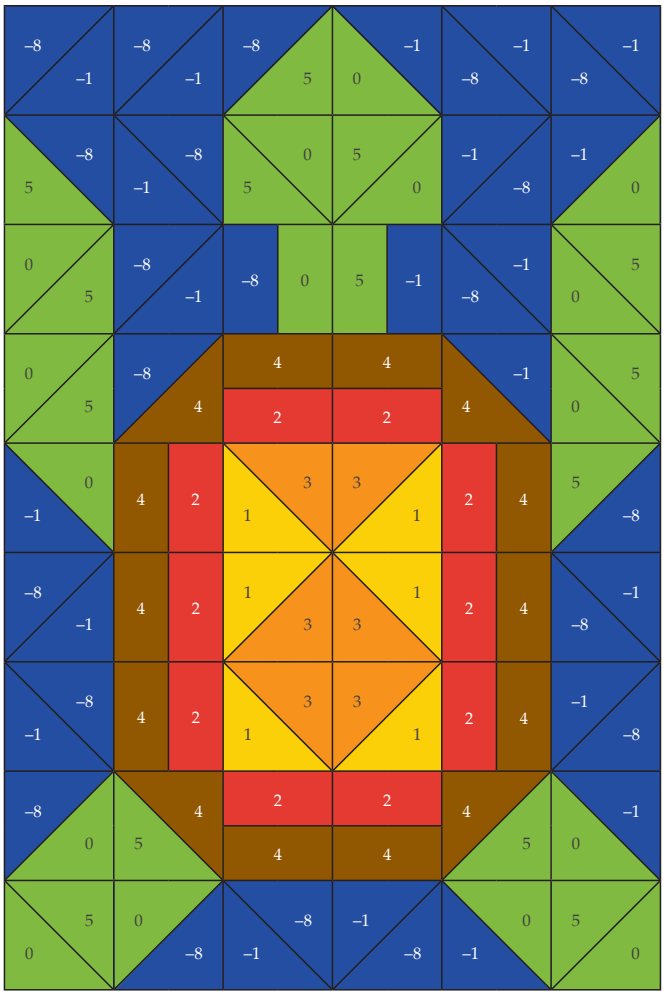
$$4y+5=7+y-5$$
$$4y+5=y+2$$
$$4y+5-y=y+2-y$$
$$3y+5=2$$
$$3y+5-5=2-5$$
$$3y=-3$$
$$\frac{3y}{3}=\frac{-3}{3}$$
$$y=-1$$

7. **Green**

$$2-3z=z+2$$
$$2-3z+3z=z+2+3z$$
$$2=4z+2$$
$$2-2=4z+2-2$$
$$0=4z$$
$$\frac{0}{4}=\frac{4z}{4}$$
$$0=z$$
$$z=0$$

8. **Brown**

$$p-3=5-p$$
$$p-3+p=5-p+p$$
$$2p-3=5$$
$$2p-3+3=5+3$$
$$2p=8$$
$$\frac{2p}{2}=\frac{8}{2}$$
$$p=4$$



REVIEW

1. a. $\sqrt{100} = 10$

   b. does not exist
   (cannot take a square root of a negative number)

2. a. $s = p + 13$

   b. $c = 2.5a$

   c. $B = C - 37$

3. 36 weeks • 7 days / week = 252 days

   1,184 pages ÷ 252 days

$$
\begin{array}{r}
4.6\ldots \\
252\overline{)1184.0\ldots} \\
-1008 \\
\hline
1760 \\
-1512 \\
\hline
248
\end{array}
$$

   5 pages per day

4. a. $10 \bullet 7 = 70$

   Amount of sales tax: $0.70

   $10 + 0.70 = 10.70$

   Total cost: $10.70

   b. $4 \bullet 7 = 28$

   Amount of sales tax: $0.28

   $4 + 0.28 = 4.28$

   Total cost: $4.28

   c. $6 \bullet 7 = 42$

   Amount of sales tax: $0.42

   $6 + 0.42 = 6.42$

   Total cost: $6.42

Solving Equations Review

PRACTICE

Note: Equations can be solved in various ways, but the final answers should be the same.

Ladder 1:

1. a. $3x = 12$

$\frac{3x}{3} = \frac{12}{3}$

$x = 4$

b. $8 = 4a$

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

$2 = a$

$a = 2$

c. $2c = 5$

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

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

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

d. $3 = 8g$

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

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

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

e. $\frac{1}{2}z = \frac{3}{4}$

$\frac{2}{1} \cdot \frac{1}{2}z = \frac{3}{4} \cdot \frac{2}{1}$

$z = \frac{3}{\cancel{4}_{2}} \cdot \frac{\cancel{2}^{1}}{1}$

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

Ladder 2:

2. a. $3x + 12 = 12$

$3x + 12 - 12 = 12 - 12$

$3x = 0$

$\frac{3x}{3} = \frac{0}{3}$

$x = 0$

b. $8 = 4a - 4$

$8 + 4 = 4a - 4 + 4$

$12 = 4a$

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

$3 = a$

$a = 3$

c. $2c - 4 = 5$

$2c - 4 + 4 = 5 + 4$

$2c = 9$

$\frac{2c}{2} = \frac{9}{2}$

$c = \frac{9}{2}$

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

d. $3 = 8g - 4$

$3 + 4 = 8g - 4 + 4$

$7 = 8g$

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

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

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

e. $\frac{1}{2}z+\frac{1}{4}=\frac{3}{4}$

$\frac{1}{2}z+\frac{1}{4}-\frac{1}{4}=\frac{3}{4}-\frac{1}{4}$

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

$\frac{2}{1}\bullet\frac{1}{2}z=\frac{\cancel{1}}{\cancel{2}}\bullet\frac{\cancel{2}}{\cancel{1}}$

$z=1$

Ladder 3:

3. a. $3x+12=12+x$

$3x+12-x=12+x-x$

$2x+12=12$

$2x+12-12=12-12$

$2x=0$

$\frac{2x}{2}=\frac{0}{2}$

$x=0$

b. $8-2a=4a-4$

$8-2a+2a=4a-4+2a$

$8=6a-4$

$8+4=6a-4+4$

$12=6a$

$\frac{12}{6}=\frac{6a}{6}$

$2=a$

$a=2$

c. $2c-4=5-3c$

$2c-4+3c=5-3c+3c$

$5c-4=5$

$5c-4+4=5+4$

$5c=9$

$\frac{5c}{5}=\frac{9}{5}$

$c=\frac{9}{5}$

$c=1\frac{4}{5}$

d. $3+2g=8g-4$

$3+2g-2g=8g-4-2g$

$3=6g-4$

$3+4=6g-4+4$

$7=6g$

$\frac{7}{6}=\frac{6g}{6}$

$\frac{7}{6}=g$

$g=\frac{7}{6}$

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

e. $\frac{1}{2}z+\frac{1}{4}=\frac{3}{4}-\frac{1}{4}z$

$\frac{1}{2}z+\frac{1}{4}+\frac{1}{4}z=\frac{3}{4}-\frac{1}{4}z+\frac{1}{4}z$

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

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

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

$\frac{4}{3}\bullet\frac{3}{4}z=\frac{1}{\cancel{2}}\bullet\frac{\overset{2}{\cancel{4}}}{3}$

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

Ladder 4:

4. a. $5+3x+12=12+x-7$

$3x+17=5+x$

$3x+17-x=5+x-x$

$2x+17=5$

$2x+17-17=5-17$

$2x=-12$

$\frac{2x}{2}=\frac{-12}{2}$

$x=-6$

b. $a+8-2a=2+4a-4$

$-a+8=4a-2$

$-a+8+a=4a-2+a$

$8=5a-2$

$8+2=5a-2+2$

$10=5a$

$\frac{10}{5}=\frac{5a}{5}$

$2=a$

$a=2$

c. $2c-4+c=5-3c+2$

$3c-4=7-3c$

$3c-4+3c=7-3c+3c$

$6c-4=7$

$6c-4+4=7+4$

$6c=11$

$\frac{6c}{6}=\frac{11}{6}$

$c=\frac{11}{6}$

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

d. $-3g+3+2g=8g-4-g$

$-g+3=7g-4$

$-g+3+g=7g-4+g$

$3=8g-4$

$3+4=8g-4+4$

$7=8g$

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

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

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

e. $\frac{1}{2}z+\frac{1}{4}-\frac{3}{4}z=\frac{3}{4}+\frac{1}{4}z$

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

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

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

$\frac{1}{4}-\frac{3}{4}=\frac{3}{4}+\frac{1}{2}z-\frac{3}{4}$

$-\frac{1}{2}=\frac{1}{2}z$

$-\frac{1}{2}\bullet\frac{2}{1}=\frac{1}{2}z\bullet\frac{2}{1}$

$-1=z$

$z=-1$

5. Equation: $2x+1=15$

$2x+1=15$

$2x+1-1=15-1$

$2x=14$

$\frac{2x}{2}=\frac{14}{2}$

$x=7$

Answer: 7 pancakes

6. Equation: $g+(g-4)=26$

$g+(g-4)=26$

$g+g-4=26$

$2g-4=26$

$2g-4+4=26+4$

$2g=30$

$\frac{2g}{2}=\frac{30}{2}$

$g=15$

Answer: 15 girls

7. Equation: $4c = 100$

$$4c = 100$$
$$\frac{4c}{4} = \frac{100}{4}$$
$$c = 25$$

Answer: 25 cars

8. Equation: $8 + 9s = 35$

$$8 + 9s = 35$$
$$8 + 9s - 8 = 35 - 8$$
$$9s = 27$$
$$\frac{9s}{9} = \frac{27}{9}$$
$$s = 3$$

Answer: 3 siblings

Solving for a Variable in Terms of Other Variables

WARM-UP

a.
$$-8x+5=40-x$$
$$-8x+5+8x=40-x+8x$$
$$5=40+7x$$
$$5-40=40+7x-40$$
$$-35=7x$$
$$\frac{-35}{7}=\frac{7x}{7}$$
$$-5=x$$
$$\boxed{x=-5}$$

b.
$$8-9z=z+8$$
$$8-9z+9z=z+8+9z$$
$$8=10z+8$$
$$8-8=10z+8-8$$
$$0=10z$$
$$\frac{0}{10}=\frac{10z}{10}$$
$$0=z$$
$$\boxed{z=0}$$

PRACTICE

1. $W=Fd$ $\quad F=\frac{W}{d}$ $\quad \boxed{d=\frac{W}{F}}$

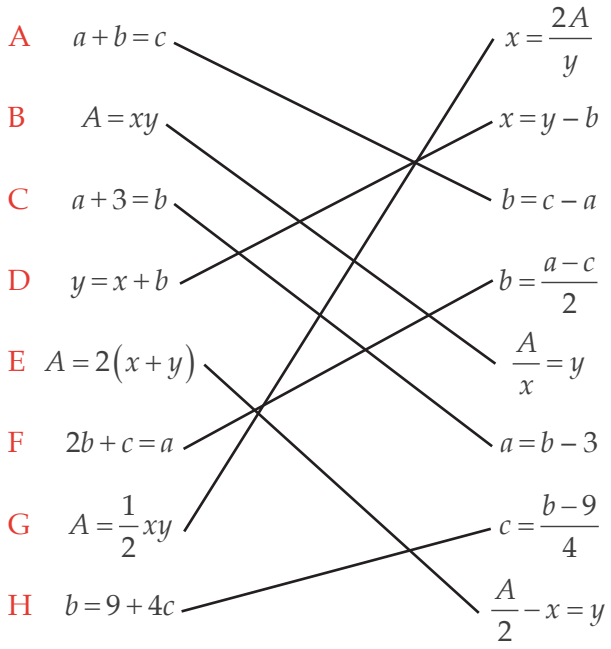
2. a.
$$A=lw$$
$$\frac{A}{l}=\frac{lw}{l}$$
$$\frac{A}{l}=w$$
$$\boxed{w=\frac{A}{l}}$$

b.
$$A=\frac{1}{2}bh$$
$$2\bullet A=\frac{1}{2}bh\bullet\frac{2}{1}$$
$$2A=bh$$
$$\frac{2A}{h}=\frac{bh}{h}$$
$$\frac{2A}{h}=b$$
$$\boxed{b=\frac{2A}{h}}$$

3. a.
$$P=2l+2w$$
$$P-2w=2l+2w-2w$$
$$P-2w=2l$$
$$\frac{P-2w}{2}=\frac{2l}{2}$$
$$\frac{P-2w}{2}=l$$
$$\boxed{l=\frac{P-2w}{2}}$$

b.
$$l=\frac{P-2w}{2}$$
$$l=\frac{140-2(25)}{2}$$
$$l=\frac{140-50}{2}$$
$$l=\frac{90}{2}$$
$$l=\boxed{45}$$

4.



Detailed work for each matching pair is shown below.

A
$$a+b=c$$
$$a+b-a=c-a$$
$$b=c-a$$

B
$$A=xy$$
$$\frac{A}{x}=\frac{xy}{x}$$
$$\frac{A}{x}=y$$

C
$$a+3=b$$
$$a+3-3=b-3$$
$$a=b-3$$

D
$$y=x+b$$
$$y-b=x+b-b$$
$$y-b=x$$
$$x=y-b$$

E
$$A=2(x+y)$$
$$A=2x+2y$$
$$A-2x=2x+2y-2x$$
$$A-2x=2y$$
$$\frac{A-2x}{2}=\frac{2y}{2}$$
$$\frac{A}{2}-x=y$$

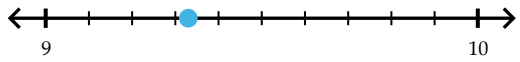
F
$$2b+c=a$$
$$2b+c-c=a-c$$
$$2b=a-c$$
$$\frac{2b}{2}=\frac{a-c}{2}$$
$$b=\frac{a-c}{2}$$

G
$$A=-xy$$
$$2\bullet A=-\frac{xy}{2}\bullet 2$$
$$2A=xy$$
$$\frac{2A}{y}=\frac{xy}{y}$$
$$\frac{2A}{y}=x$$
$$x=\frac{2A}{y}$$

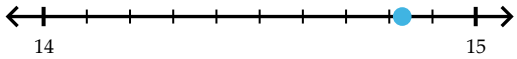
H
$$b=9+4c$$
$$b-9=9+4c-9$$
$$b-9=4c$$
$$\frac{b-9}{4}=\frac{4c}{4}$$
$$\frac{b-9}{4}=c$$
$$c=\frac{b-9}{4}$$

REVIEW

1. a. $\sqrt{87} \approx 9.33$



b. $\sqrt{220} \approx 14.83$



2. a.
$$-12x + 47 = -5x + 68$$
$$-12x + 47 + 12x = -5x + 68 + 12x$$
$$47 = 7x + 68$$
$$47 - 68 = 7x + 68 - 68$$
$$-21 = 7x$$
$$\frac{-21}{7} = \frac{7x}{7}$$
$$-3 = x$$
$$x = -3$$

b.
$$\frac{y}{-10} + 12 = 7.2$$
$$\frac{y}{-10} + 12 - 12 = 7.2 - 12$$
$$\frac{y}{-10} = -4.8$$
$$-10 \bullet \frac{y}{-10} = -4.8 \bullet (-10)$$
$$y = 48$$

3. $14 \text{ ft} \bullet 15 \text{ ft} = 210 \text{ sq ft}$
$210 \text{ sq ft} \bullet \$3.50/\text{sq ft} = \$735$

4. a.
$$z + 40 = 338$$
$$z + 40 - 40 = 338 - 40$$
$$z = 338 - 40$$
$$z = 298$$

b.
$$2.4a = 4.8$$
$$\frac{2.4a}{2.4} = \frac{4.8}{2.4}$$
$$a = 2$$

5. a. $-5 < 5$

b. $0 > -12$

c. $|-11| = 11$

d. $|4 + 3| = |7| = 7$
$|-3 - 4| = |-7| = 7$
$|4 + 3| = |-3 - 4|$

e. $|5 - 3| = |2| = 2$
$|5 - 3| > -2$

f. $-125 < 115$

Solving and Graphing One-Step Inequalities

WARM-UP

a.
$$\begin{aligned} 9-8f &= 3+f+7-8f \\ 9-8f &= 10-7f \\ 9-8f+8f &= 10-7f+8f \\ 9 &= 10+f \\ 9-10 &= 10+f-10 \\ -1 &= f \end{aligned}$$
$f=-1$

b.
$$\begin{aligned} \frac{7}{9}m-2 &= -20+\frac{1}{9}m \\ \frac{7}{9}m-2-\frac{1}{9}m &= -20+\frac{1}{9}m-\frac{1}{9}m \\ \frac{6}{9}m-2 &= -20 \\ \frac{6}{9}m-2+2 &= -20+2 \\ \frac{6}{9}m &= -18 \\ \frac{9}{6}\cdot\frac{6}{9}m &= -\frac{\overset{3}{\cancel{18}}}{1}\cdot\frac{9}{\cancel{6}} \end{aligned}$$
$m=-27$

PRACTICE

1. A $3x>5$ — $x=2$

B $1\le x-3$ — $x=\frac{1}{2}$

C $3x<10$ — $x=-1$

D $-x\ge\frac{1}{2}$ — $x=4.2$

Detailed work showing the true statements created by solutions is shown below.

A
$$\begin{aligned} 3(2) &> 5 \\ 6 &> 5 \end{aligned}$$
$$\begin{aligned} 3(4.2) &> 5 \\ 12.6 &> 5 \end{aligned}$$

B
$$\begin{aligned} 1 &\le 4.2-3 \\ 1 &\le 1.2 \end{aligned}$$

C
$$\begin{aligned} 3(2) &< 10 \\ 6 &< 10 \end{aligned}$$
$$\begin{aligned} 3\left(\frac{1}{2}\right) &< 10 \\ 1\frac{1}{2} &< 10 \end{aligned}$$
$$\begin{aligned} 3(-1) &< 10 \\ -3 &< 10 \end{aligned}$$

D
$$\begin{aligned} -(-1) &\ge \frac{1}{2} \\ 1 &\ge \frac{1}{2} \end{aligned}$$

2. a. $x - 1 \le 5$

$x - 1 + 1 \le 5 + 1$

$x \le 6$

b. $-5x > 15$

$\frac{-5x}{-5} > \frac{15}{-5}$

$x < -3$

(flip the inequality sign)

c. $-3x < -6$

$\frac{-3x}{-3} < \frac{-6}{-3}$

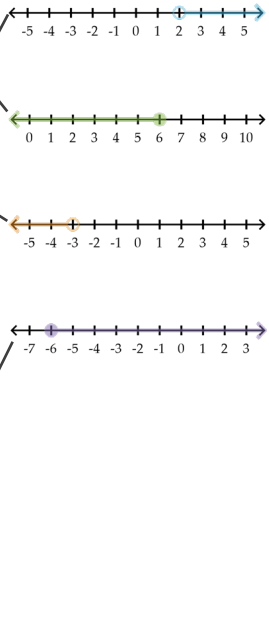
$x > 2$

(flip the inequality sign)

d. $x + 2 \ge -4$

$x + 2 - 2 \ge -4 - 2$

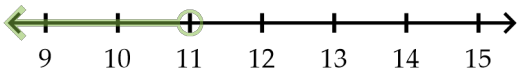
$x \ge -6$



3. a. $x - 6 < 5$

$x - 6 + 6 < 5 + 6$

$x < 11$

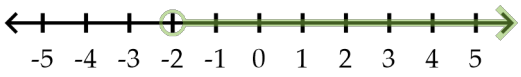


b. $4 > -2x$

$\frac{4}{-2} > \frac{-2x}{-2}$

$-2 < x$

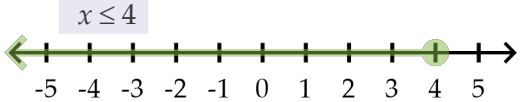
$x > -2$



c. $x + 3 \le 7$

$x + 3 - 3 \le 7 - 3$

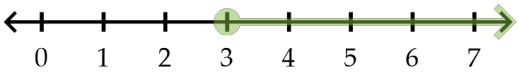
$x \le 4$



d. $3x \ge 9$

$\frac{3x}{3} \ge \frac{9}{3}$

$x \ge 3$



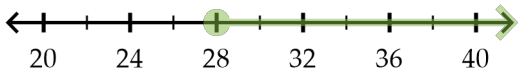
4. Inequality: $72 + x \ge 100$

$72 + \quad \ge 100$

$72 + \quad -72 \ge 100 - 72$

Solution: ≥ 28

Answer: at least 28 more books



REVIEW

1. $w = f \bullet d$

$$\frac{w}{f} = \frac{f \bullet d}{f}$$

$$\frac{w}{f} = d$$

$$d = \frac{w}{f}$$

2. a. $$-16.2 + 4b = 8.8 + 9b$$

$$-16.2 + 4b - 4b = 8.8 + 9b - 4b$$

$$-16.2 = 8.8 + 5b$$

$$-16.2 - 8.8 = 8.8 + 5b - 8.8$$

$$-25 = 5b$$

$$\frac{-25}{5} = \frac{5b}{5}$$

$$-5 = b$$

$$b = -5$$

b. $$-\frac{1}{9}c + 15 = 7\frac{3}{10}$$

$$-\frac{1}{9}c + 15 = \frac{73}{10}$$

$$-\frac{1}{9}c + 15 - 15 = \frac{73}{10} - 15$$

$$-\frac{1}{9}c = \frac{73}{10} - \frac{150}{10}$$

$$-\frac{1}{9}c = -\frac{77}{10}$$

$$-\frac{9}{1} \bullet \left(-\frac{1}{9}c\right) = -\frac{77}{10} \bullet \left(-\frac{9}{1}\right)$$

$$c = \frac{693}{10}$$

$$c = 69\frac{3}{10}$$

3. a. $3^2 + 2(2.5)$

$= 9 + 5$

$= 14$

b. $3 - 2.5 = 0.5$

4. a. $794 \div 65 = 12.2153\ldots \approx 12.2$

12.2 hours

b. $0.2 \bullet 60 = 12$ minutes

12 hours 12 minutes

5. $$\frac{3}{4} \div \frac{3}{1} = \frac{\cancel{3}}{4} \bullet \frac{1}{\cancel{3}} = \frac{1}{4}$$

$\frac{1}{4}$ lb

6. a. $14.0 = 14$

b. $37.0 = 37$

c. $63.0 = 63$

7. a. $14 \bullet 2 = 28$

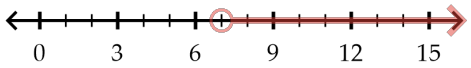
b. $37 \bullet 2 = 74$

c. $63 \bullet 2 = 126$

Solving and Graphing Multi-Step Inequalities

WARM-UP

$$x - 10 > -3$$
$$x - 10 + 10 > -3 + 10$$
$$x > 7$$



PRACTICE

1. a. open
   b. closed
   c. closed
   d. open

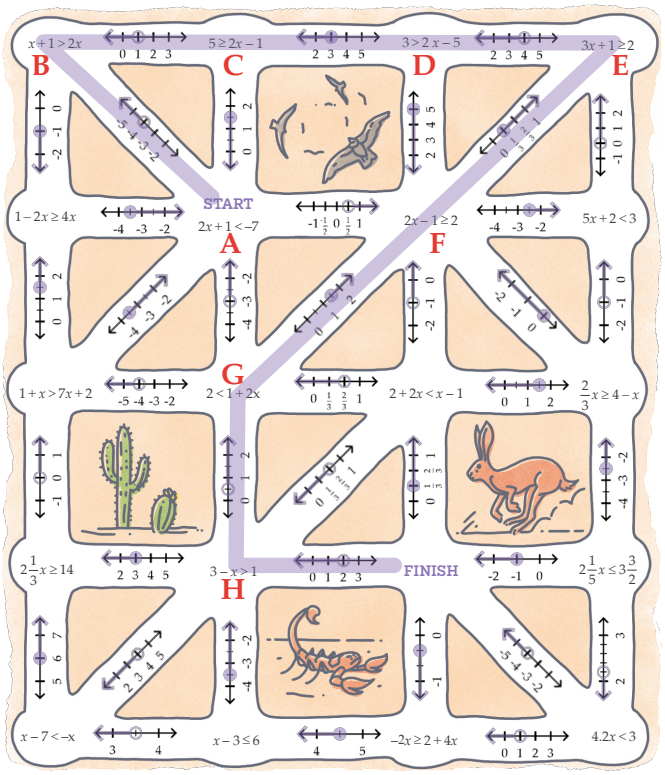
2. a.
$$-2x + 5 < 7$$
$$-2x + 5 - 5 < 7 - 5$$
$$-2x < 2$$
$$\frac{-2x}{-2} < \frac{2}{-2}$$
$$x > -1$$

   b.
$$2x + 5 < 7$$
$$2x + 5 - 5 < 7 - 5$$
$$\frac{2x}{2} < \frac{2}{2}$$
$$x < 1$$

3. a. Inequality: $25x + 250 \geq 800$
$$25x + 250 \geq 800$$
$$25x + 250 - 250 \geq 800 - 250$$
$$\frac{25x}{25} \geq \frac{550}{25}$$
Solution: $x \geq 22$
Answer: 22 weeks

   b. Inequality: $7x + 2.5 < 34$
$$7x + 2.5 < 34$$
$$7x + 2.5 - 2.5 < 34 - 2.5$$
$$7x < 31.5$$
$$\frac{7x}{7} < \frac{31.5}{7}$$
Solution: $x < 4.5$
Answer: up to 4.5 minutes

4. Work for each problem is shown below.



A
$$2x+1<-7$$
$$2x+1-1<-7-1$$
$$2x<-8$$
$$\frac{2x}{2}<\frac{-8}{2}$$
$$x<-4$$

B
$$x+1>2x$$
$$x+1-x>2x-x$$
$$1>x$$
$$x<1$$

C
$$5\geq 2x-1$$
$$5+1\geq 2x-1+1$$
$$6\geq 2x$$
$$\frac{6}{2}\geq\frac{2x}{2}$$
$$3\geq x$$
$$x\leq 3$$

D
$$3>2x-5$$
$$3+5>2x-5+5$$
$$8>2x$$
$$\frac{8}{2}>\frac{2x}{2}$$
$$4>x$$
$$x<4$$

E
$$3x+1\geq 2$$
$$3x+1-1\geq 2-1$$
$$3x\geq 1$$
$$\frac{3x}{3}\geq\frac{1}{3}$$
$$x\geq\frac{1}{3}$$

F
$$2x-1\geq 2$$
$$2x-1+1\geq 2+1$$
$$2x\geq 3$$
$$\frac{2x}{2}\geq\frac{3}{2}$$
$$x\geq\frac{3}{2}$$
$$x\geq 1\frac{1}{2}$$

G
$$2<1+2x$$
$$2-1<1+2x-1$$
$$1<2x$$
$$\frac{1}{2}<\frac{2x}{2}$$
$$\frac{1}{2}<x$$
$$x>\frac{1}{2}$$

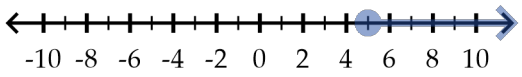
H
$$3-x>1$$
$$3-x-3>1-3$$
$$-x>-2$$
$$\frac{-1x}{-1}>\frac{-2}{-1}$$
$$x<2$$

REVIEW

1. $x + 2 \geq 7$

$x + 2 - 2 \geq 7 - 2$

$x \geq 5$



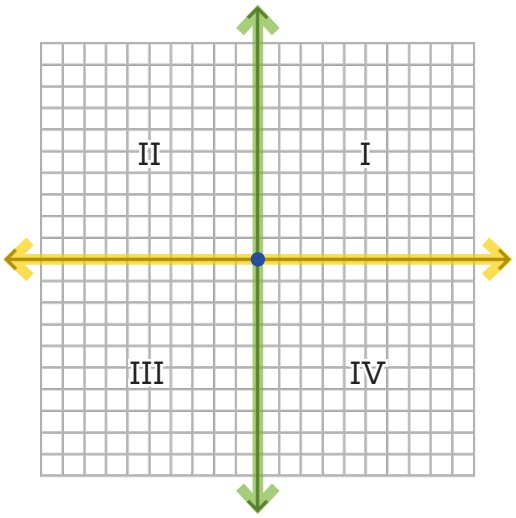
2. $F = ma$

$\frac{F}{a} = \frac{ma}{a}$

$\frac{F}{a} = m$

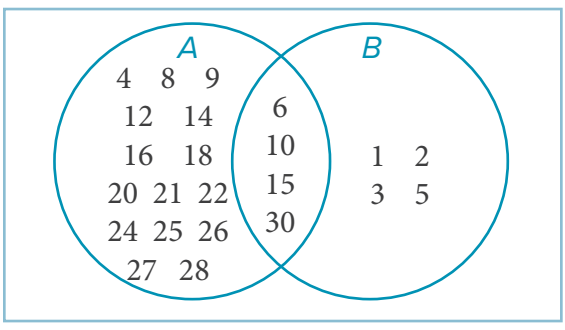
$m = \frac{F}{a}$

3.



4. $A = \{4,6,8,9,10,12,14,15,16,18,20,21,22,24,25,26,27,28,30\}$

$B = \{1,2,3,5,6,10,15,30\}$



a. The intersection of A and B:
$\{6,10,15,30\}$

b. The union of A and B:
$\{1,2,3,4,5,6,8,9,10,12,14,15,16,18,20,21,22,24,25,26,27,28,30\}$

c. The intersection of the complement of A and B (elements only in B):
$\{1,2,3,5\}$

5. November has 30 days.

$10 \text{ min} \bullet 30 = 300 \text{ min}$

$300 \text{ min} \div 60 \text{ min per hr} = 5 \text{ hr}$

Fractions of a Group

WARM-UP

1. a. $|-125| = 125$

   b. $|54| = 54$

   c. $\left|-\frac{1}{2}\right| = \frac{1}{2}$

   d. $|0.42| = 0.42$

2. a. $5+(-4)-2+(-1)-3$
   $=1-2+(-1)-3$
   $=-1+(-1)-3$
   $=-2-3$
   $=-5$

   b. $10-(-2)+5-7+4$
   $=12+5-7+4$
   $=17-7+4$
   $=10+4$
   $=14$

PRACTICE

1. $\frac{1}{4} \cdot x = 51$

   $\frac{\cancel{4}}{\cancel{1}} \cdot \frac{\cancel{1}}{\cancel{4}} \cdot x = 51 \cdot 4$

   $x = 204$

   204 peaches

2. $\frac{3}{8} \cdot x = 30$

   $\frac{\cancel{8}}{\cancel{3}} \cdot \frac{\cancel{3}}{\cancel{8}} \cdot x = \cancel{30}^{10} \cdot \frac{8}{\cancel{3}_{1}}$

   $x = 80$

   80 pounds of carrots

3. $\frac{5}{6} \cdot x = 35$

   $\frac{\cancel{6}}{\cancel{5}} \cdot \frac{\cancel{5}}{\cancel{6}} \cdot x = \cancel{35}^{7} \cdot \frac{6}{\cancel{5}_{1}}$

   $x = 42$

   42 heads of cabbage

4. $\frac{2}{\cancel{7}} \cdot \cancel{56}^{8} = 16$

   16 red onions

5. $\frac{5}{\cancel{12}} \cdot \cancel{84}^{7} = 35$

   35 yellow apples

6. $\frac{3}{\cancel{4}} \cdot \cancel{28}^{7} = 21$

   21 heads of iceberg lettuce

7. a. $35+25+25+20=105$

   105 pounds

   b. $x \cdot 105 = 35$

   $\frac{x \cdot 105}{105} = \frac{35}{105}$

   $x = \frac{35}{105}$

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

c. $x \bullet 105 = 25$

$$\frac{x \bullet 105}{105} = \frac{25}{105}$$

$$x = \frac{25}{105} = \frac{5}{21}$$

d. $35 + 25 + 20 = 80$

$x \bullet 105 = 80$

$$\frac{x \bullet 105}{105} = \frac{80}{105}$$

$$x = \frac{80}{105} = \frac{16}{21}$$

REVIEW

1. $1.5 < 7x + 12$

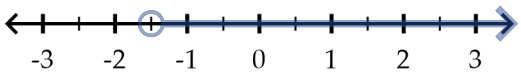
$1.5 - 12 < 7x + 12 - 12$

$-10.5 < 7x$

$$\frac{-10.5}{7} < \frac{7x}{7}$$

$-1.5 < x$

$x > -1.5$



2. $D = \frac{m}{V}$

$V \bullet D = \frac{m}{V} \bullet V$

$DV = m$

$m = DV$

3. $3 \overline{)45}$

$3 \overline{)15}$

5

$45 = 3 \bullet 3 \bullet 5$

$3 \overline{)75}$

$5 \overline{)25}$

5

$75 = 3 \bullet 5 \bullet 5$

LCM: $3 \bullet 3 \bullet 5 \bullet 5 = 225$

4. a. 55.8880

b. 91.4100

5. a. $5\frac{1}{4} + 2\frac{1}{8} = \frac{21}{4} + \frac{17}{8} = \frac{42}{8} + \frac{17}{8} = \frac{59}{8} = 7\frac{3}{8}$

b. $8\frac{2}{3} + 9\frac{2}{3} = \frac{26}{3} + \frac{29}{3} = \frac{55}{3} = 18\frac{1}{3}$

6. Saturday

7. Two weeks is 14 days. There are 31 days in December. December 31 is three days after December 28.

$14 - 3 = 11$

January 11

Ratios and Proportions

WARM-UP

a. $\frac{81}{36} = 2\frac{9}{36} = 2\frac{1}{4}$

b. $\frac{106}{9} = 11\frac{7}{9}$

c. $\frac{54}{8} = 6\frac{6}{8} = 6\frac{3}{4}$

PRACTICE

1.

In Words	As a Fraction	With a Colon
4 to 5	$\frac{4}{5}$	4 : 5
2 to 7	$\frac{2}{7}$	2 : 7
8 to 3	$\frac{8}{3}$	8 : 3
5 to 3	$\frac{5}{3}$	5 : 3

2. a. $\frac{4}{5} = \frac{8}{10}$

$\frac{4}{5} \neq \frac{7}{10}$

not proportional

b. $\frac{20}{30} = \frac{60}{90}$ $\frac{30}{45} = \frac{60}{90}$

$\frac{20}{30} = \frac{30}{45}$

proportional

3. a. $\frac{\boxed{2}}{\textcircled{3}} = \frac{\textcircled{10}}{\boxed{15}}$ b. $\frac{\boxed{10}}{\textcircled{8}} = \frac{\textcircled{5}}{\boxed{4}}$ c. $\frac{\boxed{12}}{\textcircled{16}} = \frac{\textcircled{9}}{\boxed{12}}$

4. a. $\frac{11}{32} \stackrel{?}{=} \frac{2}{5}$

$11 \cdot 5 = 55$

$32 \cdot 2 = 64$

$55 \neq 64$

not proportional

b. $\frac{15}{25} \stackrel{?}{=} \frac{6}{10}$

$15 \cdot 10 = 150$

$25 \cdot 6 = 150$

$150 = 150$

proportional

5. a. $\frac{13}{20} \stackrel{?}{=} \frac{4}{5}$

$20 \cdot 4 = 80$

$13 \cdot 5 = 65$

$80 \neq 65$

not proportional

b. $\frac{6}{4}=\frac{18}{12}$ $\frac{9}{6}=\frac{18}{12}$

$\frac{6}{4}=\frac{9}{6}$

proportional

c. $\frac{12}{7}\stackrel{?}{=}\frac{20}{12}$

$12\bullet 12=144$

$7\bullet 20=140$

$144\neq 140$

not proportional

6. $\frac{1}{2}\stackrel{?}{=}\frac{2.5}{5}$

$1\bullet 5=5$

$2\bullet 2.5=5$

$5=5$

yes, proportional

7. $\frac{4}{3}\stackrel{?}{=}\frac{10}{6}$

$4\bullet 6=24$

$3\bullet 10=30$

$24\neq 30$

no

REVIEW

1. $\frac{1}{\cancel{3}}\bullet\cancel{42}^{14}=14$

14 dancers

2. a. $32\div 8=4$

$4\bullet 3=12$

b. $48\div 8=6$

$6\bullet 3=18$

c. $400\div 8=50$

$50\bullet 3=150$

3. $25<-11x-19$

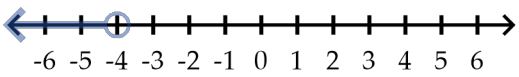
$25+19<-11x-19+19$

$44<-11x$

$\frac{44}{-11}<\frac{-11x}{-11}$

$-4>x$

$x<-4$



4. a. $14-\left(-\sqrt[3]{8}\bullet 9\right)$

$=14-\left(-2\bullet 9\right)$

$=14-\left(-18\right)$

$=14+18$

$=32$

b. $\frac{\sqrt{144}+8\bullet 6}{34-13-2^4}$

$=\frac{12+8\bullet 6}{34-13-16}$

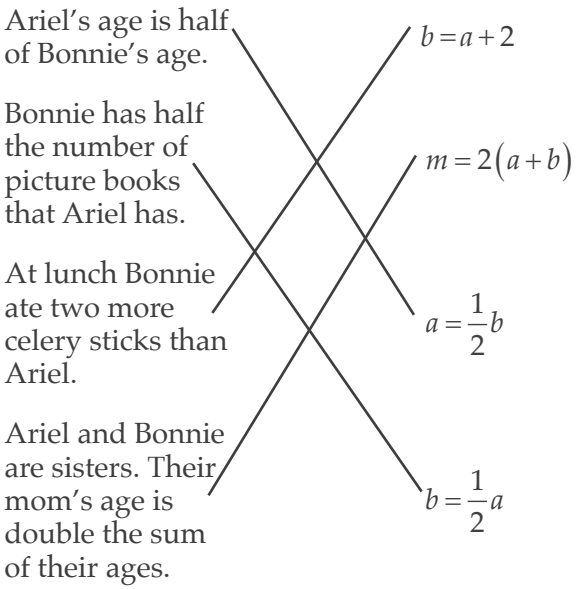
$=\frac{12+48}{34-13-16}$

$=\frac{60}{21-16}$

$=\frac{60}{5}$

$=12$

5.



Solving Ratio Problems: Part 1

WARM-UP

a. $\frac{1}{8} \stackrel{?}{=} \frac{6}{48}$

$1 \cdot 48 = 48$

$8 \cdot 6 = 48$

$48 = 48$

yes

b. $\frac{8}{38} \stackrel{?}{=} \frac{3}{16}$

$8 \cdot 16 = 128$

$38 \cdot 3 = 114$

$128 \neq 114$

no

PRACTICE

1. a. $\frac{3}{8} = \frac{9}{x}$

b. $\frac{6}{8} = \frac{z}{15}$

c. $\frac{5}{3} = \frac{a}{6}$

2. a. $\frac{b}{12} = \frac{4}{3}$

$3 \cdot 4 = 12$

$4 \cdot 4 = 16$

$b = 16$

b. $\frac{15}{21} = \frac{5}{t}$

$15 \div 3 = 5$

$21 \div 3 = 7$

$t = 7$

3. a. $\frac{6}{28} = \frac{15}{p}$

$6p = 28 \cdot 15$

$6p = 420$

$\frac{6p}{6} = \frac{420}{6}$

$p = 70$

b. $\frac{c}{30} = \frac{35}{21}$

$21c = 30 \cdot 35$

$21c = 1050$

$\frac{21c}{21} = \frac{1050}{21}$

$c = 50$

4. $\frac{3 \text{ lb flour}}{2 \text{ lb eggs}} = \frac{6 \text{ lb flour}}{e \text{ lb eggs}}$

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

$3 \cdot 2 = 6$

$2 \cdot 2 = 4$

$e = 4$

4 lb

5. $\frac{5 \text{ oz flour}}{8 \text{ oz dough}} = \frac{f \text{ oz flour}}{32 \text{ oz dough}}$

$$\frac{5}{8} = \frac{f}{32}$$

$8 \cdot 4 = 32$

$5 \cdot 4 = 20$

$f = 20$

20 oz

6. $\frac{7 \text{ boxes elbow macaroni}}{2 \text{ boxes bowtie pasta}} = \frac{b \text{ boxes elbow macaroni}}{10 \text{ boxes bowtie pasta}}$

$$\frac{7}{2} = \frac{b}{10}$$

$7 \cdot 10 = 2b$

$70 = 2b$

$\frac{70}{2} = \frac{2b}{2}$

$35 = b$

35 boxes

7. $\frac{4 \text{ whole wheat loaves}}{7 \text{ total loaves}} = \frac{28 \text{ whole wheat loaves}}{x \text{ total loaves}}$

$$\frac{4}{7} = \frac{28}{x}$$

$4x = 7 \cdot 28$

$4x = 196$

$\frac{4x}{4} = \frac{196}{4}$

$x = 49$

49 loaves

REVIEW

1. a. $\frac{14}{42} = \frac{42}{126}$

$\frac{3}{9} = \frac{42}{126}$

$\frac{14}{42} = \frac{3}{9}$

b. $\frac{2}{8} = \frac{14}{56}$

$\frac{7}{28} = \frac{14}{56}$

$\frac{2}{8} = \frac{7}{28}$

c. $\frac{5}{20} = \frac{25}{100}$

$\frac{10}{50} = \frac{20}{100}$

$\frac{5}{20} \neq \frac{10}{50}$

2. $-15 \geq 10x + 10$

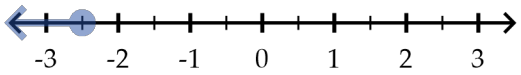
$-15 - 10 \geq 10x + 10 - 10$

$-25 \geq 10x$

$\frac{-25}{10} \geq \frac{10x}{10}$

$-2.5 \geq x$

$x \leq -2.5$



3. a. 56 is between the perfect squares 49 and 64.

$\sqrt{49} = 7$

$\sqrt{64} = 8$

7 & 8

b. 93 is between the perfect squares 81 and 100.

$\sqrt{81} = 9$

$\sqrt{100} = 10$

9 & 10

4. a. $\dfrac{2\frac{1}{2}}{\frac{9}{10}} = \dfrac{5}{2} \div \dfrac{9}{10} = \dfrac{5}{\cancel{2}_{1}} \bullet \dfrac{\cancel{10}^{5}}{9} = \dfrac{25}{9} = 2\dfrac{7}{9}$

b. $\dfrac{\frac{32}{5}}{\frac{16}{3}} = \dfrac{32}{5} \div \dfrac{16}{3} = \dfrac{\cancel{32}^{2}}{5} \bullet \dfrac{3}{\cancel{16}_{1}} = \dfrac{6}{5} = 1\dfrac{1}{5}$

5. a. $9 + 11 + 12 = 32$ people

b. $9 + 11 = 20$

$x \bullet 32 = 20$

$\dfrac{x \bullet 32}{32} = \dfrac{20}{32}$

$x = \dfrac{5}{8}$

c. 32 people + 4 people = 36 people

12 adults + 2 adults = 14 adults

$a \bullet 36 = 14$

$\dfrac{a \bullet 36}{36} = \dfrac{14}{36}$

$a = \dfrac{7}{18}$

Solving Ratio Problems: Part 2

WARM-UP

a. $\frac{1}{3} = \frac{15}{f}$

$3 \bullet 15 = 1 \bullet f$

$45 = f$ or $f = 45$

b. $\frac{1}{2} = \frac{h}{32}$

$2 \bullet h = 1 \bullet 32$

$2h = 32$

$\frac{2h}{2} = \frac{32}{2}$

$h = 16$

PRACTICE

1.

Ratio of Flour to Cream This is a part : part ratio.	Ratio of Flour to Biscuit Dough This is a part : whole ratio.	Ratio of Cream to Biscuit Dough This is a part : whole ratio.
4 cups : 3 cups	4 cups : 7 cups	3 cups : 7 cups
7 oz : 4 oz	7 oz : 11 oz	4 oz : 11 oz Amount of cream = 4 oz Amount of biscuit dough = 11 oz Amount of flour = 11 oz – 4 oz = 7 oz
2 cups : 1 cup	2 cups : 3 cups Amount of flour = 2 cups Amount of biscuit dough = 3 cups Amount of cream = 3 cups – 2 cups = 1 cup	1 cup : 3 cups
10 oz : 10 oz Amount of flour = 10 oz Amount of cream = 10 oz Amount of biscuit dough = 10 oz + 10 oz = 20 oz	10 oz : 20 oz	10 oz : 20 oz

2. Total pounds of sorbet in recipe =
4 lb + 1 lb = 5 lb

$$\frac{4 \text{ lb strawberries}}{5 \text{ lb sorbet}} = \frac{s \text{ lb strawberries}}{5 \text{ lb sorbet}}$$

$$\frac{4}{5} \overset{\bullet 1}{=} \frac{s}{5} \quad \bullet 1$$

$$4 \bullet 1 = 4$$

$$s = 4$$

4 lb of strawberries

3. Total pounds of flatbread in recipe =
1 lb + 1 lb = 2 lb

$$\frac{1 \text{ lb yogurt}}{2 \text{ lb flatbread}} = \frac{4 \text{ lb yogurt}}{f \text{ lb flatbread}}$$

$$\frac{1}{2} \overset{\bullet 4}{=} \frac{4}{f} \quad \bullet 4$$

$$2 \bullet 4 = 8$$

$$f = 8$$

8 lb of flatbread dough

4. Total ounces of tomato soup in recipe =
24 oz + 8 oz = 32 oz

$$\frac{8 \text{ oz cream}}{32 \text{ oz tomato soup}} = \frac{c \text{ oz cream}}{128 \text{ oz tomato soup}}$$

$$\frac{8}{32} = \frac{c}{128}$$

$$32 \bullet c = 8 \bullet 128$$

$$32c = 1024$$

$$\frac{32c}{32} = \frac{1024}{32}$$

$$c = 32$$

32 oz of cream

5. Total grams of gnocchi in recipe =
500 grams + 115 grams = 615 grams

$$\frac{500 \text{ grams potatoes}}{615 \text{ grams gnocchi}} = \frac{5000 \text{ grams potatoes}}{x \text{ grams gnocchi}}$$

$$\frac{500}{615} = \frac{5000}{x}$$

$$615 \bullet 5000 = 500 \bullet x$$

$$\frac{3075000}{500} = \frac{500x}{500}$$

$$6150 = x$$

6,150 grams of gnocchi

6. Total cups of soup in recipe =
5 cups + 4 cups = 9 cups

$$\frac{5 \text{ cups squash}}{9 \text{ cups soup}} = \frac{15 \text{ cups squash}}{y \text{ cups soup}}$$

$$\frac{5}{9} = \frac{15}{y}$$

$$9 \bullet 15 = 5 \bullet y$$

$$135 = 5y$$

$$27 = y$$

27 cups of soup

7. Total ounces of cake in recipe =
9 ounces + 8 ounces = 17 ounces

$$\frac{9 \text{ ounces chocolate chips}}{17 \text{ ounces cake}} = \frac{z \text{ ounces chocolate chips}}{544 \text{ ounces cake}}$$

$$\frac{9}{17} = \frac{z}{544}$$

$$17 \bullet z = 9 \bullet 544$$

$$17z = 4896$$

$$\frac{17z}{17} = \frac{4896}{17}$$

$$z = 288$$

288 ounces of chocolate chips

REVIEW

1. a. $\frac{16}{m} = \frac{40}{30}$

$m \bullet 40 = 16 \bullet 30$

$40m = 480$

$\frac{40m}{40} = \frac{480}{40}$

$m = 12$

b. $\frac{5}{12} = \frac{n}{156}$

$12 \bullet n = 5 \bullet 156$

$12n = 780$

$\frac{12n}{12} = \frac{780}{12}$

$n = 65$

2. $\frac{12 \text{ cups flour}}{4 \text{ loaves bread}} = \frac{x \text{ cups flour}}{1 \text{ loaf bread}}$

$\div 4$

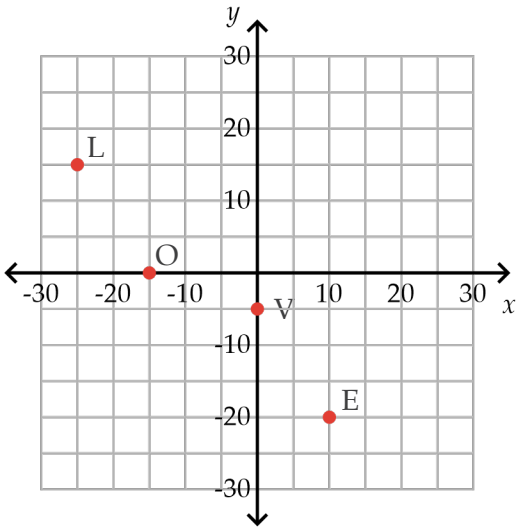
$\frac{12}{4} \quad \frac{x}{1}$

$\div 4$

$x = 3$

3 cups of flour

3.



4. a. $5(1.5) + 6(8)$

$= 7.5 + 48$

$= 55.5$

b. $10(1.5) - 8(8)$

$= 15 - 64$

$= -49$

5. a. $A = l \bullet w$

$242 = 11w$

$\frac{242}{11} = \frac{11w}{11}$

$22 = w$

The longer side is 22 inches.

b. $P = 2l + 2w$

$P = 2(11) + 2(22)$

$P = 22 + 44$

$P = 66$

The perimeter is 66 inches.

c. $\frac{\text{shorter side}}{\text{longer side}} = \frac{11}{22} = \frac{1}{2}$

1 : 2

Rounding Fractions and Mixed Numbers

WARM-UP

a. $\frac{32}{48} = \frac{4}{6} = \frac{2}{3}$

b. $\frac{18}{34} = \frac{9}{17}$

PRACTICE

1. a. Same numerator. The fraction with the larger denominator is the smaller fraction.

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

b. Same denominator. The fraction with the larger numerator is the larger fraction.

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

c. Same numerator. The fraction with the larger denominator is the smaller fraction.

$\frac{3}{7} < \frac{3}{5}$

d. Different numerators and denominators. The common denominator is 156.

$\frac{8}{13} = \frac{96}{156}$

$\frac{7}{12} = \frac{91}{156}$

$\frac{8}{13} > \frac{7}{12}$

e. Different numerators and denominators. The common denominator is 126.

$\frac{3}{14} = \frac{27}{126}$

$\frac{2}{9} = \frac{28}{126}$

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

2. a. $\frac{3}{5}$ rounds to 1.

Half of 5 is 2.5, and $3 > 2.5$.

$\frac{3}{5} > \frac{1}{2}$

b. $2\frac{5}{8}$ rounds to 3.

Half of 8 is 4, and $5 > 4$.

$\frac{5}{8} > \frac{1}{2}$

c. $5\frac{2}{7}$ rounds to 5.

Half of 7 is 3.5, and $2 < 3.5$.

$\frac{2}{7} < \frac{1}{2}$

d. $13\frac{1}{2}$ rounds to 14.

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

3. a. $\frac{5}{6} = \frac{35}{42}$

$\frac{6}{7} = \frac{36}{42}$

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

b. $\frac{3}{8} < \frac{3}{7}$; same numerator

The fraction with the larger denominator is the smaller fraction.

$\frac{3}{7} < \frac{4}{7}$; same denominator

Half of 7 is 3.5, so $\frac{3}{7} < \frac{1}{2}$.

Half of 7 is 3.5, so $\frac{4}{7} > \frac{1}{2}$.

$\frac{3}{8}, \frac{3}{7}, \frac{1}{2}, \frac{4}{7}$

REVIEW

1. a. $4 + 5 = 9$

$\frac{4}{9}$

b. $\frac{4 \text{ males}}{5 \text{ females}} = \frac{m \text{ males}}{25 \text{ females}}$

$$\frac{4}{5} = \frac{m}{25}$$
$$4 \cdot 25 = 5m$$
$$100 = 5m$$
$$\frac{100}{5} = \frac{5m}{5}$$
$$20 = m$$
$$m = 20$$

20 male tutors

2. a. $12(6q + 7) = 72q + 84$

b. $20(3 + 6r) = 120r + 60$

3. a. $10^{-5} = \frac{1}{10^5} = \frac{1}{100000}$

b. $(-5)^{-4} = \frac{1}{(-5)^4} = \frac{1}{625}$

c. $-8^{-3} = -\frac{1}{8^3} = -\frac{1}{512}$

4. a. $5 \cdot (2 - 7)$
$= 5 \cdot (-5)$
$= -25$

b. $(5 \cdot 2) - 7$
$= 10 - 7$
$= 3$

c. $5 \cdot 2 - 7$
$= 10 - 7$
$= 3$

5. Part B

Multiplication is performed before subtraction.

6. a. $\$40{,}000 \div \$10 = 4000$

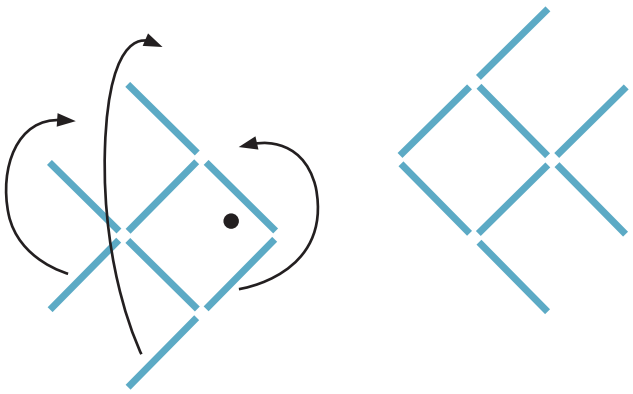
4,000 bills

b. $\$150 \div \$0.10 = \$1{,}500 \div \$1 = 1500$

1,500 dimes

Logic Lesson 2

Fish Sticks



Sled Dog Dilemma

An example of how to solve the problem is given below.

A B C D E F

AB
AC
AD
AE
AF
BC
BD
BE
BF
CD
CE
CF
DE
DF
EF

1st group: AB CD EF
2nd group: AC BE DF
3rd group: AD BF CE
4th group: AF BC DE
5th group: AE BD CF

5 trips

The Midnight Sun

An example of how to solve the problem is given below.

1st guess: 5:00 PM
At 6:00 PM it will be six hours until midnight.
At 7:00 PM it will be five hours until midnight.

2nd guess: 8:00 PM
At 9:00 PM it will be three hours until midnight.
At 10:00 PM it will be two hours until midnight.

3rd guess: 9:00 PM
At 10:00 PM it will be two hours until midnight.
At 11:00 PM it will be one hour until midnight.

9:00 PM

Salik's Squares

The completed puzzle is shown below. Puzzles like this can be solved in many different ways. An example of how to reason through this puzzle is shown below the solution.

7	9	3	5	4	1	8	2	6
1	2	6	9	7	8	3	5	4
8	5	4	3	6	2	1	9	7
6	4	8	1	2	7	9	3	5
5	1	7	6	9	3	2	4	8
9	3	2	8	5	4	6	7	1
3	8	5	7	1	9	4	6	2
2	6	9	4	8	5	7	1	3
4	7	1	2	3	6	5	8	9

A 7	9	3	B 5	4	1	C 8	2	6
1	2	6	9	7	8	3	5	4
8	5	4	3	6	2	1	9	7
D 6	4	8	E 1	2	7	F 9	3	5
5	1	7	6	9	3	2	4	8
9	3	2	8	5	4	6	7	1
G 3	8	5	H 7	1	9	I 4	6	2
2	6	9	4	8	5	7	1	3
4	7	1	2	3	6	5	8	9

Square F (highlighted) is missing values 1, 2, 3, and 8.

The top row of squares D, E, and F (highlighted) is missing values 3, 6, and 7.

Square D and square E already have a 3 in the 9 x 9 square. Therefore, the missing 3 in the highlighted row must go in the top space in square F.

The middle row of D and the top row of E already have a 1, so a 1 cannot be placed in the top or middle row of square F. Therefore, a 1 goes in the empty space in the bottom row of square F.

Square E and square F already have 6s. Therefore, the 6 missing in the highlighted row must go in the top space in square D.

The last number needed in the highlighted row is 7. There is only one missing space, so 7 must go in that space (top row in square E). To check that no mistakes have been made, be sure there are no other 7s in square E or in the column that now contains the 7.

Square F is now missing a 2 and an 8 in the middle row. The left column of squares C, F, and I already contain an 8, so the empty space in the left column of square F is a 2. Place an 8 in the final space available in square F. Continue looking for missing values in other rows, columns, and squares and checking for possible answers.

Mascot Mix-Up

		Mascot					Color				
		Arctic Fox	Narwhal	Puffin	Reindeer	Beluga Whale	Blue	White	Black	Green	Red
Sport	Football	✓	X	X	X	X	X	X	✓	X	X
	Futsal	X	X	✓	X	X	X	X	X	✓	X
	Handball	X	X	X	X	✓	✓	X	X	X	X
	Downhill Skiing	X	✓	X	X	X	X	✓	X	X	X
	Cross-Country Skiing	X	X	X	✓	X	X	X	X	X	✓
Color	Blue	X	X	X	X	✓					
	White	X	✓	X	X	X					
	Black	✓	X	X	X	X					
	Green	X	X	✓	X	X					
	Red	X	X	X	✓	X					

Information that can be gathered from each clue is shown to the right. A check is placed in a box when the answer is known for certain, and an X is placed in a box if it cannot be the answer. When a check is placed in a box, Xs can be placed in the rest of the row and column for that section.

1. The narwhal or reindeer must be white.
2. The cross-country skiing team chose red and either the arctic fox or the reindeer.
3. The downhill skiing team chose either the beluga whale or the narwhal. If they chose the narwhal, it is white. If they chose the beluga whale, it is red.
4. Handball is either the beluga whale or narwhal, and not black. Handball is an indoor sport.
5. The puffins play an indoor sport in green. Futsal and handball are indoor sports.
6. The only teams whose mascot name could match the first letter of their colors are beluga whales (with blue or black) and reindeer (with red). This means the cross-country skiing team chose the red reindeer. Therefore, the narwhal is white and was chosen by the downhill skiing team. Handball must have chosen the blue beluga whale as its mascot. This means the futsal team is the green puffins. The last team is the football team, which must have chosen the black arctic fox as its mascot.

Percentages

WARM-UP

a. $6:11$

b. $6 + 11 = 17$
$6:17$

c. $11:17$

PRACTICE

1.

Percent	Decimal	Fraction / Mixed Number
64%	0.64	$\frac{16}{25}$
0.3%	0.003	$\frac{3}{1000}$
285%	2.85	$2\frac{17}{20}$

$64\% = 0.64$
$\frac{64}{100} = \frac{16}{25}$

$0.3\% = 0.003$
$\frac{0.3}{100} = \frac{3}{1000}$

$285\% = 2.85$
$\frac{285}{100} = 2\frac{85}{100} = 2\frac{17}{20}$

2. a. $0.35 \cdot 360 = 126$

b. $0.12 \cdot 150 = 18$

3. a. $x \cdot 325 = 78$
$\frac{x \cdot 325}{325} = \frac{78}{325}$
$x = 0.24$
24%

b. $x \cdot 325 = 910$
$\frac{x \cdot 325}{325} = \frac{910}{325}$
$x = 2.8$
280%

4. a. $3 = 0.06 \cdot y$
$\frac{3}{0.06} = \frac{0.06 \cdot y}{0.06}$
$50 = y$
$y = 50$

b. $552 = 1.20 \cdot y$
$\frac{552}{1.20} = \frac{1.20 \cdot y}{1.20}$
$460 = y$
$y = 460$

5. $0.24 \cdot 375 = 90$
90 students

6. $l \cdot 265 = 106$
$\frac{l \cdot 265}{265} = \frac{106}{265}$
$l = 0.4$
40%

REVIEW

1. There are three clear days out of every five days. November has 30 days.

$$\frac{3 \text{ clear}}{5 \text{ days}} = \frac{c \text{ clear}}{30 \text{ days}}$$

$$\frac{3}{5} = \frac{c}{30}$$

$$5 \cdot 6 = 30$$

$$3 \cdot 6 = 18$$

$$c = 18$$

18 days

2. $\frac{5}{8} > \frac{1}{2}$

24

3. a.

$$\frac{1}{3}x - 7 = 20$$

$$\frac{1}{3}x - 7 + 7 = 20 + 7$$

$$\frac{1}{3}x = 27$$

$$3 \cdot \frac{1}{3}x = 27 \cdot 3$$

$$x = 81$$

b.

$$-16 = 7y - 2$$

$$-16 + 2 = 7y - 2 + 2$$

$$-14 = 7y$$

$$\frac{-14}{7} = \frac{7y}{7}$$

$$-2 = y$$

$$y = -2$$

4. Two weeks later is another Thursday. 13 days is one day less than two weeks, so it will be a Wednesday.

5.

$$\begin{array}{r} {}^{1}\cancel{2}{}^{9}\cancel{0}{}^{9}\cancel{0}^{1}.00 \\ -\ 38.90 \\ \hline 161.10 \end{array} \qquad \begin{array}{r} 1\cancel{6}{}^{5}\cancel{1}{}^{1}\cancel{.}{}^{0}\cancel{1}{}^{1}0 \\ -\ 46.34 \\ \hline 114.76 \end{array}$$

$114.76

6. Area:

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

$$= \frac{9}{4} \cdot \frac{13}{5}$$

$$= \frac{117}{20}$$

$$= 5\frac{17}{20}$$

$5\frac{17}{20}$ cm^2

Perimeter:

$$2\left(2\frac{1}{4}\right) + 2\left(2\frac{3}{5}\right)$$

$$= 2\left(\frac{9}{4}\right) + 2\left(\frac{13}{5}\right)$$

$$= \frac{9}{2} + \frac{26}{5}$$

$$= \frac{45}{10} + \frac{52}{10}$$

$$= \frac{97}{10}$$

$$= 9\frac{7}{10}$$

$9\frac{7}{10}$ cm

Percent Increase

WARM-UP

1. $42.3\% = 0.423$
2. $0.094 = 9.4\%$
3. $\frac{196}{100} = 1\frac{96}{100} = 1\frac{24}{25}$

PRACTICE

1.

Original Amount	New Amount	Amount of Increase (new amount – original amount)	Percent Increase (amount of increase ÷ original amount)
10	13.8	$13.8 - 10 = 3.8$	$3.8 \div 10 = 0.38 = 38\%$
5	7	$7 - 5 = 2$	$2 \div 5 = 0.4 = 40\%$
2.5	3	$3 - 2.5 = 0.5$	$0.5 \div 2.5 = 20\%$

2. $40000 - 25000 = 15000$
$15000 \div 25000 = 0.6$
60%

3.

Original Amount	Percent Increase	Total Percent as a Decimal (percent increase + 100%)	New Amount (original amount • total percent as decimal)
10	2.3%	$2.3\% + 100\% = 102.3\% = 1.023$	$10 \cdot 1.023 = 10.23$
5	25%	$25\% + 100\% = 125\% = 1.25$	$5 \cdot 1.25 = 6.25$
2.5	90%	$90\% + 100\% = 190\% = 1.90$	$2.5 \cdot 1.90 = 4.75$

4. $46\% + 100\% = 146\% = 1.46$
$\$6.50 \cdot 1.46 = \$9.49$

5.

New Amount	Percent Increase	Proportion $\frac{100 + \text{percent increase}}{100} = \frac{\text{new amount}}{\text{original amount}}$	Original Amount (solve proportion)
20	25%	$\frac{125}{100} = \frac{20}{x}$	$125x = 20 \cdot 100$ $x = 16$
27	8%	$100\% + 8\% = 108\%$ $\frac{108}{100} = \frac{27}{x}$	$108x = 27 \cdot 100$ $108x = 2700$ $\frac{108x}{108} = \frac{2700}{108}$ $x = 25$
82.5	120%	$100\% + 120\% = 220\%$ $\frac{220}{100} = \frac{82.5}{x}$	$220x = 82.5 \cdot 100$ $220x = 8250$ $\frac{220x}{220} = \frac{8250}{220}$ $x = 37.5$

6. $15\% + 100\% = 115\%$

$$\frac{115}{100} = \frac{1426}{h}$$
$$115h = 100 \cdot 1426$$
$$115h = 142600$$
$$\frac{115h}{115} = \frac{142600}{115}$$
$$h = 1240$$

1,240 bison

REVIEW

1. a. Each pig has 4 feet. $48 \div 4 = 12$
There are 12 pigs.
Each pig has 1 tail.
12 tails

b. Each pig has 2 ears. $2 \cdot 12 = 24$
24 ears

2. $0.88 \cdot f = 176$

$$\frac{0.88 \cdot f}{0.88} = \frac{176}{0.88}$$
$$f = 200$$

200 fans

3. a.
$$5\overline{)26.0}\quad 5.2$$
$$-25$$
$$10$$
$$-10$$
$$0$$

$\frac{26}{5} = 5.2$

b.
$$
\begin{array}{r}
6.75 \\
8\overline{)54.00} \\
-48 \\
\hline
60 \\
-56 \\
\hline
40 \\
-40 \\
\hline
0
\end{array}
$$

$\frac{54}{8} = 6.75$

4. The McPhies' wedding anniversary is 17 days before the Smiths' anniversary. January 6 is six days into the month of January. $17 - 6 = 11$, so go back 11 days into December.
December has 31 days. $31 - 11 = 20$
The McPhies' anniversary is on December 20.

5. Four hours behind 4:00 PM is 12:00 PM. Two hours further back is 10:00 AM.

6. $0.65 \bullet \$142 = \$92.30$

7. a. $\frac{66}{192} = \frac{22}{64} = \frac{11}{32}$

b. $\frac{175}{275} = \frac{7}{11}$

Percent Decrease

WARM-UP

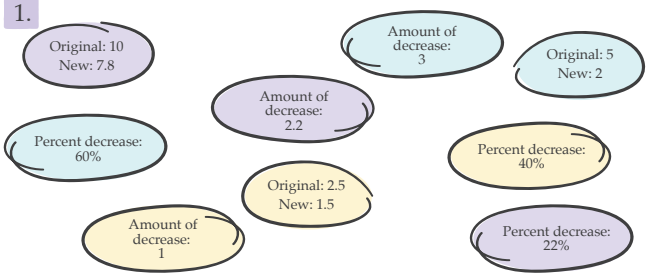
a. $\frac{42}{50} = \frac{84}{100} = 84\%$

b. $0.065 = 6.5\%$

c. $\frac{\sqrt{64}}{25} = \frac{8}{25} = \frac{32}{100} = 32\%$

PRACTICE

1.



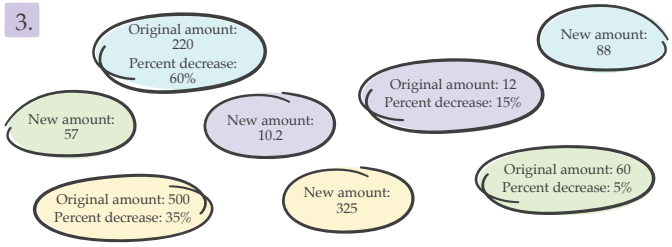
Detailed work for the matching bubbles is shown below.

Original: 5
New: 2
Amount of decrease: $5 - 2 = 3$
$3 \div 5 = 0.6$
Percent decrease: 60%

Original: 2.5
New: 1.5
Amount of decrease: $2.5 - 1.5 = 1$
$1 \div 2.5 = 0.4$
Percent decrease: 40%

2. Original: $1,200
New: $570
Amount of decrease:
$1,200 – $570 = $630
$630 \div 1200 = 0.525$
Percent decrease: 52.5%

3.



Detailed work for the matching bubbles is shown below.

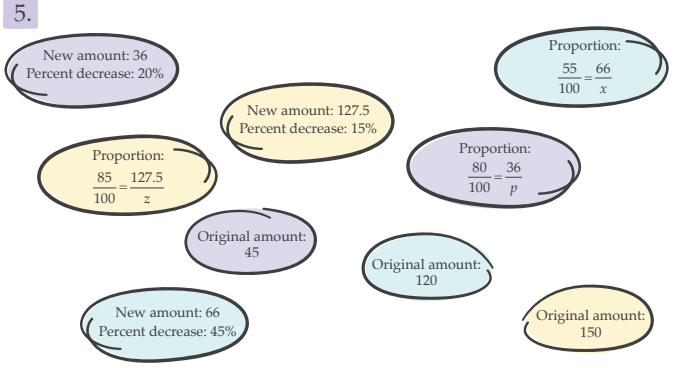
Original amount: 220
Percent decrease: 60%
Percent left: $100\% - 60\% = 40\%$
New amount: $0.40 \cdot 220 = 88$

Original amount: 60
Percent decrease: 5%
Percent left: $100\% - 5\% = 95\%$
New amount: $0.95 \cdot 60 = 57$

Original amount: 500
Percent decrease: 35%
Percent left: $100\% - 35\% = 65\%$
New amount: $0.65 \cdot 500 = 325$

4. Original amount: 560
Percent decrease: 15%
Percent left: $100\% - 15\% = 85\%$
New amount: $0.85 \cdot 560 = 476$
476 employees

5.



Detailed work for the matching bubbles is shown below.

New amount: 127.5
Percent decrease: 15%
Percent left: 100% – 15% = 85%
Proportion:

$$\frac{85}{100}=\frac{127.5}{z}$$

Original amount:

$$85z = 100 \bullet 127.5$$
$$85z = 12750$$
$$\frac{85z}{85} = \frac{12750}{85}$$
$$z = 150$$

New amount: 66
Percent decrease: 45%
Percent left: 100% – 45% = 55%
Proportion:

$$\frac{55}{100}=\frac{66}{x}$$

Original amount:

$$55x = 100 \bullet 66$$
$$55x = 6600$$
$$\frac{55x}{55} = \frac{6600}{55}$$
$$x = 120$$

6. New amount: 36600
Percent decrease: 40%
Percent left: 100% – 40% = 60%
Proportion:

$$\frac{60}{100}=\frac{36600}{p}$$

Original amount:

$$60p = 100 \bullet 36600$$
$$60p = 3660000$$
$$\frac{60p}{60} = \frac{3660000}{60}$$
$$p = 61000$$

$61,000

REVIEW

1. $18 - 16 = 2$
$2 \div 16 = 0.125$
12.5%

2. a. $n - 42 = -51$
$n - 42 + 42 = -51 + 42$
$n = -9$

b. $19p = 209$
$\frac{19p}{19} = \frac{209}{19}$
$p = 11$

3. $0.30 \bullet 80 = 24$
24 fans

4. a. $12 \bullet 3 = 36$

b. $1.2 \bullet 0.3 = 0.36$

c. $12 \bullet 0.03 = 0.36$

5. a. $\frac{24}{30}=\frac{32}{q}$
$24q = 30 \bullet 32$
$24q = 960$
$\frac{24q}{24} = \frac{960}{24}$
$q = 40$

b. $\frac{r}{108} = \frac{3}{9}$

$9r = 108 \cdot 3$

$9r = 324$

$\frac{9r}{9} = \frac{324}{9}$

$r = 36$

c. $\frac{1}{5} = \frac{s}{55}$

$1 \cdot 55 = 5s$

$55 = 5s$

$\frac{55}{5} = \frac{5s}{5}$

$11 = s$

$s = 11$

6. December has 31 days.

143141 ÷ 31

$$\begin{array}{r} 4617.4 \\ 31\overline{)143141.0} \\ -124 \\ \hline 191 \\ -186 \\ \hline 54 \\ -31 \\ \hline 231 \\ -217 \\ \hline 14\,0 \\ -12\,4 \\ \hline 1\,6 \end{array}$$

Stop dividing after the tenths place is reached in order to round to the nearest whole number.

4,617 visitors

Simple Interest

WARM-UP

a. $d = rt$
$d = 9 \cdot 7$
$d = 63$
63 miles

b. $d = rt$
$16 = 2t$
$\frac{16}{2} = \frac{2t}{2}$
$8 = t$
$t = 8$
8 hours

PRACTICE

1. I is interest
P is principal
r is interest rate
t is time

2. a. annually → 1 time a year
3 years • 1 time / year = 3 times

b. quarterly → 4 times a year
5 years • 4 times / year = 20 times

c. monthly → 12 times a year
2 years • 12 times / year = 24 times

d. semiannually → 2 times a year
5 years • 2 times / year = 10 times

3. principal: 1000 rate: 0.05 time: 7
$I = Prt$
$I = 1000(0.05)(7)$
$I = 350$
$350

4. principal: 2500 rate: 0.04 time: 3
$I = Prt$
$I = 2500(0.04)(3)$
$I = 300$
$300

5. a. $5\frac{3}{4} \cdot 12$
$= \frac{23}{\cancel{4}} \cdot \overset{3}{\cancel{12}}$
$= 69$

b. principal: 500 rate: 0.01 time: 69
$I = Prt$
$I = 500(0.01)(69)$
$I = 345$
$345

c. $500 + $345 = $845

REVIEW

1. $10 = 0.025 \bullet x$

$$\frac{10}{0.025} = \frac{0.025 \bullet x}{0.025}$$

$400 = x$

$x = 400$

2. $\frac{7}{20}$ and $\frac{9}{20}$ are both less than 1.

$\frac{7}{2}$ and $\frac{9}{2}$ are both greater than 1.

When the denominators are equal, the fraction with the smaller numerator will be smaller. When the numerators are equal, the fraction with the greater denominator is smaller.

$\frac{7}{20} < \frac{9}{20} < \frac{7}{2} < \frac{9}{2}$

3. $\frac{3.5 \text{ servings}}{1 \text{ can}} = \frac{105 \text{ servings}}{c \text{ cans}}$

Fractions may be switched.

$3.5c = 1 \bullet 105$

$3.5c = 105$

$\frac{3.5c}{3.5} = \frac{105}{3.5}$

$c = 30$

30 cans

4. a.
$$\begin{array}{r} {\scriptstyle 1} \\ 24083 \\ +\ 1790 \\ \hline 25873 \end{array}$$

b. $10 \bullet (24083 + 1790)$

$= 10 \bullet (25873)$

$= 258730$

5. a. $14 + 8n$

b. $30 \div n - 16$

6. $0.22 \bullet 30 = 6.6$

$6.60

7. a. $854 \div 32 = 26.6875$

b. $722 \div 11 = 65.6363... = 65.\overline{63}$

Compound Interest

WARM-UP

1. a. $\frac{1}{25} = \frac{4}{100} = 4\%$

   b. $\frac{4}{5} = \frac{80}{100} = 80\%$

   c. $\frac{7}{10} = \frac{70}{100} = 70\%$

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

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

   c. $5 \bullet \frac{2}{5} = 2$

PRACTICE

1. a. $(1.035)^4 = 1.147523... \approx 1.148$

   b. $(1.04)^7 = 1.3159317... \approx 1.316$

   c. $(1.076)^{11} = 2.238386... \approx 2.238$

2. $A = P(1+r)^t$

   $A = 300(1+0.05)^4$

   $A = 300(1.05)^4$

   $A = 300 \bullet 1.21550625$

   $A = 364.651875$

   $364.65

3. $A = P(1+r)^t$

   $A = 5000(1+0.03)^{20}$

   $A = 5000(1.03)^{20}$

   $A \approx 5000 \bullet 1.806111235$

   $A \approx 9030.556173$

   $9,030.56

4. a. $I = Prt$

   $I = 1000(0.06)(30)$

   $I = 1800$

   $1,800

   b. $1,000 + $1,800 = $2,800

   c. $A = P(1+r)^t$

   $A = 1000(1+0.06)^{30}$

   $A = 1000(1.06)^{30}$

   $A \approx 1000 \bullet 5.743491173$

   $A \approx 5743.491173$

   $5,743.49

   d. $5,743.49 – $2,800 = $2,943.49

   The account earning compound interest earned $2,943.49 more.

REVIEW

1. $$60 = x \bullet 150$$
$$\frac{60}{150} = \frac{x \bullet 150}{150}$$
$$0.4 = x$$
$$x = 0.4$$
40%

2. a. $7.5 \div 24 = 0.3125 =$ 31.25%

   b. $3.25 \div 24 = 0.1354166\ldots \approx$ 13.54%

   c. $1.5 \div 24 = 0.0625 =$ 6.25%

   d. $1 \div 24 = 0.04166\ldots \approx$ 4.17%

   e. $2 \div 24 = 0.0833\ldots \approx$ 8.33%

3. 4 : 1

4. $100\% - 15\% = 85\%$
$$0.85 \bullet r = 38.25$$
$$\frac{0.85 \bullet r}{0.85} = \frac{38.25}{0.85}$$
$$r = 45$$
$45.00

5. $I = Prt$
$I = 1000(0.035)(7)$
$I = 245$

$1,000 + $245 = $1,245

6. a. $71.026 + (-153.49)$
$$\begin{array}{r} 153.490 \\ -\ 71.026 \\ \hline 82.464 \end{array}$$
$$|-153.49| > |71.026|$$
$71.026 - 153.49 =$ -82.464

   b. $9423 - 86.2$
$$\begin{array}{r} 9423.0 \\ -\ \ \ 86.2 \\ \hline 9336.8 \end{array}$$
$9423 - 86.2 =$ 9336.8

7. a.
$$-4h + 12 = 3h + 61$$
$$-4h + 12 + 4h = 3h + 61 + 4h$$
$$12 = 7h + 61$$
$$12 - 61 = 7h + 61 - 61$$
$$-49 = 7h$$
$$\frac{-49}{7} = \frac{7h}{7}$$
$$-7 = h$$
$$h = -7$$

   b.
$$\frac{2}{3}i - \frac{7}{12} = \frac{3}{4} - \frac{5}{6}i$$
$$\frac{2}{3}i - \frac{7}{12} + \frac{5}{6}i = \frac{3}{4} - \frac{5}{6}i + \frac{5}{6}i$$
$$\frac{4}{6}i - \frac{7}{12} + \frac{5}{6}i = \frac{3}{4}$$
$$\frac{9}{6}i - \frac{7}{12} = \frac{3}{4}$$
$$\frac{9}{6}i - \frac{7}{12} + \frac{7}{12} = \frac{3}{4} + \frac{7}{12}$$
$$\frac{9}{6}i = \frac{9}{12} + \frac{7}{12}$$
$$\frac{9}{6}i = \frac{16}{12}$$
$$\frac{6}{9} \bullet \frac{9}{6}i = \frac{16}{12} \bullet \frac{6}{9}$$
$$i = \frac{8}{9}$$

Identifying Unit Rates

WARM-UP

a. $\frac{26}{32} = \frac{13}{16}$

b. $\frac{12}{150} = \frac{4}{50} = \frac{2}{25}$

PRACTICE

1. a. Unit rate: dollars ÷ oz
$5.60 \div 4 = 1.40$
Unit cost: $1.40 per oz

b. Unit rate: dollars ÷ lb
$7.50 \div 2.5 = 3$
Unit cost: $3.00 per lb

c. Unit rate: dollars ÷ L
$4.98 \div 2 = 2.49$
Unit cost: $2.49 per L

2. a. Unit rate: goals scored ÷ games played
$5 \div 1 = 5$
5 goals per game

b. Unit rate: garden length ÷ number of rows
$10 \div 4 = 2.5$
2.5 ft per row

c. Unit rate: g fiber ÷ bananas
$15 \div 5 = 3$
3 g fiber per banana

3. Unit rate: miles ÷ hours

$$3\frac{1}{2} \div \frac{3}{5}$$
$$= \frac{7}{2} \div \frac{3}{5}$$
$$= \frac{7}{2} \cdot \frac{5}{3}$$
$$= \frac{35}{6}$$
$$= 5\frac{5}{6}$$

$5\frac{5}{6}$ miles per hour

4. Unit rate: steps ÷ hours
$9588 \div 12 = 799$
799 steps per hour

REVIEW

1. $A = P(1+r)^t$

$A = 3000(1+0.03)^7$

$A = 3000(1.03)^7$

$A \approx 3000 \bullet 1.22987...$

$A \approx 3689.62$

$3,689.62

2. $160 - 132 = 28$

$\frac{28}{132} = 0.2121... = 0.\overline{21}$

21%

3. $100\% - 20\% = 80\%$

Discounted price: $0.8 \bullet \$28 = \$22.40$

Tax: $0.0625 \bullet \$22.40 = \$1.40$

Total: $\$22.40 + \$1.40 = \$23.80$

4. a. $\frac{1 \text{ cup dry rice}}{4 \text{ servings}} = \frac{r \text{ cups dry rice}}{10 \text{ servings}}$

$\frac{1}{4} = \frac{r}{10}$

$1 \bullet 10 = 4r$

$10 = 4r$

$\frac{10}{4} = \frac{4r}{4}$

$2.5 = r$

$r = 2.5$

$2\frac{1}{2}$ cups of dry rice

b. $\frac{2 \text{ cups water}}{1 \text{ cup dry rice}} = \frac{w \text{ cups water}}{2.5 \text{ cups dry rice}}$

$\frac{2}{1} = \frac{w}{2.5}$

$2 \bullet 2.5 = 1w$

$5 = w$

$w = 5$

5 cups of water

5. a. $(7.2 \times 10^5) \div (1.8 \times 10^2)$

$7.2 \div 1.8 = 4$

$10^5 \div 10^2$

$= \frac{\cancel{10} \bullet \cancel{10} \bullet 10 \bullet 10 \bullet 10}{\cancel{10} \bullet \cancel{10}}$

$= 10 \bullet 10 \bullet 10$

$= 10^3$

$(7.2 \times 10^5) \div (1.8 \times 10^2) = 4 \times 10^3$

b. $(4.28 \times 10^{10}) \bullet (5.5 \times 10^7)$

$4.28 \bullet 5.5 = 23.54$

$10^{10} \bullet 10^7$

$= 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10$
$\bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 \bullet 10 = 10^{17}$

$(4.28 \times 10^{10}) \bullet (5.5 \times 10^7) = 23.54 \times 10^{17}$

The decimal point must move one place to the left, so the exponent must increase by one.

$(4.28 \times 10^{10}) \bullet (5.5 \times 10^7) = 2.354 \times 10^{18}$

6. One week after October 23 is October 30 because $23 + 7 = 30$.
There are 31 days in October, so one week after October 30 is November 6.
$6 + 14 = 20$
Two weeks after November 6 is November 20.

7. a. $12 + 5x - 18 - x$

$= 5x - x + 12 - 18$

$= 4x - 6$

b. $-9 + 33y + (-6) - 16y$

$= 33y + (-16y) + (-9) + (-6)$

$= 17y - 15$

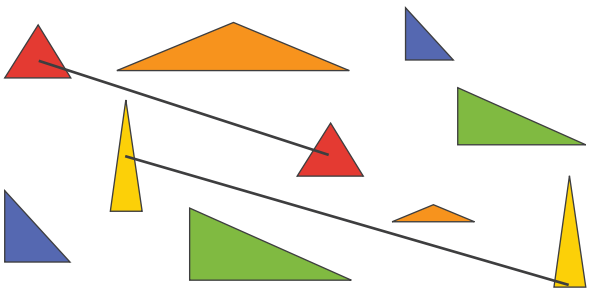
Proportions Within Similar Triangles

WARM-UP

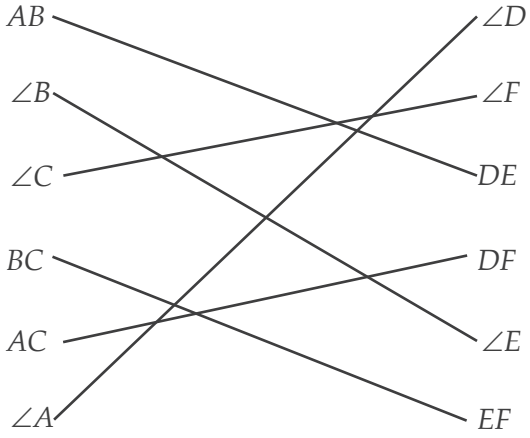
$$\frac{14}{17} = \frac{x}{68}$$
$$14 \cdot 68 = 17x$$
$$952 = 17x$$
$$\frac{952}{17} = \frac{17x}{17}$$
$$56 = x$$
$$x = 56$$

PRACTICE

1.



2.



3. a. $\frac{AC}{PR} = \frac{2}{4} = \frac{1}{2}$

$\frac{AB}{PQ} = \frac{4}{7}$

$\frac{BC}{QR} = \frac{3}{6} = \frac{1}{2}$

no

b. $\frac{AB}{KL} = \frac{5}{25} = \frac{1}{5}$

$\frac{BC}{LM} = \frac{5}{25} = \frac{1}{5}$

$\frac{CA}{MK} = \frac{2}{10} = \frac{1}{5}$

yes

4. Proportions may be set up in different ways, but the final answer should be the same.

a. $\frac{AB}{DE} = \frac{AC}{DF}$

$\frac{3}{4.5} = \frac{4}{x}$

$3x = 18$

$\frac{3x}{3} = \frac{18}{3}$

$x = 6$

6 cm

b. $\frac{HJ}{KM} = \frac{HI}{KL}$

$\frac{3}{p} = \frac{4}{12}$

$36 = 4p$

$\frac{36}{4} = \frac{4p}{4}$

$9 = p$

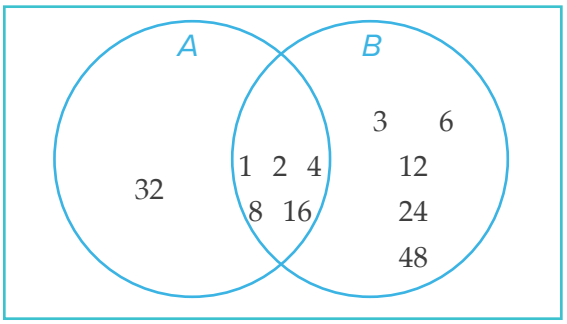
9 ft

REVIEW

1. 2,250 calories ÷ 5 meals = 450 calories per meal

2. $A = \{1,2,4,8,16,32\}$

$B = \{1,2,3,4,6,8,12,16,24,48\}$



a. The intersection of A and B
$\{1,2,4,8,16\}$

b. The union of A and B
$\{1,2,3,4,6,8,12,16,24,32,48\}$

c. The intersection of A and not B (everything only in A)
$\{32\}$

3. a. $\sqrt{196} = 14$

b. $\sqrt{6400} = 80$

4. a. $\sqrt[3]{-125} = -5$

b. $\sqrt[3]{-343} = -7$

5.
$2\overline{)32}$	$2\overline{)208}$
$2\overline{)16}$	$2\overline{)104}$
$2\overline{)8}$	$2\overline{)52}$
$2\overline{)4}$	$2\overline{)26}$
2	13

$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

$208 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 13$

GCF: $2 \cdot 2 \cdot 2 \cdot 2 = 16$

LCM: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 13 = 416$

6. $\frac{70 \text{ dollars}}{5 \text{ hours}} = \frac{d \text{ dollars}}{8 \text{ hours}}$

$560 = 5d$

$\frac{560}{5} = \frac{5d}{5}$

$112 = d$

$112

7. $1 + 3 = 4$

The ratio of red paint to pink paint is 1:4.

$\frac{1 \text{ cup red}}{4 \text{ cups pink}} = \frac{r \text{ cups red}}{16 \text{ cups pink}}$

$16 = 4r$

$\frac{16}{4} = \frac{4r}{4}$

$4 = r$

Red paint: 4 cups

The ratio of white paint to pink paint is 3:4.

$$\frac{3 \text{ cups white}}{4 \text{ cups pink}} = \frac{w \text{ cups white}}{16 \text{ cups pink}}$$

$$48 = 4w$$

$$\frac{48}{4} = \frac{4w}{4}$$

$$12 = w$$

White paint: 12 cups

Metric and US Customary Units

WARM-UP

a. $4.32 \bullet 10^3 \rightarrow 4.32$
4320

b. $0.0087 \bullet 10^7 \rightarrow 0.0087$
87000

PRACTICE

1.

cm M		mm P	
dL A		L E	
kg T		hg S	
dm T		dam R	
g I		mg E	
hL C		cL K	

METRIC

2.

	a.	b.	c.
kiloliters	$0.2 \div 10 = 0.02$	$0.0004 \div 10 = 0.00004$	$10 \div 10 = 1$
hectoliters	0.2	$0.004 \div 10 = 0.0004$	10
dekaliters	2	$0.04 \div 10 = 0.004$	$10 \bullet 10 = 100$
liters	20	$0.4 \div 10 = 0.04$	$100 \bullet 10 = 1000$
deciliters	200	0.4	$1000 \bullet 10 = 10000$
centiliters	$200 \bullet 10 = 2000$	$0.4 \bullet 10 = 4$	$10000 \bullet 10 = 100000$
milliliters	$2000 \bullet 10 = 20000$	$4 \bullet 10 = 40$	$100000 \bullet 10 = 1000000$

3.

A	2 gal	6 qt
B	4 ft	45 in
C	50 oz	3 lb
D	2 mi	10,000 ft
E	25 c	9 qt
F	3 tn	3,500 lb
G	6,500 yd	4 mi
H	7 pt	1 gal
I	20 ft	7 yd

Work for each row is shown below.

A
2 • 4 = 8
2 gal = 8 qt

B
4 • 12 = 48
4 ft = 48 in

C
3 • 16 = 48
3 lb = 48 oz

D
2 • 5280 = 10560
2 mi = 10,560 ft

E
9 • 4 = 36
9 qt = 36 c

F
3 • 2000 = 6000
3 tn = 6,000 lb

G
4 • 1760 = 7040
4 mi = 7,040 yd

H
1 • 8 = 8
1 gal = 8 pt

I
7 • 3 = 21
7 yd = 21 ft

4. Only 5 matches need to be found. Here are the first five squares as examples.

5 • 1000 = 5000
5 km = 5,000 m

24 ÷ 12 = 2
24 in = 2 ft

3 • 2 = 6
3 pt = 6 c

5 • 100 = 500
5 dag = 500 dg

2 • 3 = 6
2 yd = 6 ft

5 km	24 in	3 pt	5 dag	2 yd	0.005 kg
4 pt	1 gal	50 cg	4 c	5,280 yd	2 c
5,000 dL	1,000 lb	6 pt	1 tn	5,000 m	3 qt
1 qt	2 mi	500 cm	6 c	2 ft	0.05 dag
6 ft	5 g	3 mi	4 qt	1 pt	0.5 gal
5,000 mm	2,000 lb	500 dg	16,000 oz	5 hL	10,560 ft

REVIEW

1. $75 \div 3 = 25$
$25 \bullet 2 = 50$

2. a. $5\overline{)28.0}$ = 5.6

$$\begin{array}{r} -25 \\ \hline 30 \\ -30 \\ \hline 0 \end{array}$$

$28 \div 5 = 5.6$

b. $11\overline{)54.00...}$ = $4.\overline{90}$

$$\begin{array}{r} -44 \\ \hline 100 \\ -99 \\ \hline 10 \end{array}$$

$54 \div 11 = 4.\overline{90}$

3. Unit rate: windows ÷ hours
$9 \div 2 = 4.5$
Cruz's rate: 4.5 windows per hour

$6 \div 1.5 = 4$
Enza's rate: 4 windows per hour

Cruz washed at a faster rate.

4. Unit rate: dollars ÷ loads
$28.08 \div 108 = 0.26$
Detergent X: $0.26 per load

$12.60 \div 42 = 0.3$
Detergent Y: $0.30 per load

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

$$= \frac{13}{8} + \frac{11}{4}$$
$$= \frac{13}{8} + \frac{22}{8}$$
$$= \frac{35}{8}$$
$$= 4\frac{3}{8}$$

b. $6\frac{5}{6} - 3\frac{1}{3}$

$$= \frac{41}{6} - \frac{10}{3}$$
$$= \frac{41}{6} - \frac{20}{6}$$
$$= \frac{21}{6}$$
$$= 3\frac{3}{6}$$
$$= 3\frac{1}{2}$$

Unit Conversions

WARM-UP

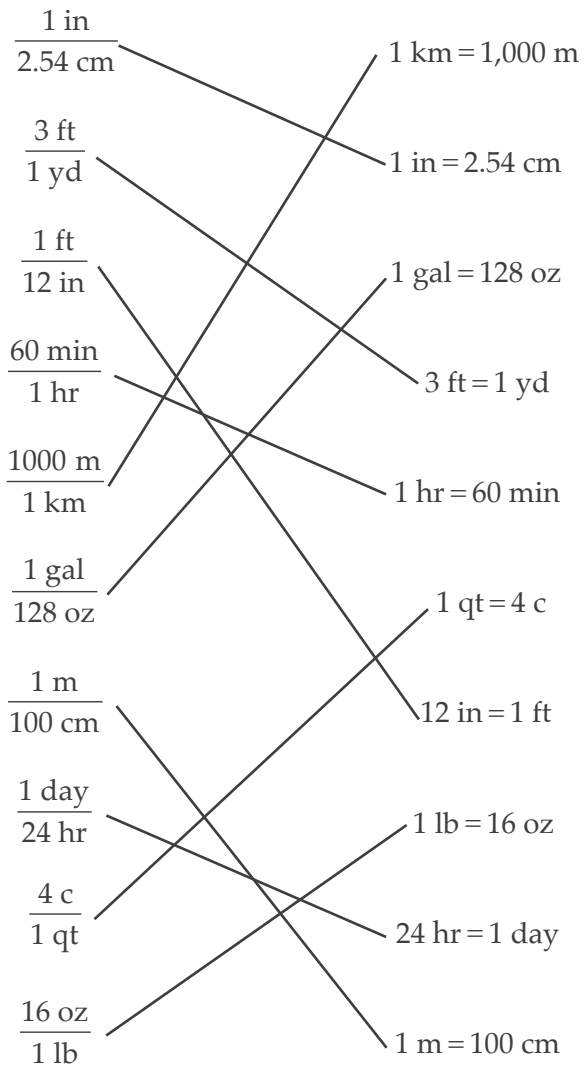
a. $254 \cdot 1000 = 254000$

b. $254 \div 100 = 2.54$

c. $254 \div 1000 = 0.254$

PRACTICE

1.



2. Choose the unit multiplier with the starting unit in the denominator (so it will cancel) and the ending unit in the numerator.

a. $\frac{1\text{ m}}{100\text{ cm}}$ or $\frac{100\text{ cm}}{1\text{ m}}$

b. $\frac{60\text{ min}}{1\text{ hr}}$ or $\frac{1\text{ hr}}{60\text{ min}}$

c. $\frac{1\text{ in}}{2.54\text{ cm}}$ or $\frac{2.54\text{ cm}}{1\text{ in}}$

d. $\frac{16\text{ oz}}{1\text{ lb}}$ or $\frac{1\text{ lb}}{16\text{ oz}}$

e. $\frac{2\text{ c}}{1\text{ pt}}$ or $\frac{1\text{ pt}}{2\text{ c}}$

3. a. $\frac{56\text{ oz}}{1} \cdot \frac{1\text{ lb}}{16\text{ oz}} = \frac{56\text{ lb}}{16} = 3.5\text{ lb}$

b. $\frac{9000\text{ sec}}{1} \cdot \frac{1\text{ min}}{60\text{ sec}} \cdot \frac{1\text{ hr}}{60\text{ min}} = \frac{9000\text{ hr}}{3600} = 2.5\text{ hr}$

4. a. $\frac{3.5\text{ m}}{1} \cdot \frac{100\text{ cm}}{1\text{ m}} = \frac{350\text{ cm}}{1} = 350\text{ cm}$

b. $\frac{3.25\text{ gal}}{1} \cdot \frac{16\text{ c}}{1\text{ gal}} = \frac{52\text{ c}}{1} = 52\text{ c}$

REVIEW

1. a. F
   Similar triangles have the same shape but not necessarily the same size.

   b. T

   c. F
   Triangles can be similar to each other if the side lengths are proportional.

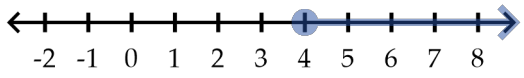
   d. F
   Not all right triangles have proportional side lengths.

2. $1.5 \bullet 1000 = 1500$
   1,500 m

3. $72 - 54 = 18$
   $18 \div 72 = 0.25$
   25%

4. $54 \div 120 = 0.45$
   45%

5. $7 \le 3x - 5$
   $7 + 5 \le 3x - 5 + 5$
   $12 \le 3x$
   $\frac{12}{3} \le \frac{3x}{3}$
   $4 \le x$
   $x \ge 4$



6. a. The decimal point must move one place to the left, so the exponent must increase by one.

   $72 \times 10^{-6} = 7.2 \times 10^{-5}$

   b. The decimal point must move two places to the right, so the exponent must decrease by two.

   $0.088 \times 10^{8} = 8.8 \times 10^{6}$

7. $2 + 1 = 3$

$$\frac{2 \text{ votes for Leah}}{3 \text{ total votes}} = \frac{l \text{ votes for Leah}}{24 \text{ total votes}}$$

$$\frac{2}{3} = \frac{l}{24}$$
$$2 \bullet 24 = 3l$$
$$48 = 3l$$
$$\frac{48}{3} = \frac{3l}{3}$$
$$16 = l$$

16 votes

Converting Square Units

WARM-UP

1. a. $0.7 = 70\%$

   b. $0.\overline{3} = 0.\overline{333} = 33.\overline{3}\%$

   c. $0.123 = 12.3\%$

2. a. $3.2 \div 0.8 = 32 \div 8 = 4$

   b. $2.5 \div 0.5 = 25 \div 5 = 5$

PRACTICE

1. a.
$$\frac{864 \text{ in} \bullet \text{in}}{1} \bullet \frac{1 \text{ ft}}{12 \text{ in}} \bullet \frac{1 \text{ ft}}{12 \text{ in}} = \frac{864 \text{ ft} \bullet \text{ft}}{144} = 6 \text{ ft}^2$$

   b. $6 \text{ ft}^2 - 4 \text{ ft}^2 = 2 \text{ ft}^2$

2. a.
$$\frac{0.5 \text{ yd} \bullet \text{yd}}{1} \bullet \frac{3 \text{ ft}}{1 \text{ yd}} \bullet \frac{3 \text{ ft}}{1 \text{ yd}} = \frac{4.5 \text{ ft} \bullet \text{ft}}{1} = 4.5 \text{ ft}^2$$

   b. $4.5 \text{ ft}^2 - 3 \text{ ft}^2 = 1.5 \text{ ft}^2$
   The vinca have 1.5 ft^2 more space.

3. a.
$$\frac{0.5 \text{ m} \bullet \text{m}}{1} \bullet \frac{100 \text{ cm}}{1 \text{ m}} \bullet \frac{100 \text{ cm}}{1 \text{ m}}$$
$$= \frac{5000 \text{ cm} \bullet \text{cm}}{1} = 5{,}000 \text{ cm}^2$$

   b. orchids, sunflowers, tulips

4. a.
$$\frac{5400 \text{ cm} \bullet \text{cm}}{1} \bullet \frac{1 \text{ in}}{2.54 \text{ cm}} \bullet \frac{1 \text{ in}}{2.54 \text{ cm}}$$
$$= \frac{5400 \text{ in} \bullet \text{in}}{6.4516} \approx 837 \text{ in}^2$$

   b. $864 \text{ in}^2 - 837 \text{ in}^2 = 27 \text{ in}^2$
   The rose bed is 27 in^2 larger.

5. Gardenias:
$$\frac{1 \text{ yd} \bullet \text{yd}}{1} \bullet \frac{3 \text{ ft}}{1 \text{ yd}} \bullet \frac{3 \text{ ft}}{1 \text{ yd}} = \frac{9 \text{ ft} \bullet \text{ft}}{1} = 9 \text{ ft}^2$$
$$\frac{9 \text{ ft} \bullet \text{ft}}{1} \bullet \frac{12 \text{ in}}{1 \text{ ft}} \bullet \frac{12 \text{ in}}{1 \text{ ft}} = \frac{1296 \text{ in} \bullet \text{in}}{1} = 1{,}296 \text{ in}^2$$

   Daisies:
$$\frac{4 \text{ ft} \bullet \text{ft}}{1} \bullet \frac{12 \text{ in}}{1 \text{ ft}} \bullet \frac{12 \text{ in}}{1 \text{ ft}} = \frac{576 \text{ in} \bullet \text{in}}{1} = 576 \text{ in}^2$$

REVIEW

1. $|-12| = 12$

$$\frac{12^2}{12} = \frac{\cancel{12} \bullet 12}{\cancel{12}} = 12$$

$3^4 = 3 \bullet 3 \bullet 3 \bullet 3 = 81$

$\sqrt{144} = 12$

2. $1253.54 - 140 - 275 - 25.87 - 80.71 - 305.48 - 315 = 111.48$

$111.48

3. $330 \div 3 = 110$

$110 \bullet 2 = 220$

4. 3 weeks = 21 days

$6 \bullet 21 = 126$

126 pages

5. $15620 \div 100 = 156.2$

156.2 m

6. a. $$\frac{36 + 2^3 \bullet 6}{2}$$
$$= \frac{36 + 8 \bullet 6}{2}$$
$$= \frac{36 + 48}{2}$$
$$= \frac{84}{2}$$
$$= 42$$

b. $(-3 + 6)^3 - \sqrt{16}$

$= 3^3 - \sqrt{16}$

$= 27 - 4$

$= 23$

Operations with Mixed Measures

WARM-UP

a. $3 \bullet 16 = 48$
$3 \text{ lb} = 48 \text{ oz}$

$48 \text{ oz} > 40 \text{ oz}$

$3 \text{ lb} > 40 \text{ oz}$

b. $2 \bullet 3 = 6$
$2 \text{ yd} = 6 \text{ ft}$

$6 \bullet 12 = 72$
$2 \text{ yd} = 72 \text{ in}$

$72 \text{ in} < 80 \text{ in}$

$2 \text{ yd} < 80 \text{ in}$

PRACTICE

1.
$$\begin{array}{r} 3 \text{ hr } 45 \text{ min} \\ +\ 4 \text{ hr } 25 \text{ min} \\ \hline 7 \text{ hr } 70 \text{ min} \end{array}$$

$70 \text{ min} = 1 \text{ hr } 10 \text{ min}$

$$\begin{array}{r} 7 \text{ hr} \\ +\ 1 \text{ hr } 10 \text{ min} \\ \hline 8 \text{ hr } 10 \text{ min} \end{array}$$

2.
$$\begin{array}{r} {}^{11}\cancel{12} \text{ min } {}^{75}\cancel{15} \text{ sec} \\ -\ 5 \text{ min } 35 \text{ sec} \\ \hline 6 \text{ min } 40 \text{ sec} \end{array}$$

3. $3 \text{ ft } 8 \text{ in} \bullet 4$
$3 \text{ ft} \bullet 4 = 12 \text{ ft}$
$8 \text{ in} \bullet 4 = 32 \text{ in} \rightarrow 2 \text{ ft } 8 \text{ in}$
$12 \text{ ft} + 2 \text{ ft } 8 \text{ in} = 14 \text{ ft } 8 \text{ in}$

4. $8 \text{ min } 45 \text{ sec} \div 7$
$8 \text{ min} \div 7 = 1 \text{ min R } 1 \text{ min}$
$1 \text{ min} = 60 \text{ sec}$
$60 \text{ sec} + 45 \text{ sec} = 105 \text{ sec}$
$105 \text{ sec} \div 7 = 15 \text{ sec}$

1 min 15 sec

5.
$$\begin{array}{r} {}^{4}\cancel{5} \text{ lb } {}^{21}\cancel{5} \text{ oz} \\ -\ 2 \text{ lb } 8 \text{ oz} \\ \hline 2 \text{ lb } 13 \text{ oz} \end{array}$$

6. $4 \text{ mi } 2025 \text{ ft} \div 3$
$4 \text{ mi} \div 3 = 1 \text{ mi R } 1 \text{ mi}$
$1 \text{ mi} = 5280 \text{ ft}$
$5280 \text{ ft} + 2025 \text{ ft} = 7305 \text{ ft}$
$7305 \text{ ft} \div 3 = 2435 \text{ ft}$

1 mi 2,435 ft

7.
$$\begin{array}{r} 7 \text{ yd } 2 \text{ ft} \\ +\ 3 \text{ yd } 1 \text{ ft} \\ \hline 10 \text{ yd } 3 \text{ ft} \end{array}$$

$3 \text{ ft} = 1 \text{ yd}$

$10 \text{ yd} + 1 \text{ yd} = 11 \text{ yd}$

8. $2 \text{ gal } 3 \text{ qt} \bullet 6$
$2 \text{ gal} \bullet 6 = 12 \text{ gal}$
$3 \text{ qt} \bullet 6 = 18 \text{ qt} \rightarrow 4 \text{ gal } 2 \text{ qt}$
$12 \text{ gal} + 4 \text{ gal } 2 \text{ qt} = 16 \text{ gal } 2 \text{ qt}$

9. a. 1 cup = 16 Tbsp
16 Tbsp + 5 Tbsp = 21 Tbsp

b. 21 Tbsp • 4 = 84 Tbsp
84 Tbsp → 5 cups 4 Tbsp

10.
$$\begin{array}{rrrr} & {\scriptstyle 13} & & {\scriptstyle 64} \\ & 2\text{ hr} & \cancel{14}\text{ min} & \cancel{4}\text{ sec} \\ -\ & 2\text{ hr} & 1\text{ min} & 9\text{ sec} \\ \hline & 0\text{ hr} & 12\text{ min} & 55\text{ sec} \end{array}$$

12 min 55 sec

REVIEW

1. a. 36 in • 36 in = 1,296 in^2

b. Width: 36 ÷ 12 = 3
3 ft
Length: 36 ÷ 12 = 3
3 ft

c. 3 ft • 3 ft = 9 ft^2

2. 45 is between the perfect squares 36 and 49.
$\sqrt{36} = 6$
$\sqrt{49} = 7$
6 and 7

3.
$$\frac{BC}{EF} = \frac{AB}{DE}$$
$$\frac{x}{18} = \frac{8}{24}$$
$$24x = 18 \bullet 8$$
$$24x = 144$$
$$\frac{24x}{24} = \frac{144}{24}$$
$$x = 6$$

4. a. $3.75

b. $15.60

c. $9.28

5. a. $44 ÷ 8 hours = $5.50 per hour

b. 5.5 • 14 = 77
$77

6. $800\overline{)14240}$ → $\begin{array}{r} 17 \\ 80\overline{)1424} \\ -\ 80 \\ \hline 624 \\ -560 \\ \hline 64 \end{array}$

$$14240 \div 800 = 17\frac{64}{80} = 17\frac{8}{10} = 17\frac{4}{5}$$

Mixed Review

Tables may vary. Students must have the five required ingredients in their tables (tortillas, meat, cheese, beans, sauce). The total cost must be $35.00 or less. A sample table with three extra ingredients is shown below. Check the student's work using a calculator.

Ingredient	Variety	Unit Cost	Quantity	Ingredient Cost
Tortillas	Precooked flour	$2.75	1	$2.75 • 1 = $2.75
Meat	Pork	$4.25	2	$4.25 • 2 = $8.50
Cheese	3-Cheese blend	$5.78	1	$5.78 • 1 = $5.78
Beans	Pinto beans	$0.78	3	$0.78 • 3 = $2.34
Sauce	Green sauce	$2.19	3	$2.19 • 3 = $6.57
Extra Ingredient 1	Onion	$0.65	1	$0.65 • 1 = $0.65
Extra Ingredient 2	Sour cream	$2.48	1	$2.48 • 1 = $2.48
Extra Ingredient 3	Red sauce	$1.78	1	$1.78 • 1 = $1.78
Extra Ingredient 4				
Extra Ingredient 5				
			Subtotal	$30.85
			Tax Amount (3%)	$0.93
			TOTAL	**$31.78**

Subtotal: $2.75 + $8.50 + $5.78 + $2.34 + $6.57 + $0.65 + $2.48 + $1.78 = $30.85

Tax Amount: 0.03 • $30.85 ≈ $0.93

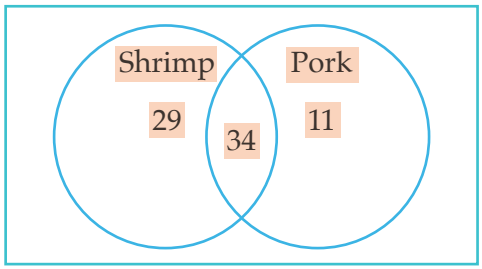
TOTAL: $30.85 + $0.93 = $31.78

Unit 2 Review

1. a. The number of people who want both shrimp and pork goes in the overlapping region.

Subtract the number of people who want both from the number of people who want shrimp.
$63 - 34 = 29$

Subtract the number of people who want both from the number of people who want pork.
$45 - 34 = 11$

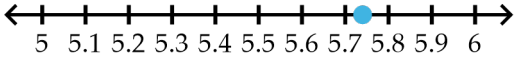


b. $29 + 34 + 11 = 74$ villagers

c. $A \cap B$

2. a. 33 is between the perfect squares 25 and 36.

b. $\sqrt{33} \approx 5.74$

c. 

3. a. $\sqrt{81} = 9$

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

c. $\sqrt[3]{-27} = -3$

4. a.
$$\frac{2}{3}a - 1 = 1\frac{1}{3}$$
$$\frac{2}{3}a - 1 + 1 = 1\frac{1}{3} + 1$$
$$\frac{2}{3}a = \frac{4}{3} + \frac{3}{3}$$
$$\frac{2}{3}a = \frac{7}{3}$$
$$\frac{\cancel{3}}{\cancel{2}} \cdot \frac{\cancel{2}}{\cancel{3}}a = \frac{7}{\cancel{3}} \cdot \frac{\cancel{3}}{2}$$
$$a = \frac{7}{2}$$
$$a = 3\frac{1}{2}$$

b.
$$1 - 0.7b = -0.75$$
$$1 - 0.7b - 1 = -0.75 - 1$$
$$-0.7b = -1.75$$
$$\frac{-0.7b}{-0.7} = \frac{-1.75}{-0.7}$$
$$b = 2.5$$

5. a. $37 = 5m + 2$

b.
$$37 = 5m + 2$$
$$37 - 2 = 5m + 2 - 2$$
$$35 = 5m$$
$$\frac{35}{5} = \frac{5m}{5}$$
$$7 = m$$
$$m = 7$$

7 mud carp

6.
$$C = \pi d$$
$$\frac{C}{\pi} = \frac{\pi d}{\pi}$$
$$\frac{C}{\pi} = d$$
$$d = \frac{C}{\pi}$$

7. a. $3x+1>x+5$

$3x+1-x>x+5-x$

$2x+1>5$

$2x+1-1>5-1$

$2x>4$

$\frac{2x}{2}>\frac{4}{2}$

$x>2$

b. $2x-2\le 6-4x$

$2x-2+4x\le 6-4x+4x$

$6x-2\le 6$

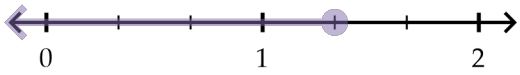
$6x-2+2\le 6+2$

$6x\le 8$

$\frac{6x}{6}\le\frac{8}{6}$

$x\le\frac{4}{3}$

$x\le 1\frac{1}{3}$



8. a. $\frac{12}{18}=\frac{2}{3}$

b. $\frac{3}{\cancel{7}}\bullet\cancel{56}^{8}=24$

24 firecrackers

c. $64=x\bullet 200$

$\frac{64}{200}=\frac{x\bullet 200}{200}$

$\frac{8}{25}=x$

$x=0.32$

32%

d. $128=0.4\bullet x$

$\frac{128}{0.4}=\frac{0.4\bullet x}{0.4}$

$320=x$

$x=320$

9. $100\%+35\%=135\%$

$1.35s=4023$

$\frac{1.35s}{1.35}=\frac{4023}{1.35}$

$s=2980$

2,980 fireworks

10. $100\%-15\%=85\%=0.85$

$0.85\bullet 1200=1020$

1,020 fireworks

11. a. $\frac{3}{14}=\frac{45}{210}$

$\frac{5}{30}=\frac{35}{210}$

$\frac{3}{14}\neq\frac{5}{30}$

no

b. $\frac{6}{45}=\frac{t}{75}$

$6\bullet 75=45t$

$450=45t$

$\frac{450}{45}=\frac{45t}{45}$

$10=t$

$t=10$

10 tangerines

12. $5+3=8$

$$\frac{5 \text{ oranges}}{8 \text{ total fruit}} = \frac{g \text{ oranges}}{24 \text{ total fruit}}$$

$$\frac{5}{8} = \frac{g}{24}$$
$$5 \cdot 24 = 8g$$
$$120 = 8g$$
$$\frac{120}{8} = \frac{8g}{8}$$
$$15 = g$$
$$g = 15$$

15 oranges

13. a. Half of 7 is 3.5.

Since $4 > 3.5$, $\frac{4}{7} > \frac{1}{2}$. This fraction rounds up.

1 kg

b. Half of 5 is 2.5.

Since $2 < 2.5$, $\frac{2}{5} < \frac{1}{2}$. This fraction rounds down.

3 kg

c. Half of 12 is 6. Since $\frac{6}{12} = \frac{1}{2}$, this fraction rounds up.

6 kg

14. a. $I = Prt$

$I = 2500 \cdot 0.10 \cdot 5$

$I = 1250$

2,500 yuan + 1,250 yuan = 3,750 yuan

b. $A = P(1+r)^t$

$A = 2500(1+0.10)^5$

$A = 2500(1.10)^5$

$A = 2500 \cdot 1.61051$

$A \approx 4026$

4,026 yuan

15. 30000 yuan ÷ 500 grams = 300 yuan ÷ 5 grams = 60 yuan/gram

16. a. Check to see if the ratio of corresponding sides is equal.

$$\frac{4}{5} = \frac{28}{35}$$

$$\frac{4}{5} = \frac{28}{35}$$

$$\frac{6}{7} = \frac{30}{35}$$

The ratios are not all equal.

no

b. Proportion may differ, but the final answer should be the same.

$$\frac{AB}{DE} = \frac{AC}{DF}$$
$$\frac{8}{16} = \frac{17}{s}$$
$$8s = 16 \cdot 17$$
$$8s = 272$$
$$\frac{8s}{8} = \frac{272}{8}$$
$$s = 34$$

34 cm

17. a. 10 mm = 1 cm

$400 \div 10 = 40$

40 cm

b. 12 in = 1 ft

$114 \div 12$

$$\begin{array}{r} 9.5 \\ 12\overline{)114.0} \\ \underline{-108} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

9.5 ft

C. $\frac{1.2 \text{ } \cancel{\text{hr}}}{1} \bullet \frac{60 \text{ } \cancel{\text{min}}}{1 \text{ } \cancel{\text{hr}}} \bullet \frac{60 \text{ sec}}{1 \text{ } \cancel{\text{min}}} = \frac{4320 \text{ sec}}{1}$

1.2 hr = 4,320 sec

18. $\frac{600 \text{ } \cancel{\text{cm}} \bullet \cancel{\text{cm}}}{1} \bullet \frac{1 \text{ in}}{2.54 \text{ } \cancel{\text{cm}}} \bullet \frac{1 \text{ in}}{2.54 \text{ } \cancel{\text{cm}}}$

$= \frac{600 \text{ in} \bullet \text{in}}{6.4516} \approx 93 \text{ in}^2$

19.
$$\begin{array}{r} 4 \text{ mi } \ 900 \text{ yd} \\ +\ 1 \text{ mi } 1100 \text{ yd} \\ \hline 5 \text{ mi } 2000 \text{ yd} \end{array}$$

1 mi = 1,760 yd

2000 yd – 1760 yd = 240 yd
2000 yd = 1 mi 240 yd

5 mi + 1 mi 240 yd = 6 mi 240 yd

20. 7 lb ÷ 6 = 1 lb R 1 lb
1 lb = 16 oz
16 oz + 8 oz = 24 oz
24 oz ÷ 6 = 4 oz

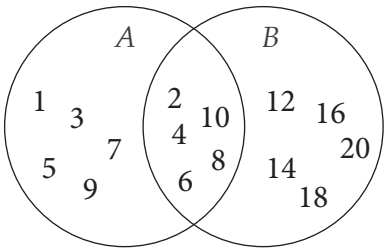
1 lb 4 oz

Fun Fact words:
1: spring
2: lotus
14: red
4: lucky
5: fish
7: firecrackers
9: fireworks
11: tangerines
12: oranges
16: dragon
17: lantern
20: tangyuan

Unit 2 Assessment

Note to parent/teacher: This assessment covers concepts taught in Unit 2. Problems are designed to assess multiple skills. If a problem is missed, show the student the answer and allow him or her time to find the error. Often, students can correct mistakes when checking their work. If the student still has difficulty, have him or her revisit the corresponding lesson for review. Corresponding lesson numbers are listed in the course book at the end of each problem.

1. 3 — rational $(\mathbb{Q})$
   0 — whole numbers (W)
   -11 — irrational (I)
   $\frac{1}{2}$ — natural numbers $(\mathbb{N})$
   $\sqrt{2}$ — integers $(\mathbb{Z})$

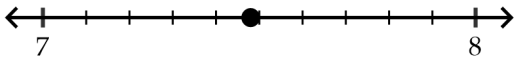
2. 

   The intersection of A and B is the overlap.
   $A \cap B = \{2,4,6,8,10\}$

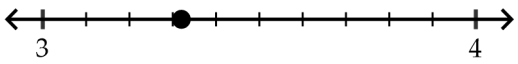
3. a. 56 is between the perfect squares 49 and 64.
   $\sqrt{49} = 7$
   $\sqrt{64} = 8$
   7 and 8

   b. 11 is between the perfect squares 9 and 16.
   $\sqrt{9} = 3$
   $\sqrt{16} = 4$
   3 and 4

4. a. $\sqrt{56} \approx 7.48$



   b. $\sqrt{11} \approx 3.32$



5. a.
$$5x - 10 = 45$$
$$5x - 10 + 10 = 45 + 10$$
$$5x = 55$$
$$\frac{5x}{5} = \frac{55}{5}$$
$$x = 11$$

   b.
$$\frac{1}{2}z - \frac{5}{6} = \frac{1}{6}$$
$$\frac{1}{2}z - \frac{5}{6} + \frac{5}{6} = \frac{1}{6} + \frac{5}{6}$$
$$\frac{1}{2}z = \frac{6}{6}$$
$$\frac{1}{2}z = 1$$
$$\frac{2}{1} \cdot \frac{1}{2}z = 1 \cdot 2$$
$$z = 2$$

   c.
$$a + 5 = 6a$$
$$a + 5 - a = 6a - a$$
$$5 = 5a$$
$$\frac{5}{5} = \frac{5a}{5}$$
$$1 = a$$
$$a = 1$$

d.
$$7-4c=8c+17$$
$$7-4c+4c=8c+17+4c$$
$$7=12c+17$$
$$7-17=12c+17-17$$
$$-10=12c$$
$$\frac{-10}{12}=\frac{12c}{12}$$
$$-\frac{5}{6}=c$$
$$c=-\frac{5}{6}$$

6. a. false

A number multiplied by itself equals the number under the square root symbol. Any number multiplied by itself will equal a non-negative number.

b. true

7. a. 4

b. 3

c. 1

d. –2

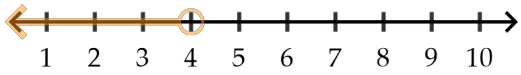
8. Equation: $s+\frac{2}{3}s=35$

$$\frac{3}{3}s+\frac{2}{3}s=35$$
$$\frac{5}{3}s=35$$
$$\frac{3}{5}\bullet\frac{5}{3}s=\cancel{35}^{7}\bullet\frac{3}{\cancel{5}}$$

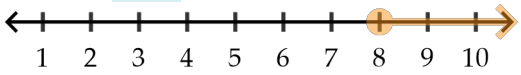
Solution: $s=21$

9.
$$A=\frac{1}{2}bh$$
$$2\bullet A=\frac{1}{2}bh\bullet\frac{2}{1}$$
$$2A=bh$$
$$\frac{2A}{h}=\frac{bh}{h}$$
$$\frac{2A}{h}=b$$
$$b=\frac{2A}{h}$$

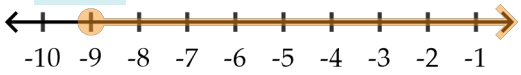
10. a.
$$4t<16$$
$$\frac{4t}{4}<\frac{16}{4}$$
$$t<4$$



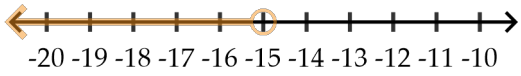
b.
$$r+27\geq 35$$
$$r+27-27\geq 35-27$$
$$r\geq 8$$



c.
$$-8n\leq 72$$
$$\frac{-8n}{-8}\leq\frac{72}{-8}$$
$$n\geq -9$$



d.
$$85-q>100$$
$$85-q-85>100-85$$
$$-q>15$$
$$\frac{-q}{-1}>\frac{15}{-1}$$
$$q<-15$$



11.
$$\frac{3}{\cancel{5}}\bullet\cancel{120}^{24}=72$$

72 chocolate chip cookies

12.
$$\frac{}{12}\bullet x=14$$
$$\frac{12}{7}\bullet\frac{7}{12}\bullet x=\cancel{14}^{2}\bullet\frac{12}{\cancel{7}}$$
$$x=24$$

24 cars

13. a. $\frac{6}{7} \stackrel{?}{=} \frac{36}{42}$

$6 \cdot 42 = 252$

$7 \cdot 36 = 252$

$252 = 252$

$\frac{6}{7} = \frac{36}{42}$

b. $\frac{10}{11} = \frac{500}{550}$

$\frac{48}{50} = \frac{528}{550}$

$\frac{10}{11} \neq \frac{48}{50}$

14. a. $3 + 8 = 11$

$\frac{8 \text{ hats}}{11 \text{ total}} = \frac{h \text{ hats}}{88 \text{ total}}$

$\frac{8}{11} = \frac{h}{88}$

$8 \cdot 88 = 11h$

$704 = 11h$

$\frac{704}{11} = \frac{11h}{11}$

$64 = h$

$h = 64$

64 hats

b. $\frac{4 \text{ ties}}{3 \text{ scarves}} = \frac{60 \text{ ties}}{s \text{ scarves}}$

$\frac{4}{3} = \frac{60}{s}$

$4s = 3 \cdot 60$

$4s = 180$

$\frac{4s}{4} = \frac{180}{4}$

$s = 45$

45 scarves

c. $5 - 2 = 3$

$\frac{3 \text{ children's shirts}}{5 \text{ total shirts}} = \frac{c \text{ children's shirts}}{140 \text{ total shirts}}$

$\frac{3}{5} = \frac{c}{140}$

$3 \cdot 140 = 5c$

$420 = 5c$

$\frac{420}{5} = \frac{5c}{5}$

$84 = c$

$c = 84$

84 children's shirts

15. a. $\frac{1}{2} = \frac{2}{4}$

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

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

b. Half of 7 is 3.5, and $3 < 3.5$.

$\frac{3}{7} < \frac{1}{2}$

c. Half of 6 is 3.

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

16. When fractions have the same numerator, the fraction with the greater denominator is the smaller fraction.

$\frac{3}{8}, \frac{3}{7}, \frac{3}{6}, \frac{3}{5}, \frac{3}{4}, \frac{3}{3}, \frac{3}{2}$

17. a. $0.35 \cdot 145 = 50.75$

b. $x \cdot 60 = 24$

$\frac{x \cdot 60}{60} = \frac{24}{60}$

$x = 0.4$

40%

c. $110\% = 1.1$

$1.1 \bullet x = 55$

$\frac{1.1 \bullet x}{1.1} = \frac{55}{1.1}$

$x = 50$

18. $400000 - 250000 = 150000$
Amount of increase: 150000
$150000 \div 250000 = 0.6$
Percent increase: 60%

19. $300 - 18 = 282$
Amount of decrease: 282
$282 \div 300 = 0.94$
Percent decrease: 94%

20. Principal: 450
Rate: $2\% = 0.02$
Time: 16 years $\bullet$ 12 = 192 months
$I = Prt$
$I = 450 \bullet 0.02 \bullet 192$
$I = 1728$
$1,728

21. Principal: 80
Rate: $15\% = 0.15$
Time: 6 years
$A = P(1+r)^t$

$A = 80(1+0.15)^6$

$A = 80(1.15)^6$

$A \approx 185.04$

$185.04

22. Unit rate: strawberries $\div$ oranges
$5 \div 2 = 2.5$
$7.5 \div 3 = 2.5$
$10 \div 4 = 2.5$
2.5 strawberries/orange

23. $\frac{CA}{DO} = \frac{CT}{DG}$

$\frac{4}{x} = \frac{2}{6}$

$4 \bullet 6 = 2x$

$24 = 2x$

$\frac{24}{2} = \frac{2x}{2}$

$12 = x$

12 cm

24. 1 km = 10 hm
$30 \bullet 10 = 300$

25. 1 mi = 5,280 ft
$4 \bullet 5280 = 21120$
4 mi = 21,120 ft

26. $\frac{815.34 \text{ cm}}{1} \bullet \frac{1 \text{ in}}{2.54 \text{ cm}} = \frac{815.34 \text{ in}}{2.54} = 321$ in

27. $\frac{2{,}592 \text{ in} \bullet \text{in}}{1} \bullet \frac{1 \text{ ft}}{12 \text{ in}} \bullet \frac{1 \text{ ft}}{12 \text{ in}} = \frac{2{,}592 \text{ ft} \bullet \text{ft}}{144} = 18 \text{ ft}^2$

28. a.
$$\begin{array}{r} 3 \text{ ft } 8 \text{ in} \\ +\ 8 \text{ ft } 9 \text{ in} \\ \hline 11 \text{ ft } 17 \text{ in} \end{array}$$

17 inches can be written as 1 ft 5 in.

$$\begin{array}{r} 11 \text{ ft} \\ +\ 1 \text{ ft } 5 \text{ in} \\ \hline 12 \text{ ft } 5 \text{ in} \end{array}$$

b. 1 lb = 16 oz

$$\begin{array}{r} {}^{14}\cancel{15} \text{ lb } {}^{23}\cancel{7} \text{ oz} \\ -\ 4 \text{ lb } 9 \text{ oz} \\ \hline 10 \text{ lb } 14 \text{ oz} \end{array}$$

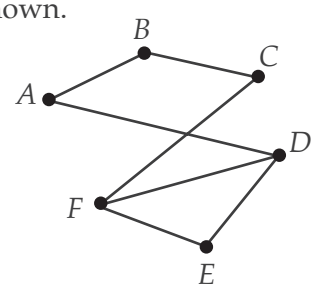
c. $6 \text{ hr} \bullet 2 = 12 \text{ hr}$
$35 \text{ min} \bullet 2 = 70 \text{ min} \rightarrow 1 \text{ hr } 10 \text{ min}$
$12 \text{ hr} + 1 \text{ hr } 10 \text{ min} = 13 \text{ hr } 10 \text{ min}$

d. $80 \text{ ft} \div 5 = 16 \text{ ft}$
$10 \text{ in} \div 5 = 2 \text{ in}$
16 ft 2 in

Enrichment: Graph Theory

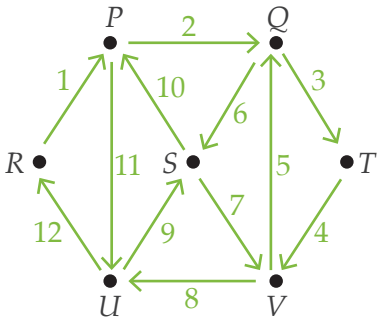
This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1. The lines connecting letters must be the same, but the placement can vary. An example is shown.

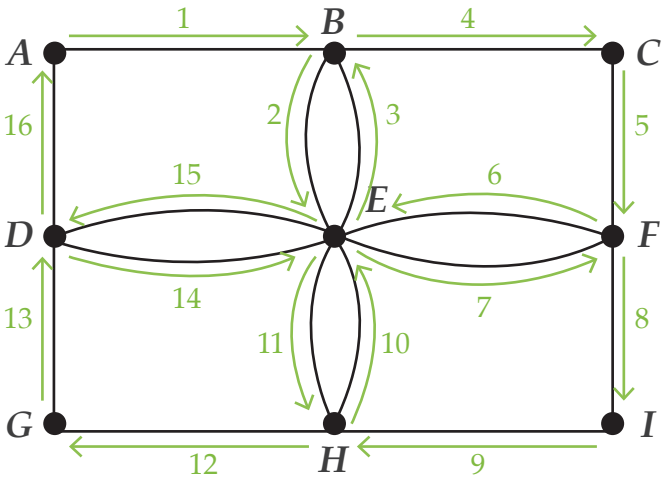


2. a. Vertex P has 4 neighbors (R, U, S, and Q). The degree of P is 4.
   b. Vertex Q has 4 neighbors (P, S, V, and T). The degree of Q is 4.
   c. Vertex R has 2 neighbors (P and U). The degree of R is 2.
   d. Vertex S has 4 neighbors (P, Q, V, and U). The degree of S is 4.
   e. Vertex T has 2 neighbors (Q and V). The degree of T is 2.
   f. Vertex U has 4 neighbors (R, P, S, and V). The degree of U is 4.
   g. Vertex V has 4 neighbors (U, S, Q, and T). The degree of V is 4.

   Below is an example path through the graph. The numbers represent the order in which the edges are traveled.



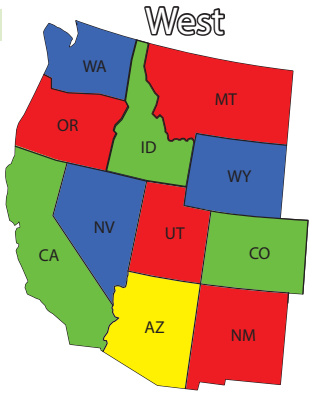
3. Below is an example path through the graph. The numbers represent the order in which the edges are traveled.



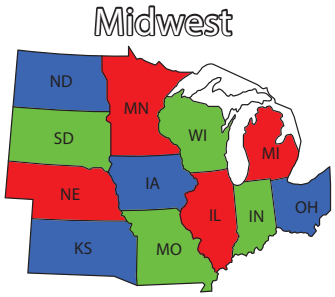
4. Answers may vary. An example is shown. Only four colors are needed, but students may have used more colors as they tried this activity.

5. Answers may vary. Examples are shown. Only four colors are needed, but students may have used more colors as they tried this activity.

a. 4



b. 3



Scale Drawings

WARM-UP

a. $\frac{12}{33} = \frac{132}{f}$

$12 \cdot 11 = 132$

$33 \cdot 11 = f$

$f = 363$

b. $1 \text{ ft} = 12 \text{ in}$

$1 \text{ in} = 2.54 \text{ cm}$

$$\frac{609.6 \text{ cm}}{1} \cdot \frac{1 \text{ in}}{2.54 \text{ cm}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = \frac{609.6 \text{ ft}}{30.48} = 20 \text{ ft}$$

PRACTICE

1. a. $\frac{1 \text{ in}}{500 \text{ yd}} = \frac{4 \text{ in}}{x \text{ yd}}$

$\frac{1}{500} = \frac{4}{x}$

$1 \cdot x = 4 \cdot 500$

$x = 2000$

2,000 yd

b. $\frac{1 \text{ in}}{500 \text{ yd}} = \frac{x \text{ in}}{3{,}200 \text{ yd}}$

$\frac{1}{500} = \frac{x}{3200}$

$500 \cdot x = 1 \cdot 3200$

$500x = 3200$

$\frac{500x}{500} = \frac{3200}{500}$

$x = 6.4$

6.4 in

2. $1 \text{ cm} : 100 \text{ km}$

a. $\frac{1 \text{ cm}}{100 \text{ km}} = \frac{5 \text{ cm}}{x \text{ km}}$

$\frac{1}{100} = \frac{5}{x}$

$1 \cdot x = 100 \cdot 5$

$x = 500$

500 km

b. $\frac{1 \text{ cm}}{100 \text{ km}} = \frac{6.15 \text{ cm}}{x \text{ km}}$

$\frac{1}{100} = \frac{6.15}{x}$

$1 \cdot x = 100 \cdot 6.15$

$x = 615$

615 km

c. $\frac{1 \text{ cm}}{100 \text{ km}} = \frac{x \text{ cm}}{300 \text{ km}}$

$\frac{1}{100} = \frac{x}{300}$

$100 \cdot x = 1 \cdot 300$

$100x = 300$

$\frac{100x}{100} = \frac{300}{100}$

$x = 3$

3 cm

3. a. $\frac{1 \text{ cm}}{66 \text{ m}} = \frac{5 \text{ cm}}{x \text{ m}}$

$\frac{1}{66} = \frac{5}{x}$

$1 \cdot x = 66 \cdot 5$

$x = 330$

330 m

b. $\frac{1 \text{ cm}}{66 \text{ m}} = \frac{x \text{ cm}}{125 \text{ m}}$

$\frac{1}{66} = \frac{x}{125}$

$66 \cdot x = 1 \cdot 125$

$66x = 125$

$\frac{66x}{66} = \frac{125}{66}$

$x = 1.8\overline{93}$

1.9 cm

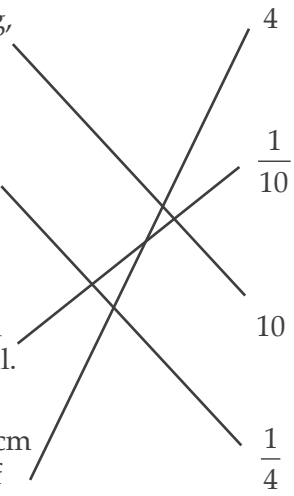
4.

A An object is 2 cm long, and a model of it is 20 cm long.

B A picture is 4 ft wide, and a reprint of it is 1 ft wide.

C A tree is 20 ft tall, and a model of it is 2 ft tall.

D A photo of a leaf is 5 cm wide, and a reprint of it is 20 cm wide.



Detailed work for the problems is shown below.

A $20 \text{ cm} \div 2 \text{ cm} = 10$

B $1 \text{ ft} \div 4 \text{ ft} = \frac{1}{4}$

C $2 \text{ ft} \div 20 \text{ ft} = \frac{2}{20} = \frac{1}{10}$

D $20 \text{ cm} \div 5 \text{ cm} = 4$

REVIEW

1. $\begin{array}{r} \overset{18}{\cancel{19}} \text{ ft } \overset{15}{\cancel{3}} \text{ in} \\ -\ 1 \text{ ft } 7 \text{ in} \\ \hline 17 \text{ ft } 8 \text{ in} \end{array}$

2. 1 gallon = 16 cups

$\frac{3 \cancel{\text{ gal}}}{1} \cdot \frac{16 \text{ cups}}{1 \cancel{\text{ gal}}} = 48 \text{ cups}$

1 cup = 1 serving

48 servings

3. $x \cdot 500 = 360$

$\frac{x \cdot 500}{500} = \frac{360}{500}$

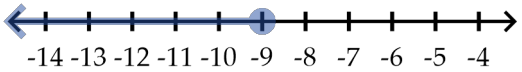
$x = \frac{360}{500} = \frac{18}{25}$

4. $15 \geq x + 24$

$15 - 24 \geq x + 24 - 24$

$-9 \geq x$

$x \leq -9$



5. a. -10^{-4}

$= -\frac{1}{10^4}$

$= -\frac{1}{10 \cdot 10 \cdot 10 \cdot 10}$

$= -\frac{1}{10000}$

b. 7^{-3}

$$= \frac{1}{7^3}$$

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

$$= \frac{1}{343}$$

c. $(-2)^{-4}$

$$= \frac{1}{(-2)^4}$$

$$= \frac{1}{-2 \bullet (-2) \bullet (-2) \bullet (-2)}$$

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

6. $1{,}000 \text{ g} = 1 \text{ kg}$
$3.3 \bullet 1000 = 3300$
$3.3 \text{ kg} = 3{,}300 \text{ g}$

Direct Proportions

WARM-UP

a. Unit rate: slices of bread ÷ loaves
$12 \div 3 = 4$
$16 \div 4 = 4$
$32 \div 8 = 4$
4 slices per loaf

b. $m \div 6 = 4$
$m = 6 \bullet 4$
$m = 24$

PRACTICE

1. a. $6 \div 4 = 1.5$
$9 \div 6 = 1.5$
$12 \div 8 = 1.5$
yes

b. $6 \div 20 = 0.3$
$4 \div 16 = 0.25$
$2 \div 8 = 0.25$
no

c. $5 \div 10 = 0.5$
$10 \div 15 = 0.6$
$15 \div 20 = 0.75$
no

2. a. $6 \div 2 = 3$
$18 \div 6 = 3$
$36 \div 12 = 3$

$k = 3$
Equation: $y = 3x$

x	2	4	6	12	$42 \div 3 = 14$
y	6	$3 \bullet 4 = 12$	18	36	42

b. $5 \div 20 = \frac{1}{4}$
$3 \div 12 = \frac{1}{4}$
$2 \div 8 = \frac{1}{4}$

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

Equation: $y = \frac{1}{4}x$

x	$9 \div \frac{1}{4}$ $= 9 \bullet 4$ $= 36$	28	20	12	8
y	9	$\frac{1}{\cancel{4}} \bullet \cancel{28}^{7}$ $= 7$	5	3	2

c. $12 \div 3 = 4$
$40 \div 10 = 4$
$60 \div 15 = 4$

$k = 4$
Equation: $y = 4x$

x	3	5	10	$44 \div 4 = 11$	15
y	12	$4 \bullet 5 = 20$	40	44	60

3. a. $2 \div 5 = 0.4$
$4 \div 10 = 0.4$
$6 \div 15 = 0.4$
$8 \div 19 \approx 0.42$
$10 \div 25 = 0.4$

x	5	10	15	~~19~~	25
y	2	4	6	~~8~~	10

b. $8 \div 1 = 8$
$16 \div 2 = 8$
$35 \div 4 = 8.75$
$48 \div 6 = 8$
$64 \div 8 = 8$

x	1	2	~~4~~	6	8
y	8	16	~~35~~	48	64

REVIEW

1. $\frac{1 \text{ in}}{50 \text{ mi}} = \frac{2.5 \text{ in}}{x \text{ mi}}$

$\frac{1}{50} = \frac{2.5}{x}$

$1x = 50 \bullet 2.5$

$x = 125$

125 miles

2. $\frac{6}{7} \bullet x = 24$

$\frac{7}{6} \bullet \frac{6}{7} \bullet x = \frac{\overset{4}{\cancel{24}}}{1} \bullet \frac{7}{\cancel{6}}$

$x = 28$

28 students

3. $\frac{1 \cancel{\text{ mi}}}{1} \bullet \frac{5280 \cancel{\text{ ft}}}{1 \cancel{\text{ mi}}} \bullet \frac{1 \text{ yd}}{3 \cancel{\text{ ft}}} = \frac{5280 \text{ yd}}{3} = 1{,}760 \text{ yd}$

4. $73 \div 120 = 0.60833\ldots$
61%

5. a. $18 \text{ ft} \div 3 = 6 \text{ yd}$
$24 \text{ ft} \div 3 = 8 \text{ yd}$
$A = lw$
$A = 6 \text{ yd} \bullet 8 \text{ yd} = 48 \text{ yd}^2$

b. $\$32 \bullet 48 = \$1{,}536$

Inverse Proportions

WARM-UP

1. a. As a increases, b increases.

   b. $15 \div 3 = 5$
   $60 \div 12 = 5$
   $k = 5$

   c. $f \div 5 = 8$
   $8 \bullet 5 = 40$
   $f = 40$

PRACTICE

1. a. decreases
   b. increases

2. a. x decreases
   y increases

x	24	16	8
y	2	3	6
$x \bullet y$	48	48	48

   yes
   The products are all the same.

   yes
   One variable increases while the other decreases.

   b. x increases
   y increases

x	10	15	20
y	5	10	15
$x \bullet y$	50	150	300

   no
   The products are not all the same.

   no
   Both variables are increasing.

3. a. $2 \bullet 6 = 12$
   $4 \bullet 3 = 12$
   $12 \bullet 1 = 12$

   $k = 12$

   Equation: $y = \frac{12}{x}$

   b. $18 \bullet 2 = 36$
   $9 \bullet 4 = 36$
   $6 \bullet 6 = 36$

   $k = 36$

   Equation: $y = \frac{36}{x}$

   c. $2 \bullet 10 = 20$
   $4 \bullet 5 = 20$
   $5 \bullet 4 = 20$

   $k = 20$

   Equation: $y = \frac{20}{x}$

4.

START	x: 5, 10 y: 8, 4	x: 3, 4 y: 5, 6	x: 3, 6 y: 8, 18	x: 8, 4 y: 6, 24
x: 5, 15 y: 10, 20	x: 6, 4 y: 2, 3	x: 3, 4 y: 12, 9	x: 26, 13 y: 2, 4	x: 6, 3 y: 9, 18
x: 2, 4 y: 8, 16	x: 11, 20 y: 3, 5	x: 4, 32 y: 8, 64	x: 6, 12 y: 5, 9	x: 2, 7 y: 14, 4
x: 4, 3 y: 5, 6	x: 22, 7 y: 4, 12	x: 31, 8 y: 2, 8	x: 12, 36 y: 2, 6	FINISH

REVIEW

1. a. -1

   b. -7

2. $$\frac{9}{5}x + 16 = -2$$
$$\frac{9}{5}x + 16 - 16 = -2 - 16$$
$$\frac{9}{5}x = -18$$
$$\frac{5}{9} \cdot \frac{9}{5}x = -\cancel{18}^{2} \cdot \frac{5}{\cancel{9}}$$
$$x = -10$$

3. 33 min 45 sec
   29 min 18 sec
   + 27 min 36 sec
   89 min 99 sec

   89 min = 1 hr 29 min
   99 sec = 1 min 39 sec

   1 hr 29 min + 1 min 39 sec =
   1 hr 30 min 39 sec

4. Amount of increase: 225 – 180 = 45
   45 ÷ 180 = 0.25
   Percent increase: 25%

5. a. Dozen: \$1.56 ÷ 12 eggs = \$0.13 per egg
   18-pack: \$2.52 ÷ 18 eggs = \$0.14 per egg

   b. The one-dozen egg carton is cheaper per egg.

Graphs of Direct Proportions

WARM-UP

a. $48 \div 6 = 8$
$64 \div 8 = 8$
$72 \div 9 = 8$
$96 \div 12 = 8$

yes

b. $k = 8$

c. $y = 8x$

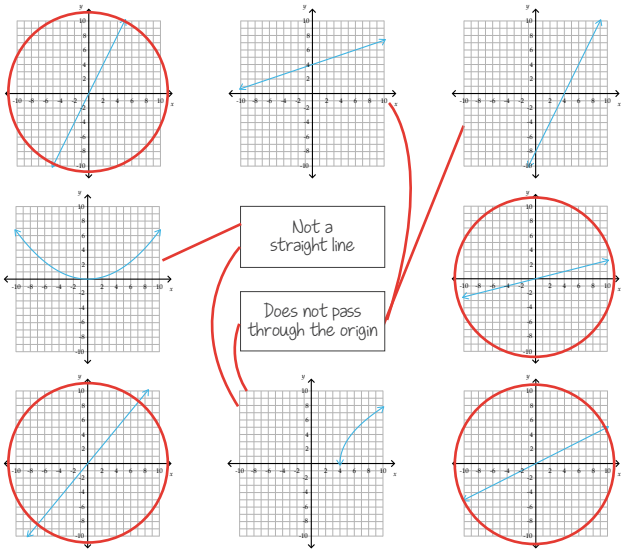
PRACTICE

1. a. A graph representing a directly proportional relationship is always a straight line that passes through the origin.

   b. A graph does not show a directly proportional relationship if it is curved.

   c. To find the constant of proportionality, find the point where the x-value is 1. The y-value is the constant k.

2.

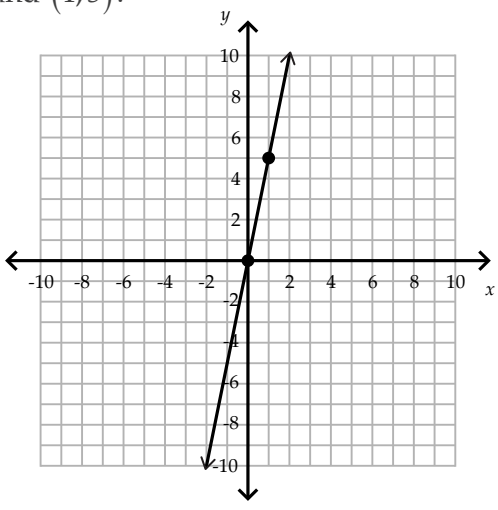


3. a. The point with an x-value of 1 is $(1,2)$.
$k = 2$

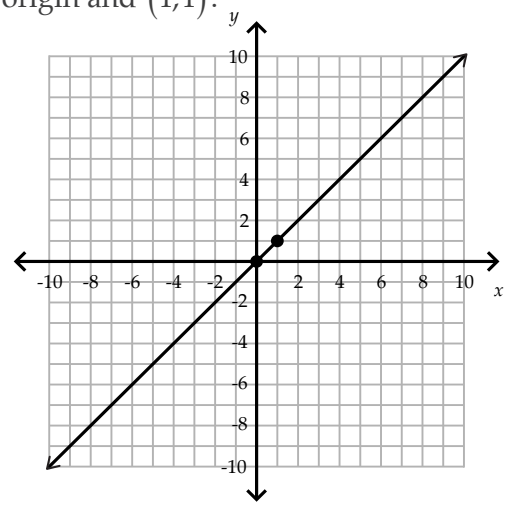
   b. The point with an x-value of 1 is $(1,3)$.
$k = 3$

   c. The point with an x-value of 1 is $(1,4)$.
$k = 4$

4. a. When $x = 1$, $y = 5$. The graph must be a straight line that goes through the origin and $(1,5)$.



b. When $x = 1$, $y = 1$. The graph must be a straight line that goes through the origin and $(1,1)$.



REVIEW

1. $10 \div 2 = 5$
$20 \div 4 = 5$
$25 \div 5 = 5$

$k = 5$
Equation: $y = 5x$

x	2	$15 \div 5 = 3$	4	5	6
y	10	15	20	25	$6 \bullet 5 = 30$

2. $\frac{SM}{BI} = \frac{3}{7.5} = \frac{2}{5}$

$\frac{ML}{IG} = \frac{4}{10} = \frac{2}{5}$

$\frac{SL}{BG} = \frac{5}{12.5} = \frac{2}{5}$

yes

3. a. Common denominator: 40

$\frac{3}{5} = \frac{24}{40}$

b. Common denominator: 56

$\frac{4}{7} = \frac{32}{56}$

$\frac{5}{8} = \frac{35}{56}$

$\frac{4}{7} < \frac{5}{8}$

4. a. $1 \text{ yd} = 3 \text{ ft}$
$1 \text{ mi} = 5280 \text{ ft}$

Jan: $\frac{200 \text{ yd}}{1} \bullet \frac{3 \text{ ft}}{1 \text{ yd}} = 600 \text{ ft}$

Jerry: $\frac{0.1 \text{ mi}}{1} \bullet \frac{5280 \text{ ft}}{1 \text{ mi}} = 528 \text{ ft}$

Jan ran farther.

b. $1 \text{ gal} = 16 \text{ c}$

$\frac{3 \text{ gal}}{1} \bullet \frac{16 \text{ c}}{1 \text{ gal}} = 48 \text{ c}$

No, the pot can only hold 48 cups of cider.

Graphing Using a T-Chart

WARM-UP

1. a. $2 \cdot 2 \cdot 2 = 8$

   b. $3 \cdot 3 \cdot 3 = 27$

   c. $64 = 4 \cdot 4 \cdot 4$
   4

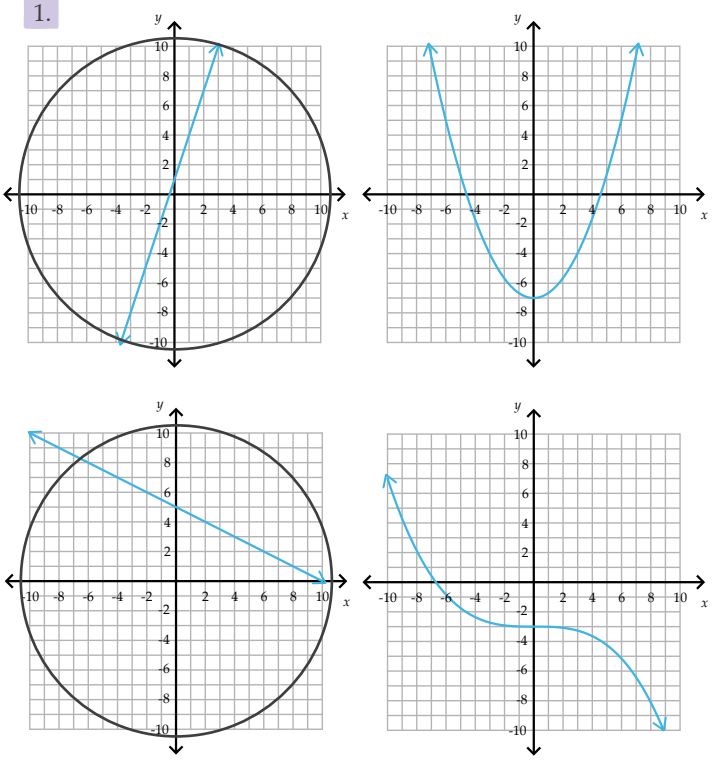
   d. $125 = 5 \cdot 5 \cdot 5$
   5

2. a. $400 \div 10^2 = 400 \div 100 = 4$

   b. $5000 \div 10^4 = 5000 \div 10000 = 0.5$

PRACTICE

1.



2. a. $y = 2(-5) = -10$
   $y = 2(0) = 0$
   $y = 2(5) = 10$

x	y	
–5	–10	$(-5,-10)$
0	0	$(0,0)$
5	10	$(5,10)$

   b. $y = -5 + 5 = 0$
   $y = 0 + 5 = 5$
   $y = 5 + 5 = 10$

x	y	
–5	0	$(-5,0)$
0	5	$(0,5)$
5	10	$(5,10)$

c. $y=\frac{1}{\cancel{2}}\left(-\cancel{6}^{3}\right)-6$

$=-3-6$

$=-9$

$y=\frac{1}{2}(0)-6$

$=0-6$

$=-6$

$y=\frac{1}{\cancel{2}}\left(\cancel{6}^{3}\right)-6$

$=3-6$

$=-3$

x	y	
-6	-9	$(-6,-9)$
0	-6	$(0,-6)$
6	-3	$(6,-3)$

d. $y=-(-5)+4=5+4=9$

$y=-(0)+4=0+4=4$

$y=-(5)+4=-5+4=-1$

x	y	
-5	9	$(-5,9)$
0	4	$(0,4)$
5	-1	$(5,-1)$

e. $y=-3(-2)-3$

$=6-3$

$=3$

$y=-3(0)-3$

$=0-3$

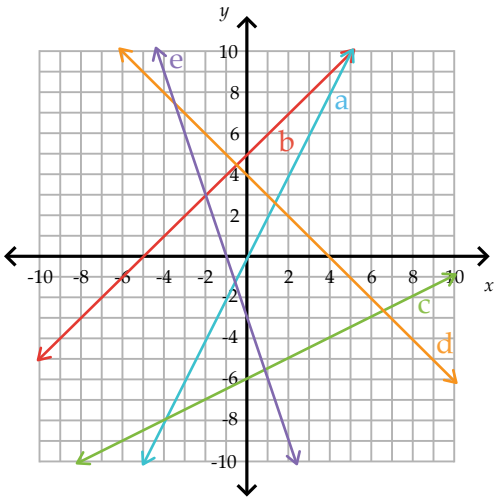
$=-3$

$y=-3(2)-3$

$=-6-3$

$=-9$

x	y	
-2	3	$(-2,3)$
0	-3	$(0,-3)$
2	-9	$(2,-9)$



Regions between lines may be colored in with any colors desired.

REVIEW

1. $k = xy$
$3 \bullet 10 = 30$
$6 \bullet 5 = 30$
$15 \bullet 2 = 30$

$k = 30$

Equation: $y = \frac{30}{x}$

2. a. $x + 22 = 70 - 7x$
$x + 22 + 7x = 70 - 7x + 7x$
$8x + 22 = 70$
$8x + 22 - 22 = 70 - 22$
$8x = 48$
$\frac{8x}{8} = \frac{48}{8}$
$x = 6$

b. $2 - 2.3a = 4.7a - 5$
$2 - 2.3a + 2.3a = 4.7a - 5 + 2.3a$
$2 = 7a - 5$
$2 + 5 = 7a - 5 + 5$
$7 = 7a$
$\frac{7}{7} = \frac{7a}{7}$
$a = 1$

3. a. $\frac{3^2}{5} = \frac{3 \bullet 3}{5} = \frac{9}{5}$

b. $\left(\frac{3}{5}\right)^2 = \frac{3}{5} \bullet \frac{3}{5} = \frac{9}{25}$

4. a. $\frac{7}{8}$ in

b. $1\frac{1}{2}$ in

c. $2\frac{3}{16}$ in

5. a. 87 rounded to the nearest ten is 90.
52 rounded to the nearest ten is 50.

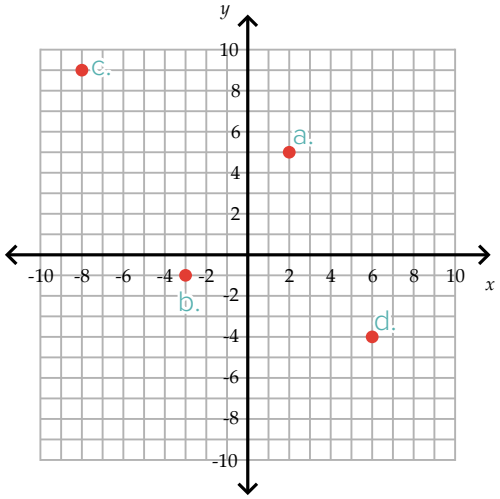
$90 \bullet 50 = 4500$
$87 \bullet 52 \approx 4500$

b. 39 rounded to the nearest ten is 40.
112 rounded to the nearest ten is 110.

$40 \bullet 110 = 4400$
$39 \bullet 112 \approx 4400$

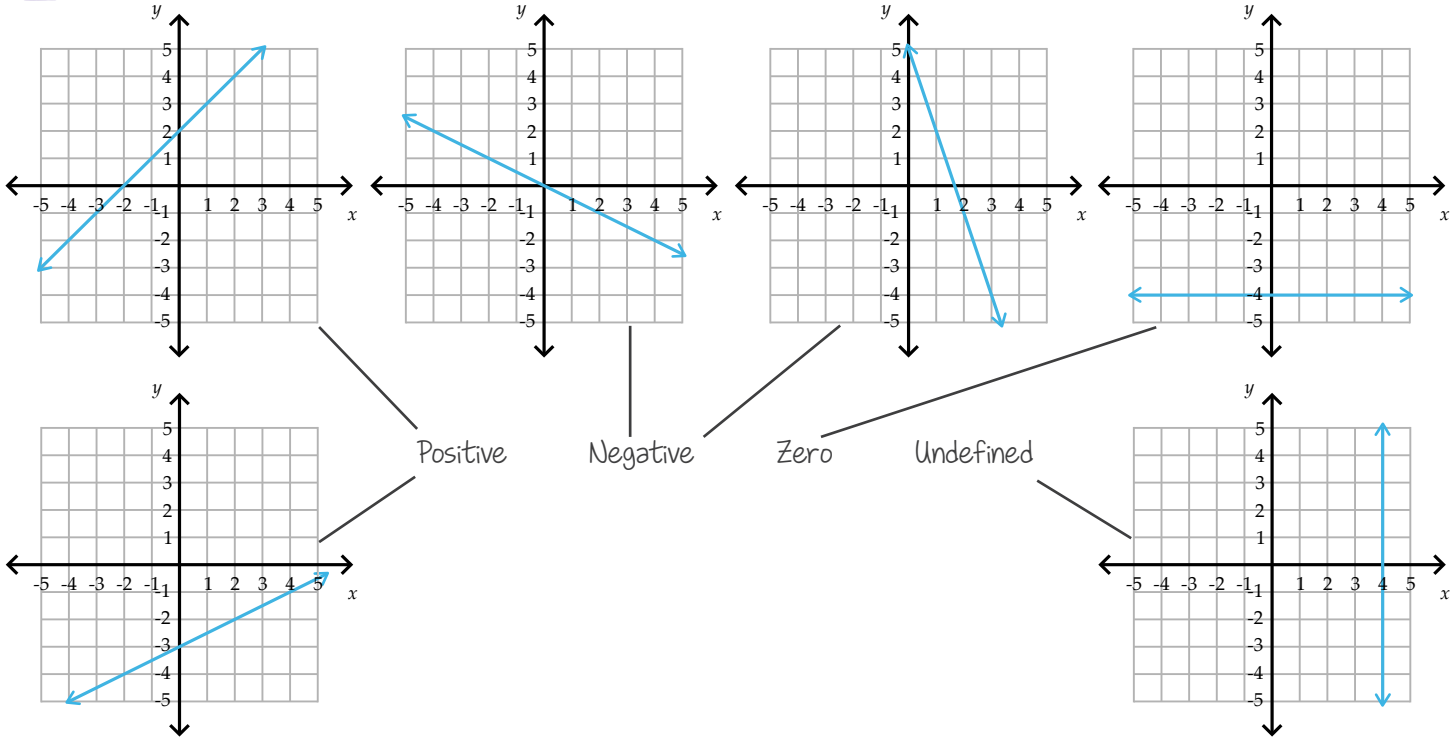
Slope of a Line

WARM-UP



PRACTICE

1.



2. a. 3

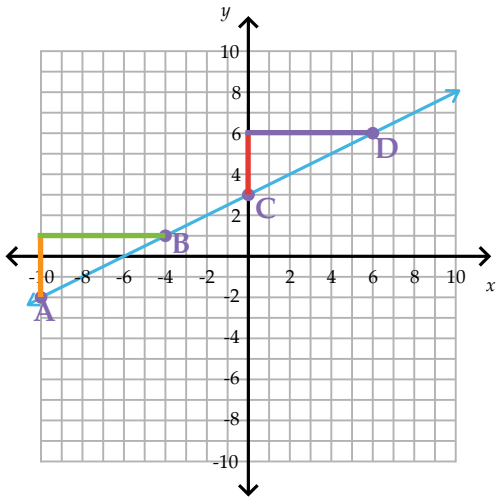
b. 6

c. $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{6} = \frac{1}{2}$

d. 3

e. 6

f. $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{6} = \frac{1}{2}$



3. a. –18

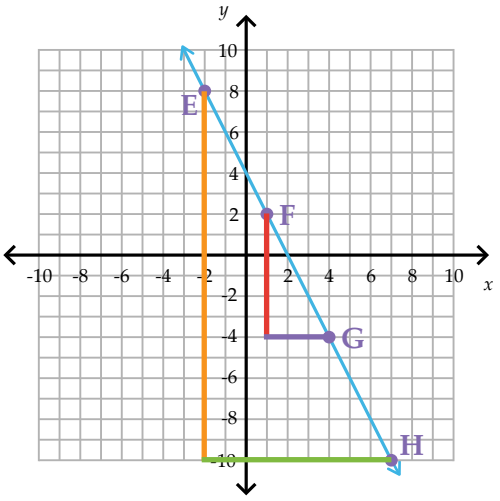
b. 9

c. $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-18}{9} = -\frac{18}{9} = -2$

d. –6

e. 3

f. $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-6}{3} = -\frac{6}{3} = -2$



4. a. The vertical change in *y*-values is the rise.

b. The run is the horizontal change in *x*-values.

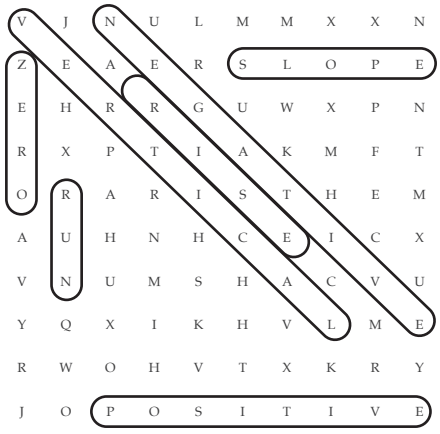
c. The steepness and direction of the line are given by its slope. It is defined as the change in *y*-values divided by the change in *x*-values.

d. A negative slope shows *y*-values decreasing as *x*-values increase.

e. A positive slope shows *y*-values increasing as *x*-values increase.

f. A horizontal line has a slope equal to zero.

g. A vertical line has a slope that is undefined.



REVIEW

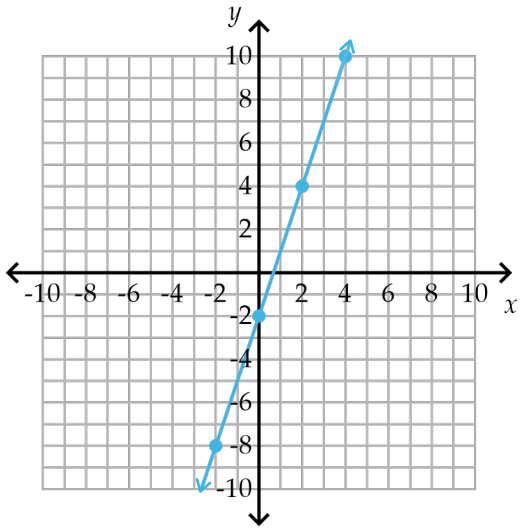
1. $y = 3(-2) - 2$
$= -6 - 2$
$= -8$

$y = 3(0) - 2$
$= 0 - 2$
$= -2$

$y = 3(2) - 2$
$= 6 - 2$
$= 4$

$y = 3(4) - 2$
$= 12 - 2$
$= 10$

x	y	
–2	–8	$(-2,-8)$
0	–2	$(0,-2)$
2	4	$(2,4)$
4	10	$(4,10)$



2. $100\% - 60\% = 40\%$
$0.40 \bullet \$112 = \$44.80$
Sale price: $44.80

$0.07 \bullet \$44.80 = \$3.14$
$\$44.80 + \$3.14 = \$47.94$
Total cost: $47.94

3. $42 \text{ in} \div 12 = 3.5 \text{ ft}$

$$\frac{1 \text{ in}}{1 \text{ ft}} = \frac{w \text{ in}}{3.5 \text{ ft}}$$

$$\frac{1}{1} = \frac{w}{3.5}$$

$$1w = 1 \bullet 3.5$$

$$w = 3.5$$

Width: 3.5 in

$78 \text{ in} \div 12 = 6.5 \text{ ft}$

$$\frac{1 \text{ in}}{1 \text{ ft}} = \frac{l \text{ in}}{6.5 \text{ ft}}$$

$$\frac{1}{1} = \frac{l}{6.5}$$

$$1l = 1 \bullet 6.5$$

$$l = 6.5$$

Length: 6.5 in

4. a. $440 \div 4 = 110$

b. $72 \div 2 = 36$
$36 \div 2 = 18$
$72 \div 4 = 18$

c. $1400 \div 2 = 700$
$700 \div 2 = 350$
$1400 \div 4 = 350$

d. $36 \div 4 = 9$

e. $900 \div 2 = 450$
$450 \div 2 = 225$
$900 \div 4 = 225$

Slope-Intercept Form

WARM-UP

a. The slant is going downward as the graph moves from left to right.

negative

b. $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-3}{1} = -\frac{3}{1} = -3$

or

$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-6}{2} = -\frac{6}{2} = -3$

PRACTICE

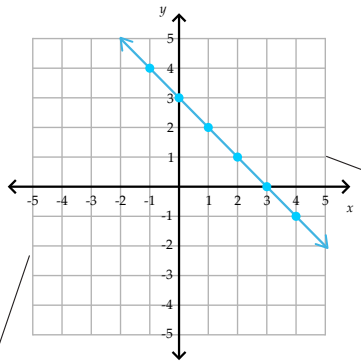
1. *A*: neither
B: *y*-intercept
C: *x*-intercept
D: both
E: *x*-intercept
F: neither
G: *y*-intercept
H: neither

2. a. *x*-intercept $(8,0)$
y-intercept $(0,-4)$

b. *x*-intercept $(0,0)$
y-intercept $(0,0)$

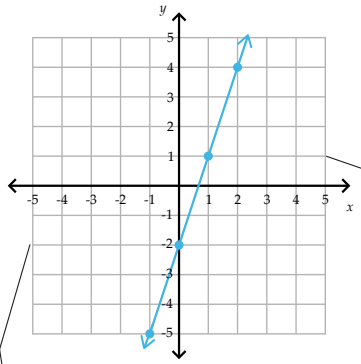
c. *x*-intercept none
y-intercept $(0,-7)$

3.



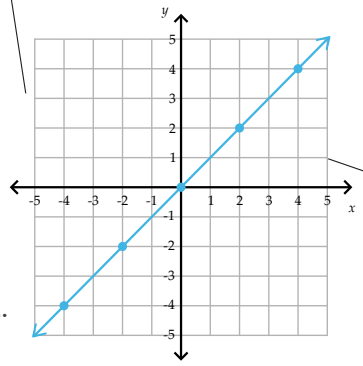
$b = 0$
The line crosses the *y*-axis at 0.

$m = -1$
The rise is –1, and the run is 1.



$b = 3$
The line crosses the *y*-axis at 3.

$m = 3$
The rise is 3, and the run is 1.



$b = -2$
The line crosses the *y*-axis at –2.

$m = 1$
The rise is 2, and the run is 2.

4. a. $m = \frac{2}{1} = 2$

$b = 1$

Equation: $y = 2x + 1$

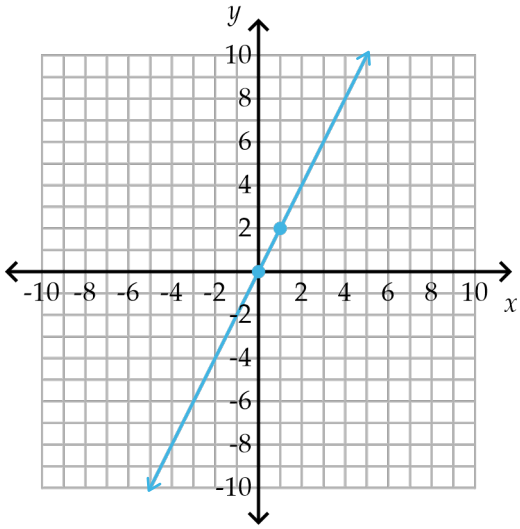
b. $m = \frac{-1}{2} = -\frac{1}{2}$

$b = 0$

Equation: $y = -\frac{1}{2}x$

REVIEW

1. The graph goes through the origin and the point $(1,2)$.



2. $\frac{16 \cancel{ft} \bullet \cancel{ft}}{1} \bullet \frac{12 \text{ in}}{1 \cancel{ft}} \bullet \frac{12 \text{ in}}{1 \cancel{ft}} = 2{,}304 \text{ in}^2$

3. a. $\frac{4}{3} \stackrel{?}{=} \frac{15}{20}$

$4 \bullet 20 = 80$

$3 \bullet 15 = 45$

$\frac{4}{3} \neq \frac{15}{20}$

no

b. $\frac{7}{2} \stackrel{?}{=} \frac{35}{10}$

$7 \bullet 5 = 35$

$2 \bullet 5 = 10$

$\frac{7}{2} = \frac{35}{10}$

yes

c. $\frac{2}{10} \stackrel{?}{=} \frac{3}{15}$

$2 \bullet 15 = 30$

$10 \bullet 3 = 30$

$\frac{2}{10} = \frac{3}{15}$

yes

4. a. Add \$5 to \$96.03.

\$96.03 + \$5.00 = \$101.03

Give \$101.03 to the cashier.

b. Add \$1.50 to \$28.56.

\$28.56 + \$1.50 = \$30.06

Give \$30.06 to the cashier.

5. a. Half of 20: 10

$20 + 10 = 30$

$20 \bullet 1.5 = 30$

b. Half of 140: 70

$140 + 70 = 210$

$140 \bullet 1.5 = 210$

c. Half of 50: 25

$50 + 25 = 75$

$50 \bullet 1.5 = 75$

d. Half of 5: 2.5

$5 + 2.5 = 7.5$

$5 \bullet 1.5 = 7.5$

Graphing Linear Equations

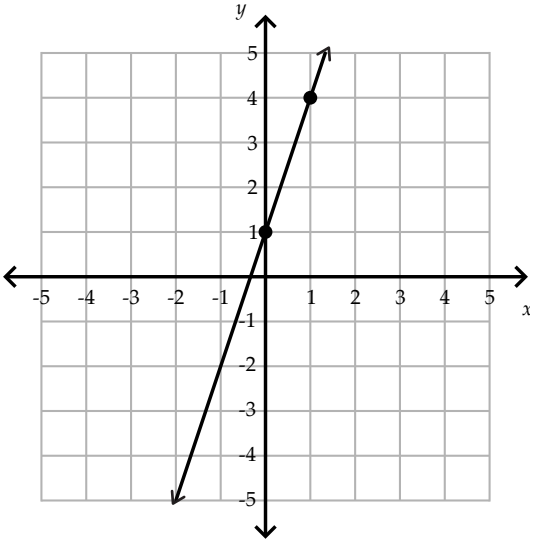
WARM-UP

1. slope $= 4 = \frac{4}{1}$
   a. Rise: 4
   b. Run: 1

2. slope $= \frac{2}{3}$
   a. Rise: 2
   b. Run: 3

PRACTICE

1. a. $b = 1$, so the y-intercept is $(0,1)$
   b. $m = 3$
   c. $m = 3 = \frac{3}{1}$
   Rise: 3 Run: 1
   d.

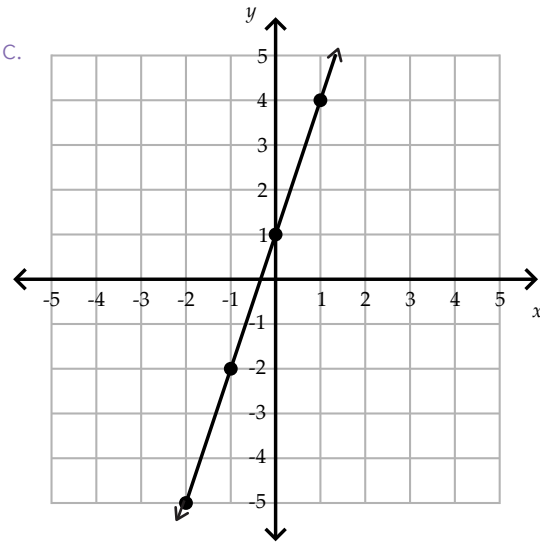


2. a.

x	y
–2	$y = 3(-2) + 1 = -6 + 1 = -5$
–1	$y = 3(-1) + 1 = -3 + 1 = -2$
0	$y = 3(0) + 1 = 0 + 1 = 1$
1	$y = 3(1) + 1 = 3 + 1 = 4$

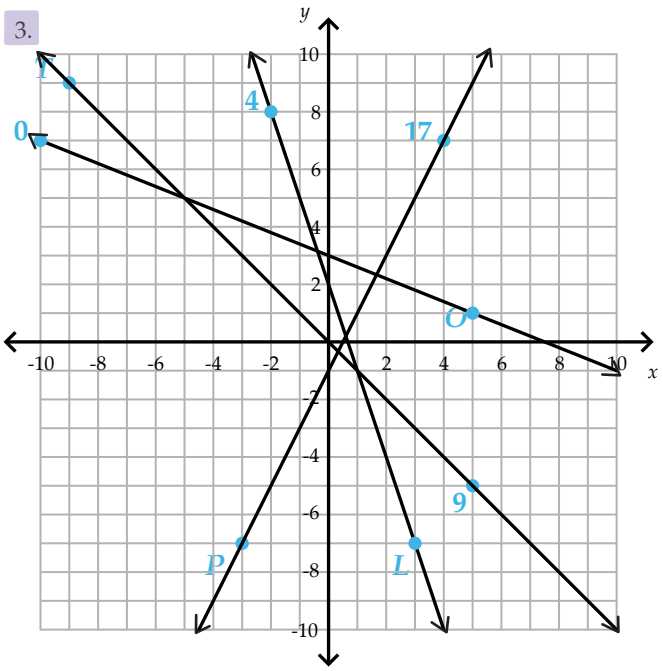
b. $(-2,-5)$, $(-1,-2)$, $(0,1)$, $(1,4)$

c.



d. They are the same line.

3.



Answer: They're always PLOTTING something!

REVIEW

1. $\text{slope} = \dfrac{\text{rise}}{\text{run}} = \dfrac{3}{1} = 3$

$m = 3$

The line crosses the y-axis at $(0,-5)$.
$b = -5$

$y = mx + b$
$y = (3)x + (-5)$
Equation: $y = 3x - 5$

2. a. Move the decimal point 3 places to the left.
$1.987 \bullet 10^{-3} = 0.001987$

b. Move the decimal point 8 places to the right.
$6.004 \bullet 10^{8} = 600{,}400{,}000$

3. a. $20q - 2r + 4s$
$20(1) - 2(8) + 4(10)$
$= 20 - 16 + 40$
$= 44$

b. $50q + 3r + 2s$
$50(1) + 3(8) + 2(10)$
$= 50 + 24 + 20$
$= 94$

4. a. Half of 20 is 10. Twice 20 is 40.
$10 + 40 = 50$

b. Half of 150 is 75. Twice 150 is 300.
$75 + 300 = 375$

c. Half of 30 is 15. Twice 30 is 60.
$15 + 60 = 75$

d. Half of 10 is 5. Twice 10 is 20.
$5 + 20 = 25$

5. $\dfrac{68}{120} = 68 \div 120 = 0.56666...$
$0.56666... = 56.666...\% \approx 57\%$

Functions

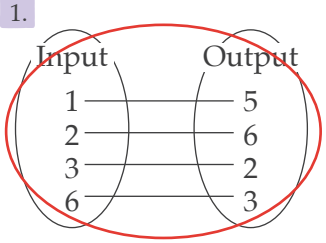
WARM-UP

a. m = slope

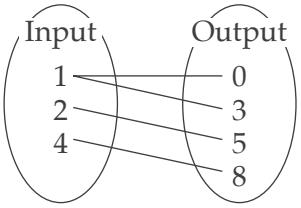
b. b = y-coordinate of the y-intercept

PRACTICE

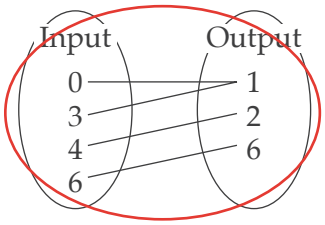
1.



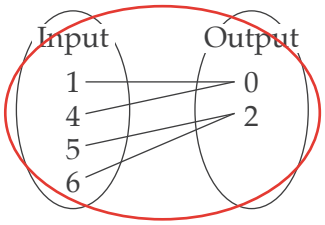
Each input value has only one output value.



The input value 1 has two outputs, 0 and 3.



Each input value has only one output value.



Each input value has only one output value.

2. a. Since $-2-4=-6$, the rule could be "Subtract 4 from the input." Check the other input/output pairs.

$-2-4=-6$ ✓
$-1-4=-5$ ✓
$0-4=-4$ ✓
$2-4=-2$ ✓
$3-4=-1$ ✓
Rule: Subtract 4 from the input.

$1-4=-3$
Missing value: -3

b. Since $-2\div 2=-1$, the rule could be "Divide the input by 2." Check the other input/output pairs.

$-2\div 2=-1$ ✓
$-1\div 2=-0.5$ ✓
$0\div 2=0$ ✓
$1\div 2=0.5$ ✓
$3\div 2=1.5$ ✓

Rule: Divide the input by 2.

$2\div 2=1$
Missing value: 1

c. Since $(-2)^3=-8$, the rule could be "Cube the input." Check the other input/output pairs.

$(-2)^3=-8$ ✓
$(-1)^3=-1$ ✓
$0^3=0$ ✓
$1^3=1$ ✓
$3^3=27$ ✓
Rule: Cube the input.

$2^3=8$
Missing value: 8

3. a. $y=x+3$

b. $y=\frac{1}{3}x$

c. $y=2x-1$

d. $y=x-5$

REVIEW

1. 300 miles ÷ 12 months = 25 miles per month
   25 miles per month • 9 months = 225 miles

2. a. The x-values are increasing, and the y-values are decreasing.

   The variables x and y are inversely proportional.

   b. $k = xy$
   $6 \cdot 7 = 42$
   $10.5 \cdot 4 = 42$
   $14 \cdot 3 = 42$
   $21 \cdot 2 = 42$
   $k = 42$

   $y = \frac{42}{x}$

3. $\frac{2 \text{ cm}}{1 \text{ mm}} = \frac{l \text{ cm}}{8 \text{ mm}}$

   $1l = 2 \cdot 8$

   $l = 16$

   16 cm

4. $\frac{16 \cancel{\text{cm}}}{1} \cdot \frac{1 \text{ in}}{2.54 \cancel{\text{cm}}} = \frac{16 \text{ in}}{2.54} \approx 6.3 \text{ in}$

   6.3 inches

5. Principal: \$2,500
   Rate: 0.4%
   Time: 8 years

   $I = Prt$
   $I = 2500 \cdot 0.004 \cdot 8$
   $I = 80$

   \$2,500 + \$80 = \$2,580

Graphing Functions

WARM-UP

1. a. –12

   b. 50

   c. –450

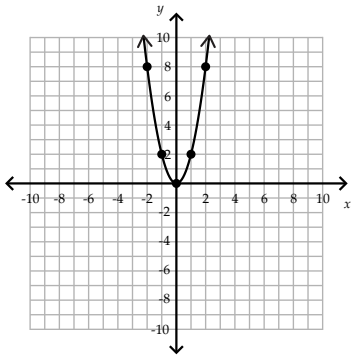
2. a. $5 \bullet (-2) \bullet 3 \bullet (-4)$
   $= -10 \bullet 3 \bullet (-4)$
   $= -30 \bullet (-4)$
   $= 120$

   b. $-3 \bullet 4 \bullet (-3) \bullet (-2)$
   $= -12 \bullet (-3) \bullet (-2)$
   $= 36 \bullet (-2)$
   $= -72$

PRACTICE

1. a.

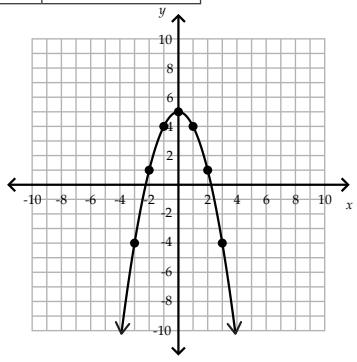
x (input)	y (output)	
–2	8	$y = 2(-2)^2 = 2 \bullet 4 = 8$
–1	2	$y = 2(-1)^2 = 2 \bullet 1 = 2$
0	0	$y = 2(0)^2 = 2 \bullet 0 = 0$
1	2	$y = 2(1)^2 = 2 \bullet 1 = 2$
2	8	$y = 2(2)^2 = 2 \bullet 4 = 8$



no

b.

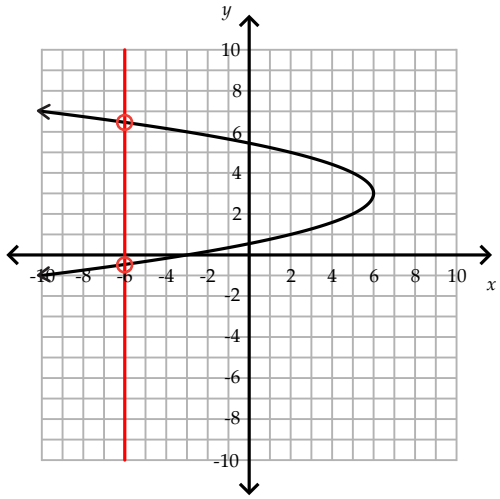
x (input)	y (output)	
–3	–4	$y = -(-3)^2 + 5 = -9 + 5 = -4$
–2	1	$y = -(-2)^2 + 5 = -4 + 5 = 1$
–1	4	$y = -(-1)^2 + 5 = -1 + 5 = 4$
0	5	$= -(0)^2 + 5 = 0 + 5 = 5$
1	4	$y = -(1)^2 + 5 = -1 + 5 = 4$
2	1	$y = -(2)^2 + 5 = -4 + 5 = 1$
3	–4	$y = -(3)^2 + 5 = -9 + 5 = -4$



no

2. a. yes, yes

b. no, no
The placement of the vertical line may vary, but the places where the vertical line intersects the curve should be circled.



c. yes, yes

d. yes, yes

REVIEW

1. yes
Each input value has only one output value.

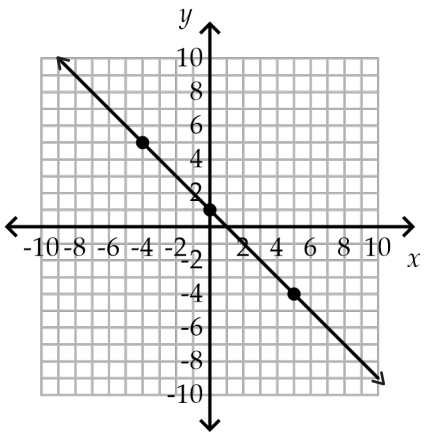
2. The points used may vary. Below are a few examples:

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{4}{2} = 2$$

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{12}{6} = 2$$

$m = 2$

3. Slope: -1
y-intercept: $(0,1)$



4. $(3 \bullet 10^3) + (5 \bullet 10^2) + (8 \bullet 10^0) + (5 \bullet 10^{-1}) + (2 \bullet 10^{-3})$

5. a. $\dfrac{3^4 + 3^2}{\sqrt{100}} = \dfrac{81+9}{10} = \dfrac{90}{10} = 9$

b. $(7-5)^2 + 4 \bullet 7$
$= (2)^2 + 4 \bullet 7$
$= 4 + 4 \bullet 7$
$= 4 + 28$
$= 32$

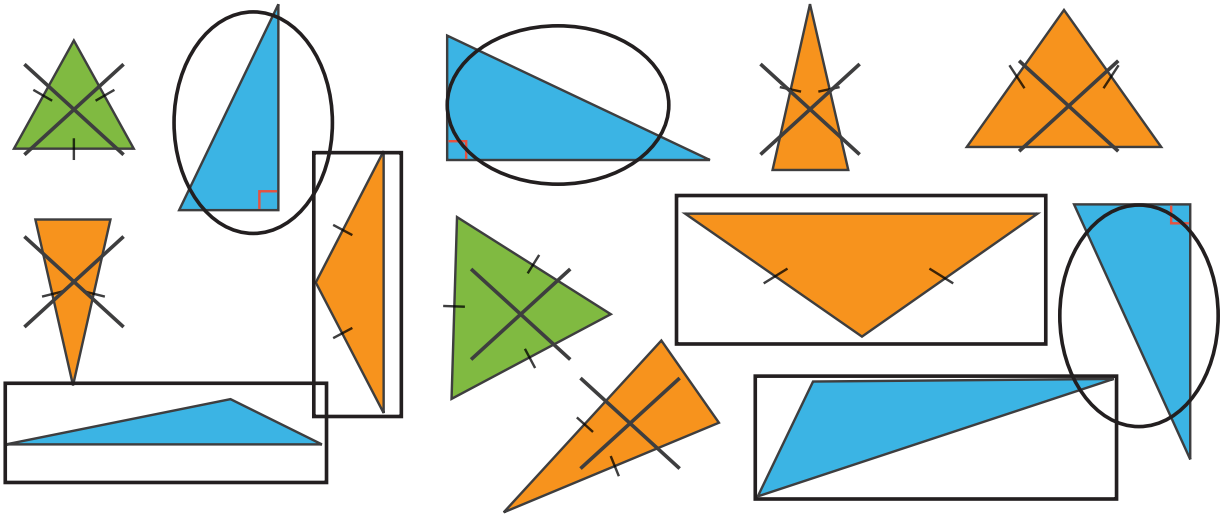
Triangles

WARM-UP

$$
\begin{aligned}
2p + 4p - 3p &= 21 \\
6p - 3p &= 21 \\
3p &= 21 \\
\frac{3p}{3} &= \frac{21}{3} \\
p &= 7
\end{aligned}
$$

PRACTICE

1.



2.

A triangle has two angles measuring 40°. What is the measure of the third angle?	74°	**A** A right triangle has an angle measuring 36°. What is the measure of the third angle?	80°
60°	**B** What are each of the angle measures in an equilateral triangle?	**C** An isosceles triangle has one angle that measures 20°. What is the measure of each of the two congruent angles?	**D** What is the measure of each of the non-right angles of an isosceles right triangle?
45°	**E** A triangle has two angles measuring 35° and 71°. What is the third angle measure?	100°	54°

Detailed work for the problems is shown below.

A
$$\begin{aligned} 90° + 36° + x &= 180° \\ 126° + x &= 180° \\ 126° + x - 126° &= 180° - 126° \\ x &= 54° \end{aligned}$$

B
$$\begin{aligned} x + x + x &= 180° \\ 3x &= 180° \\ \frac{3x}{3} &= \frac{180°}{3} \\ x &= 60° \end{aligned}$$

C
$$\begin{aligned} x + x + 20° &= 180° \\ 2x + 20° &= 180° \\ 2x + 20° - 20° &= 180° - 20° \\ 2x &= 160° \\ \frac{2x}{2} &= \frac{160°}{2} \\ x &= 80° \end{aligned}$$

D
$$\begin{aligned} x + x + 90° &= 180° \\ 2x + 90° &= 180° \\ 2x + 90° - 90° &= 180° - 90° \\ 2x &= 90° \\ \frac{2x}{2} &= \frac{90°}{2} \\ x &= 45° \end{aligned}$$

E
$$\begin{aligned} 35° + 71° + x &= 180° \\ 106° + x &= 180° \\ x + 106° - 106° &= 180° - 106° \\ x &= 74° \end{aligned}$$

3. a. $3 + 4 = 7$ 7 is greater than 5 (the third side).
$4 + 5 = 9$ 9 is greater than 3.
$3 + 5 = 8$ 8 is greater than 4.
yes

b. $3 + 3 = 6$ 6 is greater than 5.
$3 + 5 = 8$ 8 is greater than 3.
yes

c. $4 + 6 = 10$ 10 is not greater than the third side of 11.
no

REVIEW

1. a. $4 \div 2 = 2$
$6 \div 4 = 1.5$
$8 \div 6 = 1.\overline{3}$
no

b. $10 \div 2 = 5$
$35 \div 7 = 5$
$55 \div 11 = 5$
yes

2.
$$\begin{array}{r} {}^{10}\cancel{11}\text{ min }{}^{73}\cancel{13}\text{ sec} \\ -\ 9\text{ min }49\text{ sec} \\ \hline 1\text{ min }24\text{ sec} \end{array}$$

3. 4 child passes + 9 adult passes = 13 total passes

$$\begin{aligned} \frac{4 \text{ child passes}}{13 \text{ total passes}} &= \frac{144 \text{ child passes}}{x \text{ total passes}} \\ \frac{4}{13} &= \frac{144}{x} \\ 4x &= 13 \bullet 144 \\ 4x &= 1872 \\ \frac{4x}{4} &= \frac{1872}{4} \\ x &= 468 \end{aligned}$$

468 total passes

4. The points used to find the slope can vary. Below are a few examples showing rise over run between two points.

$m = \frac{3}{1} = 3$ or $m = \frac{12}{4} = 3$

$b = 4$

Equation: $y = 3x + 4$

5. a. $4p - 16q$

$4(3.5) - 16(-1)$

$= 14 - (-16)$

$= 14 + 16$

$= 30$

b. $9q + 2p$

$9(-1) + 2(3.5)$

$= -9 + 7$

$= -2$

Transformations

WARM-UP

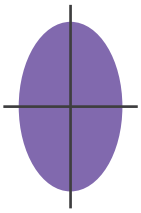
a. 6

b. 6

c. hexagon

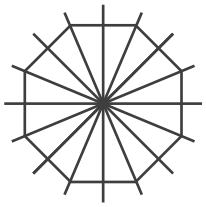
PRACTICE

1. a. 2



b. 5

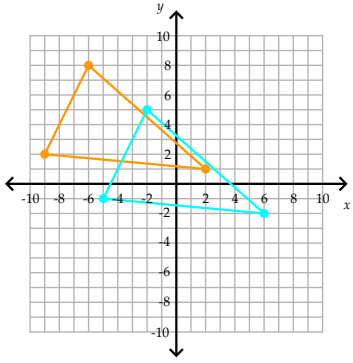
c. 8



2. a. This flower can be rotated five times and look the same.
Order of rotational symmetry: 5

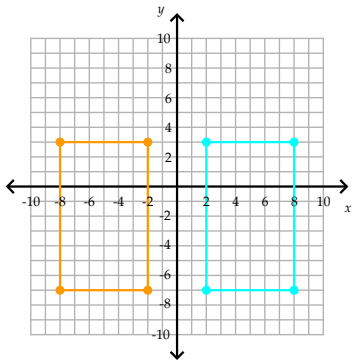
b. This flower can be rotated three times and look the same.
Order of rotational symmetry: 3

3. a. Move each point down 3 units and to the right 4 units.



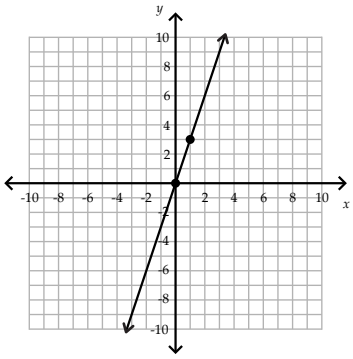
Preimage	Image
(–6,8)	(–2,5)
(–9,2)	(–5,–1)
(2,1)	(6,–2)

b. The y-coordinate stays the same. The x-coordinate changes its sign.



Preimage	Image
$(-8,3)$	$(8,3)$
$(-2,3)$	$(2,3)$
$(-2,-7)$	$(2,-7)$
$(-8,-7)$	$(8,-7)$

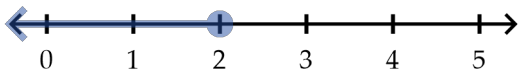
REVIEW

1. 

2. $33 \div 6 = 5.5$
$5.50 per person

3. $1 \text{ km} = 100 \text{ dam}$
$5 \bullet 100 = 500$
$5 \text{ km} = 500 \text{ dam}$

4. $14x - 3 \le 25$
$14x - 3 + 3 \le 25 + 3$
$14x \le 28$
$\frac{14x}{14} \le \frac{28}{14}$
$x \le 2$



5. Amount of decrease: $45 - 36 = 9$
$9 \div 45 = 0.2$
Percent decrease: 20%

Constructing Angles

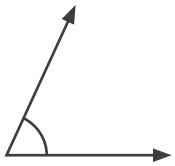
WARM-UP

1. Line segment
2. Ray
3. Line

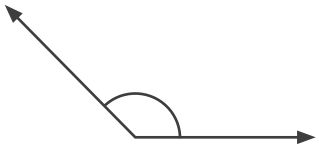
PRACTICE

1. a. 115°
   b. 40°
   c. 160°
   d. 20°

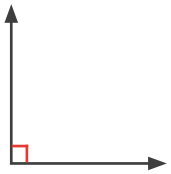
2. a.



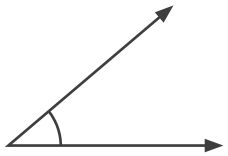
b.



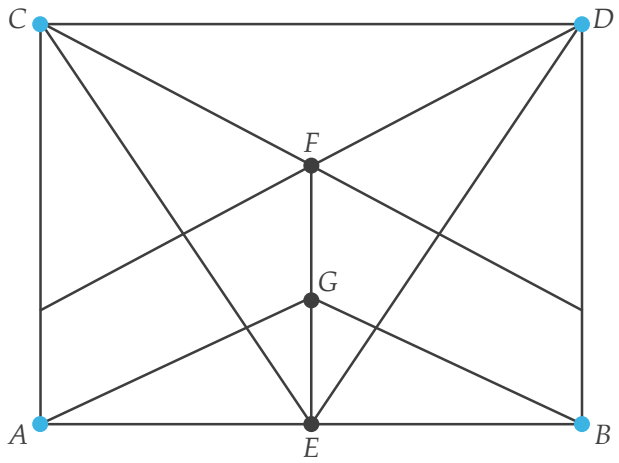
c.



d.



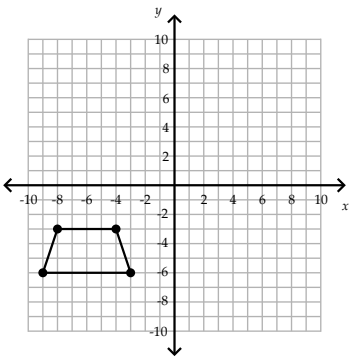
3.



The student may color in the design as desired.

REVIEW

1. The shape is in the same vertical position but on the opposite side of the y-axis (and the same distance from the y-axis).



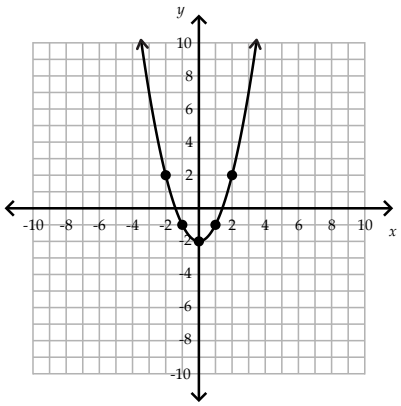
2. acute, isosceles

3. Any two points can be used to find the slope.
An example is given below.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{4}{8} = \frac{1}{2}$$

4.

x (input)	y (output)	
−2	2	$y = (-2)^2 - 2 = 4 - 2 = 2$
−1	−1	$y = (-1)^2 - 2 = 1 - 2 = -1$
0	−2	$y = (0)^2 - 2 = 0 - 2 = -2$
1	−1	$y = (1)^2 - 2 = 1 - 2 = -1$
2	2	$y = (2)^2 - 2 = 4 - 2 = 2$



5. $\frac{47}{423} = \frac{1}{9}$

Constructing Triangles

WARM-UP

a. pencil

b. hinge

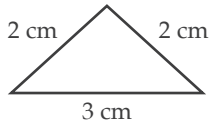
c. pivot point

d. radius

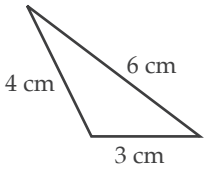
PRACTICE

1. Triangle orientation may vary, but the side lengths should be as indicated below. Note: Triangles are not drawn to scale.

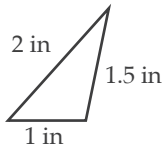
a.



b.

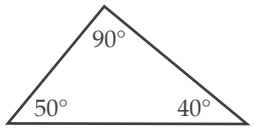


c.

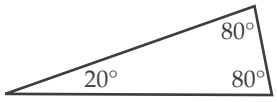


2. Triangles may vary, but the angle measures should be the same.

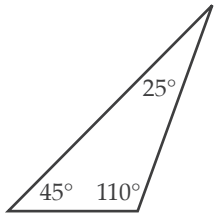
a.



b.



c.



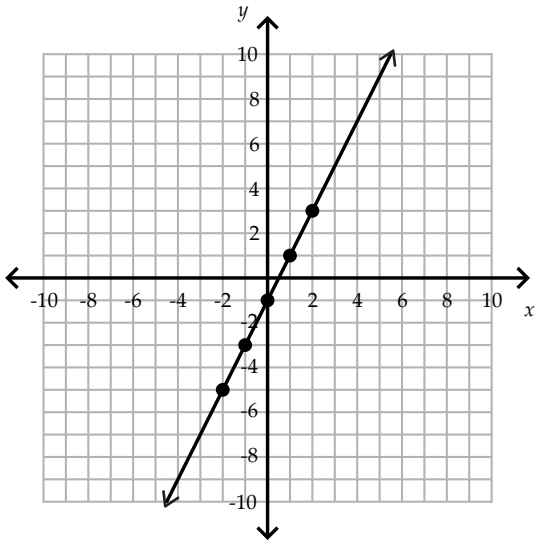
REVIEW

1. yes

Each input value only has one output value.

2. $b = -1$ y-intercept: $(0, -1)$

$m = 2 = \frac{2}{1}$ Go up 2 and to the right 1.



3. A (B) (C) (D) (E) F G (H) (I) J (K) L M N (O) P
Q R S T U V W (X) Y Z

4. a. $p = 2c + 123$

b. $957 = 2c + 123$

$957 - 123 = 2c + 123 - 123$

$834 = 2c$

$\frac{834}{2} = \frac{2c}{2}$

$417 = c$

417 chapter books

5. $g = \frac{l \bullet w \bullet h}{231}$

$231 \bullet g = \frac{l \bullet w \bullet h}{231} \bullet 231$

$231g = l \bullet w \bullet h$

$\frac{231g}{l \bullet w} = \frac{l \bullet w \bullet h}{l \bullet w}$

$\frac{231g}{l \bullet w} = h$

$h = \frac{231g}{lw}$

Logic Lesson 3

Who's New on the Farm?

a. poult, jake, jenny

b. cria

c. foal, colt, filly

d. cygnet

e. cosset

100 Animals for $100

If Simon purchased all of one animal, he could buy one of the following sets:
10 goat kids for $100
33 bunnies for $99
200 chicks for $100

Since he must buy at least one of each type of animal, try different combinations using numbers less than those shown above.

Some guesses are shown below.

If Simon purchased 50 chicks for $25 and 25 bunnies for $75, there would be no more money left for goat kids. Simon must purchase more than 0 goat kids but fewer than 10 goat kids.

If Simon purchased 5 goat kids for $50, there would be $50 left to spend and 95 more animals to purchase. If Simon next purchased 5 bunnies for $15, then 90 animals are left and $35 remains. 90 chicks would cost $45, which is too much. Try another combination with fewer rabbits and more chicks.

If Simon purchased 5 goat kids for $50 and 1 bunny for $3, there would be $47 left and 94 animals left.

94 chicks • $0.50 = $47 This combination works.

5 goat kids, 1 bunny, and 94 chicks

Caroline's Corn

First day: x
Second day: $x + 6$
Third day: $x + 6 + 6 = x + 12$
Fourth day: $x + 12 + 6 = x + 18$
Fifth day: $x + 18 + 6 = x + 24$
The sum of all five days is 100.

$$x + x + 6 + x + 12 + x + 18 + x + 24 = 100$$
$$5x + 60 = 100$$
$$5x + 60 = 100 - 60$$
$$5x = 40$$
$$\frac{5x}{5} = \frac{40}{5}$$
$$x = 8$$

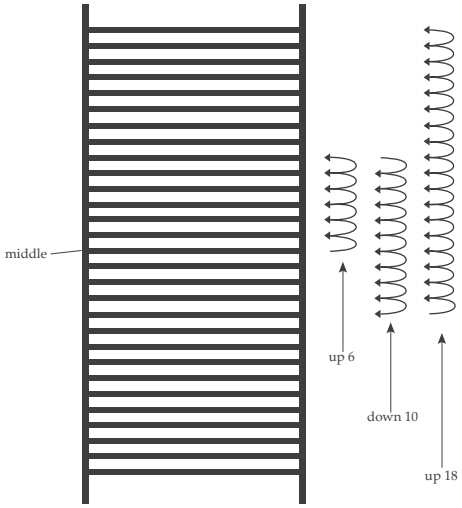
8 rows

Farmer Freddie's Ladder

Draw a picture.
Draw a line to represent the middle rung.
Draw new rungs as you move up and down.
Go up 6 rungs. Then go down 10 rungs.
Then go up 18 rungs. This represents the top of the ladder.

If 0 represents the middle, the top of the ladder is $0 + 6 - 10 + 18 = 14$ rungs above the middle. That means there are 14 rungs below the middle.

14 rungs above + 1 middle rung + 14 rungs below = 29 rungs



Ferguson's Fresh Milk

Return the 15 empty bottles to get five new bottles. Return three of the five new bottles when they are empty and receive one new, full bottle. There are still two empty bottles remaining.

Empty the new bottle and add it to the two remaining empty bottles. Return these three empty bottles and receive one new, full bottle.

Total bottles received:

$15 + 5 + 1 + 1 = 22$

Free bottles received:

22 total bottles received – 15 bottles paid for = 7 free bottles of milk

Family Farms

Information that can be gathered from each clue is shown below. A check is placed in a box when the answer is known for certain, and an X is placed in a box if it cannot be the answer. When a check is placed in a box, Xs can be placed in the rest of the row and column for that section.

1. The Gil family must live in Argentina or Spain.

2. The Gil family and the other family who lives in Argentina or Spain do not grow peanuts.

3. The family who grows oranges lives in Spain.

4. The Santos family lives in the US but does not grow peanuts. The Santos family does not grow oranges and does not live in Argentina or Spain.

5. The Gil family grows fruit. The only fruit is oranges. The Gil family lives in Spain and grows oranges.

6. The Moreno family does not live in the US, which means that the Moreno family lives in Argentina.

7. The peanut farm is not in Iowa. This means that the peanut farm is in Florida. Since the Santoses live in the US but do not grow peanuts, the Santos family lives in Iowa.

8. The corn farm is outside the US. This means that the Moreno family lives in Argentina and grows corn. This means the Santos family grows soybeans. This also means the Cardoso family lives in Florida and grows peanuts.

		Location of Farm				Crop			
		Argentina	Spain	Florida (US)	Iowa (US)	Peanuts	Oranges	Corn	Soybeans
Family	Santos Family	X	X	X	✓	X	X	X	✓
	Moreno Family	✓	X	X	X	X	X	✓	X
	Cardoso Family	X	X	✓	X	✓	X	X	X
	Gil Family	X	✓	X	X	X	✓	X	X
Crop	Peanuts	X	X	✓	X				
	Oranges	X	✓	X	X				
	Corn	✓	X	X	X				
	Soybeans	X	X	X	✓				

a. The Santos family lives in Iowa and grows soybeans.

b. The Moreno family lives in Argentina and grows corn.

c. The Cardoso family lives in Florida and grows peanuts.

d. The Gil family lives in Spain and grows oranges.

Polygon Diagonals and Angles

WARM-UP

a. triangle

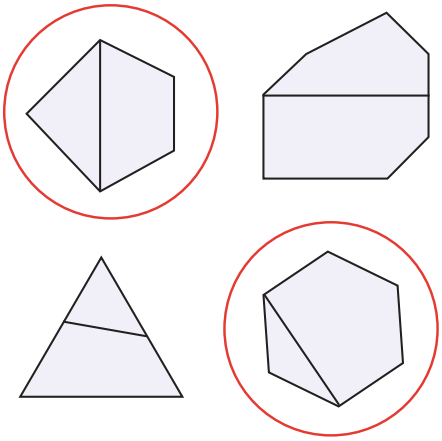
b. quadrilateral

c. pentagon

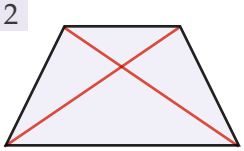
d. hexagon

PRACTICE

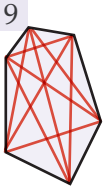
1.



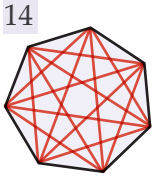
2. a. 2



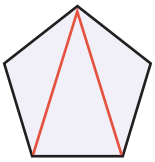
b. 9



c. 14



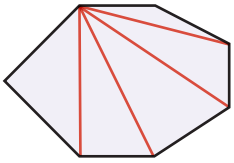
3. a.



$3 \cdot 180° = 540°$

Sum: 540°

b.



$5 \cdot 180° = 900°$

Sum: 900°

4. a. $n = 9$

$(n-2)180°$

$= (9-2)180°$

$= (7)180°$

$= 1260°$

Sum: 1,260°

b. $n = 8$

$(n-2)180°$

$= (8-2)180°$

$= (6)180°$

$= 1080°$

Sum: 1,080°

5.

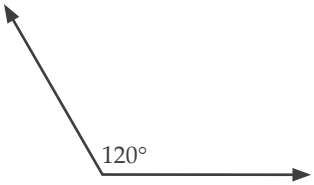
n (number of sides)	$n - 2$ (number of triangles)	Interior angle sum (multiply the number of triangles by 180)	Interior angle measure (divide the interior angle sum by the number of sides)
3	1	180°	60°
4	$4 - 2 = 2$	$2 \cdot 180° = 360°$	$360° \div 4 = 90°$
5	$5 - 2 = 3$	$3 \cdot 180° = 540°$	$540° \div 5 = 108°$
6	$6 - 2 = 4$	$4 \cdot 180° = 720°$	$720° \div 6 = 120°$
7	$7 - 2 = 5$	$5 \cdot 180° = 900°$	$900° \div 7 \approx 129°$
8	$8 - 2 = 6$	$6 \cdot 180° = 1080°$	$1080° \div 8 = 135°$
9	$9 - 2 = 7$	$7 \cdot 180° = 1260°$	$1260° \div 9 = 140°$
10	$10 - 2 = 8$	$8 \cdot 180° = 1440°$	$1440° \div 10 = 144°$

6. a. increasing

b. Answers may vary. As the number of sides/angles of a regular polygon increases, the angles widen (get larger).

REVIEW

1.



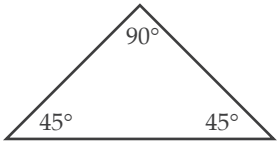
2. Any two points can be used to find the slope. Below is an example.

$m = \frac{2}{10} = \frac{1}{5}$

$b = 5$

$y = \frac{1}{5}x + 5$

3. Triangle size and orientation may vary. Two angles must measure 45°, and the third must measure 90°.



4. $1 \text{ gal} = 4 \text{ qt}$

$\frac{26 \cancel{\text{ qt}}}{1} \cdot \frac{1 \text{ gal}}{4 \cancel{\text{ qt}}} = \frac{26 \text{ gal}}{4} = 6.5 \text{ gal}$

5. $40 \cdot 5 = 200$
$50 \cdot 4 = 200$
$80 \cdot 2.5 = 200$

yes

Finding Polygon Angle Measures

WARM-UP

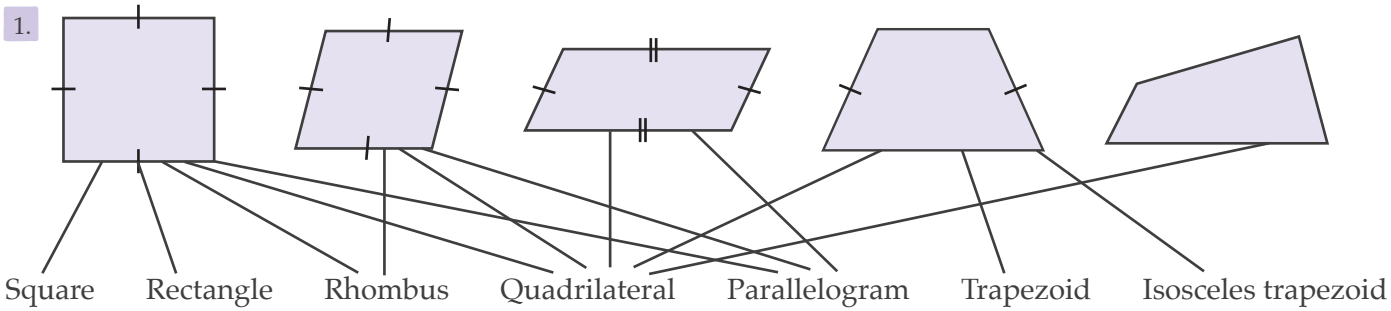
a. scalene

b. isosceles

c. equilateral

PRACTICE

1.



2. a.

b.

3. a. $m\angle A + m\angle B + m\angle C + m\angle D = 360°$

$40° + 2x + 2x + 40° = 360°$

$4x + 80° = 360°$

$4x + 80° - 80° = 360° - 80°$

$4x = 280°$

$\frac{4x}{4} = \frac{280°}{4}$

$x = 70°$

$2x = 2 \bullet 70° = 140°$

$m\angle C = 140°$

b. $m\angle E + m\angle F + m\angle G + m\angle H = 360°$

$45° + 90° + 90° + 5p = 360°$

$5p + 225° = 360°$

$5p + 225° - 225° = 360° - 225°$

$5p = 135°$

$\frac{5p}{5} = \frac{135°}{5}$

$p = 27°$

$5p = 5 \bullet 27° = 135°$

$m\angle H = 135°$

c. $m\angle P + m\angle Q + m\angle R + m\angle S = 360°$

$3t + 150° + 3t + 150° = 360°$

$6t + 300° = 360°$

$6t + 300° - 300° = 360° - 300°$

$6t = 60°$

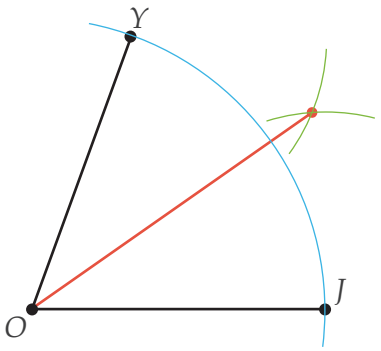
$\frac{6t}{6} = \frac{60°}{6}$

$t = 10°$

$3t = 3 \bullet 10° = 30°$

$m\angle P = 30°$

REVIEW

1. 

2. $\frac{1 \text{ cm}}{50 \text{ ft}} = \frac{6.5 \text{ cm}}{l \text{ ft}}$

$\frac{1}{50} = \frac{6.5}{l}$

$1l = 50 \bullet 6.5$

$l = 325$

325 feet

3. a. Since 1,413 is 3 more than the multiple of 10 less than it (1,410), there are 3 left over as the remainder.

3

b. Since 732 is 2 more than the multiple of 10 less than it (730), there are 2 left over as the remainder.

2

c. Since 929 is 9 more than the multiple of 10 less than it (920), there are 9 left over as the remainder.

9

4. $-12x + 23 = -13$

$-12x + 23 - 23 = -13 - 23$

$-12x = -36$

$\frac{-12x}{-12} = \frac{-36}{-12}$

$x = 3$

5. a. $7p \div 2$ or $\frac{7p}{2}$

b. $2(q + r)$

Angle Relationships

WARM-UP

a. $47 + 43 = a$
$90 = a$

b. $71 + b = 90$
$71 + b - 71 = 90 - 71$
$b = 19$

PRACTICE

1. **A** $80° + 10° = 90°$
$80° + 100° = 180°$

B $25° + 65° = 90°$
$25° + 155° = 180°$

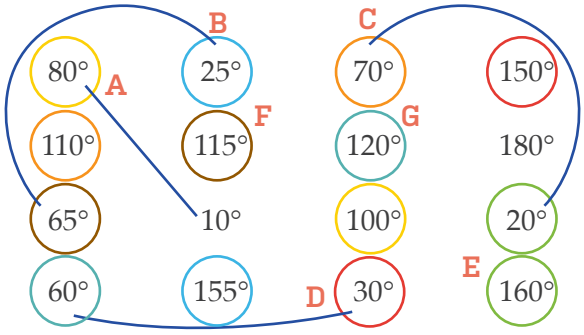
C $70° + 20° = 90°$
$70° + 110° = 180°$

D $30° + 60° = 90°$
$30° + 150° = 180°$

E $160° + 20° = 180°$

F $115° + 65° = 180°$

G $120° + 60° = 180°$



2. a. $35° + a = 90°$
$35° + a - 35° = 90° - 35°$
$a = 55°$

b. $18° + b = 90°$
$18° + b - 18° = 90° - 18°$
$b = 72°$

3. a. $64° + f = 180°$
$64° + f - 64° = 180° - 64°$
$f = 116°$

b. $122° + g = 180°$
$122° + g - 122° = 180° - 122°$
$g = 58°$

4. a. Vertical angles are congruent. $s = 59°$

b. Vertical angles are congruent. $t = 80°$

5. Angle measures can be found in different ways and in different orders. An example of how to find each angle measure is shown below.

$a + 100° = 180°$
$a + 100° - 100° = 180° - 100°$
$a = 80°$

$b + 100° = 180°$
$b + 100° - 100° = 180° - 100°$
$b = 80°$

$c + 100° = 180°$
$c + 100° - 100° = 180° - 100°$
$c = 80°$

$d + 55° = 180°$
$d + 55° - 55° = 180° - 55°$
$d = 125°$

Angle e is part of a quadrilateral with three other known angles.

$$e + 100° + 60° + 125° = 360°$$
$$e + 285° = 360°$$
$$e + 285° - 285° = 360° - 285°$$
$$e = 75°$$

Angles e and f form a line.

$$f + 75° = 180°$$
$$f + 75° - 75° = 180° - 75°$$
$$f = 105°$$

Vertical angles e and g are congruent.

$g = 75°$

Vertical angles f and h are congruent.

$h = 105°$

Angle i is part of a quadrilateral with three other known angles.

$$i + 100° + 80° + 105° = 360°$$
$$i + 285° = 360°$$
$$i + 285° - 285° = 360° - 285°$$
$$i = 75°$$

Angles i and j form a line.

$$j + 75° = 180°$$
$$j + 75° - 75° = 180° - 75°$$
$$j = 105°$$

Vertical angles i and k are congruent.

$k = 75°$

Vertical angles j and l are congruent.

$l = 105°$

Angle m is part of a triangle with two other known angles.

$$m + 35° + 75° = 180°$$
$$m + 110° = 180°$$
$$m + 110° - 110° = 180° - 110°$$
$$m = 70°$$

Angle n is part of a quadrilateral with three other known angles.

$$n + 100° + 80° + 105° = 360°$$
$$n + 285° = 360°$$
$$n + 285° - 285° = 360° - 285°$$
$$n = 75°$$

Angles m, n, and p form a line.

$$p + 70° + 75° = 180°$$
$$p + 145° = 180°$$
$$p + 145° - 145° = 180° - 145°$$
$$p = 35°$$

Angle q is part of a triangle with two other known angles.

$$q + 80° + 35° = 180°$$
$$q + 115° = 180°$$
$$q + 115° - 115° = 180° - 115°$$
$$q = 65°$$

REVIEW

1. $m\angle H + m\angle A + m\angle T = 180°$
$m\angle H + 55° + 63° = 180°$
$m\angle H + 118° = 180°$
$m\angle H + 118° - 118° = 180° - 118°$
$m\angle H = 62°$

2. $\frac{(n-2)180°}{n}$
$\frac{(10-2)180°}{10}$
$= \frac{(8)180°}{10}$
$= \frac{1440°}{10}$
$= 144°$

3. a. $\$30.05 - \$28.01 = \$2.04$

   b. By giving an extra nickel, she would get back 4 cents in coins rather than 99 cents in coins.

4.

x (input)	y (output)
-2	-6
-1	1
0	2
1	3
2	10

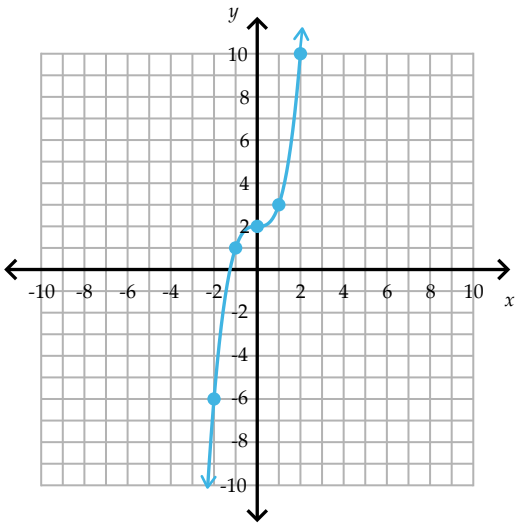
$y = (-2)^3 + 2 = -8 + 2 = -6$

$y = (-1)^3 + 2 = -1 + 2 = 1$

$y = 0^3 + 2 = 0 + 2 = 2$

$y = 1^3 + 2 = 1 + 2 = 3$

$y = 2^3 + 2 = 8 + 2 = 10$



Parallel Lines and Transversals

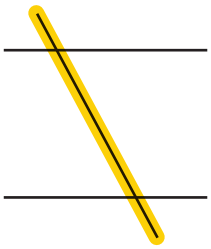
WARM-UP

$$a + 68° + 52° = 180°$$
$$a + 120° = 180°$$
$$a + 120° - 120° = 180° - 120°$$
$$a = 60°$$

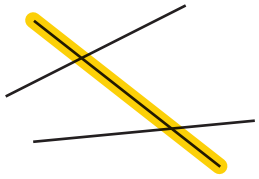
$$b + 82° + 80° + 77° = 360°$$
$$b + 239° = 360°$$
$$b + 239° - 239° = 360° - 239°$$
$$b = 121°$$

PRACTICE

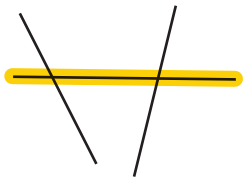
1. a.



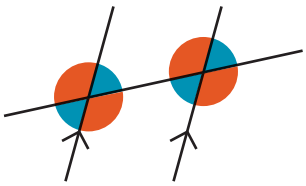
b.



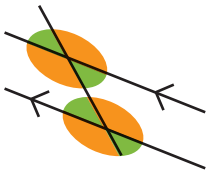
c.



2. a.



b.



3. Angles can be found in different ways and in different orders. Some examples are shown below.

a. Angle A and the given angle are supplementary.

$$m\angle A + 50° = 180°$$
$$m\angle A + 50° - 50° = 180° - 50°$$
$$m\angle A = 130°$$

b. Vertical angles A and B are congruent.

$m\angle B = 130°$

c. Angle C is a vertical angle with the given angle. Vertical angles are congruent.

$m\angle C = 50°$

d. Angles A and D are corresponding angles, so their measures are the same.

$m\angle D = 130°$

e. Angles C and E are alternate interior angles, so their measures are the same.
$m\angle E = 50°$

f. Angles A and F are alternate interior angles, so their measures are the same.
$m\angle F = 130°$

g. Angles C and G are corresponding angles, so their measures are the same.
$m\angle G = 50°$

4. a. Angle x and the given angle are corresponding angles.
$x = 57°$

b. Angle z and the given angle are corresponding angles.
$z = 108°$

c. Angle p and the given angle are alternate exterior angles.
$p = 85°$

d. Angle r and the given angle are alternate interior angles.
$r = 120°$

5. **DOWN**

1. Angles that add to 90° are called complementary angles.

2. Interior angles on opposite sides of the transversal are called alternate interior angles.

3. A transversal is a line that intersects two or more lines.

6. Corresponding angles on parallel lines are congruent.

8. Alternate exterior angles are located on opposite sides of the transversal.

ACROSS

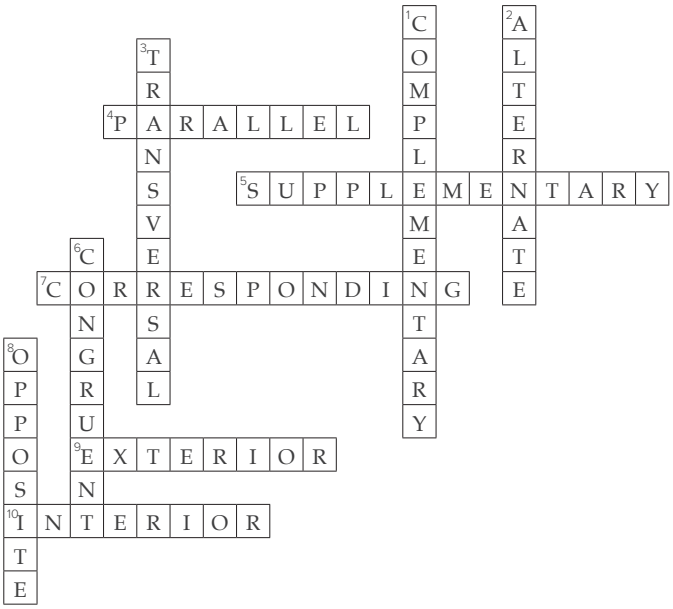
4. Parallel lines are lines that never intersect and are always the same distance apart.

5. Angles that add to 180° are called supplementary angles.

7. Angles that are located in the same position on parallel lines are called corresponding angles.

9. Angles that are outside the parallel lines are called exterior angles.

10. Interior angles are angles that are between the parallel lines.



REVIEW

1. $m\angle R + m\angle I + m\angle S + m\angle E = 360°$

$$x + 124° + 124° + x = 360°$$
$$2x + 248° = 360°$$
$$2x + 248° - 248° = 360° - 248°$$
$$2x = 112°$$
$$\frac{2x}{2} = \frac{112°}{2}$$
$$x = 56°$$

$m\angle R = 56°$

$m\angle E = 56°$

2. $m\angle 1 + 27° = 180°$

$m\angle 1 + 27° - 27° = 180° - 27°$

$m\angle 1 = 153°$

$m\angle 2 = 27°$

$m\angle 3 = 153°$

3. $(n-2)180°$

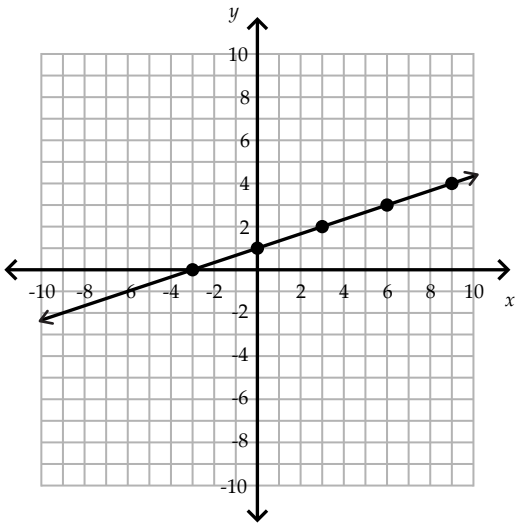
$(11-2)180° = (9)180° = 1{,}620°$

4. no

The graph fails the vertical line test.

5.

x	y	
–3	0	$y = \frac{1}{3}(-3) + 1 = -1 + 1 = 0$
0	1	$y = \frac{1}{3}(0) + 1 = 0 + 1 = 1$
3	2	$y = \frac{1}{3}(3) + 1 = 1 + 1 = 2$
6	3	$y = \frac{1}{3}(6) + 1 = 2 + 1 = 3$
9	4	$y = \frac{1}{3}(9) + 1 = 3 + 1 = 4$



Missing Angles in a Circle

WARM-UP

1. a. $\frac{15}{25} = \frac{60}{100} = 0.6$

   b. $\frac{7}{20} = \frac{35}{100} = 0.35$

   c. $\frac{3}{2} = 1.5$

2. a. $\cancel{7} \cdot \frac{5}{\cancel{7}} = 5$

   b. $\frac{11}{\cancel{12}} \cdot \cancel{12} = 11$

   c. $\cancel{3} \cdot \frac{\overset{2}{\cancel{4}}}{\underset{1}{\cancel{6}}} = 2$

PRACTICE

1. Circle — 360°
   Right angle — 90°
   Straight angle — 180°

2. a. $a = 135°$

   b. $b = 135°$

   c. $c = 27°$

   Angles can be found in different ways and in different orders. Some examples are shown below.

   Angle a and the 45° angle are supplementary angles.

   $a + 45° = 180°$
   $a + 45° - 45° = 180° - 45°$
   $a = 135°$

   Angles b and a are vertical angles.
   $b = 135°$

   Angle a, angle c, and the 18° angle form a line.

   $a + c + 18° = 180°$
   $135° + c + 18° = 180°$
   $c + 153° = 180°$
   $c + 153° - 153° = 180° - 153°$
   $c = 27°$

3. Angles can be found in different ways and in different orders. Some examples are shown below.

   a. Angle a and the 22° angle are complementary.

   $a + 22° = 90°$
   $a + 22° - 22° = 90° - 22°$
   $a = 68°$

   b. The 25° angle, angle a, the 22° angle, and angle b form a line.

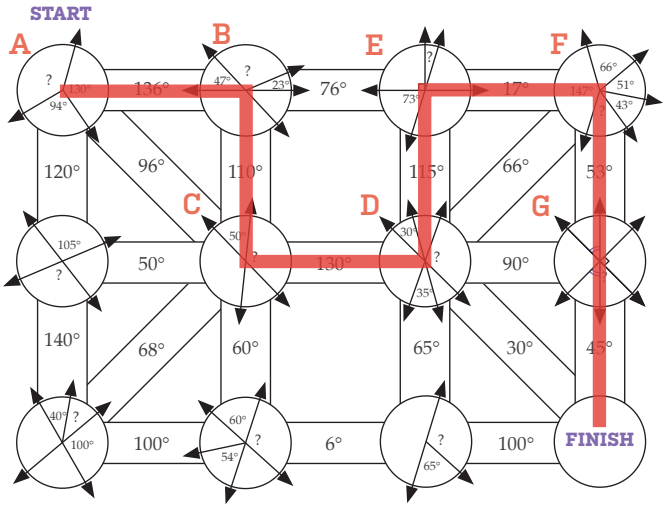
   $25° + 68° + 22° + b = 180°$
   $115° + b = 180°$
   $115° + b - 115° = 180° - 115°$
   $b = 65°$

   c. Angle c and the 25° angle are vertical angles.
   $c = 25°$

   d. Angle d and the right angle are vertical angles.
   $d = 90°$

   e. Angles e and b are vertical angles.
   $e = 65°$

4.



Detailed work for problems along the correct path is shown below.

A $a + 94° + 130° = 360°$
$a + 224° = 360°$
$a + 224° - 224° = 360° - 224°$
$a = 136°$

B $b + 47° + 23° = 180°$
$b + 70° = 180°$
$b + 70° - 70° = 180° - 70°$
$b = 110°$

C $c + 50° = 180°$
$c + 50° - 50° = 180° - 50°$
$c = 130°$

D $d + 30° + 35° = 180°$
$d + 65° = 180°$
$d + 65° - 65° = 180° - 65°$
$d = 115°$

E $e + 90° + 73° = 180°$
$e + 163° = 180°$
$e + 163° - 163° = 180° - 163°$
$e = 17°$

F $f + 147° + 66° + 51° + 43° = 360°$
$f + 307° = 360°$
$f + 307° - 307° = 360° - 307°$
$f = 53°$

G $g + 90° + g + g + 90° + g = 360°$
$4g + 180° = 360°$
$4g + 180° - 180° = 360° - 180°$
$4g = 180°$
$\frac{4g}{4} = \frac{180°}{4}$
$g = 45°$

REVIEW

1. $m\angle K + m\angle I + m\angle N + m\angle D = 360°$
$10y + 9y + 74° + 7y = 360°$
$26y + 74° = 360°$
$26y + 74° - 74° = 360° - 74°$
$26y = 286°$
$\frac{26y}{26} = \frac{286°}{26}$
$y = 11°$

$10 \cdot 11° = 110°$
$m\angle K = 110°$

$9 \cdot 11° = 99°$
$m\angle I = 99°$

$7 \cdot 11° = 77°$
$m\angle D = 77°$

2. $\frac{LI}{TO} = \frac{ID}{OP}$
$\frac{5}{6.25} = \frac{4}{x}$
$5x = 6.25 \cdot 4$
$5x = 25$
$\frac{5x}{5} = \frac{25}{5}$
$x = 5$

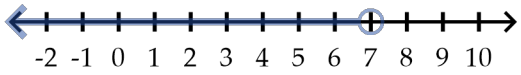
$x = 5$ cm

$$\frac{LI}{TO} = \frac{LD}{TP}$$
$$\frac{5}{6.25} = \frac{6}{y}$$
$$5y = 6.25 \bullet 6$$
$$5y = 37.5$$
$$\frac{5y}{5} = \frac{37.5}{5}$$
$$y = 7.5$$

$y = 7.5$ cm

3. Amount of increase: 115 lb – 100 lb = 15 lb
$15 \div 100 = 0.15 \rightarrow 15\%$
Percent increase: 15%

4. $5x < 35$
$$\frac{5x}{5} < \frac{35}{5}$$
$x < 7$



5. 5 wearing green + 1 not wearing green = 6 total
$$\frac{1 \text{ not wearing green}}{6 \text{ total students}} = \frac{4 \text{ not wearing green}}{x \text{ total students}}$$
$$\frac{1}{6} = \frac{4}{x}$$
$$1x = 6 \bullet 4$$
$$x = 24$$

24 students

Pythagorean Theorem

WARM-UP

a. $\sqrt{121} = 11$

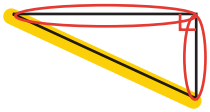
b. $8 \bullet 8 = 64$

c. $\sqrt{169} = 13$

PRACTICE

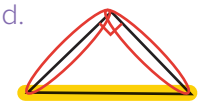
1. a.

b.



c.

d.



2. a. $a^2 + b^2 = 7^2 + 24^2$
$= 49 + 576$
$= 625$

$c^2 = 25^2 = 625$ ✓

b. $a^2 + b^2 = 21^2 + 20^2$
$= 441 + 400$
$= 841$

$c^2 = 29^2 = 841$ ✓

3. a. $a = 24 \quad b = 10 \quad c = ?$

$24^2 + 10^2 = c^2$

$576 + 100 = c^2$

$676 = c^2$

$\sqrt{676} = \sqrt{c^2}$

$26 = c$

b. $a = 8 \quad b = ? \quad c = 10$

$8^2 + b^2 = 10^2$

$64 + b^2 = 100$

$64 + b^2 - 64 = 100 - 64$

$b^2 = 36$

$\sqrt{b^2} = \sqrt{36}$

$b = 6$

c. $a = ? \quad b = 12 \quad c = 37$

$a^2 + 12^2 = 37^2$

$a^2 + 144 = 1369$

$a^2 + 144 - 144 = 1369 - 144$

$a^2 = 1225$

$\sqrt{a^2} = \sqrt{1225}$

$a = 35$

REVIEW

1. a. Angle BIG and angle RIB are supplementary angles.

$$m\angle BIG + 61° = 180°$$
$$m\angle BIG + 61° - 61° = 180° - 61°$$
$$m\angle BIG = 119°$$

b. Angle RIB and angle TIG are vertical angles.

$m\angle TIG = 61°$

c. Angles RIH, HIT, and TIG have a sum of 180°.

$$80° + m\angle HIT + 61° = 180°$$
$$m\angle HIT + 141° = 180°$$
$$m\angle HIT + 141° - 141° = 180° - 141°$$
$$m\angle HIT = 39°$$

2. Angles can be found in different ways and in different orders. Some examples are shown below.

a. Angles 1 and 4 are vertical angles, so their measure is the same.

$m\angle 1 = 76°$

b. Angles 1 and 2 are supplementary angles, so their sum is 180°.

$$m\angle 2 + 76° = 180°$$
$$m\angle 2 + 76° - 76° = 180° - 76°$$
$$m\angle 2 = 104°$$

c. Angles 2 and 3 are vertical angles, so their measure is the same.

$m\angle 3 = 104°$

d. Angles 4 and 5 are alternate interior angles, so their measure is the same.

$m\angle 5 = 76°$

e. Angles 2 and 6 are corresponding angles, so their measure is the same.

$m\angle 6 = 104°$

f. Angles 6 and 7 are vertical angles, so their measure is the same.

$m\angle 7 = 104°$

g. Angles 1 and 8 are alternate exterior angles, so their measure is the same.

$m\angle 8 = 76°$

3. a. S
Adjacent angles are two angles that have the same vertex and a common side. They are not necessarily equal in measure.

b. S
Adjacent angles do not need to have a sum of 180° to share a vertex and a common side.

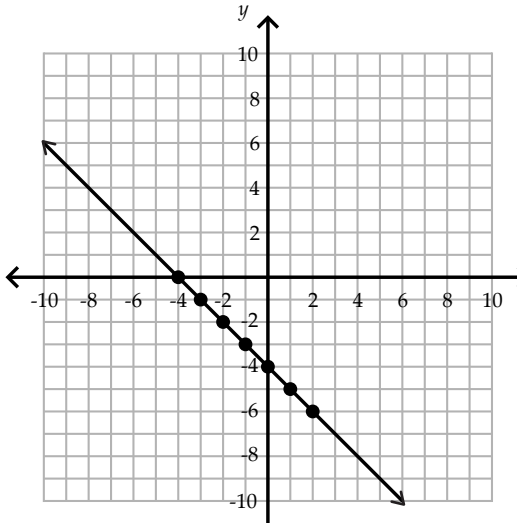
c. N
Complementary angles have a sum of 90°, which means that they do not have a sum of 180°.

d. A

e. A

4. The y-intercept is $(0,-4)$.

The slope is $m = -\frac{1}{1}$. Move down 1 and to the right 1 (or up 1 and to the left 1).



5. a. $\sqrt[3]{-1} = -1$

$\sqrt[3]{1} = 1$

$\sqrt[3]{-1} \neq \sqrt[3]{1}$

b. $3^2 = 9$

$(-3)^2 = 9$

$3^2 = (-3)^2$

c. $2^3 = 8$

$2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

$2^3 \neq 2^{-3}$

d. $(-1)^2 = 1$

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

$(-1)^2 = 1^{-2}$

Perimeter of Polygons

WARM-UP

$P = 4 \text{ in} + 5 \text{ in} + 3 \text{ in} + 4 \text{ in} = 16 \text{ in}$

PRACTICE

1. $P = 5s$

$60 = 5s$

$\frac{60}{5} = \frac{5s}{5}$

$12 = s$

12 cm

2. $P = 2l + 2w$

$50 = 2l + 2 \cdot 10$

$50 = 2l + 20$

$50 - 20 = 2l + 20 - 20$

$30 = 2l$

$\frac{30}{2} = \frac{2l}{2}$

$15 = l$

15 ft

3. $P = 2b + 2b + b$

$100 = 5b$

$\frac{100}{5} = \frac{5b}{5}$

$20 = b$

20 m

4. a. $P = 2l + 2w$

$210 = 2(3s) + 2(s + 1)$

$210 = 6s + 2s + 2$

$210 = 8s + 2$

$210 - 2 = 8s + 2 - 2$

$208 = 8s$

$\frac{208}{8} = \frac{8s}{8}$

$26 = s$

$3s = 3 \cdot 26 = 78$

Length: 78 ft

$s + 1 = 26 + 1 = 27$

Width: 27 ft

b. $P = 2l + 2w$

$228 = 2(3d) + 2(d + 10)$

$228 = 6d + 2d + 20$

$228 = 8d + 20$

$228 - 20 = 8d + 20 - 20$

$208 = 8d$

$\frac{208}{8} = \frac{8d}{8}$

$26 = d$

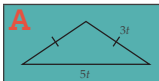
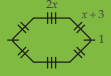
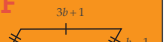
$3d = 3 \cdot 26 = 78$

Length: 78 ft

$d + 10 = 26 + 10 = 36$

Width: 36 ft

5.

A  The perimeter is 77 m.	**B** A rectangle has a length 3 times as long as the width. The perimeter is 48 m.	10 cm, 8 cm, 1 cm	8 in
6 m, 18 m	**C**  The perimeter is 54 cm.	7 cm	**D** A square has a perimeter of 28 cm.
5 in, 19 in	**E** An equilateral triangle has a perimeter of 24 in.	21 m, 35 m	**F**  The perimeter is 48 in.

Detailed work for matching boxes is shown below.

A
$$P = 3t + 3t + 5t$$
$$77 = 11t$$
$$\frac{77}{11} = \frac{11t}{11}$$
$$7 = t$$

$3t = 3 \bullet 7 = 21$
$5t = 5 \bullet 7 = 35$
21 m, 35 m

B
$$l = 3w$$
$$P = 2l + 2w$$
$$48 = 2(3w) + 2w$$
$$48 = 6w + 2w$$
$$48 = 8w$$
$$\frac{48}{8} = \frac{8w}{8}$$
$$6 = w$$

$3w = 3 \bullet 6 = 18$
6 m, 18 m

C
$$P = 2x + x + 3 + 1 + x + 3 + 2x + x + 3 + 1 + x + 3$$
$$54 = 8x + 14$$
$$54 - 14 = 8x + 14 - 14$$
$$40 = 8x$$
$$\frac{40}{8} = \frac{8x}{8}$$
$$5 = x$$

$x + 3 = 5 + 3 = 8$
$2x = 2 \bullet 5 = 10$
1 cm, 8 cm, 10 cm

D
$$P = 4s$$
$$28 = 4s$$
$$\frac{28}{4} = \frac{4s}{4}$$
$$7 = s$$

7 cm

E
$$P = 3t$$
$$24 = 3t$$
$$\frac{24}{3} = \frac{3t}{3}$$
$$8 = t$$

8 in

F
$$P = 2l + 2w$$
$$48 = 2(3b + 1) + 2(b - 1)$$
$$48 = 6b + 2 + 2b - 2$$
$$48 = 8b$$
$$\frac{48}{8} = \frac{8b}{8}$$
$$6 = b$$

$b - 1 = 6 - 1 = 5$
$3b + 1 = 3 \bullet 6 + 1 = 18 + 1 = 19$
5 in, 19 in

REVIEW

1. a. 6500

   b. 15000

2. a. The least common denominator of 3 and 50 is 150.

$$\frac{16}{50}=\frac{48}{150}$$

$$\frac{1}{3}=\frac{50}{150}$$

$$\frac{16}{50}<\frac{1}{3}$$

   b. Half of 46 is 23, and $22 < 23$.

$$\frac{22}{46}<\frac{1}{2}$$

3. $-\frac{1}{4}(8x-84y+200)$

$$=-\frac{1}{\cancel{4}}\cdot\cancel{8}^{2}x+\frac{1}{\cancel{4}}\cdot\cancel{84}^{21}y-\frac{1}{\cancel{4}}\cdot\cancel{200}^{50}$$

$$=-2x+21y-50$$

4. a. Note: Anything (except 0) to the 0 power is 1, so the first set of parentheses simplifies to 1.

$$\left(\frac{1}{8}-\frac{2}{17}\right)^{0}-\left[2\left(\frac{3}{2}-\frac{5}{4}\right)\div\frac{1}{6}\right]$$

$$=1-\left[2\left(\frac{6}{4}-\frac{5}{4}\right)\div\frac{1}{6}\right]$$

$$=1-\left[\cancel{2}\left(\frac{1}{\cancel{4}_{2}}\right)\div\frac{1}{6}\right]$$

$$=1-\left[\frac{1}{2}\div\frac{1}{6}\right]$$

$$=1-\left[\frac{1}{\cancel{2}}\cdot\frac{\cancel{6}^{3}}{1}\right]$$

$$=1-3$$

$$=-2$$

   b. $14\cdot 2-3^{2}\cdot 2\div 6$

$$=14\cdot 2-9\cdot 2\div 6$$

$$=28-18\div 6$$

$$=28-3$$

$$=25$$

5. a. 2

   b. $\frac{\frac{1}{2}\,\cancel{c}}{1}\cdot\frac{16\text{ Tbsp}}{1\,\cancel{c}}=8\text{ Tbsp}$

$$=8$$

Area of Polygons

WARM-UP

a. $\frac{2}{3}x = \frac{8}{9}$

$\frac{\cancel{3}}{\cancel{2}} \bullet \frac{\cancel{2}}{\cancel{3}} x = \frac{\overset{4}{\cancel{8}}}{\cancel{9}} \bullet \frac{\cancel{3}}{\cancel{2}}$

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

b. $30 - 3y = 3$

$30 - 3y - 30 = 3 - 30$

$-3y = -27$

$\frac{-3y}{-3} = \frac{-27}{-3}$

$y = 9$

PRACTICE

1. a. $b = 20$ ft, $h = 8$ ft

b. $b = 3$ m, $h = 1$ m

c. $b_1 = 2.5$ km

$b_2 = 4$ km

$h = 2$ km

(2.5 km and 4 km may be switched.)

2. a. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(24)(14)$

$A = \frac{1}{\cancel{2}}\left(\overset{12}{\cancel{24}}\right)(14)$

$A = 12 \bullet 14$

$A = 168$

168 mm^2

b. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(6)(4)$

$A = \frac{1}{\cancel{2}}\left(\overset{3}{\cancel{6}}\right)(4)$

$A = 3 \bullet 4$

$A = 12$

12 cm^2

c. $A = bh$

$A = 80 \bullet 60$

$A = 4800$

4,800 mm^2

d. $A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(8 + 12)16$

$A = \frac{1}{2}(20)16$

$A = (10)16$

$A = 160$

160 cm^2

3. a. $A = \frac{1}{2}bh$

$35 = \frac{1}{2}b(10)$

$35 = \frac{1}{2}(10)b$

$35 = 5b$

$\frac{35}{5} = \frac{5b}{5}$

$7 = b$

7 cm

b. $A = \frac{1}{2}bh$

$10 = \frac{1}{2}(5)h$

$10 = \frac{5}{2}h$

$\frac{2}{\cancel{5}} \cdot \overset{2}{\cancel{10}} = \frac{\cancel{5}}{\cancel{2}}h \cdot \frac{\cancel{2}}{\cancel{5}}$

$4 = h$

4 in

REVIEW

1. $a = 33$ in $\quad b = ? \quad c = 55$ in

$33^2 + b^2 = 55^2$

$1089 + b^2 = 3025$

$1089 + b^2 - 1089 = 3025 - 1089$

$b^2 = 1936$

$\sqrt{b^2} = \sqrt{1936}$

$b = 44$

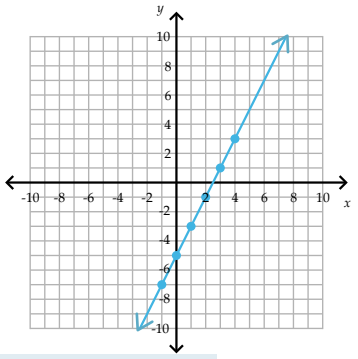
44 in

2. $12 \div 3 = 4$
$20 \div 5 = 4$
$36 \div 9 = 4$
$40 \div 10 = 4$

$y = 4x$

3. The y-intercept is $(0, -5)$.

The slope $m = 2 = \frac{2}{1}$. Move up 2 and to the right 1 (or down 2 and to the left 1).



4. a. $\angle 4, \angle 7, \angle 2, \angle 5$

b. $\angle 1$ & $\angle 8$, $\angle 5$ & $\angle 4$

5. $\frac{20}{100} \cdot 2\frac{1}{2} = \frac{1}{\cancel{5}} \cdot \frac{\cancel{5}}{2} = \frac{1}{2}$

Area and Circumference of Circles

WARM-UP

a. $P = 2l + 2w$

$P = 2(18) + 2(10)$

$P = 36 + 20$

$P = 56$

56 mm

b. $A = bh$

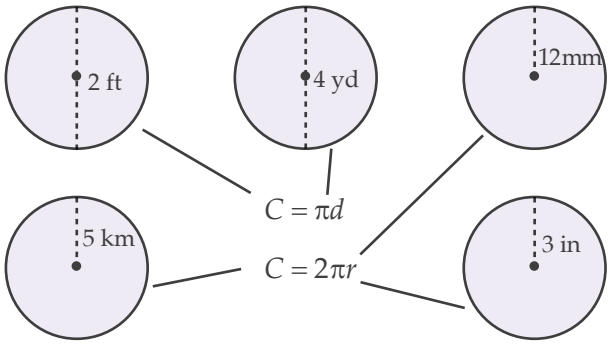
$A = (18)(8)$

$A = 144$

144 mm^2

PRACTICE

1.



2. a. $C = \pi d$

$C = 70\pi$

$C \approx 219.91$

219.91 cm

b. $C = 2\pi r$

$C = 2\pi(50)$

$C = 100\pi$

$C \approx 314.16$

314.16 cm

3. Area of a complete circle with radius 1 m:

$A = \pi r^2$

$A = \pi(1)^2$

$A = 1\pi$

$A \approx 3.14$

Area of the semicircle:

$A \approx 3.14 \div 2$

$A \approx 1.57$

1.57 m^2

Circumference of a circle with radius 1 m:

$C = 2\pi r$

$C = 2\pi(1)$

$C = 2\pi$

$C \approx 6.28$

Half of the circumference:

$6.28 \div 2 = 3.14$

Diameter:

$2r = 2 \bullet 1 = 2$

Perimeter of the semicircle (half of the circumference plus the diameter):

$P \approx 3.14 + 2 = 5.14$

5.14 m

4. a. Small pizza radius: $10 \text{ in} \div 2 = 5 \text{ in}$

$A = \pi r^2$

$A = \pi(5)^2$

$A = 25\pi$

$A \approx 78.54$

Small pizza area $\approx 78.54 \text{ in}^2$

Medium pizza radius: $12 \text{ in} \div 2 = 6 \text{ in}$

$A = \pi r^2$

$A = \pi(6)^2$

$A = 36\pi$

$A \approx 113.1$

Medium pizza area $\approx 113.1 \text{ in}^2$

Large pizza radius: $15 \text{ in} \div 2 = 7.5 \text{ in}$

$A = \pi r^2$

$A = \pi(7.5)^2$

$A = 56.25\pi$

$A \approx 176.71$

Large pizza area $\approx 176.71 \text{ in}^2$

b. $176.71 \text{ in}^2 \div 2 \approx 88.36 \text{ in}^2$

c. $88.36 \text{ in}^2 - 78.54 \text{ in}^2 = 9.82 \text{ in}^2$

Sue and her brother ate 9.82 in^2 more pizza.

5. a. $C = \pi d$

$C = 10\pi$

$C \approx 31.42$

31.42 in

b. $C = \pi d$

$C = 12\pi$

$C \approx 37.7$

37.7 in

c. $C = \pi d$

$C = 15\pi$

$C \approx 47.12$

47.12 in

d. Circumference eaten by Sue and her brother (half of a large pizza):
$47.12 \text{ in} \div 2 = 23.56 \text{ in}$

Circumference eaten by Sue's parents (small pizza): 31.42 in
$31.42 \text{ in} - 23.56 \text{ in} = 7.86 \text{ in}$

Sue's parents ate 7.86 in more crust.

REVIEW

1. $800 \text{ m} + 600 \text{ m} = 1{,}400 \text{ m}$

2. $800^2 + 600^2 = c^2$

$640000 + 360000 = c^2$

$1000000 = c^2$

$\sqrt{1000000} = \sqrt{c^2}$

$1000 = c$

1,000 m

3. Amount of decrease: $1400 \text{ m} - 1000 \text{ m} = 400 \text{ m}$

$400 \div 1400 \approx 0.29$

Percent decrease: 29%

4. $A = lw$

$A = 800 \bullet 600$

$A = 480000$

$480{,}000 \text{ m}^2$

5. $\frac{4}{\cancel{5}} \bullet \overset{96000}{\cancel{480000}} = 384000$

$384{,}000 \text{ m}^2$

6. $\frac{480000 \cancel{\text{m}} \bullet \cancel{\text{m}}}{1} \bullet \frac{1 \text{ km}}{1000 \cancel{\text{m}}} \bullet \frac{1 \text{ km}}{1000 \cancel{\text{m}}}$

$= \frac{480000 \text{ km} \bullet \text{km}}{1000000}$

$= 0.48 \text{ km}^2$

Composite Figures

WARM-UP

1. a. $0.6 = \frac{6}{10} = \frac{3}{5}$

   b. $1.25 = 1\frac{25}{100} = 1\frac{1}{4}$

   c. $0.02 = \frac{2}{100} = \frac{1}{50}$

2. a. $15 \cdot 4 = 60$
   $15 \cdot 0.4 = 6$

   b. $7 \cdot 11 = 77$
   $7 \cdot 1.1 = 7.7$

   c. $20 \cdot 5 = 100$
   $20 \cdot 0.5 = 10$

PRACTICE

1. a. Total length of right side of apartment:
   $14 \text{ ft} + 8 \text{ ft} + 14 \text{ ft} = 36 \text{ ft}$

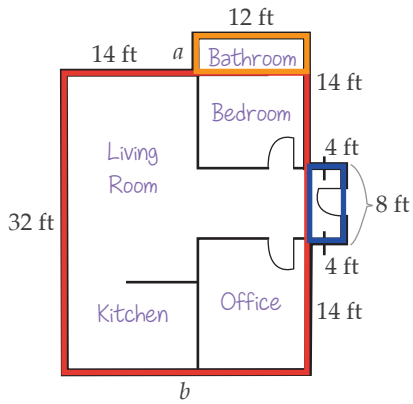
   $a = 36 \text{ ft} - 32 \text{ ft} = 4 \text{ ft}$

   b. $b = 14 \text{ ft} + 12 \text{ ft} = 26 \text{ ft}$

   c. $P = 32 + 14 + 4 + 12 + 14 + 4 + 8 + 4 + 14 + 26 = 132$

   132 feet

   d. The rectangles the apartment is split into may vary. An example is shown below with the apartment split into the three rectangles shown.



Area of large red rectangle (living room, kitchen, office, bedroom):
$l = 32 \text{ ft} \quad w = 26 \text{ ft}$
$A = lw$
$A = 32 \cdot 26$
$A = 832$

Area of orange rectangle (bathroom):
$l = 12 \text{ ft} \quad w = 4 \text{ ft}$
$A = lw$
$A = 12 \cdot 4$
$A = 48$

Area of blue rectangle (entry):
$l = 8 \text{ ft} \quad w = 4 \text{ ft}$
$A = lw$
$A = 8 \cdot 4$
$A = 32$

Area of apartment:
$832 + 48 + 32 = 912$
912 ft^2

2. a. Total length of top of office complex:
   $41 \text{ ft} + 20 \text{ ft} = 61 \text{ ft}$

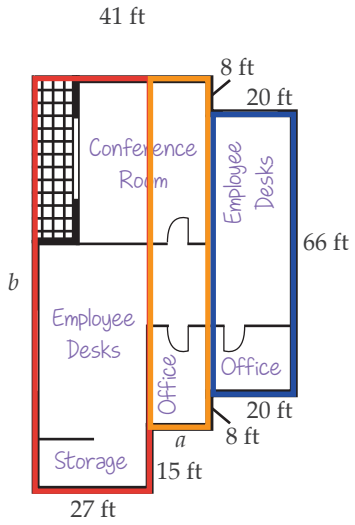
   $a = 61 \text{ ft} - 20 \text{ ft} - 27 \text{ ft} = 14 \text{ ft}$

   b. $b = 8 \text{ ft} + 66 \text{ ft} + 8 \text{ ft} + 15 \text{ ft} = 97 \text{ ft}$

c. $P = 97 + 41 + 8 + 20 + 66 + 20 + 8 + 14 + 15 + 27 = 316$

316 ft

d. The rectangles the office complex is split into may vary. An example is shown below with the office complex split into the three rectangles shown.



Area of left rectangle (red):
$l = 97$ ft $\quad w = 27$ ft
$A = lw$
$A = 97 \bullet 27$
$A = 2619$

Area of middle rectangle (orange):
$l = 97$ ft $- 15$ ft $= 82$ ft $\quad w = 14$ ft
$A = lw$
$A = 82 \bullet 14$
$A = 1148$

Area of right rectangle (blue):
$l = 66$ ft $\quad w = 20$ ft
$A = lw$
$A = 66 \bullet 20$
$A = 1320$

Area of office complex:
$2619 + 1148 + 1320 = 5087$
5,087 ft^2

3. a. The two semicircles make one complete circle. The perimeter of the composite shape includes the circumference of the circle and the left and right sides of the rectangle.

Circumference of circle:
$C = \pi d$
$C = 2\pi$
$C \approx 6.28$

Left and right sides of rectangle:
$4 + 4 = 8$

Perimeter of the composite shape:
$P = 6.28 + 8 = 14.28$
14.28 ft

The area of the composite shape includes the area of the circle and rectangle.

Area of circle:
$A = \pi r^2$
$A = \pi(1)^2$
$A = 1\pi$
$A \approx 3.14$

Area of rectangle:
$A = lw$
$A = 2 \bullet 4$
$A = 8$

Area of the composite shape:
$A = 3.14 + 8 = 11.14$
11.14 ft^2

b. The four semicircles make two complete circles. The perimeter of the composite shape includes the circumference of two circles and part of the perimeter of the parallelogram.

Circumference of one circle:
$C = \pi d$
$C = \pi(1)$
$C = \pi$
$C \approx 3.14$

Perimeter of parallelogram (not counting the portions connected to the semicircles):

$P = 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 = 8$

Perimeter of composite shape:
$P = 3.14 + 3.14 + 8 = 14.28$
14.28 ft

The area of the composite shape includes the area of two circles and the area of the parallelogram.

Area of one circle:

$A = \pi r^2$

$A = \pi(0.5)^2$

$A = 0.25\pi$

$A \approx 0.79$

Area of parallelogram:

$b = 1 \text{ ft} + 1 \text{ ft} + 1 \text{ ft} = 3 \text{ ft} \quad h = 2.5 \text{ ft}$

$A = bh$

$A = 3 \bullet 2.5$

$A = 7.5$

Area of composite shape:

$A = 0.79 + 0.79 + 7.5 = 9.08$

9.08 ft^2

REVIEW

1. a. Shorter walls: $l = 12$ ft $w = 8$ ft

$A = lw$

$A = 12 \bullet 8$

$A = 96$

Longer walls: $l = 13$ ft $w = 8$ ft

$A = lw$

$A = 13 \bullet 8$

$A = 104$

Total area of the walls (two shorter walls and two longer walls):

$A = 96 + 96 + 104 + 104 = 400$

400 ft^2

b. $400 \text{ ft}^2 \bullet 2 = 800 \text{ ft}^2$

$$\frac{400 \text{ ft}^2}{1 \text{ gal paint}} = \frac{800 \text{ ft}^2}{x \text{ gal paint}}$$

$$\frac{400}{1} = \frac{800}{x}$$

$$400x = 800$$

$$\frac{400x}{400} = \frac{800}{400}$$

$$x = 2$$

2 gallons of paint

2. Each point is moved left 3 units and down 4 units. The x-coordinate decreases by 3, and the y-coordinate decreases by 4.

Preimage	$(-1,1)$	$(4,8)$	$(3,-5)$
Image	$(-4,-3)$	$(1,4)$	$(0,-9)$

3. a. 10% of 260 is 26.

$26 \div 2 = 13$

$26 + 13 = 39$

15% of 260 = 39

b. 10% of 500 is 50.

$50 \div 2 = 25$

$50 + 25 = 75$

15% of 500 = 75

4. a. $-23 - (-23) = -23 + 23 = 0$

b. $-597 + (-228)$

Same sign; add absolute values.

$$\begin{array}{r} {\scriptstyle 1\,1} \\ 597 \\ +\ 228 \\ \hline 825 \end{array}$$

Answer is negative.

$-597 + (-228) = -825$

Inscribed Shapes

WARM-UP

a. $P = 5a$

$40 = 5a$

$\frac{40}{5} = \frac{5a}{5}$

$8 = a$

8 km

b. $\frac{(n-2)180°}{n}$

$= \frac{(5-2)180°}{5}$

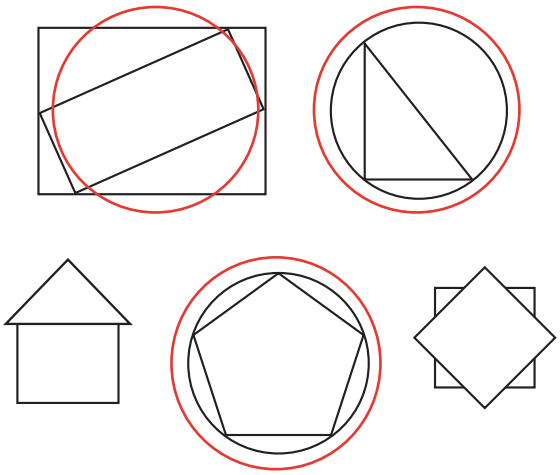
$= \frac{(3)180°}{5}$

$= \frac{540°}{5}$

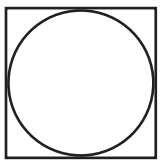
$= 108°$

PRACTICE

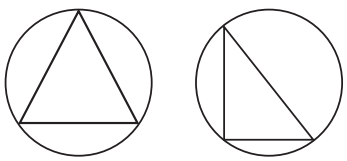
1.



2.



3. Answers may vary. The triangle should touch the circle at each vertex of the triangle. Two examples are given.



4. a. $A = s^2$

$A = 4^2$

$A = 16$

16 ft^2

b. $r = 4 \text{ ft} \div 2 = 2 \text{ ft}$

$A = \pi r^2$

$A = \pi(2)^2$

$A = 4\pi$

$A \approx 12.57$

12.57 ft^2

c. $16 - 12.57 = 3.43$

3.43 ft^2

5. a. $A = s^2$

$A = 7^2$

$A = 49$

49 in^2

b. $A = s^2$

$A = 5^2$

$A = 25$

25 in^2

c. $49 - 25 = 24$

24 in^2

6. a. $A = \frac{1}{2}bh$

$A = \frac{1}{2}(20)(10)$

$A = \frac{1}{\cancel{2}}\left(\cancel{20}^{10}\right)(10)$

$A = 100$

100 cm^2

b. $r = 20 \text{ cm} \div 2 = 10 \text{ cm}$

$A = \pi r^2$

$A = \pi(10)^2$

$A = 100\pi$

$A \approx 314.16$

314.16 cm^2

c. $314.16 - 100 = 214.16$

214.16 cm^2

REVIEW

1. Area of rectangle:
$l = 5$ in $\quad w = 2$ in

$A = lw$

$A = 5 \bullet 2$

$A = 10$

10 in^2

Area of one triangle:
$b = 2 \quad h = 2$

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(2)(2)$

$A = \frac{1}{\cancel{2}}\left(\cancel{2}^{1}\right)(2)$

$A = 2$

2 in^2

Area of composite figure:
$A = 10 + 2 + 2 = 14$

14 in^2

2. $P = 6.2 + 8.7 + 3.6 + x + 10.7$

$34.7 = 29.2 + x$

$34.7 - 29.2 = 29.2 + x - 29.2$

$5.5 = x$

5.5 cm

3. a Point A: $-3\frac{3}{6} = -3\frac{1}{2}$

b. Point B: $-2\frac{4}{6} = -2\frac{2}{3}$

c. Point C: $-2\frac{1}{6}$

4. a. $34.4 = 8a$

$\frac{34.4}{8} = \frac{8a}{8}$

$4.3 = a$

b. $25 + b = -59.22$

$25 + b - 25 = -59.22 - 25$

$b = -84.22$

5. a. $\frac{7 \cancel{\text{ days}}}{1 \text{ week}} \bullet \frac{24 \text{ hours}}{1 \cancel{\text{ day}}} = 168$ hours per week

168 hours

b. $\frac{14}{168} = \frac{7}{84} = \frac{1}{12}$

Mixed Review

Function 1:

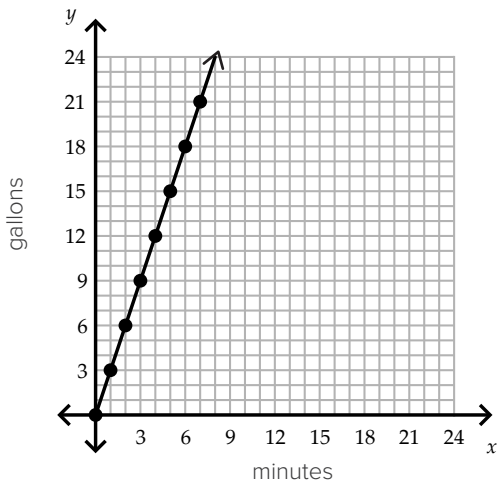
x (minutes)	y (gallons)
0	0
1	3
2	$2 \bullet 3 = 6$
3	$3 \bullet 3 = 9$
4	$4 \bullet 3 = 12$
5	$5 \bullet 3 = 15$
6	$6 \bullet 3 = 18$
7	$7 \bullet 3 = 21$

$y = 3x$

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

y-intercept: $(0,0)$

Plot the y-intercept. Use the slope to move up 3 and to the right 1.



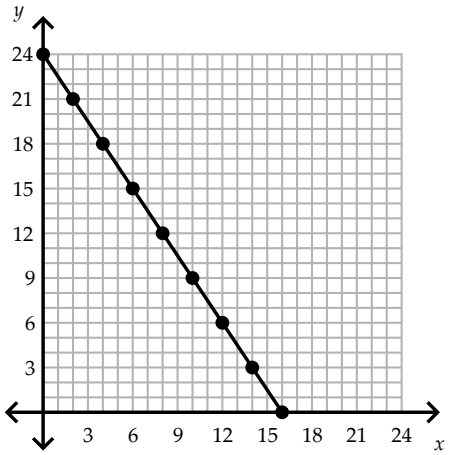
Function 2:

x	y
0	$-\frac{3}{2}(0) + 24 = 0 + 24 = 24$
2	$-\frac{3}{\cancel{2}}(\cancel{2}) + 24 = -3 + 24 = 21$
4	$-\frac{3}{\cancel{2}}(\overset{2}{\cancel{4}}) + 24 = -6 + 24 = 18$
6	$-\frac{3}{\cancel{2}}(\overset{3}{\cancel{6}}) + 24 = -9 + 24 = 15$
8	$-\frac{3}{\cancel{2}}(\overset{4}{\cancel{8}}) + 24 = -12 + 24 = 12$
10	$-\frac{3}{\cancel{2}}(\overset{5}{\cancel{10}}) + 24 = -15 + 24 = 9$
12	$-\frac{3}{\cancel{2}}(\overset{6}{\cancel{12}}) + 24 = -18 + 24 = 6$
14	$-\frac{3}{\cancel{2}}(\overset{7}{\cancel{14}}) + 24 = -21 + 24 = 3$
16	$-\frac{3}{\cancel{2}}(\overset{8}{\cancel{16}}) + 24 = -24 + 24 = 0$

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

y-intercept: $(0,24)$

Plot the y-intercept $(0,24)$. Use the slope to move down 3 and to the right 2.



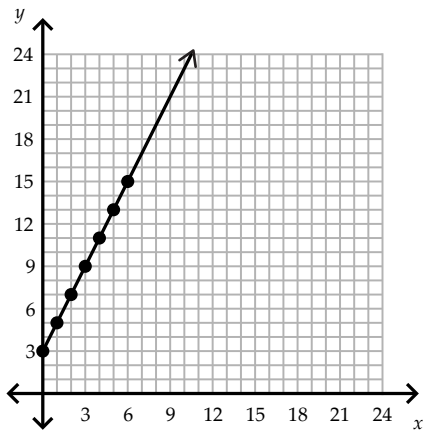
Contexts will vary. The context can relate to the original situation in any way. Some examples are below.

Example context: The pool empties at a rate of 3 gallons every 2 minutes. It starts with 24 gallons of water and is empty after 16 minutes.

Example context: Jude is cleaning leaves out of a pool. There are 24 leaves in the pool when he starts cleaning. He cleans out 3 leaves every 2 minutes. It takes Jude 16 minutes to clean all the leaves out of the pool.

Function 3:

x	y	
0	3	$(0,3)$
1	5	$(1,5)$
2	7	$(2,7)$
3	9	$(3,9)$
4	11	$(4,11)$
5	13	$(5,13)$
6	15	$(6,15)$



$m = \frac{\text{rise}}{\text{run}} = \frac{2}{1} = 2$

y-intercept: $(0,3)$

$y = 2x + 3$

Contexts will vary. The context can relate to the original situation in any way. Some examples are below.

Example context: Jude had 3 dollars saved when he started working with his dad. His dad paid him 2 dollars an hour.

Example context: A client's pool has 3 feet of water in it at the start of the work day. Jude begins to fill the pool at a rate of 2 feet per minute.

Function 4:

x	y
0	24
1	21
2	18
3	15
4	12
5	9
6	6
7	3
8	0

$m = \frac{\text{rise}}{\text{run}} = -\frac{3}{1} = -3$

y-intercept: $(0, 24)$

$y = -3x + 24$

a. The value of y is 0 when x is 8.
8 pools

b. 24 tablets • 12 = 288 tablets

c. 8 pools • 12 = 96 pools

Unit 3 Review

1. a. $15 \div 45 = \frac{1}{3}$

1 cm : 3 m

b. $\frac{1 \text{ cm}}{3 \text{ m}} = \frac{x \text{ cm}}{30 \text{ m}}$

$\frac{1}{3} = \frac{x}{30}$

$1 \bullet 30 = 3x$

$30 = 3x$

$\frac{30}{3} = \frac{3x}{3}$

$10 = x$

10 cm

2. a. direct

The variables (kiwi vines and fruit) increase together at a constant rate.

b. $k = 20$

$100 \div 20 = 5$

5 vines

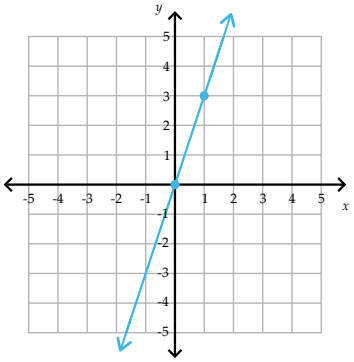
c. inverse

As one variable increases (number of people), the other variable decreases (work time).

3. a. $k = \frac{y}{x} = \frac{3}{1} = 3$

b. $y = 3x$

c. When $x = 1$, $y = 3$. The graph is a line that goes through the origin and $(1,3)$.



4. a. $(4,0)$

b. $(0,2)$

c. negative

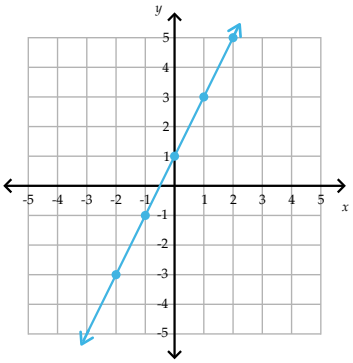
The slope is moving down from left to right.

d. $m = \frac{\text{rise}}{\text{run}} = -\frac{1}{2}$

e. $y = -\frac{1}{2}x + 2$

5. a.

x	y	
-2	$2(-2)+1 = -4+1 = -3$	$(-2,-3)$
-1	$2(-1)+1 = -2+1 = -1$	$(-1,-1)$
0	$2(0)+1 = 0+1 = 1$	$(0,1)$
1	$2(1)+1 = 2+1 = 3$	$(1,3)$
2	$2(2)+1 = 4+1 = 5$	$(2,5)$



b. no

The graph does not go through the origin.

c. yes

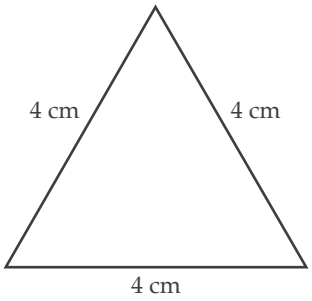
It is a straight line.

6. a. Note: Student measurements should be within a few degrees of these answers.

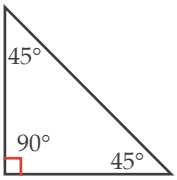
$m\angle C = 50°$

$m\angle F = 120°$

b. Triangle may vary in orientation but should have accurate side lengths.



c. Triangle may vary in orientation and size but should have accurate angle measurements.



d. acute and scalene

obtuse and isosceles

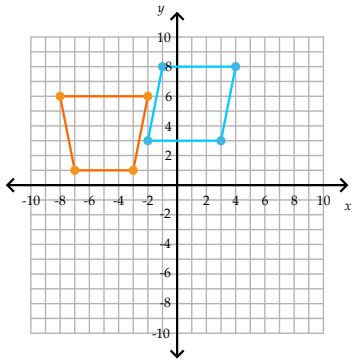
acute and equilateral

right and isosceles

7. a. The x-value increases by 8 units.

Preimage	Image
$(-10,3)$	$(-2,3)$
$(-5,3)$	$(3,3)$
$(-4,8)$	$(4,8)$
$(-9,8)$	$(-1,8)$

The blue parallelogram is the answer for Part A. The orange trapezoid is the answer for Part B.



b. The x-value stays the same. The y-value changes its sign.

Preimage	Image
$(-8,-6)$	$(-8,6)$
$(-7,-1)$	$(-7,1)$
$(-3,-1)$	$(-3,1)$
$(-2,-6)$	$(-2,6)$

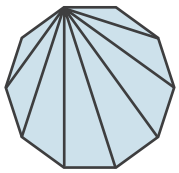
c. 2

A vertical and horizontal line of symmetry can be drawn.

d. 4

The quinoa plot can be rotated four times and still look the same.

8. a. Answers may vary. An example is shown below.



b. 8

c. $(n-2)180°$

$(10-2)180°$

$=(8)180°$

$=1440°$

d. $1440° \div 10 = 144°$

9. $4x + 4x + 112° + 112° = 360°$

$8x + 224° = 360°$

$8x + 224° - 224° = 360° - 224°$

$8x = 136°$

$\frac{8x}{8} = \frac{136°}{8}$

$x = 17°$

$m\angle C = 4x = 4 \bullet 17 = 68°$

10. a. $90°$

b. $180°$

11. Angles can be found in different ways and in different orders. Some examples are shown below.

a. vertical angles, equal measure

$t = 73°$

b. alternate interior angles, equal measure

$v = 118°$

c. complementary angles

$x + 27° = 90°$

$x + 27° - 27° = 90° - 27°$

$x = 63°$

d. supplementary angles

$y + 69° = 180°$

$y + 69° - 69° = 180 - 69°$

$y = 111°$

e. Angle a and the 40° angle form a pair of vertical angles with the 74° angle.

$a + 40° = 74°$

$a + 40° - 40° = 74° - 40°$

$a = 34°$

Angle b and the 74° angle are supplementary.

$b + 74° = 180°$

$b + 74° - 74° = 180° - 74°$

$b = 106°$

Angles b and c are vertical angles.

$c = 106°$

12. $a = 3$ dm $\quad b = ?$ $\quad c = 5$ dm

$3^2 + b^2 = 5^2$

$9 + b^2 = 25$

$9 + b^2 - 9 = 25 - 9$

$b^2 = 16$

$\sqrt{b^2} = \sqrt{16}$

$b = 4$

4 dm

13. $P = 2l + 2w$

$46 = 2(2g) + 2(g - 1)$

$46 = 4g + 2g - 2$

$46 = 6g - 2$

$46 + 2 = 6g - 2 + 2$

$48 = 6g$

$\frac{48}{6} = \frac{6g}{6}$

$8 = g$

$2g = 2 \bullet 8 = 16$

Length: 16 m

$g - 1 = 8 - 1 = 7$

Width: 7 m

14. a. $A = \frac{1}{2}bh$

$A = \frac{1}{\cancel{2}}\left(\overset{3}{\cancel{6}}\right)(6)$

$A = (3)(6)$

$A = 18$

Area: 18 m^2

b. $A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(8 + 12)3$

$A = \frac{1}{\cancel{2}}\left(\overset{10}{\cancel{20}}\right)3$

$A = (10)3$

$A = 30$

Area: 30 m^2

15. $r = 2 \text{ m} \div 2 = 1 \text{ m}$

Area of complete circle:

$A = \pi r^2$

$A = \pi(1)^2$

$A = \pi$

$A \approx 3.14$

Area of semicircle:

$3.14 \div 2 = 1.57$

1.57 m^2

Circumference of complete circle:

$C = \pi d$

$C = \pi(2)$

$C = 2\pi$

$C \approx 6.28$

Divide the circumference in half:

$6.28 \div 2 = 3.14$

Add the length of the diameter:

$P = 3.14 + 2 = 5.14$

5.14 m

16. a. The height of the triangle is the radius of the circle.

$50 \text{ cm} \div 2 = 25 \text{ cm}$

Area of triangle:

$A = \frac{1}{2}bh$

$A = \frac{1}{\cancel{2}}\left(\overset{25}{\cancel{50}}\right)(25)$

$A = (25)(25)$

$A = 625$

625 cm^2

Area of square (two triangles):

$625 \bullet 2 = 1250$

1,250 cm^2

b. Area of circle:

$A = \pi r^2$

$A = \pi(25)^2$

$A = 625\pi$

$A \approx 1963.5$

Area of table not covered:

$1963.5 - 1250 = 713.5$

713.5 cm^2

Unit 3 Assessment

Note to parent/teacher: This assessment covers concepts taught in Unit 3. Problems are designed to assess multiple skills. If a problem is missed, show the student the answer and allow him or her time to find the error. Often, students can correct mistakes when checking their work. If the student still has difficulty, have him or her revisit the corresponding lesson for review. Corresponding lesson numbers are listed in the course book at the end of each problem.

1. $\frac{1 \text{ cm}}{117 \text{ mi}} = \frac{21 \text{ cm}}{x \text{ mi}}$

$\frac{1}{117} = \frac{21}{x}$

$1x = 117 \cdot 21$

$x = 2457$

2,457 mi

2. a. direct

The quotient of y and x is always the same value. Both variables increase.

$18 \div 3 = 6$

$48 \div 8 = 6$

$60 \div 10 = 6$

$84 \div 14 = 6$

$k = 6$

b. inverse

The product of x and y is always the same value. As x increases, y decreases.

$66 \cdot 1 = 66$

$22 \cdot 3 = 66$

$11 \cdot 6 = 66$

$6 \cdot 11 = 66$

$k = 66$

3. a. yes

It is a straight line that goes through the origin. The point with an x-value of 1 is $(1,-3)$.

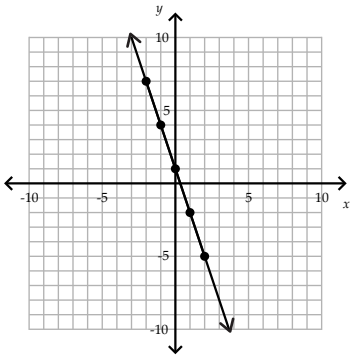
$k = -3$

b. no

It is not a straight line.

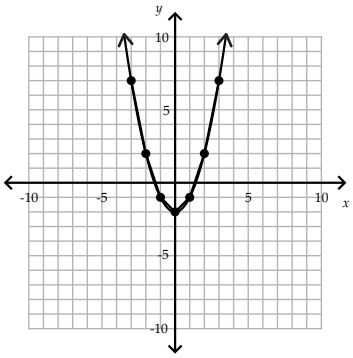
4. a.

x	y	
-2	$-3(-2)+1=6+1=7$	$(-2,7)$
-1	$-3(-1)+1=3+1=4$	$(-1,4)$
0	$-3(0)+1=0+1=1$	$(0,1)$
1	$-3(1)+1=-3+1=-2$	$(1,-2)$
2	$-3(2)+1=-6+1=-5$	$(2,-5)$



b.

x	y	
-3	$(-3)^2-2=9-2=7$	$(-3,7)$
-2	$(-2)^2-2=4-2=2$	$(-2,2)$
-1	$(-1)^2-2=1-2=-1$	$(-1,-1)$
0	$0^2-2=0-2=-2$	$(0,-2)$
1	$1^2-2=1-2=-1$	$(1,-1)$
2	$2^2-2=4-2=2$	$(2,2)$
3	$3^2-2=9-2=7$	$(3,7)$



5. a. $m = \frac{\text{rise}}{\text{run}} = \frac{-3}{1}$

Slope: -3

y-intercept: $(0,5)$

Equation: $y = -3x + 5$

b. $m = \frac{\text{rise}}{\text{run}} = \frac{2}{3}$

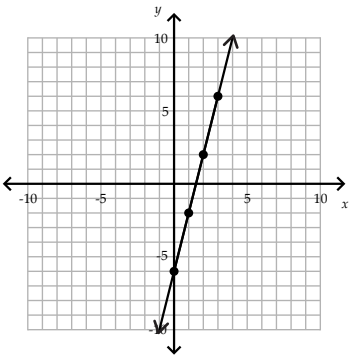
Slope: $\frac{2}{3}$

y-intercept: $(0,1)$

Equation: $y = \frac{2}{3}x + 1$

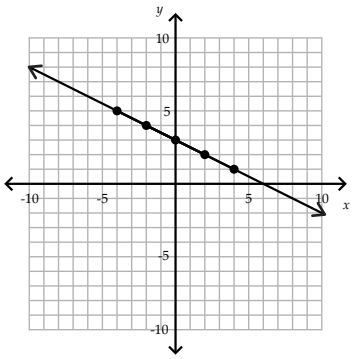
6. a. The y-intercept is $(0,-6)$.

$m = 4$ Move up 4 and right 1.



b. The y-intercept is $(0,3)$.

$m = -\frac{1}{2}$ Move down 1 and right 2 (or up 1 and left 2).



7. Since $0 + 3 = 3$, the rule could be "Add 3 to the input." Check the other input/output pairs.

$0 + 3 = 3$ ✓

$1 + 3 = 4$ ✓

$3 + 3 = 6$ ✓

$4 + 3 = 7$ ✓

Rule: Add 3 to the input.

$2 + 3 = 5$

x	y
0	3
1	4
2	5
3	6
4	7

Equation: $y = x + 3$

8. a. no

The graph fails the vertical line test.

b. yes

The graph passes the vertical line test.

9. 37°

$106° + 37° + 37° = 180°$

10. a. no

$4 + 11 = 15$ ◄— not greater than 15

The sum of two sides is not greater than the third side.

b. yes

$30+40=70 \quad 70>50$

$30+50=80 \quad 80>40$

$40+50=90 \quad 90>30$

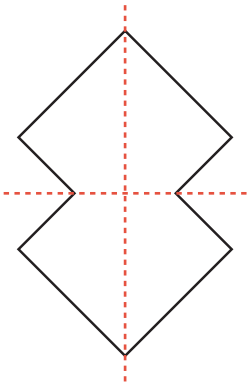
The sum of any two sides is greater than the third side.

c. no

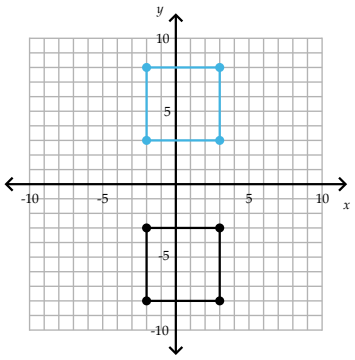
$7+3=10$ ← not greater than 12

The sum of two sides is not greater than the third side.

11. 2

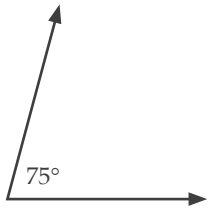


12. The x-values stay the same. The y-values switch signs.

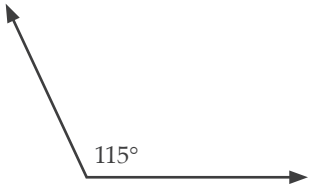


Preimage	Image
$(-2,8)$	$(-2,-8)$
$(-2,3)$	$(-2,-3)$
$(3,3)$	$(3,-3)$
$(3,8)$	$(3,-8)$

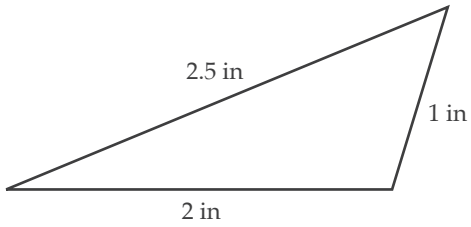
13. a.



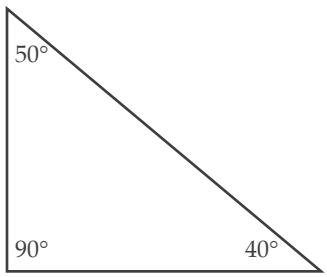
b.



14. a.



b.



15. $n=6$

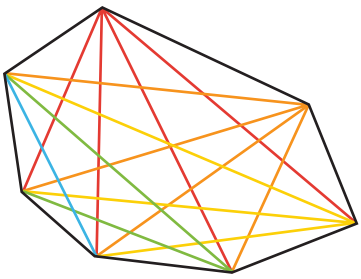
$(n-2)180°$

$(6-2)180°$

$=(4)180°$

$=720°$

16.



14 diagonals

17. $4x + 3x + 5° + 2x + 130° = 360°$

$9x + 135° = 360°$

$9x + 135° - 135° = 360° - 135°$

$9x = 225°$

$\frac{9x}{9} = \frac{225°}{9}$

$x = 25°$

$4 \bullet 25° = 100°$

$m\angle C = 100°$

$3(25°) + 5° = 75° + 5° = 80°$

$m\angle O = 80°$

$2 \bullet 25° = 50°$

$m\angle A = 50°$

18. $c + 30° = 90°$

$c + 30° - 30° = 90° - 30°$

$c = 60°$

19. Angles can be found in different ways and in different orders. Some examples are shown below.

Angle a and the 132° angle are supplementary angles.

$a + 132° = 180°$

$a + 132° - 132° = 180° - 132°$

$a = 48°$

Angle c and the 132° angle are vertical angles.

$c = 132°$

Angles d and a are vertical angles.

$d = 48°$

Angles e and a are corresponding angles.

$e = 48°$

Angles c and f are alternate interior angles.

$f = 132°$

Angle g and the 132° angle are alternate exterior angles.

$g = 132°$

Angles h and d are corresponding angles.

$h = 48°$

20. Angles can be found in different ways and in different orders. Some examples are shown below.

Angle x and the 43° angle form a vertical angle with the 85° angle.

$x + 43° = 85°$

$x + 43° - 43° = 85° - 43°$

$x = 42°$

Angle y, the 85° angle, and the 77° angle form a straight line.

$y + 77° + 85° = 180°$

$y + 162° = 180°$

$y + 162° - 162° = 180° - 162°$

$y = 18°$

Angle z, the 61° angle, the 43° angle, and angle x form a line.

$z + 61° + 43° + 42° = 180°$

$z + 146° = 180°$

$z + 146° - 146° = 180° - 146°$

$z = 34°$

21. $a = 3 \quad b = 4 \quad c = ?$

$3^2 + 4^2 = c^2$

$9 + 16 = c^2$

$25 = c^2$

$\sqrt{25} = \sqrt{c^2}$

$5 = c$

5 feet

22. $P = 6x$

$72 = 6x$

$\frac{72}{6} = \frac{6x}{6}$

$12 = x$

12 feet

23. $A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(4+6)2$

$A = \frac{1}{\cancel{2}}\left(\overset{5}{\cancel{10}}\right)2$

$A = (5)2$

$A = 10$

10 cm^2

24. There are two semicircles with a diameter of 6 cm. The two semicircles form a circle. The radius of the circle is 3 cm.

$A = \pi r^2$

$A = \pi(3)^2$

$A = 9\pi$

$A \approx 28.27$

28.27 cm^2

Area of rectangle:

$l = 6 + 1 + 1 = 8 \qquad w = 1$

$A = lw$

$A = 8 \bullet 1$

$A = 8$

8 cm^2

Area of composite shape:

28.27 cm^2 + 8 cm^2 = 36.27 cm^2

25. Area of square:

$A = s^2$

$A = 5^2$

$A = 25$

25 in^2

Area of circle:

$A = \pi r^2$

$A = \pi(2.5)^2$

$A = 6.25\pi$

$A \approx 19.63$

19.63 in^2

Remaining area:

25 – 19.63 = 5.37

5.37 in^2

Enrichment: Circumference and Diameter

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

Part 1

Items 1, 2, and 3: Answers may vary for students' measured circles. An example is given below.

Item 1: top of a mug

Circumference: 11 in

Diameter: 3.5 in

Ratio: $\frac{C}{d} = \frac{11}{3.5} \approx 3.1429$

1. Students may notice that the ratio quotients are very close to each other. Students may also notice that the quotient is close to the value of pi.

2. $C = \pi d$

$\frac{C}{d} = \frac{\pi d}{d}$

$\frac{C}{d} = \pi$

$\pi = \frac{C}{d}$

Part 2

First Circle:

2. a. Radius: 3 in
   b. Diameter: 6 in
   c. Circumference: 6π in

12. a. The radius is approximately the same length as BC.
   b. Half of the circumference is approximately the same length as AB.

Second Circle:

8. Students may now notice that AB is approximately half of the circumference, and BC is approximately the length of the radius.

Third Circle:

8. Half of the circumference is colored in each color.

9. Side AB is approximately half of the circumference of the circle.

10. 3 inches (It is the radius of the circle.)

11. Side BC is approximately the length of the radius of the circle.

12. a. Length: $AB \approx \frac{1}{2}C$
   b. Width: $BC \approx r$
   c. $A = lw = AB \bullet BC \approx \frac{1}{2}C \bullet r$

Scale Factor with Area

WARM-UP

$5^2 + 12^2 = x^2$

$25 + 144 = x^2$

$169 = x^2$

$\sqrt{169} = \sqrt{x^2}$

$13 = x$

13 ft

PRACTICE

1. Actual

Width: 6 m Length: 10 m

Area: $A = lw = 6 \bullet 10 = 60$

Model

Width: $\cancel{6}^{3}\ \text{m} \bullet \frac{1}{\cancel{20}_{10}} = \frac{3}{10}\ \text{m}$

Length: $\cancel{10}\ \text{m} \bullet \frac{1}{\cancel{20}_{2}} = \frac{1}{2}\ \text{m}$

Area:

$A = lw$

$A = \frac{3}{10} \bullet \frac{1}{2}$

$A = \frac{3}{20}$

	Width	Length	Area
Actual	6 m	10 m	60 m^2
Model	$\frac{3}{10}$ m	$\frac{1}{2}$ m	$\frac{3}{20}$ m^2

2. Actual

Radius: 20 ft

The area is one-fourth of the area of a circle with the same radius.

Area of circle:

$A = \pi r^2$

$A = \pi(20)^2$

$A = 400\pi$

$A \approx 1256.64$

Area of sandbox:

$A = 1256.64 \div 4 = 314.16$

Model

Radius: $20\ \text{ft} \bullet \frac{1}{2} = 10\ \text{ft}$

The area is one-fourth of the area of a circle with the same radius.

Area of circle:

$A = \pi r^2$

$A = \pi(10)^2$

$A = 100\pi$

$A \approx 314.16$

Area of sandbox:

$A = 314.16 \div 4 = 78.54$

	Radius	Area
Actual	20 ft	314.16 ft^2
Model	10 ft	78.54 ft^2

3. a. 100 cm = 1 m

$40 \div 100 = 0.4$

Length: 0.4 m

$35 \div 100 = 0.35$

Width: 0.35 m

b. $8 \div 0.4 = 20$

$7 \div 0.35 = 20$

Scale factor: 20

c. $A = lw$

$A = 0.4 \bullet 0.35$

$A = 0.14$

0.14 m^2

d. $A = lw$

$A = 8 \bullet 7$

$A = 56$

56 m^2

e. $56 \div 0.14 = 400$

Scale factor: 400

4. a. $6 \div 4 = 1.5$

Scale factor: 1.5

b. City:

$A = \pi r^2$

$A = \pi(6)^2$

$A = 36\pi$

$A \approx 113.1$

113.1 yd^2

Park:

$A = \pi r^2$

$A = \pi(4)^2$

$A = 16\pi$

$A \approx 50.27$

50.27 yd^2

c. $113.1 \div 50.27 = 2.25$

Scale factor: 2.25

5. a. $\frac{5}{20} = \frac{1}{4}$

$\frac{12}{48} = \frac{1}{4}$

Scale factor: $\frac{1}{4}$

b. $\frac{30}{480} = \frac{1}{16}$

Scale factor: $\frac{1}{16}$

c. The scale factor of the area is the square of the scale factor of the dimensions. One-fourth squared is one-sixteenth.

REVIEW

1. $7.5-(-14.5)=7.5+14.5=22$

2. $42<15x-3$

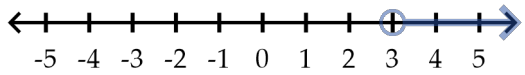
$42+3<15x-3+3$

$45<15x$

$\frac{45}{15}<\frac{15x}{15}$

$3<x$

$x>3$



3. a. $5 \cdot 2=10$

$2.5 \cdot 4=10$

$1 \cdot 10=10$

inversely proportional

b. $6 \div 3=2$ $\quad 3 \cdot 6=18$

$7 \div 4=1.75$ $\quad 4 \cdot 7=28$

$8 \div 5=1.6$ $\quad 5 \cdot 8=40$

not proportional

c. $8 \div 2=4$

$16 \div 4=4$

$24 \div 6=4$

directly proportional

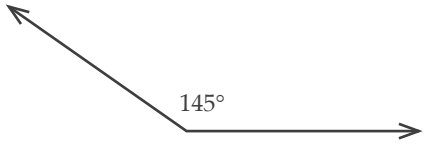
4. Since 112 is even, the numbers must be even to have a product of 112. Test even numbers with a sum of 22.

$8+14=22$

$8 \cdot 14=112$

8 and 14

5. a.



b. $145°+x=180°$

$145°+x-145°=180°-145°$

$x=35°$

Arcs and Sectors

WARM-UP

a. $C = \pi d$

$C = 7.8\pi$

$C \approx 24.5$

24.5 mm

b. $r = 7.8 \text{ mm} \div 2 = 3.9 \text{ mm}$

$A = \pi r^2$

$A = \pi(3.9)^2$

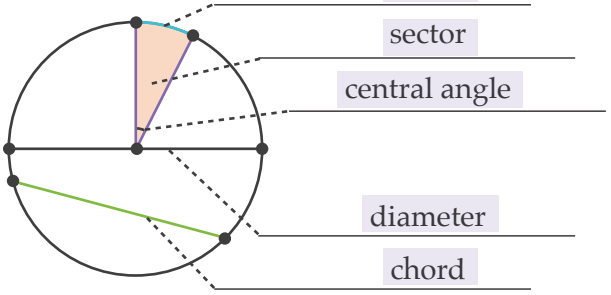
$A = 15.21\pi$

$A \approx 47.78$

47.8 mm^2

PRACTICE

1.



2. a. $\frac{90°}{360°} = \frac{1}{4}$

b. $\frac{72°}{360°} = \frac{1}{5}$

3. a. $x = 360° - 72° = 288°$

$\frac{x}{360°} = \frac{288°}{360°} = \frac{4}{5}$

b. $x = 360° - 300° = 60°$

$\frac{x}{360°} = \frac{60°}{360°} = \frac{1}{6}$

4. a. $\frac{m\angle ABC}{360°} = \frac{120°}{360°} = \frac{1}{3}$

$\frac{1}{3} \cdot 18.85 \approx 6.28$

Length of $\overset{\frown}{AC}$: 6.28 cm

$\frac{1}{3} \cdot 28.27 \approx 9.42$

Area of the shaded sector: 9.42 cm^2

b. $\frac{m\angle DEF}{360°} = \frac{60°}{360°} = \frac{1}{6}$

$\frac{1}{6} \cdot 31.42 \approx 5.24$

Length of $\overset{\frown}{DF}$: 5.24 ft

$\frac{1}{6} \cdot 78.54 \approx 13.09$

Area of the shaded sector: 13.09 ft^2

5. a. $A = \pi r^2$

$A = \pi(6)^2$

$A = 36\pi$

$A \approx 113.1$

113.1 in^2

b. $\frac{3}{12} = \frac{1}{4}$

c. $\frac{1}{4} \bullet 113.1 = 28.3$

28.3 in^2

d. $C = 2\pi r$

$C = 2\pi(6)$

$C = 12\pi$

$C \approx 37.7$

37.7 in

e. $\frac{1}{12}$

f. $\frac{1}{12} \bullet 37.7 = 3.1$

3.1 in

REVIEW

1. Area

Area of trapezoid:

$A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(5.2 + 3)1.3$

$A = \frac{1}{2}(8.2)1.3$

$A = 5.33$

5.33 cm^2

The area of the semicircle is half of the area of a full circle with a radius of 2.6 cm.

Area of circle:

$A = \pi r^2$

$A = \pi(2.6)^2$

$A = 6.76\pi$

$A \approx 21.24$

21.24 cm^2

Area of semicircle:

$A = 21.24 \div 2$

10.62 cm^2

Area of composite shape:

$5.33 + 10.62 = 15.95$

15.95 cm^2

Perimeter

Circumference of circle:

$C = \pi d$

$C = 5.2\pi$

$C \approx 16.34$

16.34 cm

Half of circumference:

$16.34 \text{ cm} \div 2 = 8.17 \text{ cm}$

Perimeter of composite shape:

$1.5 + 3 + 2 + 8.17 = 14.67$

14.67 cm

2. Length of square side:

$P = 4s$

$24 = 4s$

$\frac{24}{4} = \frac{4s}{4}$

$6 = s$

6 ft

This is also the diameter of the circle.

Area of square:

$A = s^2$

$A = 6^2$

$A = 36$

36 ft^2

Radius of circle:

$r = 6 \text{ ft} \div 2 = 3 \text{ ft}$

Area of circle:

$A = \pi r^2$

$A = \pi(3)^2$

$A = 9\pi$

$A \approx 28.27$

28.27 ft^2

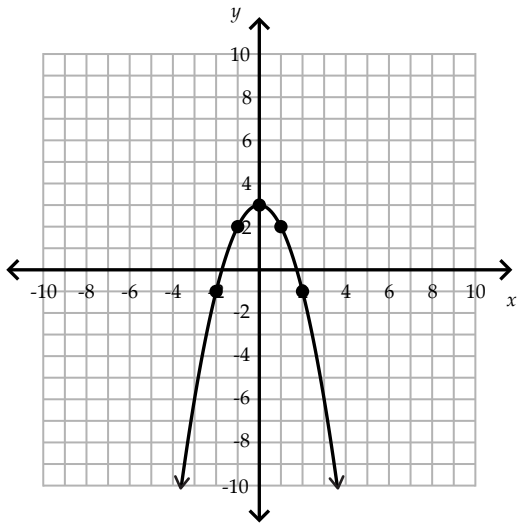
Area of shaded region:

$36 - 28.27 = 7.73$

7.73 ft^2

3.

x (input)	y (output)	
-2	$-(-2)^2 + 3$ $= -4 + 3$ $= -1$	$(-2, -1)$
-1	$-(-1)^2 + 3$ $= -1 + 3$ $= 2$	$(-1, 2)$
0	$-(0)^2 + 3$ $= 0 + 3$ $= 3$	$(0, 3)$
1	$-(1)^2 + 3$ $= -1 + 3$ $= 2$	$(1, 2)$
2	$-(2)^2 + 3$ $= -4 + 3$ $= -1$	$(2, -1)$



4. Scale factor of dimensions: 5

Scale factor of area: $5^2 = 25$

$3 \text{ m}^2 \bullet 25 = 75 \text{ m}^2$

Geometric Solids

WARM-UP

a.
$$h^2 + 28^2 = 35^2$$
$$h^2 + 784 = 1225$$
$$h^2 + 784 - 784 = 1225 - 784$$
$$h^2 = 441$$
$$\sqrt{h^2} = \sqrt{441}$$
$$h = 21$$

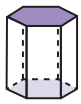
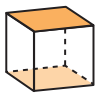
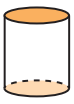
21 km

b.
$$A = \frac{1}{2}bh$$
$$A = \frac{1}{\cancel{2}}\left(\overset{14}{\cancel{28}}\right)(21)$$
$$A = 294$$

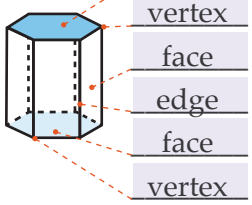
294 km^2

PRACTICE

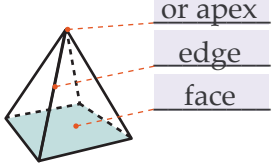
1.

Solid	Name
	prism
	sphere
	pyramid
	prism
	cone
	prism
	pyramid
	prism
	cylinder

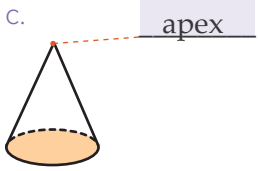
2. a.



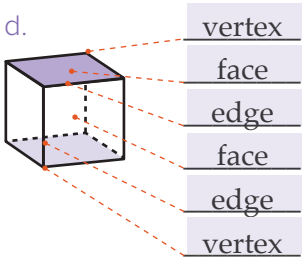
b.



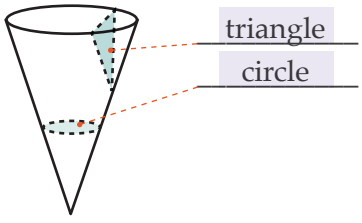
c.



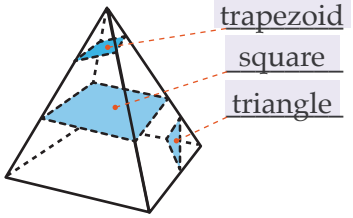
d.



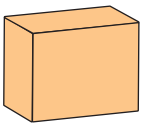
3. a.



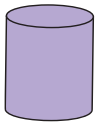
b.



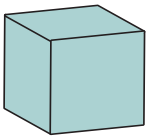
4. Rectangular Prism



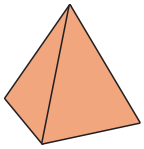
Cylinder



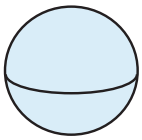
Cube



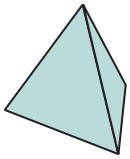
Square Pyramid



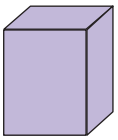
Sphere



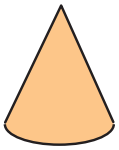
Triangular Pyramid



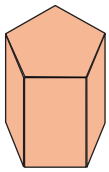
Square Prism



Cone



Pentagonal Prism



P	T	R	I	A	N	G	U	L	A	R	P	Y	R	A	M	I	D	A	U
B	E	T	F	D	D	J	D	K	Z	V	R	E	F	O	V	M	Q	P	Q
H	Z	N	C	P	M	A	V	D	B	E	F	Q	E	D	U	X	L	E	C
U	M	N	T	O	G	N	W	X	P	G	V	M	N	C	A	E	L	X	Y
W	M	J	R	A	N	S	O	Y	M	D	L	L	W	F	G	X	O	I	B
T	B	S	L	E	G	E	S	C	L	U	Y	E	F	T	Q	B	O	T	C
V	C	V	U	I	C	O	T	T	Z	O	K	D	P	U	T	S	L	A	Y
Z	E	U	X	E	R	T	N	M	G	K	D	G	B	O	I	F	N	B	L
M	X	R	I	H	F	L	A	A	S	L	W	E	U	L	U	D	C	E	I
E	W	I	T	X	F	S	S	N	L	W	L	Q	D	V	I	V	S	Y	N
Q	U	K	Z	E	Y	T	Q	S	G	P	Q	A	U	E	M	S	T	E	D
O	F	R	B	W	X	O	G	U	B	U	R	S	P	H	E	R	E	F	E
H	J	I	Y	S	D	R	R	I	A	X	L	I	V	U	J	Y	T	C	R
K	B	C	C	K	P	Y	I	V	L	R	I	A	S	Q	G	T	R	G	P
S	M	I	U	D	A	D	D	Z	R	F	E	X	R	M	Z	L	Q	X	Y
A	S	S	B	B	J	J	P	Y	M	W	A	P	P	P	M	I	H	B	G
Z	A	M	B	R	E	P	Z	T	I	V	Z	C	R	D	R	L	N	M	P
D	N	Z	D	I	M	R	H	B	P	M	U	S	E	I	U	I	X	I	X
R	L	R	N	A	S	V	B	P	J	C	X	R	G	R	S	Z	S	R	Z
M	L	S	Q	U	A	R	E	P	Y	R	A	M	I	D	M	M	M	M	L

REVIEW

1. a. $A = \pi r^2$

$A = \pi(4.2)^2$

$A = 17.64\pi$

$A \approx 55.4$

55.4 in^2

b. $\frac{40°}{360°} = \frac{1}{9}$

9 wedges

c. Circumference of circle:

$C = 2\pi r$

$C = 2\pi(4.2)$

$C = 8.4\pi$

$C \approx 26.4$

26.4 in

Length of $\overset{\frown}{MN}$:

$\frac{1}{9} \cdot 26.4 = 2.9$

2.9 in

2. Principal: \$3,000
Rate: 2.5%
Time: 4 years
$I = Prt$
$I = 3000 \bullet 0.025 \bullet 4$
$I = 300$
\$300

3. $10.4^2 + 7.8^2 = c^2$
$108.16 + 60.84 = c^2$
$169 = c^2$
$\sqrt{169} = \sqrt{c^2}$
$13 = c$
13 dm

4. 1 ft = 12 in
6 in, 9 in, 12 in
$6 + 9 = 15$
$15 > 12$
$9 + 12 = 21$
$21 > 6$
$6 + 12 = 18$
$18 > 9$
yes

Surface Area of Prisms and Pyramids

WARM-UP

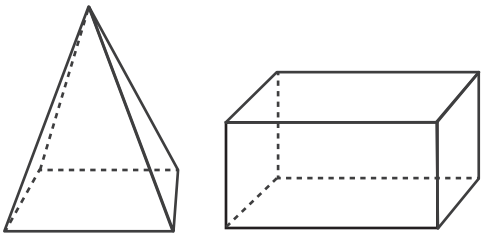
a. sphere

b. cylinder

c. pentagonal prism

PRACTICE

1. Nets should fold up into the following figures.



2. a. square pyramid

b. $A = s^2$
$A = 1.5^2$
$A = 2.25$
2.25 in^2

c. $A = \frac{1}{2}bh$
$A = \frac{1}{2}(1.5)(2)$
$A = 1.5$
1.5 in^2

d. $SA = 4 \bullet 1.5 + 2.25$
$= 6 + 2.25$
$= 8.25$
8.25 in^2

3. a. rectangular prism

b. $A = lw$
$A = 2 \bullet 1.5$
$A = 3$
3 in^2

c. $A = lw$
$A = 1.5 \bullet 1$
$A = 1.5$
1.5 in^2

d. $A = lw$
$A = 2 \bullet 1$
$A = 2$
2 in^2

e. $SA = 2 \bullet 3 + 2 \bullet 1.5 + 2 \bullet 2$
$= 6 + 3 + 4$
$= 13$
13 in^2

REVIEW

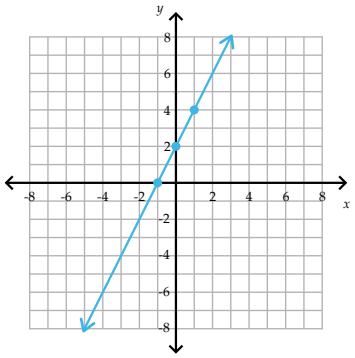
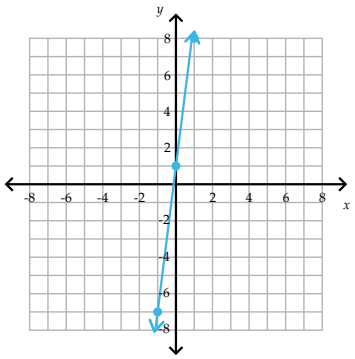
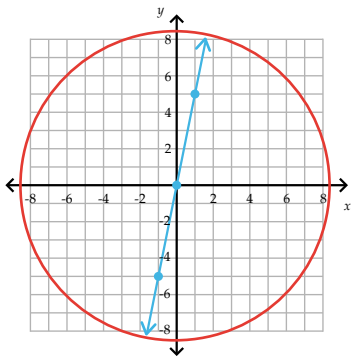
1. Angles can be found in different ways and in different orders. Some examples are shown below.

   a. $\angle TWH$ and the 68° angle are vertical angles.

   $m\angle TWH = 68°$

   b. $\angle OWH$ and the 68° angle are supplementary.

   $$m\angle OWH + 68° = 180°$$
   $$m\angle OWH + 68° - 68° = 180° - 68°$$
   $$m\angle OWH = 112°$$

2. 



When $x = 1$, $y = 5$.

$k = 5$

3. Angle s and the angle to the left of it (call it x) are supplementary. Angle x and the 142.6° angle are alternate interior angles and have the same measure. Therefore, angle x is 142.6°.

$$s + 142.6° = 180°$$
$$s + 142.6° - 142.6° = 180° - 142.6°$$
$$s = 37.4°$$

4. a. $4:5$

   b. $$\frac{4}{5} = \frac{t}{140}$$
   $$4 \cdot 140 = 5t$$
   $$560 = 5t$$
   $$\frac{560}{5} = \frac{5t}{5}$$
   $$112 = t$$

   112 front toes

Surface Area of Cylinders, Cones, and Spheres

WARM-UP

1. a. $10^3 \longrightarrow 1.000$
   1,000

   b. $10^5 \longrightarrow 1.00000$
   100,000

   c. $10^{-2} \longrightarrow .01$
   0.01

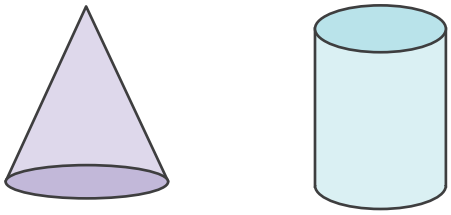
   d. $10^1 = 10$

2. a. $2.5 \bullet 10^3 \longrightarrow 2.500$
   2,500

   b. $125 \bullet 10^{-2} \longrightarrow 125$
   1.25

PRACTICE

1. Assembled shapes should look like a cone and a cylinder.



2. a. cone

   b. $r = 3.7 \text{ cm} \div 2 = 1.85 \text{ cm}$

   c. $A = \pi r^2$
   $A = \pi(1.85)^2$
   $A = 3.4225\pi$
   $A \approx 10.75$
   10.75 cm^2

   d. $A = \pi rl$
   $A = \pi(1.85)(5.5)$
   $A = 10.175\pi$
   $A \approx 31.97$
   31.97 cm^2

   e. $SA \approx 10.75 + 31.97 \approx 42.72$
   42.72 cm^2

3. a. cylinder

   b. Radius: 1.85 cm
   Area: 10.75 cm^2

   c. $C = \pi d$
   $C = 3.7\pi$
   $C \approx 11.62$
   11.62 cm

   d. $A = lw$
   $A \approx 11.62 \bullet 5.6$
   $A \approx 65.07$
   65.07 cm^2

   e. $SA = 2 \bullet 10.75 + 65.07 = 86.57 \text{ cm}^2$

4. $SA = 4\pi r^2$
   $SA = 4\pi(1.85)^2$
   $SA = 4\pi(3.4225)$
   $SA = 13.69\pi$
   $SA \approx 43.01$
   43.01 cm^2

REVIEW

1. a. Area of entire larger triangle:

$$A = \frac{1}{2}bh$$
$$A = \frac{1}{\cancel{2}}\left(\overset{2}{\cancel{4}}\right)(6)$$
$$A = (2)(6)$$
$$A = 12$$
12 mm^2

Area of white triangle:

$$A = \frac{1}{2}bh$$
$$A = \frac{1}{\cancel{2}}\left(\overset{1}{\cancel{2}}\right)(3)$$
$$A = (1)(3)$$
$$A = 3$$
3 mm^2

Area of blue portion:

$A = 12 - 3 = 9$

9 mm^2

b. $\frac{3}{6} = \frac{1}{2}$

c. $\frac{3}{12} = \frac{1}{4}$

2. a. hexagonal prism

b. Number of faces: 8

Number of edges: 18

Number of vertices: 12

3. a.
$$\frac{3 - \left(\frac{1}{2}\right)^2}{4 \div \sqrt{64}}$$
$$= \frac{3 - \frac{1}{4}}{4 \div 8}$$
$$= \frac{3 - \frac{1}{4}}{\frac{1}{2}}$$
$$= \frac{\frac{12}{4} - \frac{1}{4}}{\frac{1}{2}}$$
$$= \frac{\frac{11}{4}}{\frac{1}{2}}$$
$$= \frac{11}{\overset{2}{\cancel{4}}} \bullet \frac{\cancel{2}}{1}$$
$$= \frac{11}{2}$$
$$= 5\frac{1}{2}$$

b.
$$-10 - 4\left[\left(2^4 \bullet \frac{20}{4} + 14 \bullet 2\right) \div 9\right]$$
$$= -10 - 4\left[\left(16 \bullet \frac{20}{4} + 14 \bullet 2\right) \div 9\right]$$
$$= -10 - 4\left[\left(\overset{4}{\cancel{16}} \bullet \frac{20}{\cancel{4}} + 14 \bullet 2\right) \div 9\right]$$
$$= -10 - 4\left[(80 + 28) \div 9\right]$$
$$= -10 - 4\left[(108) \div 9\right]$$
$$= -10 - 4[12]$$
$$= -10 - 48$$
$$= -58$$

Surface Area of Composite Solids

WARM-UP

a. $A = \pi r^2$

$A = \pi(5)^2$

$A = 25\pi$

$A \approx 78.54$

78.54 in^2

b. $A = s^2$

$A = 6^2$

$A = 36$

36 cm^2

PRACTICE

1. a. cone and cylinder

b.

c.

Solid	Type of Face (quantity)	Dimensions	Calculations	Area of One Face	Total Area of Faces
Cone	Cone Side (2)	Radius: 5 cm Slant Height: 10 cm	$A = \pi(5)(10) \approx 157.08$	157.08 cm^2	314.16 cm^2
Cylinder	Rectangular Side (1)	Width: 50 cm Length: 31.42 cm	$A \approx (50)(31.42) = 1571$	$1{,}571 \text{ cm}^2$	$1{,}571 \text{ cm}^2$
				Total surface area:	$1{,}885.16 \text{ cm}^2$

2. a. hemisphere and cylinder

b. 

c.

Solid	Type of Face (quantity)	Dimensions	Calculations	Area of One Face	Total Area of Faces
Hemisphere	Hemisphere (2)	Radius: 3 mm	$= \frac{4(3)^2}{2} \approx 56.55$	56.55 mm^2	113.1 mm^2
Cylinder	Rectangular Side (1)	Width: 14 mm Length: 18.85 mm	$A \approx (14)(18.85) = 263.9$	263.9 mm^2	263.9 mm^2
				Total surface area:	377 mm^2

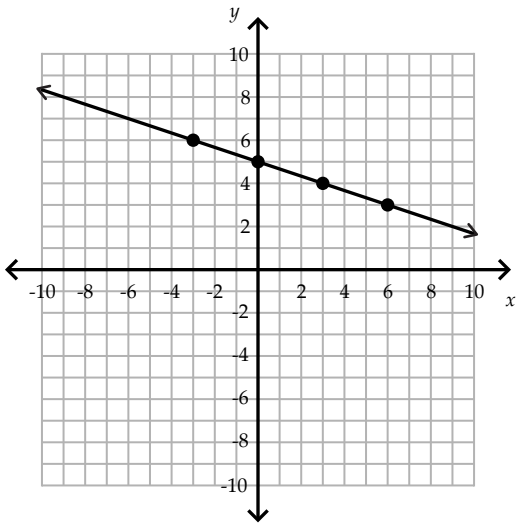
3. a. six square faces minus the area of the circle

b. only the curved part of the cone

REVIEW

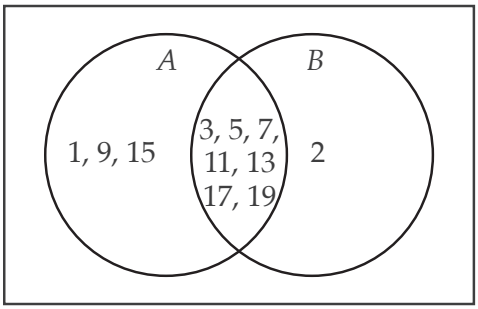
1. The y-intercept is $(0,5)$.

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



2. $A = \{1,3,5,7,9,11,13,15,17,19\}$

$B = \{2,3,5,7,11,13,17,19\}$



a. $A \cup B = \{1,2,3,5,7,9,11,13,15,17,19\}$

b. $A \cap B = \{3,5,7,11,13,17,19\}$

3. One week after March 24 is March 31.
One week after March 31 is April 7.

4. a. Sunday

Year	Leap Year	Day of the Week for May 1
2023	no	Monday
2024	yes	Wednesday
2025	no	Thursday
2026	no	Friday
2027	no	Saturday
2028	yes	Monday
2029	no	Tuesday
2030	no	Wednesday
2031	no	Thursday
2032	yes	Saturday
2033	no	Sunday

b. Since Wednesday is two days after Monday, Corbin's birthday in 2033 is two days after Sunday. Two days after Sunday is Tuesday.

Volume of Prisms and Cylinders

WARM-UP

a. $d = 2 \bullet 4.5 \text{ mi} = 9 \text{ mi}$

b. $C = \pi d$

$C = 9\pi$

$C \approx 28$

28 mi

c. $A = \pi r^2$

$A = \pi(4.5)^2$

$A = 20.25\pi$

$A \approx 64$

64 mi^2

PRACTICE

1. a. $V = Bh$

$V = 2 \bullet 5$

$V = 10$

10 m^3

b. $V = Bh$

$V = 5 \bullet 3$

$V = 15$

15 ft^3

c. $V = Bh$

$V = 20 \bullet 8$

$V = 160$

160 cm^3

d. $V = Bh$

$V = 50 \bullet 12$

$V = 600$

600 in^3

2. a. $V = s^3$

$V = 2^3$

$V = 8$

8 cm^3

b. $V = lwh$

$V = 10 \bullet 2 \bullet 3$

$V = 60$

60 ft^3

c. $V = \pi r^2 h$

$V = \pi(4)^2 6$

$V = 96\pi$

$V \approx 301.59$

301.59 cm^3

d. $V = \frac{1}{2}bhl$

$V = \frac{1}{2}(5)(2)(15)$

$V = 75$

75 in^3

3. $r = 16\text{ m} \div 2 = 8\text{ m}$

$V = \pi r^2 h$

$V = \pi(8)^2\, 40$

$V = 2560\pi$

$V \approx 8042$

$8{,}042\text{ m}^3$

4. $V = \frac{1}{2}bhl$

$V = \frac{1}{2}(8)(6)(8)$

$V = 192$

192 ft^3

REVIEW

1. Area of triangle:

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(6)(9)$

$A = 27$

27 in^2

The star is made up of 5 triangles of equal size and the pentagon, whose area is given.

$SA = 5 \bullet 27 + 61.94$

$SA \approx 196.94$

196.94 in^2

2. $r = 8.2\text{ in} \div 2 = 4.1\text{ in}$

$SA = 4\pi r^2$

$SA = 4\pi(4.1)^2$

$SA = 67.24\pi$

$SA \approx 211.24$

211.24 in^2

3. Total monthly expenses:

$\$300 + \$100 + \$200 + \$50 + \$100 = \$750$

$\$750 \div \$12/\text{hr} = 62.5\text{ hours}$

4. a. $4 \div \frac{1}{2} = 4 \bullet 2 = 8$

$8 \div 1 = 8$

$12 \div 1\frac{1}{2} = 12 \div \frac{3}{2} = \cancel{12}^{4} \bullet \frac{2}{\cancel{3}} = 8$

$16 \div 2 = 8$

$24 \div 3 = 8$

directly proportional

b. $k = 8$

$y = 8x$

c. $8 \bullet 2\frac{1}{2} = \cancel{8}^{4} \bullet \frac{5}{\cancel{2}} = 20$

20 ounces

d. It only makes sense to have a positive number of cups and ounces.

Volume of Other Geometric Solids

WARM-UP

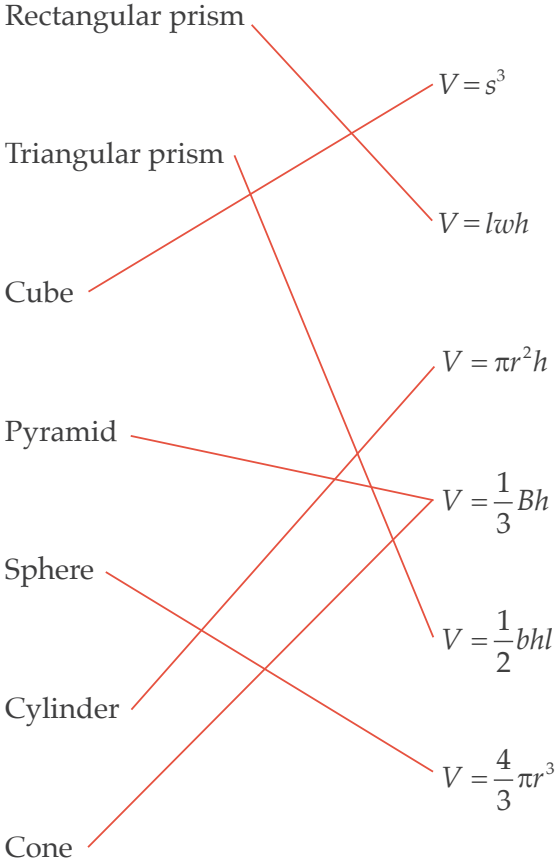
$V = Bh$

$V = 50 \bullet 24 = 1200$

1,200 mm^3

PRACTICE

1. Rectangular prism



2. a. cone and cylinder

b. Area of base (B):

$A = \pi r^2$

$A = \pi(8)^2$

$A = 64\pi$

$A \approx 201.06$

201.06 ft^2

Volume of cone:

$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(201.06)(10)$

$V \approx 670.2$

670.2 m^3

c. $V = \pi r^2 h$

$V = \pi(8)^2(40)$

$V = \pi(64)(40)$

$V = 2560\pi$

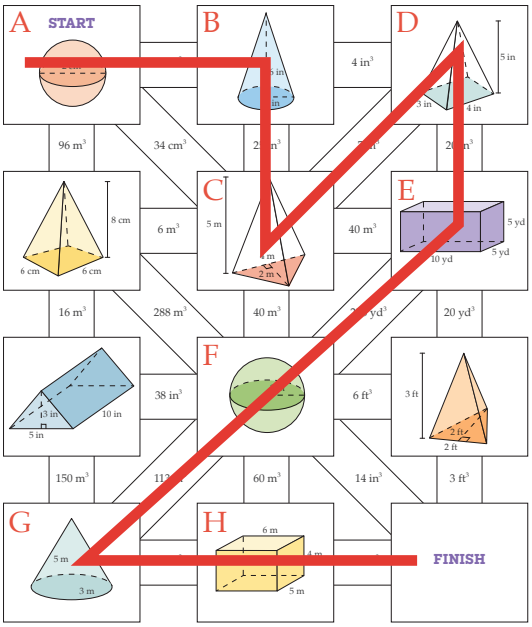
$V \approx 8042.48$

8,042.48 m^3

d. $V = 670.2 + 8042.48 = 8712.68$

8,712.68 m^3

3.



Detailed work for problems along the correct path is shown below. Answers are rounded to the nearest whole number.

A $V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(1)^3$

$V = \frac{4}{3}\pi(1)$

$V = \frac{4}{3}\pi$

$V \approx 4$

4 cm^3

B Area of base (B):

$A = \pi r^2$

$A = \pi(2)^2$

$A = 4\pi$

$A \approx 12.57$

12.57 in^2

Volume of cone:

$V = \frac{1}{3}Bh$

$V = \frac{1}{\cancel{3}}(12.57)\left(\frac{2}{\cancel{6}}\right)$

$V \approx 25$

25 in^3

C Area of base (B):

$A = \frac{1}{2}bh$

$A = \frac{1}{\cancel{2}}\left(\frac{2}{\cancel{4}}\right)(2)$

$A = 4$

4 m^2

Volume of pyramid:

$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(4)(5)$

$V \approx 7$

7 m^3

D Area of base (B):

$A = lw$

$A = 3 \bullet 4$

$A = 12$

12 in^2

Volume of pyramid:

$V = \frac{1}{3}Bh$

$V = \frac{1}{\cancel{3}}\left(\frac{4}{\cancel{12}}\right)(5)$

$V = 20$

20 in^3

E Volume of rectangular prism:

$V = lwh$

$V = 10 \bullet 5 \bullet 5$

$V = 250$

250 yd^3

F Volume of sphere:

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(3)^3$

$V = \frac{4}{\cancel{3}}\pi\left(\overset{9}{\cancel{27}}\right)$

$V = 36\pi$

$V \approx 113$

113 in^3

G Area of base (B):

$A = \pi r^2$

$A = \pi(3)^2$

$A = 9\pi$

$A \approx 28.27$

28.27 m^2

Volume of cone:

$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(28.27)(5)$

$V \approx 47$

47 m^3

H Volume of rectangular prism:

$V = lwh$

$V = 4 \bullet 5 \bullet 6$

$V = 120$

120 m^3

REVIEW

1. a. hemisphere and cylinder

b. Surface area of roof:

Surface area of a whole sphere with radius 12 ft:

$SA = 4\pi r^2$

$SA = 4\pi(12)^2$

$SA = 576\pi$

$SA \approx 1809.56$

$1{,}809.56 \text{ ft}^2$

Surface area of roof (hemisphere):

$SA = 1809.56 \div 2 = 904.78$

905 ft^2

Area of curved side:

Circumference of cylinder base (length of rectangle that makes up the cylinder side):

$C = 2\pi r$

$C = 2\pi(12)$

$C = 24\pi$

$C \approx 75.4$

75.4 ft

Width of the rectangle that makes up the cylinder side is the height of the cylinder: 30 ft

Area of curved side:

$A = lw$

$A = 75.4 \bullet 30$

$A = 2262$

$2{,}262 \text{ ft}^2$

Area of circle:

$A = \pi r^2$

$A = \pi(12)^2$

$A = 144\pi$

$A \approx 452$

452 ft^2

Surface area of the silo:

$SA = 905 + 2262 + 452$

$SA = 3619$

$3{,}619 \text{ ft}^2$

2. $m\angle L + m\angle I + m\angle F + m\angle T = 360°$

$7x + 29x + 29x + 7x = 360°$

$72x = 360°$

$\frac{72x}{72} = \frac{360°}{72}$

$x = 5°$

$m\angle L = 7x = 7(5°) = 35°$

$m\angle I = 29x = 29(5°) = 145°$

$m\angle F = m\angle I = 145°$

$m\angle T = m\angle L = 35°$

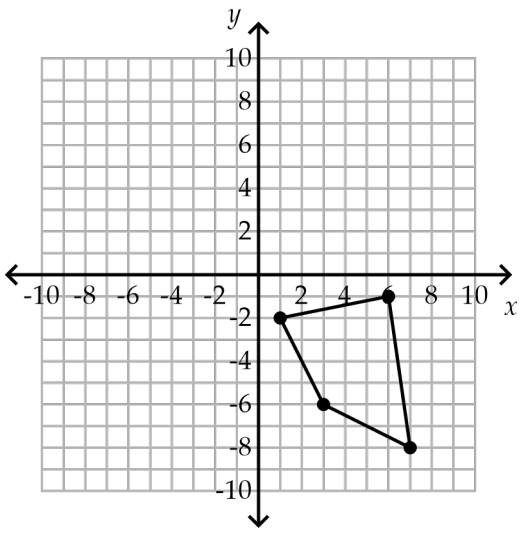
3. The x-values stay the same. The y-values switch signs. Each point is the same distance from the x-axis but on the other side.

$(1,2)$ becomes $(1,-2)$

$(3,6)$ becomes $(3,-6)$

$(6,1)$ becomes $(6,-1)$

$(7,8)$ becomes $(7,-8)$



Polynomials

WARM-UP

a. $5x + 2x - 3x$
$= 7x - 3x$
$= 4x$

b. $7y + 2(y + 3)$
$= 7y + 2y + 6$
$= 9y + 6$

c. $5z \bullet 4 + 2z$
$= 20z + 2z$
$= 22z$

PRACTICE

1. 2.

$3x^2$	$2yz - 1$	$\frac{2}{x}$
$\frac{y-1}{zy}$	$4a^2b^4 + c$	3
$9m$	$\sqrt{x}$	$4p + p^2 + 1$
$s + t + u + v$	$5 - a$	$\frac{1}{a^2}$

3.

a	a^2	ab	ab^4
$-a^2$	$a^2\,b$	$-b^2$	ab
$9b$	$7ab$	a^2b	$3a$
$-ab^4$	b^2	$5a^2b$	$3b$

4. a. $3p + 5 - p - 1$
$= 3p - p + 5 - 1$
$= 2p + 5 - 1$
$= 2p + 4$

b. $6n^2 - n - n^2 + 5 - n$
$= 6n^2 - n^2 - n - n + 5$
$= 5n^2 - n - n + 5$
$= 5n^2 - 2n + 5$

c. $-pq + pq^2 - pq - 2pq^2$
$= pq^2 - 2pq^2 - pq - pq$
$= -pq^2 - pq - pq$
$= -pq^2 - 2pq$

d. $3j + j^2k - 2j^2k$
$= 3j - j^2k$

e. $2lm - l - m + lm$
$= 2lm + lm - l - m$
$= 3lm - l - m$

f. $g^2hi - ghi + 2g^2hi + ghi + g^2 - h^2$
$= g^2hi + 2g^2hi - ghi + ghi + g^2 - h^2$
$= 3g^2hi - ghi + ghi + g^2 - h^2$
$= 3g^2hi + 0 + g^2 - h^2$
$= 3g^2hi + g^2 - h^2$

g. $x^2 - x + x^3 - x^2 + x^4 - x^5 - x^3 + x^2$
$= x^2 - x^2 + x^2 - x + x^3 - x^3 + x^4 - x^5$
$= x^2 - x + x^3 - x^3 + x^4 - x^5$
$= x^2 - x + 0 + x^4 - x^5$
$= -x^5 + x^4 + x^2 - x$

REVIEW

1. Area of square base:
$A = s^2$
$A = 3^2$
$A = 9$

Volume of pyramid:
$V = \frac{1}{3}Bh$
$V = \frac{1}{3}(9)(5)$
$V = 15$
15 m^3

2. a. $A = lw$
$A = (16)(32)$
$A = 512$
512 ft^2

b.
$$\frac{512 \text{ ft} \bullet \text{ft}}{1} \bullet \frac{12 \text{ in}}{1 \text{ ft}} \bullet \frac{12 \text{ in}}{1 \text{ ft}} = \frac{73728 \text{ in} \bullet \text{in}}{1} = 73728 \text{ in}^2$$
$512 \text{ ft}^2 = 73{,}728 \text{ in}^2$

c. $\frac{1}{64} = \frac{l}{16}$
$64 \bullet l = 1 \bullet 16$
$\frac{64l}{64} = \frac{16}{64}$
$l = 0.25$
Length of drawing: 0.25 ft

$\frac{1}{64} = \frac{w}{32}$
$64 \bullet w = 1 \bullet 32$
$\frac{64w}{64} = \frac{32}{64}$
$w = 0.5$
Width of drawing: 0.5 ft

$A = lw$
$A = (0.25)(0.5)$
$A = 0.125$
Area of drawing: 0.125 ft^2

The scale factor for area is the square of the scale factor of the dimensions.
$\left(\frac{1}{64}\right)^2 = \frac{1}{4096}$
Scale factor for area: $\frac{1}{4096}$

3. a. $C = 2\pi r$

$C = 2\pi(4)$

$C = 8\pi$

$C \approx 25.1$

25.1 in

b. $\frac{m\angle FAR}{360°} = \frac{36°}{360°} = \frac{1}{10}$

$25.1 \bullet \frac{1}{10} \approx 2.5$

2.5 in

4. a rectangle

5. $38.75\% \bullet 160$

$0.3875 \bullet 160 = 62$

62 people

Multiplying Polynomials

WARM-UP

1. a. $|-2| = 2$
$2 < 4$

b. $|-15| = 15$
$|-13| = 13$
$15 > 13$

c. $|-11| = 11$
$11 = 11$

2. a. $-10 \div 2 \bullet (-2) \div 5$
$= -5 \bullet (-2) \div 5$
$= 10 \div 5$
$= 2$

b. $24 \div (-2) \div 4 \bullet (-3)$
$= -12 \div 4 \bullet (-3)$
$= -3 \bullet (-3)$
$= 9$

PRACTICE

L $3ab \bullet a^2b$
$= 3 \bullet a \bullet b \bullet a \bullet a \bullet b$
$= 3 \bullet a \bullet a \bullet a \bullet b \bullet b$
$= 3a^3b^2$

A $2ba^3 \bullet 3ab$
$= 2 \bullet b \bullet a \bullet a \bullet a \bullet 3 \bullet a \bullet b$
$= 2 \bullet 3 \bullet a \bullet a \bullet a \bullet a \bullet b \bullet b$
$= 6a^4b^2$

O $a \bullet a^3b$
$= a \bullet a \bullet a \bullet a \bullet b$
$= a^4b$

N $ab(b + a^2)$
$= ab \bullet b + ab \bullet a^2$
$= a \bullet b \bullet b + a \bullet b \bullet a \bullet a$
$= ab^2 + a \bullet a \bullet a \bullet b$
$= ab^2 + a^3b$

O $4b^2 \bullet 2b^3a$
$= 4 \bullet b \bullet b \bullet 2 \bullet b \bullet b \bullet b \bullet a$
$= 4 \bullet 2 \bullet a \bullet b \bullet b \bullet b \bullet b \bullet b$
$= 8ab^5$

L $a(a - b)$
$= a \bullet a - a \bullet b$
$= a^2 - ab$

I $2a^2b^5 \bullet 4a^3b$
$= 2 \bullet a \bullet a \bullet b \bullet b \bullet b \bullet b \bullet b \bullet 4 \bullet a \bullet a \bullet a \bullet b$
$= 2 \bullet 4 \bullet a \bullet a \bullet a \bullet a \bullet a \bullet b \bullet b \bullet b \bullet b \bullet b \bullet b$
$= 8a^5b^6$

M $3a^2b(2ab + a^2)$
$= 3a^2b \bullet 2ab + 3a^2b \bullet a^2$
$= 3 \bullet a \bullet a \bullet b \bullet 2 \bullet a \bullet b + 3 \bullet a \bullet a \bullet b \bullet a \bullet a$
$= 3 \bullet 2 \bullet a \bullet a \bullet a \bullet b \bullet b + 3 \bullet a \bullet a \bullet a \bullet a \bullet b$
$= 6a^3b^2 + 3a^4b$

Y $2ab^2(ab-a)$

$= 2ab^2 \bullet ab - 2ab^2 \bullet a$

$= 2 \bullet a \bullet b \bullet b \bullet a \bullet b - 2 \bullet a \bullet b \bullet b \bullet a$

$= 2 \bullet a \bullet a \bullet b \bullet b \bullet b - 2 \bullet a \bullet a \bullet b \bullet b$

$= 2a^2b^3 - 2a^2b^2$

P $ba(2b^2 + 3ab)$

$= ba \bullet 2b^2 + ba \bullet 3ab$

$= b \bullet a \bullet 2 \bullet b \bullet b + b \bullet a \bullet 3 \bullet a \bullet b$

$= 2 \bullet a \bullet b \bullet b \bullet b + 3 \bullet a \bullet a \bullet b \bullet b$

$= 2ab^3 + 3a^2b^2$

Polynomial

(Polly-no-meal)

REVIEW

1. $13g^2h + 23gh$

2. a. $SA = \pi r^2 + \pi rl$

$\pi(3)^2 + \pi(3)(5)$

$= 9\pi + 15\pi$

$= 24\pi$

≈ 75.4

75.4 cm^2

b. Area of circle base:

$A = \pi r^2$

$A = \pi(3)^2$

$A = 9\pi$

$A \approx 28.3$

28.3 cm^2

Volume of cone:

$V = \frac{1}{3}Bh$

$V \approx \frac{1}{3}(28.3)(4)$

$V \approx 37.7$

37.7 cm^3

3. a. $2|\underline{180}$

$2|\underline{90}$

$3|\underline{45}$

$3|\underline{15}$

5

$2^2 \bullet 3^2 \bullet 5$

b. $2|\underline{256}$

$2|\underline{128}$

$2|\underline{64}$

$2|\underline{32}$

$2|\underline{16}$

$2|\underline{8}$

$2|\underline{4}$

2

2^8

4. a. Circumference of circle (two semicircles):

$C = \pi d$

$C = \pi(60)$

$C \approx 188$

$P = 200 + 200 + 188$

$P = 588$

588 m

b. Area of circle (two semicircles):

$A = \pi r^2$

$A = \pi(30)^2$

$A = 900\pi$

$A \approx 2827$

Area of rectangle:

$A = lw$

$A = 200 \bullet 60$

$A = 12000$

Total area:

$A = 2827 + 12000$

$A = 14827$

$14{,}827 \text{ m}^2$

Simplifying Rational Expressions

WARM-UP

a. $\frac{64}{16}$

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

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

b. $\frac{24}{30}$

$= \frac{\cancel{2} \cdot 2 \cdot 2 \cdot \cancel{3}}{\cancel{2} \cdot \cancel{3} \cdot 5}$

$= \frac{4}{5}$

c. $\frac{9}{54}$

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

$= \frac{1}{6}$

PRACTICE

9. $= \frac{2c}{3a}$

10. $= \frac{2 \cdot \cancel{b} \cdot \cancel{b} \cdot c \cdot \cancel{a}}{3 \cdot \cancel{a} \cdot a \cdot \cancel{b} \cdot \cancel{b}}$

11. $= 3c$

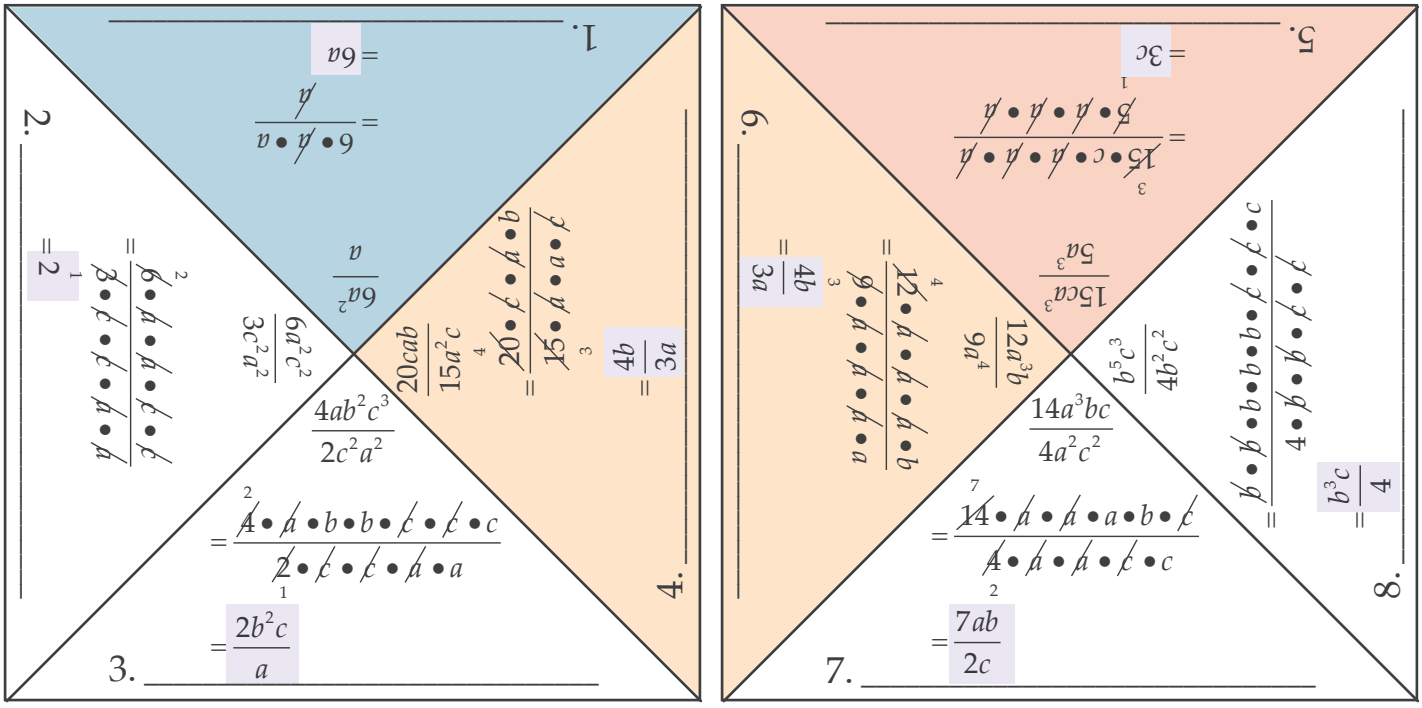
12. $= \frac{a}{bc}$

13. $= \frac{b}{3c^2}$

14. $= \frac{3}{b}$

15. $= 6a$

16. $= 2a$



REVIEW

1. a. $6b + 8m + 10c$

   b. $b = 4,\ m = 3,\ c = 10$

   Amount of money made:

   $6(4) + 8(3) + 10(10)$

   $= 24 + 24 + 100$

   $= 148$

   $148

2. Proportion: $\frac{2}{1} = \frac{x}{4}$

   $1 \bullet x = 2 \bullet 4$

   $x = 8$

   Solution: 8 national parks

3. $\left(\frac{1}{50}\right)^2 = \frac{1}{2500}$

4. $V = \pi r^2 h$

   $V = \pi(50)^2(40)$

   $V = \pi \bullet 2500 \bullet 40$

   $V \approx 314159.27$

   314,159.27 ft^3

5. a. 33°

   b. $180° - 33° = 147°$

   c. $180° - 33° - 104° = 43°$

Factoring Polynomials

WARM-UP

1. $3x(9y+2)$
$=3x \cdot 9y + 3x \cdot 2$
$=27xy+6x$

2. $2\overline{)50}$
$5\overline{)25}$
5
$50 = 2 \cdot 5 \cdot 5$

PRACTICE

1. a. $2xy^2 = \boxed{2} \cdot \textcircled{x} \cdot \textcircled{y} \cdot \boxed{y}$
$x^2y = \boxed{x} \cdot \textcircled{x} \cdot \textcircled{y}$

   b. $x \cdot y = xy$

   c. $xy(2y+x)$

   d. $xy(2y+x)$
   $= xy \cdot 2y + xy \cdot x$
   $= x \cdot y \cdot 2 \cdot y + x \cdot y \cdot x$
   $= 2 \cdot x \cdot y \cdot y + x \cdot x \cdot y$
   $= 2xy^2 + x^2y$
   yes

2. a. $6a^2bc^2 = \textcircled{2} \cdot \boxed{3} \cdot \textcircled{a} \cdot \boxed{a} \cdot \textcircled{b} \cdot \textcircled{c} \cdot \boxed{c}$
$4ab^2c = \textcircled{2} \cdot \boxed{2} \cdot \textcircled{a} \cdot \textcircled{b} \cdot \boxed{b} \cdot \textcircled{c}$

   b. $2 \cdot a \cdot b \cdot c = 2abc$

   c. $2abc(3ac+2b)$

   d. $2abc(3ac+2b)$
   $= 2abc \cdot 3ac + 2abc \cdot 2b$
   $= 2 \cdot a \cdot b \cdot c \cdot 3 \cdot a \cdot c + 2 \cdot a \cdot b \cdot c \cdot 2 \cdot b$
   $= 2 \cdot 3 \cdot a \cdot a \cdot b \cdot c \cdot c + 2 \cdot 2 \cdot a \cdot b \cdot b \cdot c$
   $= 6a^2bc^2 + 4ab^2c$
   yes

3. a. $15p^3q^2r^4 = \boxed{3} \cdot \textcircled{5} \cdot \textcircled{p} \cdot \textcircled{p} \cdot \textcircled{p} \cdot \textcircled{q} \cdot \boxed{q} \cdot \textcircled{r} \cdot \boxed{r} \cdot \boxed{r} \cdot \boxed{r}$
$20p^3qr^2 = \boxed{2} \cdot \boxed{2} \cdot \textcircled{5} \cdot \textcircled{p} \cdot \textcircled{p} \cdot \textcircled{p} \cdot \textcircled{q} \cdot \textcircled{r} \cdot \textcircled{r}$

   b. $5 \cdot p \cdot p \cdot p \cdot q \cdot r \cdot r = 5p^3qr^2$

   c. $5p^3qr^2(3 \cdot q \cdot r \cdot r - 2 \cdot 2)$
   $= 5p^3qr^2(3qr^2 - 4)$

   d. $5p^3qr^2(3qr^2 - 4)$
   $= 5p^3qr^2 \cdot 3qr^2 - 5p^3qr^2 \cdot 4$
   $= 5 \cdot p \cdot p \cdot p \cdot q \cdot r \cdot r \cdot 3 \cdot q \cdot r \cdot r$
   $\quad - 5 \cdot p \cdot p \cdot p \cdot q \cdot r \cdot r \cdot 4$
   $= 5 \cdot 3 \cdot p \cdot p \cdot p \cdot q \cdot q \cdot r \cdot r \cdot r \cdot r$
   $\quad - 5 \cdot 4 \cdot p \cdot p \cdot p \cdot q \cdot r \cdot r$
   $= 15p^3q^2r^4 - 20p^3qr^2$
   yes

4. a. $3ab^2 + 6a^2b$
   $= 3 \cdot a \cdot b \cdot b + 2 \cdot 3 \cdot a \cdot a \cdot b$
   $= 3 \cdot a \cdot b(b + 2 \cdot a)$
   $= 3ab(b+2a)$

   b. $10xyz - 8x^2$
   $= 2 \cdot 5 \cdot x \cdot y \cdot z - 2 \cdot 2 \cdot 2 \cdot x \cdot x$
   $= 2 \cdot x(5 \cdot y \cdot z - 2 \cdot 2 \cdot x)$
   $= 2x(5yz - 4x)$

c. $30h^2ij^3 + 21h^2i^2j^2$

$= 2 \bullet 3 \bullet 5 \bullet h \bullet h \bullet i \bullet j \bullet j \bullet j + 3 \bullet 7 \bullet h \bullet h \bullet i \bullet i \bullet j \bullet j$

$= 3 \bullet h \bullet h \bullet i \bullet j \bullet j(2 \bullet 5 \bullet j + 7 \bullet i)$

$= 3h^2ij^2(10j + 7i)$

REVIEW

1. Area of each triangular base:

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(18)(12)$

$A = 108$

Area of bottom rectangle:

$A = lw = 18 \bullet 11 = 198$

Area of a side rectangle:

$A = lw = 15 \bullet 11 = 165$

Surface area:

$SA = 2(108) + 198 + 2(165)$

$= 216 + 198 + 330$

$= 744$

744 cm^2

2. a. $8h^2 \bullet 9h^5$

$= 8 \bullet h \bullet h \bullet 9 \bullet h \bullet h \bullet h \bullet h \bullet h$

$= 8 \bullet 9 \bullet h \bullet h \bullet h \bullet h \bullet h \bullet h \bullet h$

$= 72h^7$

b. $9m(m^2 - 6m)$

$= 9m \bullet m^2 - 9m \bullet 6m$

$= 9 \bullet m \bullet m \bullet m - 9 \bullet 6 \bullet m \bullet m$

$= 9m^3 - 54m^2$

3. $\frac{24c^5d^4}{64c^2d^8}$

$= \frac{\overset{3}{\cancel{24}} \bullet \cancel{c} \bullet \cancel{c} \bullet c \bullet c \bullet c \bullet \cancel{d} \bullet \cancel{d} \bullet \cancel{d} \bullet \cancel{d}}{\underset{8}{\cancel{64}} \bullet \cancel{c} \bullet \cancel{c} \bullet \cancel{d} \bullet \cancel{d} \bullet \cancel{d} \bullet \cancel{d} \bullet d \bullet d \bullet d \bullet d}$

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

4. a. $a^2 + b^2 = c^2$

$5^2 + 12^2 = c^2$

$25 + 144 = c^2$

$169 = c^2$

$\sqrt{169} = \sqrt{c^2}$

$13 = c$

13 dm

b. Area of entire circle:

$A = \pi r^2$

$A = \pi(6.5)^2$

$A = 42.25\pi$

$A \approx 132.73$

Area of rectangle:

$A = lw$

$A = 12 \bullet 5$

$A = 60$

Area of the region outside the rectangle:

$A = 132.73 - 60 = 72.73$

72.73 dm^2

Populations and Sampling Methods

WARM-UP

a. Number of orange shapes: 5
Number of blue shapes: 5
$5:5 = 1:1$

b. Number of circles: 4
Total number of shapes: 10
$\frac{4}{10} = 0.4 = 40\%$

PRACTICE

1. a. yes

Sue's younger siblings are not a random sample of her population, which is the entire extended family.

b. no

The sampling method is stratified because the different fourth-grade classrooms are the groups, and the sample is taken randomly from these groups.

c. no

The sampling method is systematic because the first choice in the sample was random, and all the others are chosen at a fixed interval from the first.

d. no

The sampling method is simple because all the customers are chosen randomly, not at intervals or after being broken into groups.

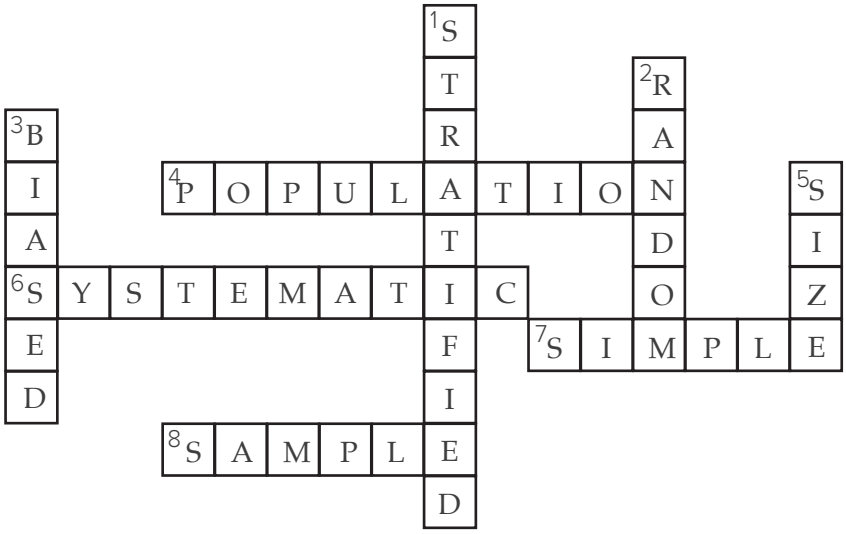
e. yes

The sample is not random. Certain people may choose to fill out the link, and others may not. The responses do not reflect a random sample of the population (which is people in general, not people who choose to fill out a survey link online).

f. yes

The randomly selected gym members are not a random sample of the entire population being considered, which is the town residents.

2.



REVIEW

1. a. $-29q^2t$

monomial binomial trinomial

b. $72v^4w^3 - 19v^4w^3x$

monomial binomial trinomial

2. a. $15m^2\left(4em + 5m^3\right)$

$= 15m^2 \bullet 4em + 15m^2 \bullet 5m^3$

$= 15 \bullet m \bullet m \bullet 4 \bullet e \bullet m + 15 \bullet m \bullet m \bullet 5 \bullet m \bullet m \bullet m$

$= 15 \bullet 4 \bullet e \bullet m \bullet m \bullet m + 15 \bullet 5 \bullet m \bullet m \bullet m \bullet m \bullet m$

$= 60em^3 + 75m^5$

b. $25ay\left(12a^3y - 7ay\right)$

$= 25ay \bullet 12a^3y - 25ay \bullet 7ay$

$= 25 \bullet a \bullet y \bullet 12 \bullet a \bullet a \bullet a \bullet y - 25 \bullet a \bullet y \bullet 7 \bullet a \bullet y$

$= 25 \bullet 12 \bullet a \bullet a \bullet a \bullet a \bullet y \bullet y - 25 \bullet 7 \bullet a \bullet a \bullet y \bullet y$

$= 300a^4y^2 - 175a^2y^2$

3. $\dfrac{48a^4r^8t^3}{32a^2r^3t^6}$

$= \dfrac{\cancel{48}^{3} \bullet \cancel{a} \bullet \cancel{a} \bullet a \bullet a \bullet \cancel{r} \bullet \cancel{r} \bullet \cancel{r} \bullet r \bullet r \bullet r \bullet r \bullet \cancel{t} \bullet \cancel{t} \bullet \cancel{t}}{\cancel{32}_{2} \bullet \cancel{a} \bullet \cancel{a} \bullet \cancel{r} \bullet \cancel{r} \bullet \cancel{r} \bullet \cancel{t} \bullet \cancel{t} \bullet \cancel{t} \bullet t \bullet t \bullet t}$

$= \dfrac{3a^2r^5}{2t^3}$

4. $26h^4i^4 + 169hi^4$

$26h^4i^4 = 2 \bullet 13 \bullet h \bullet h \bullet h \bullet h \bullet i \bullet i \bullet i \bullet i$

$169hi^4 = 13 \bullet 13 \bullet h \bullet i \bullet i \bullet i \bullet i$

GCF: $13hi^4$

$13hi^4\left(2h^3 + 13\right)$

5. $V = \dfrac{4}{3}\pi r^3$

$V = \dfrac{4}{3}\pi\left(11.25\right)^3$

$V \approx \dfrac{4}{3}\pi\left(1423.828125\right)$

$V \approx 1898.4375\pi$

$V \approx 5964.12$

$5{,}964.12 \text{ cm}^3$

Data Displays: Part 1

WARM-UP

a. $A\ (-4,3)$
b. $B\ (8,5)$
c. $C\ (-8,-5)$
d. $D\ (4,-3)$

PRACTICE

1. a. Healthy Living: $2 \bullet 20 + 10 = 50$ students
Science: $4 \bullet 20 = 80$ students
Civic Engagement: $3 \bullet 20 + 5 = 65$ students

b. $80 - 65 = 15$ students

c. $50 + 80 + 65 = 195$ students

2. a. 46 in

b. She grew the least between ages 3 and 4, 7 and 8, 8 and 9, and 10 and 11. These line segments are the least steep.

c. She grew the most between ages 0 and 1. This line segment is steepest.

d. $59 - 46 = 13$
13 in

e. $36 - 22 = 14$
14 in

f. 0 and 2
The answer for Part E is greater than the answer for Part D.

3. a. gymnastics

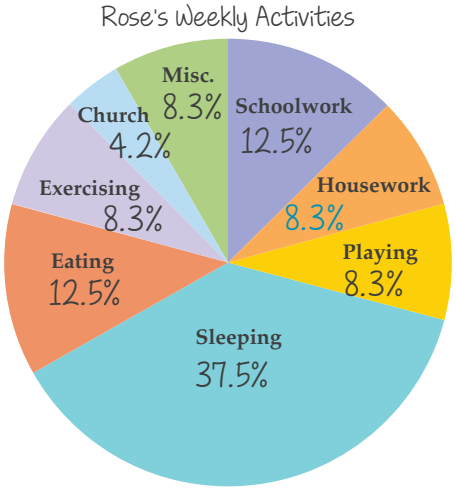
b. yoga

c. $5 - 3 = 2$

d. Indoor: $5 + 6 + 2 = 13$
Outdoor: $3 + 4 + 4 = 11$

e. $3 + 4 + 5 + 6 + 4 + 2 = 24$

4. a.



Housework: $14 \div 168$ hours $\approx 0.083 = 8.3\%$
Schoolwork: $21 \div 168 = 0.125 = 12.5\%$
Playing: $14 \div 168 \approx 0.083 = 8.3\%$
Sleeping: $63 \div 168 = 0.375 = 37.5\%$
Eating: $21 \div 168 = 0.125 = 12.5\%$
Exercising: $14 \div 168 \approx 0.83 = 8.3\%$
Church: $7 \div 168 \approx 0.042 = 4.2\%$
Misc.: $14 \div 168 \approx 0.83 = 8.3\%$

b. sleeping

c. $21 - 14 = 7$
7 hours

d. sleeping and eating: $37.5\% + 12.5\% = 50\%$

REVIEW

1. a. $2g + g + 2g + g + 2g + g = 360°$

$$9g = 360°$$

$$\frac{9g}{9} = \frac{360°}{9}$$

$$g = 40°$$

$m\angle FSL = 2g$

$= 2 \bullet 40° = 80°$

$m\angle LSO = g = 40°$

b. $A = \pi r^2$

$A = \pi(8)^2$

$A = 64\pi$

$A \approx 201.06$

Area: 201.06 ft^2

$C = 2\pi r$

$C = 2\pi(8)$

$C = 16\pi$

$C \approx 50.27$

Circumference: 50.27 ft

c. LSO: $\frac{m\angle LSO}{360°} = \frac{40°}{360°} = \frac{1}{9}$

$201.06 \bullet \frac{1}{9} = 22.34$

22.34 ft^2

FSL: $\frac{m\angle FSL}{360°} = \frac{80°}{360°} = \frac{2}{9}$

$201.06 \bullet \frac{2}{9} = 44.68$

44.68 ft^2

d. $50.27 \bullet \frac{2}{9} \approx 11.17$

11.17 ft

$50.27 \bullet \frac{1}{9} \approx 5.59$

5.59 ft

e. unbiased

systematic

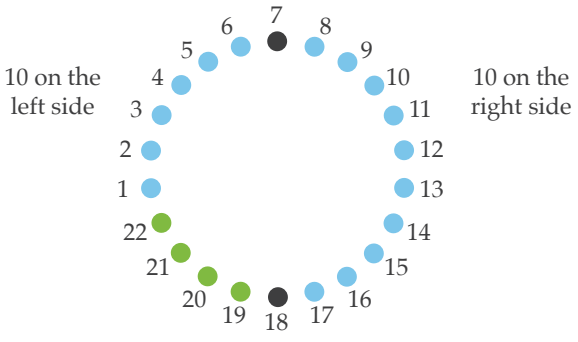
Logic Lesson 4

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

Studious Students

Draw a circle with the number 7 directly across from 18. There are 10 numbers (students) between 7 and 18 on the right side, so there must be 10 numbers (students) on the other side. That means 4 students are needed after student 18.

This is a total of 22 students.



Salamander Surveys

$$91.2\% = .912 = \frac{912}{1000} = \frac{456}{500} = \frac{228}{250} = \frac{114}{125}$$

114 out of 125 people is 91.2%.

125 people

Fairy Shrimp Population

965, 780, 785, and 762

Because each sibling guessed one digit correctly in the right place, that means that no sibling has two correct digits in correct places.

Three of the siblings guessed a number with 7 in the hundreds place. If this was their correct digit, then no other digit within their guesses would be correct. There is only one sibling left, however, and that sibling cannot have guessed two numbers in the correct places either. That means either the 6 or 5 in this guess would be correct, and no sibling would have correctly guessed the third digit. Therefore, 7 is not the correct digit for the hundreds place. This means that 9 is the correct digit in the hundreds place.

Because 9 is the correct digit in the hundreds place, this means that 6 is not the correct digit for the tens place, and 5 is not the correct digit for the ones place. The fourth guess listed is 762. We know that 7 is not correct and 6 is not correct, which means that 2 must be the digit that was correctly guessed.

Two other siblings guessed 780 and 785. The digit 7 cannot be the guess in the hundreds place, and 2 is already the correct digit for the ones place. This means that 8 must be the correct digit in these guesses.

The biologist estimated there were 982 fairy shrimp in the pool.

Cupcakes for Conservation

If all 32 cupcakes were sold individually, Robin would earn $64. The table below shows how the total earnings change as sets of three cupcakes for $4 increase.

Amount at $2 each	Amount at 3 for $4	Total Earnings ($)
32	0	$32 \cdot 2 = 64$
29	3	$29 \cdot 2 + 4 = 62$
26	6	$26 \cdot 2 + 8 = 60$
23	9	$23 \cdot 2 + 12 = 58$
20	12	$20 \cdot 2 + 16 = 56$
17	15	$17 \cdot 2 + 20 = 54$
14	18	$14 \cdot 2 + 24 = 52$

a. 14 cupcakes at $2 each

b. 18 cupcakes at 3 for $4

Expert Biologists

Information that can be gathered from each clue is shown below. A check is placed in a box when the answer is known for certain, and an X is placed in a box if it cannot be the answer. When a check is placed in a box, Xs can be placed in the rest of the row and column for that section.

1. Jack and David cannot both live in a western state or an eastern state. They must live on different sides.
2. Monique's expertise is not either of the flowers.
3. Jack is not an expert on the salamander or shrimp. Linda is not an expert on the salamander or shrimp.
4. Jack does not live in an eastern state. Linda does not live in an eastern state. David lives in an eastern state because David does not live on the same side of the country as Jack. Monique also must live in an eastern state because both western states are lived in by Jack and Linda.
5. California is a western state. Either Jack or Linda lives in California and studies the Vernal Pool Monkey Flower.
6. Monique lives in an eastern state but not in Pennsylvania, which means Monique lives in Massachusetts. This means that David lives in Pennsylvania. This also means that David is the Springtime Fairy Shrimp expert. This also means that Monique is the Spotted Salamander expert.
7. Jack does not live in Oregon. This means Jack lives in California, which means that Jack studies the Vernal Pool Monkey Flower. This means that Linda lives in the other western state, Oregon, and studies the other plant, which is the Fragrant Popcorn Flower.

		State				Species of Expertise			
		Massachusetts (eastern state)	Pennsylvania (eastern state)	Oregon (western state)	California (western state)	Vernal Pool Monkey Flower	Fragrant Popcorn Flower	Spotted Salamander	Springtime Fairy Shrimp
Biologist	Jack	X	X	X	✓	✓	X	X	X
	David	X	✓	X	X	X	X	X	✓
	Monique	✓	X	X	X	X	X	✓	X
	Linda	X	X	✓	X	X	✓	X	X
Species of Expertise	Vernal Pool Monkey Flower	X	X	X	✓				
	Fragrant Popcorn Flower	X	X	✓	X				
	Spotted Salamander	✓	X	X	X				
	Springtime Fairy Shrimp	X	✓	X	X				

Measures of Central Tendency

WARM-UP

$$9(z+2)-7z=22$$
$$9z+18-7z=22$$
$$2z+18=22$$
$$2z+18-18=22-18$$
$$2z=4$$
$$\frac{2z}{2}=\frac{4}{2}$$
$$z=2$$

PRACTICE

1. a. $3.47+3.63+3.88+3.89+3.95=18.82$
   $18.82\div 5=3.764$
   b. ~~3.47~~, ~~3.63~~, 3.88, ~~3.89~~, ~~3.95~~
   c. no mode
   d. $3.95-3.47=0.48$

2. a. $12.78+15.3+14.26+15.5+14.63=72.47$
   $72.47\div 5=14.494$
   b. Numerical order:
   ~~12.78~~, ~~14.26~~, 14.63, ~~15.3~~, ~~15.5~~
   c. no mode
   d. $15.5-12.78=2.72$

3. a. $6.95+6.9+6.2+6.92+6.99+6.85+6.88+6.97=54.66$
   $54.66\div 8=6.8325$
   b. Numerical order:
   ~~6.2~~, ~~6.85~~, ~~6.88~~, 6.9, 6.92, ~~6.95~~, ~~6.97~~, ~~6.99~~
   Find the mean of the middle two numbers.
   $6.9+6.92=13.82$
   $13.82\div 2=6.91$
   c. no mode
   d. $6.99-6.2=0.79$

4. a. $(0.51+0.52+0.53+0.49+0.52+0.51+0.53+0.5+0.54+x)\div 10=0.512$

$(0.51+0.52+0.53+0.49+0.52+0.51+0.53+0.5+0.54+x)\div 10\bullet 10=0.512\bullet 10$

$0.51+0.52+0.53+0.49+0.52+0.51+0.53+0.5+0.54+x=5.12$

$4.65+x=5.12$

$4.65+x-4.65=5.12-4.65$

$x=0.47$

World record: 0.47 seconds

b. 0.51, 0.52, 0.53 All three values appear twice.

REVIEW

1. $18p^4q^4+45p^2q^5-36p^3q^2$

$18p^4q^4=2\bullet(3\bullet 3)\bullet(p\bullet p)\bullet p\bullet p\bullet(q\bullet q)\bullet q\bullet q$

$45p^2q^5=(3\bullet 3)\bullet 5\bullet(p\bullet p)\bullet(q\bullet q)\bullet q\bullet q\bullet q$

$36p^3q^2=2\bullet 2\bullet(3\bullet 3)\bullet(p\bullet p)\bullet p\bullet(q\bullet q)$

GCF: $9p^2q^2$

$9p^2q^2(2p^2q^2+5q^3-4p)$

2. a. April & May

b. Total pairs of earrings sold:

$17+26+28+33+46=150$

$\$2.40\bullet 150=\$360$

c. $\$1200\div\$2.40=500$

500 pairs

d. $500-150=350$

350 pairs

3. 9 vertices

4. $80^2+b^2=89^2$

$6400+b^2=7921$

$6400+b^2-6400=7921-6400$

$b^2=1521$

$\sqrt{b^2}=\sqrt{1521}$

$b=39$

39 cm

Interpreting Measures of Central Tendency

WARM-UP

a. $1+2+3+3+4+5+5+6+6+7+7+7+8+9+9+10+10=102$

Number of addends: 17

$102 \div 17 = 6$

b. ~~1, 2, 3, 3, 4, 5, 5, 6,~~ 6, ~~7, 7, 7, 8, 9, 9, 10, 10~~

c. 7

7 appears 3 times.

d. Largest number: 10

Smallest number: 1

$10 - 1 = 9$

PRACTICE

1. a. Numerical order:
5, 8, 8.5, 9, 9, 9.25, 9.5, 10

mean / median
When there is an outlier, the median is a better measure of center.

b. Numerical order:
0.5, 0.5, 0.75, 0.75, 1, 1, 1.25, 1.5

mean / median
When there is not an outlier, the mean is a better measure of center.

c. Numerical order:
45, 60, 65, 75, 90, 100, 105, 180

mean / median

d. Numerical order:
25, 32, 35, 38, 43, 46, 51, 60

mean / median

2. a. 3

b. Numerical order:
3, 24, 25, 27, 36, 37, 38, 38, 45

Range with outlier: $45 - 3 = 42$

Range without outlier: $45 - 24 = 21$

c. ~~3, 24, 25, 27~~, 36, ~~37, 38, 38, 45~~

Median with outlier: 36

~~24, 25, 27~~, 36, 37, ~~38, 38, 45~~

$36 + 37 = 73$

$73 \div 2 = 36.5$

Median without outlier: 36.5

d. $3+24+25+27+36+37+38+38+45=273$

$273 \div 9 \approx 30.3$

Mean with outlier: 30.3

$24+25+27+36+37+38+38+45=270$

$270 \div 8 \approx 33.75$

Mean without outlier: 33.75

e. The mean moved 3.45, and the median only moved 0.5. The mean moved more.

f. median

The median is the better measure of center because there is an outlier that is affecting the mean more drastically than the median.

3. a. 45, 97, 100, 104, 106, 110, 112, 121, 123, 190

b. Range with outliers: $190 - 45 = 145$

Range without outliers: $123 - 97 = 26$

c. ~~45~~, ~~97~~, ~~100~~, ~~104~~, 106, 110, ~~112~~, ~~121~~, ~~123~~, ~~190~~

$106 + 110 = 216$

$216 \div 2 = 108$

Median with outliers: 108

~~97~~, ~~100~~, ~~104~~, 106, 110, ~~112~~, ~~121~~, ~~123~~

$106 + 110 = 216$

$216 \div 2 = 108$

Median without outliers: 108

d. $45 + 97 + 100 + 104 + 106 + 110 + 112 + 121 + 123 + 190 = 1108$

$1108 \div 10 = 110.8$

Mean with outliers: 110.8

$97 + 100 + 104 + 106 + 110 + 112 + 121 + 123 = 873$

$873 \div 8 = 109.1$

Mean without outliers: 109.1

e. Answers may vary.

Because there are outliers on BOTH ends, one pulls the mean up, and the other pulls the mean down. This helps to balance the data so that the mean does not change very much when outliers are removed.

REVIEW

1. $SA = 4\pi r^2$

$SA = 4\pi(8)^2$

$SA = 4\pi(64)$

$SA = 256\pi$

$SA \approx 804.25$

804.25 in^2

2. a. unbiased

b. $56 - 24 = 32$

32 people

c. Number of people surveyed:
$24 + 35 + 33 + 48 + 20 + 56 = 216$

$x \cdot 216 = 33$

$\frac{x \cdot 216}{216} = \frac{33}{216}$

$x = \frac{33}{216} \approx 0.153$

15.3%

3. $12m^3np(8m - 11n^2p)$

$= 12 \cdot m \cdot m \cdot m \cdot n \cdot p \cdot 8 \cdot m - 12 \cdot m \cdot m \cdot m \cdot n \cdot p \cdot 11 \cdot n \cdot n \cdot p$

$= 12 \cdot 8 \cdot m \cdot m \cdot m \cdot m \cdot n \cdot p - 12 \cdot 11 \cdot m \cdot m \cdot m \cdot n \cdot n \cdot n \cdot p \cdot p$

$= 96m^4np - 132m^3n^3p^2$

4. $V = -bhl$

$V = \frac{1}{2}(7)(5)(4)$

$V = 70$

70 dm^3

Data Displays: Part 2

WARM-UP

a. bar graph

b. 7 (height of bar labeled red)

c. Number of advertisements that used blue: 9
Number of advertisements that used yellow: 5
9 – 5 = 4

PRACTICE

1.

6	8	12	13	14	14
15	15	15	15	16	16
16	16	17	17	18	18
18	19	20	20	20	21
21	21	22	23	26	27
30					

2. a.

Stem	Leaf
0	6 8
1	2 3 4 4 5 5 5 5 6 6 6 6 7 7 8 8 8 9
2	0 0 0 1 1 1 2 3 6 7
3	0

b. 15 and 16
Each sum was rolled four times.

c. 5, 7, 9, 10, 11, 24, 25, 28, 29
Each of these sums was not rolled at all.

3. a. 6

b. 30

c. The median is the middle number of the set.

~~6~~	~~8~~	~~12~~	~~13~~	~~14~~	~~14~~
~~15~~	~~15~~	~~15~~	~~15~~	~~16~~	~~16~~
~~16~~	~~16~~	~~17~~	17	~~18~~	~~18~~
~~18~~	~~19~~	~~20~~	~~20~~	~~20~~	~~21~~
~~21~~	~~21~~	~~22~~	~~23~~	~~26~~	~~27~~
~~30~~					

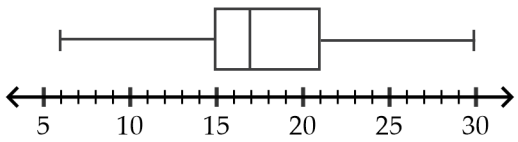
d. Q1 is the median of the lower half of the data set (all points left of the median).

~~6~~	~~8~~	~~12~~	~~13~~	~~14~~	~~14~~
~~15~~	15	~~15~~	~~15~~	~~16~~	~~16~~
~~16~~	~~16~~	~~17~~			

e. Q3 is the median of the upper half of the data set (all points right of the median).

~~18~~	~~18~~	~~18~~	~~19~~	~~20~~	~~20~~
~~20~~	21	~~21~~	~~21~~	~~22~~	~~23~~
~~26~~	~~27~~	~~30~~			

f.



4. a. 21 to 30

b. 6 to 17

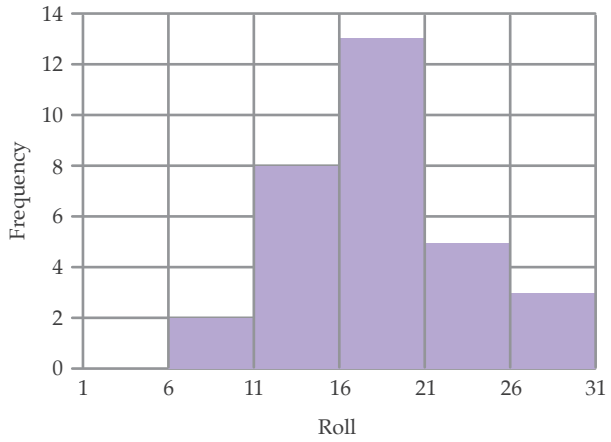
5. a.

Sum	Frequency
1–5	
6–10	II
11–15	𝍸 III
16–20	𝍸 𝍸 III
21–25	𝍸
26–30	III

b. 16 to 20

c. The minimum sum you can get with five dice is 5, and that only happens if all dice land on a 1. This would not happen very often.

d.



REVIEW

1. a. 5, 24, 24, 25, 25, 27, 28, 28, 28, 29, 29, 30

b. 5

c. $5 + 24 + 24 + 25 + 25 + 27 + 28 + 28 + 28 + 29 + 29 + 30 = 302$

$302 \div 12 \approx 25.2$

Mean with outlier: 25.2

$24 + 24 + 25 + 25 + 27 + 28 + 28 + 28 + 29 + 29 + 30 = 297$

$297 \div 11 = 27$

Mean without outlier: 27

d. ~~5~~, ~~24~~, ~~24~~, ~~25~~, ~~25~~, 27, 28, ~~28~~, ~~28~~, ~~28~~, ~~29~~, ~~29~~, ~~30~~

$27 + 28 = 55$

$55 \div 2 = 27.5$

Median with outlier: 27.5

~~24~~, ~~24~~, ~~25~~, ~~25~~, ~~27~~, 28, ~~28~~, ~~28~~, ~~29~~, ~~29~~, ~~30~~

Median without outlier: 28

e. Range with outlier: $30 - 5 = 25$

Range without outlier: $30 - 24 = 6$

f. median

g. 28 people

2. $24a^2c^3e^2 + 54a^3ce^3 - 18a^3c^2e$

$24a^2c^3e^2 = 2 \cdot 2 \cdot (2 \cdot 3) \cdot (a \cdot a) \cdot (c) \cdot c \cdot c \cdot (e) \cdot e$

$54a^3ce^3 = (2 \cdot 3) \cdot 3 \cdot 3 \cdot (a \cdot a) \cdot a \cdot (c) \cdot (e) \cdot e \cdot e$

$18a^3c^2e = (2 \cdot 3) \cdot 3 \cdot (a \cdot a) \cdot a \cdot (c) \cdot c \cdot (e)$

GCF: $6a^2ce$

$6a^2ce\left(4c^2e + 9ae^2 - 3ac\right)$

3. a. Yellowstone National Park

b. 26% of 50

$0.26 \cdot 50 = 13$ family members

Scatter Plots

WARM-UP

a. $5 (amount at 0 weeks)

b. week 4 and week 5 (steepest line segment)

c. week 5: $50

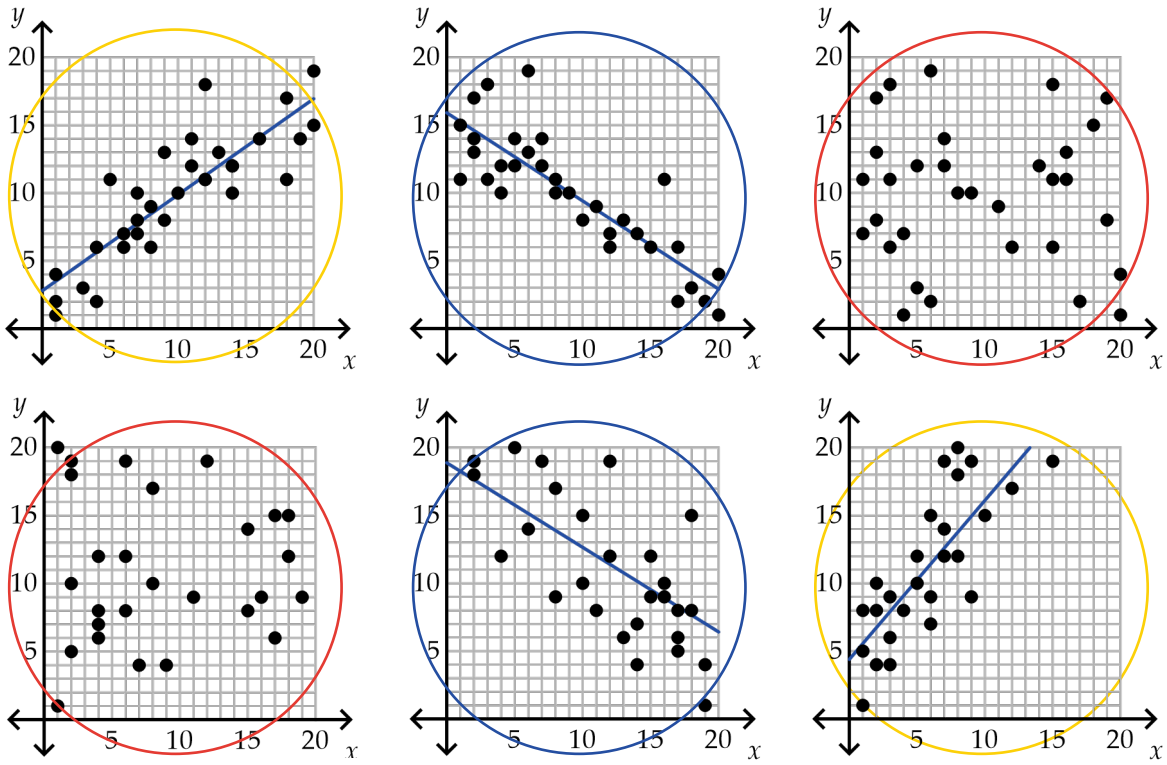
week 4: $35

$50 – $35 = $15

PRACTICE

Problems 1., 2., 3., and 4. are shown below.

Lines of best fit need not be exact, but they should be sloped in the same general direction and not too far away from the data points.

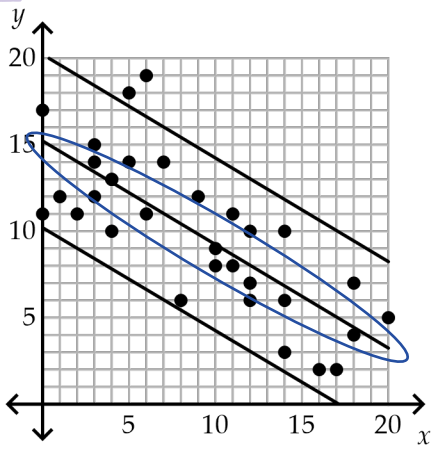


Yellow: moves up as points move right

Blue: moves down as points move right

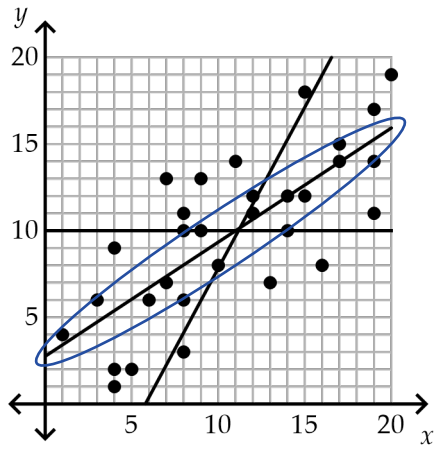
Red: no obvious trend

5. a.



Line should not be above or below most of the points.

b.



Line should follow the general trend that the points follow.

6. a. Answers will vary.

b. Answers will vary.

c. The line of best fit should be near the plotted data points and should be increasing.

d. Data will most likely show a positive correlation (people get taller as they get older), but it may show no correlation. This is more likely if teens and adults were the primary ones surveyed.

e. No, the height of a random 30-year-old cannot be determined from the data. A best fit line is only an approximation or predictor of an overall trend in data.

REVIEW

1. a. $24 - 7 = 17$

b. This part of the graph represents 25% of the data.

c. 48 This is the point farthest right.

d. 12 This is the middle line in the box.

2. a. $m = \text{slope} = \dfrac{\text{rise}}{\text{run}} = \dfrac{-4}{5} = -\dfrac{4}{5}$

b.
$$\begin{array}{r} 4 \text{ hr } 21 \text{ min} \\ 2 \text{ hr } 46 \text{ min} \\ +\ 3 \text{ hr } \ 6 \text{ min} \\ \hline 9 \text{ hr } 73 \text{ min} \end{array}$$

73 min = 1 hr 13 min

$$\begin{array}{r} 9 \text{ hr} \\ +\ 1 \text{ hr } 13 \text{ min} \\ \hline 10 \text{ hr } 13 \text{ min} \end{array}$$

c. $\dfrac{6 \cancel{\text{ ft}}}{1} \cdot \dfrac{12 \cancel{\text{ in}}}{1 \cancel{\text{ ft}}} \cdot \dfrac{2.54 \text{ cm}}{1 \cancel{\text{ in}}} = \dfrac{182.88 \text{ cm}}{1} = 182.88 \text{ cm}$

d. Amount of increase: $90 - 72 = 18$

Percent increase: $18 \div 72 = 0.25$

25%

3. $\dfrac{64g^8l^2o^3w}{16g^5l^3o^3w^2}$

$$= \frac{\overset{4}{\cancel{64}} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot g \cdot g \cdot g \cdot \cancel{l} \cdot \cancel{l} \cdot \cancel{o} \cdot \cancel{o} \cdot \cancel{o} \cdot \cancel{w}}{\underset{1}{\cancel{16}} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{g} \cdot \cancel{l} \cdot \cancel{l} \cdot l \cdot \cancel{o} \cdot \cancel{o} \cdot \cancel{o} \cdot \cancel{w} \cdot w}$$

$$= \frac{4 \cdot g \cdot g \cdot g}{l \cdot w}$$

$$= \frac{4g^3}{lw}$$

Interpreting Graphs

WARM-UP

1. a. $\frac{6}{5} = \frac{120}{100} = 120\%$ b. $\frac{2}{3} = 0.66\ldots = 66.\overline{6}\%$ c. $\frac{9}{25} = \frac{36}{100} = 36\%$

2. a. $\frac{10}{\cancel{8}_{2}} \cdot \cancel{4} = 5$ b. $\frac{6}{\cancel{9}_{3}} \cdot \cancel{3} = 2$ c. $\cancel{2} \cdot \frac{3}{\cancel{4}_{2}} = \frac{3}{2} = 1\frac{1}{2}$

PRACTICE

1.

Graph	Identify the approximate location/ interval of any mode(s).	Is the data unimodal, bimodal, or neither?	Is the data left skewed, right skewed, symmetric, or none of these?	Do there appear to be any outliers? Are the outliers on the left or right of the graph?	Is the mean <, >, or ≈ the median?
A	N/A	N/A	Left skewed	Outliers on left	<
B	4, 18	Bimodal	None	No outliers	≈
C	10–20, 40–50, 60–70	Neither	None	No outliers	N/A
D	N/A	N/A	Right skewed	Outliers on the right	>
E	5–10	Unimodal	Right skewed	Outliers on the right	>
F	45	Unimodal	Symmetric	No outliers	≈

2. a. median
   b. mean
   c. symmetric
   d. larger, skewed
   e. left, less
   f. longer
   g. mode
   h. unimodal
   i. bimodal

C M K W C K K O E C C C C I L J A V E U
M M R I O W V M G L S A J H S S N E P H
B E F P T H P K H V L N K Q F H R H Y Z
O Y V V S R X G X A Z M T O Z S T F J W
D E V W L Y O U T J C O L U L N N O N I
D G P K V Z Z T U L Q M K O Y Q V M U E
U C R U K A Z F W L I E N W N U U E N K
N S X S L C Y V V S D D T G L G I A I D
V H K Y J E S B X Q N I L J Z Q E N M N
U W S X K J S O B E I A C T N R F R O R
E D D H D R R S N I U N F S U P L Q D N
F F O G E O K B M M G L W T I F W Y A S
S Y Q B W Z Q U S Y M M E T R I C L L A
F N C J I M O D E X R E O G D B V A Q K
Y V L K G M E O V U Y R N O T D C R M I
F M B P I F O S K E W E D B Z I X G P R
P L F X I O J D P W T D J P I D L E F T
L E W O J H V O A N V C H V J V I R E X
L A P A Q I N Q G L F F H I K H M W J C
A Q N T N D B M K I J C G H H C G X B X

REVIEW

1. $(2000+3000+3000+3750+3500+x)\div 6=3000$

$(2000+3000+3000+3750+3500+x)\div 6\bullet 6=3000\bullet 6$

$2000+3000+3000+3750+3500+x=18000$

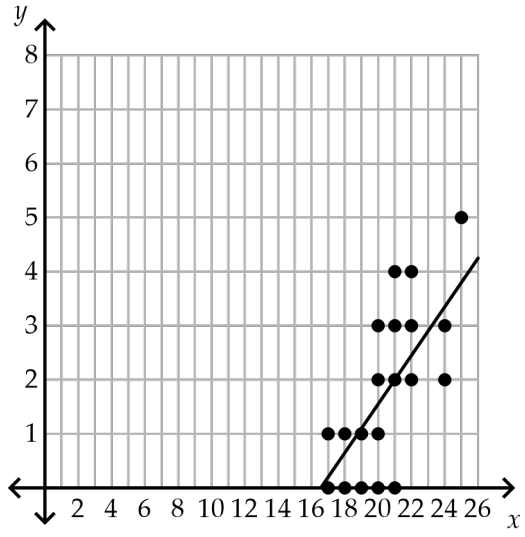
$15250+x=18000$

$15250+x-15250=18000-15250$

$x=2750$ 2,750 meters

2. a. Positive correlation

b. The line of best fit need not be exact, but it should be sloped in the same general direction and not too far away from the data points.



3. a. Number of members surveyed:
$2+23+26+17+6+2=76$

Number who spend 1.5 or more hours practicing: $17+6+2=25$

$25\div 76\approx 0.329=32.9\%$

b. Number of members surveyed:
$2+23+26+17+6+2=76$

Number who spend less than 0.5 hours practicing: 2

$2\div 76\approx 0.026=2.6\%$

4.

Name	Boxes of potatoes sold
Whitney	
Abby	
Brennen	
Ian	
Taylor	

Simple Probability

WARM-UP

1. $\frac{4}{5} = 4 \div 5 = 0.8$

   $0.8 \bullet 100\% = 80\%$

2. $32\% = \frac{32}{100} = \frac{8}{25}$

3. $0.278 \bullet 100\% = 27.8\%$

PRACTICE

1. a. $11 + 6 + 3 = 20$

   b.

Color	Probability as a Fraction	Probability as a Percent
Black	$\frac{11}{20}$	55%
Blue	$\frac{6}{20} = \frac{3}{10}$	30%
Green	$\frac{3}{20}$	15%

   c. $6 + 3 = 9$

   d. Fraction: $\frac{9}{20}$

   Percent: $\frac{9}{20} = \frac{45}{100} = 45\%$

2. a. 6

   b. Fraction: $\frac{1}{6}$

   Percent: $\frac{1}{6} \approx 0.167 = 16.7\%$

   c. There are 3 even number outcomes (2, 4, or 6).

   d. Fraction: $\frac{3}{6} = \frac{1}{2}$

   Percent: $\frac{1}{2} = \frac{50}{100} = 50\%$

   e. 4 and 6 are composite numbers, so there are 2 composite number outcomes.

   f. Fraction: $\frac{2}{6} = \frac{1}{3}$

   Percent: $\frac{1}{3} \approx 0.333 = 33.3\%$

3. a. He flipped 2 heads out of 6 flips.

   Fraction: $\frac{2}{6} = \frac{1}{3}$

   Percent: $\frac{1}{3} \approx 0.333 = 33.3\%$

   b. There is one desired outcome (heads) out of two possible outcomes (heads and tails).

   Fraction: $\frac{1}{2}$

   Percent: $\frac{1}{2} = \frac{50}{100} = 50\%$

   c. The experimental probability is what is observed when the event occurs. The probability obtained by the experiment is not always what is expected (the theoretical probability).

REVIEW

1. a. Sum: $53 + 42 + 60 + 48 + 51 + 64 = 318$

   $318 \div 6 = 53$

   Mean: 53

   b. Numerical Order: ~~42~~, ~~48~~, 51, 53, ~~60~~, ~~64~~

   $51 + 53 = 104$

   $104 \div 2 = 52$

   Median: 52

   c. Mode: no mode

   d. Range: $64 - 42 = 22$

2. a. right skewed

   b. >

3. a. Area of the circle base:

   $A = \pi r^2 = \pi(2)^2 = 4\pi \approx 12.6$

   12.6 ft^2

   Area of the rectangular (curved) side of the cylinder:

   length (height of cylinder): 4 ft

   width (circumference of the cylinder):

   $C = \pi d = \pi \bullet 4 = 4\pi \approx 12.6$

   $A = lw \approx 4 \bullet 12.6 = 50.4$

   50.4 ft^2

   Area of the side of the cone (sector):

   $A = \pi rl = \pi \bullet 2 \bullet 2.5 = 5\pi \approx 15.7$

   15.7 ft^2

   Total surface area:

   $12.6 \text{ ft}^2 + 50.4 \text{ ft}^2 + 15.7 \text{ ft}^2 = 78.7 \text{ ft}^2$

   b. $\frac{78.7 \text{ } \cancel{\text{ft}} \bullet \cancel{\text{ft}}}{1} \bullet \frac{1 \text{ yd}}{3 \text{ } \cancel{\text{ft}}} \bullet \frac{1 \text{ yd}}{3 \text{ } \cancel{\text{ft}}} = \frac{78.7 \text{ yd}^2}{9} \approx 9 \text{ yd}^2$

Types of Events

WARM-UP

a. Diagram 2 shows just Set A. 2

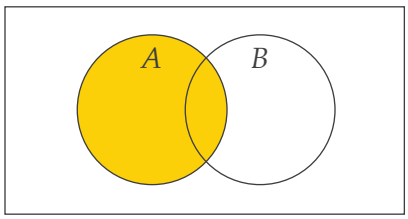
b. Diagram 3 shows just Set B. 3

c. $A \cup B$ is the union of Set A and Set B (everything in both sets). 4

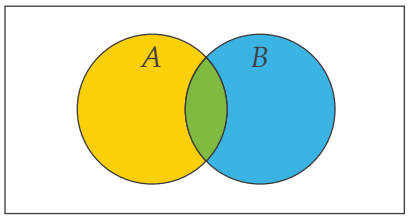
d. $A \cap B$ is the intersection of A and B (the overlapping region). 1

PRACTICE

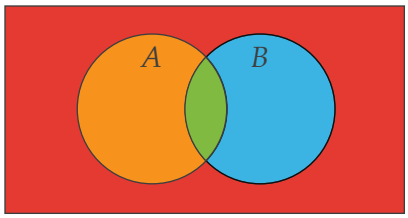
1. a.



b.



c.



d. green

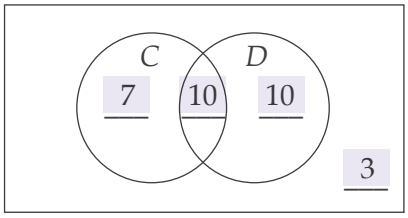
e. orange and green

2.

Sets	Mutually Exclusive?
A is the set of positive integers less than 20. B is the set of perfect squares.	no 1, 4, 9, and 16 are in both sets.
A is the set of prime numbers. B is the set of composite numbers.	yes No numbers are in both sets.
A is the set of children in a class. B is the set of girls in that same class.	no Girls are in both sets.

3. a. Since 10 kids have both types of pets, 10 goes in the intersection of C and D. Since C has 17 students, there are $17 - 10 = 7$ that are not in the intersection.

Since D has 20 students, there are $20 - 10 = 10$ that are not in the intersection. Altogether, there are 30 students, so there must be $30 - 10 - 10 - 7 = 3$ that have neither pet.



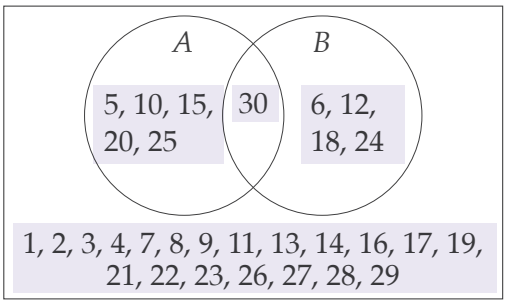
b. $7 + 10 = 17$

$\frac{17}{30}$

c. $\frac{10}{30} = \frac{1}{3}$

d. $\frac{3}{30} = \frac{1}{10}$

4. a. 30 and 60 are multiples of 5 and multiples of 6.



b. There are 10 total numbers in the union of A and B (all numbers in the circles).

$\frac{10}{30} = \frac{1}{3}$

c. There is 1 number in the intersection of A and B (overlapping region).

$\frac{1}{30}$

d. There are 5 numbers that are in A but not in B (all numbers in just A, not the overlapping region).

$\frac{5}{30} = \frac{1}{6}$

REVIEW

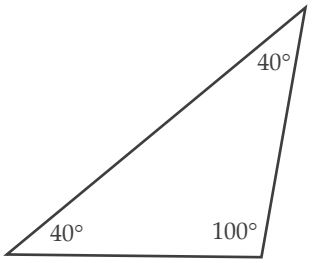
1. $\frac{8}{1992} = \frac{1}{249}$

2. median (there are outliers)

3. $$-2t + 29 = -1\frac{1}{3}t + 15$$
$$-2t + 29 + 1\frac{1}{3}t = -1\frac{1}{3}t + 15 + 1\frac{1}{3}t$$
$$-\frac{2}{3}t + 29 = 15$$
$$-\frac{2}{3}t + 29 - 29 = 15 - 29$$
$$-\frac{2}{3}t = -14$$
$$-\frac{3}{2} \bullet \left(-\frac{2}{3}t\right) = -14 \bullet \left(-\frac{3}{2}\right)$$
$$t = 21$$

4. $a = 20, b = ?, c = 101$
$$20^2 + b^2 = 101^2$$
$$400 + b^2 = 10201$$
$$400 + b^2 - 400 = 10201 - 400$$
$$b^2 = 9801$$
$$\sqrt{b^2} = \sqrt{9801}$$
$$b = 99$$
99 mm

5. a.



b. $$m\angle 1 + m\angle 2 + m\angle 3 = 180°$$
$$40° + 100° + m\angle 3 = 180°$$
$$140° + m\angle 3 = 180°$$
$$140° + m\angle 3 - 140° = 180° - 140°$$
$$m\angle 3 = 40°$$

c. isosceles, obtuse

Sample Space

WARM-UP

a. Number of desired outcomes: 1

Number of possible outcomes: 6

Probability: $\frac{1}{6}$

b. There are 2 outcomes that are less than 3: 1 and 2.

Number of desired outcomes: 2

Number of possible outcomes: 6

Probability: $\frac{2}{6} = \frac{1}{3}$

c. There are 3 even-numbered outcomes: 2, 4, and 6.

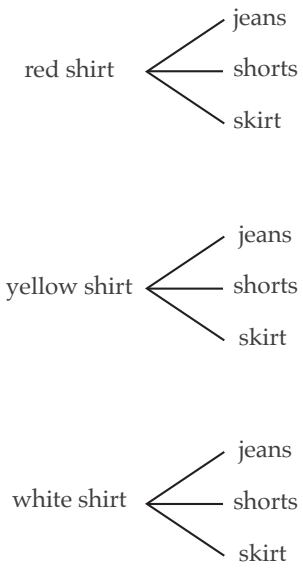
Number of desired outcomes: 3

Number of possible outcomes: 6

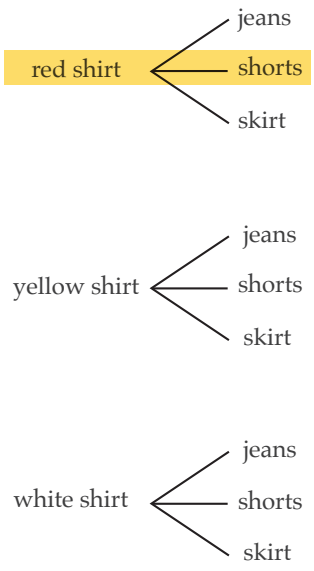
Probability: $\frac{3}{6} = \frac{1}{2}$

PRACTICE

1. a.



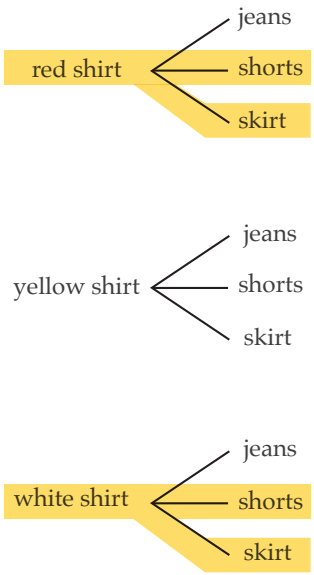
b.



There is 1 outcome with a red shirt and shorts out of 9 possible outcomes.

$\frac{1}{9}$

c.



There are 4 outcomes with neither the yellow shirt nor the jeans out of 9 possible outcomes.

$\frac{4}{9}$

2. a.

First Roll → / Second Roll ↓	1	2	2	3	3	4
1	2	3	3	4	4	5
2	3	4	4	5	5	6
2	3	4	4	5	5	6
3	4	5	5	6	6	7
3	4	5	5	6	6	7
4	5	6	6	7	7	8

b. There are 10 ways to get a sum of 5 out of 36 possible outcomes.

$\frac{10}{36} = \frac{5}{18}$

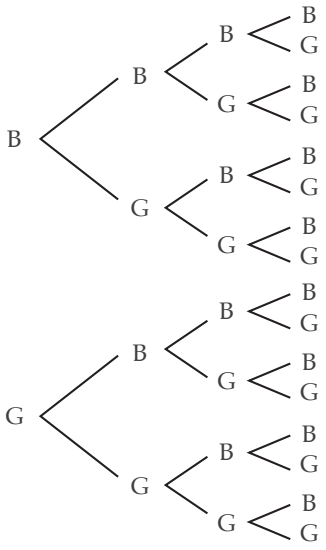
c. There are 5 ways to get a sum of 7 or 8.

$\frac{5}{36}$

d. There are 13 ways to get a sum of 2, 3, or 4.

$\frac{13}{36}$

3. a.



b. BBBB BGBB GBBB GGBB
BBBG BGBG GBBG GGBG
BBGB BGGB GBGB GGGB
BBGG BGGG GBGG GGGG

c. BBBB BGBB GBBB **GGBB**
BBBG **BGBG** **GBBG** GGBG
BBGB **BGGB** **GBGB** GGGB
BBGG BGGG GBGG GGGG

Fraction: $\frac{6}{16} = \frac{3}{8}$ Percent: 37.5%

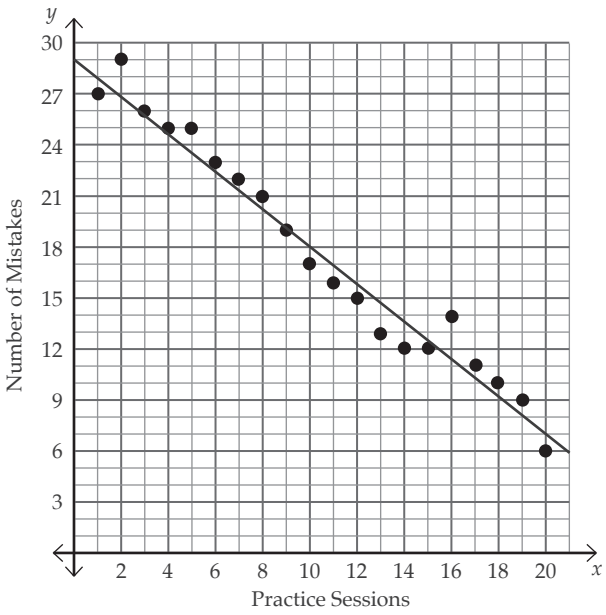
d. BBBB **BGBB** **GBBB** GGBB
BBBG BGBG GBBG **GGBG**
BBGB BGGB GBGB **GGGB**
BBGG **BGGG** **GBGG** GGGG

Fraction: $\frac{8}{16} = \frac{1}{2}$ Percent: 50%

REVIEW

1. a. negative correlation

   b. The line of best fit need not be exact, but it should be sloped in the same general direction and not too far away from the data points.



2. Number of desired outcomes: 7

   Number of possible outcomes:
   $5+3+7+3+2=20$

   $\frac{7}{20}=0.35=35\%$

3. 192 students ÷ 16 classes = 12 students per class

4. 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. $\frac{3 \bullet 1017.36}{254.34}=h$

   $\frac{3052.08}{254.34}=h$

   $12=h$

   12 cm

Compound Probability

WARM-UP

a. Possible outcomes of two flips: HH, HT, TH, TT

Probability of HT = $\frac{1}{4}$ = 25%

b. Probability of TH = $\frac{1}{4}$ = 25%

PRACTICE

1. a. 8 + 8 + 8 = 24 total socks

8 black socks + 8 brown socks = 16 dark socks

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

b. After the first pick, there are 23 socks left. There are 7 socks left of the same color he just picked.

$\frac{7}{23}$

c. $\frac{2}{3} \cdot \frac{7}{23} = \frac{14}{69}$

2. a. There are 3 numbers in the top row and 9 possible draws.

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

b. There are 2 numbers left in the top row and 8 numbers left to draw from.

$\frac{2}{8} = \frac{1}{4}$

c. There is 1 number left in the top row and 7 numbers left to draw from.

$\frac{1}{7}$

d. $\frac{1}{3} \cdot \frac{1}{4} \cdot \frac{1}{7} = \frac{1}{84}$

3. a. $\frac{2}{4} = \frac{1}{2}$

b. $\frac{1}{2}$

c. $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

d. $\frac{1}{4} \cdot \frac{1}{2} = \frac{1}{8}$

e. Tables will vary.

f. Answers will vary. The number of trials in which the student spun yellow and flipped heads should be in the numerator, and 16 should be in the denominator (before simplifying).

g. Answers will vary. The number of trials in which the student spun red and flipped tails should be in the numerator, and 16 should be in the denominator (before simplifying).

h. Answers will vary. Theoretical probability is what is expected, but experimental probability is what happens in an experiment. They may or may not be close together.

REVIEW

1. a. 8 track-only participants + 4 field-only participants = 12 participants in only one event

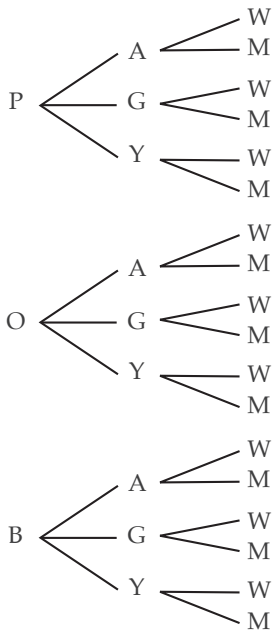
   This would be the total of the circles in a Venn diagram NOT including the overlap. Subtract from the total participants to find the overlap.

   27 members – 12 participants in only one event = 15 members

   b. 23 track participants – 15 participants of both track and field events = 8 track-only participants

   $\frac{8}{27}$

2. a. Main Dish Options, Side Options, Beverage Options



   b.

PAW	OAW	BAW
PAM	OAM	BAM
PGW	OGW	BGW
PGM	OGM	BGM
PYW	OYW	BYW
PYM	OYM	BYM

   18 options

   c. $\frac{1}{18}$

3. a. $(13-2)180°$
   $= 11 \cdot 180°$
   $= 1980°$

   b. $\frac{1980°}{13} \approx 152.3°$

Probability Simulation

1. a. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

   b. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

   c. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

   d. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

   e. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

   f. Desired outcome: 1 Possible outcomes: 6
   Fraction: $\frac{1}{6}$ Percent: 16.67%

2. Answers will vary. There should be 10 total tallies in this table. An example table is given.

Roll	Frequency
1	||
2	|
3	||
4	|
5	|||
6	|

3. Answers will vary. There should be 40 total tallies in this table. An example table is given.

Roll	Frequency
1	𝍸
2	𝍸 𝍸
3	𝍸 ||
4	|||
5	𝍸 |||
6	𝍸 |||

4. Answers will vary. Examples are given below based on the example table from Problem 2.

	Fraction:	Percent:
1.	$\frac{2}{10} = \frac{1}{5}$	20%
2.	$\frac{1}{10}$	10%
3.	$\frac{2}{10} = \frac{1}{5}$	20%
4.	$\frac{1}{10}$	10%
5.	$\frac{3}{10}$	30%
6.	$\frac{1}{10}$	10%

5. Answers will vary. Examples are given below based on the example table from Problem 3.

	Fraction:	Percent:
1.	$\frac{4}{40}=\frac{1}{10}$	10%
2.	$\frac{10}{40}=\frac{1}{4}$	25%
3.	$\frac{7}{40}$	17.5%
4.	$\frac{3}{40}$	7.5%
5.	$\frac{8}{40}=\frac{1}{5}$	20%
6.	$\frac{8}{40}=\frac{1}{5}$	20%

6. a. Answers will vary.

b. Answers will vary.

c. Experimental probability is what happens in an experiment. Theoretical probability is what is expected. The more times the die is rolled, the closer the experimental probability should get to the theoretical probability.

7. Answers will vary. There should be 50 total tallies in this table. The table below is based on the examples given in Problems 2 and 3.

Roll	Frequency
1	𝍸 |
2	𝍸 𝍸 |
3	𝍸 ||||
4	||||
5	𝍸 𝍸 |
6	𝍸 ||||

	Fraction:	Percent:
1.	$\frac{6}{50}=\frac{3}{25}$	12%
2.	$\frac{11}{50}$	22%
3.	$\frac{9}{50}$	18%
4.	$\frac{4}{50}=\frac{2}{25}$	8%
5.	$\frac{11}{50}$	22%
6.	$\frac{9}{50}$	18%

8.

First Roll → / Second Roll ↓						
	1, 1	2, 1	3, 1	4, 1	5, 1	6, 1
	1, 2	2, 2	3, 2	4, 2	5, 2	6, 2
	1, 3	2, 3	3, 3	4, 3	5, 3	6, 3
	1, 4	2, 4	3, 4	4, 4	5, 4	6, 4
	1, 5	2, 5	3, 5	4, 5	5, 5	6, 5
	1, 6	2, 6	3, 6	4, 6	5, 6	6, 6

9. There is only 1 desired outcome, 3 and 3, out of 36 total outcomes.

Fraction: $\frac{1}{36}$ Percent: 2.78%

10. a. 1, 6 6, 1 2, 5 5, 2 3, 4 4, 3

b. Desired outcomes: 6 Possible outcomes: 36

Fraction: $\frac{6}{36} = \frac{1}{6}$ Percent: 16.67%

11. a. 1, 3 3, 1 2, 2

b. Desired outcomes: 3 Possible outcomes: 36

Fraction: $\frac{3}{36} = \frac{1}{12}$ Percent: 8.33%

12.

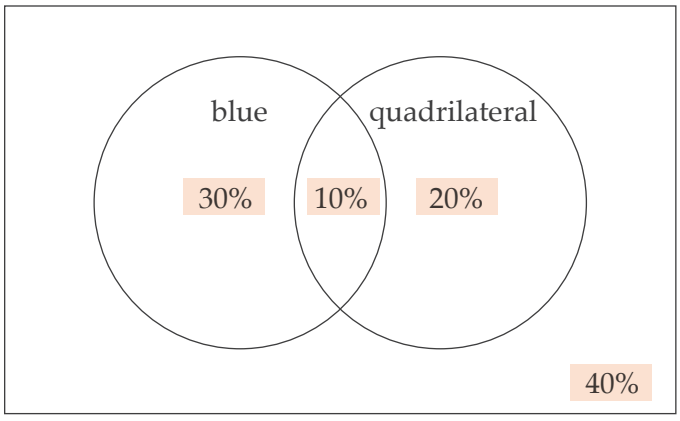
Event	Probability		Event	Probability	
	Fraction	Percent		Fraction	Percent
Drawing a hexagon	$\frac{1}{10}$	10%	Drawing a blue shape	$\frac{4}{10}=\frac{2}{5}$	40%
Drawing a quadrilateral	$\frac{3}{10}$	30%	Drawing a yellow shape	$\frac{1}{10}$	10%
Drawing a triangle	$\frac{3}{10}$	30%	Drawing a purple shape	$\frac{3}{10}$	30%
Drawing a circle	$\frac{1}{10}$	10%	Drawing an orange shape	$\frac{2}{10}=\frac{1}{5}$	20%

13. One blue shape is also a quadrilateral.
Probability of drawing a blue quadrilateral (overlapping section): 10%

Probability of drawing a blue shape: 40%
Probability of drawing a blue shape that is *not* a quadrilateral (blue-only section):
40% – 10% = 30%

Probability of drawing a quadrilateral: 30%
Probability of drawing a quadrilateral that is not blue (quadrilateral-only section):
30% – 10% = 20%

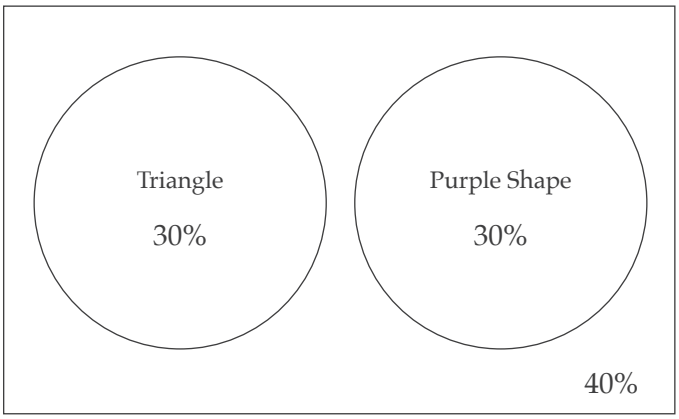
There are 4 cards with shapes that are not quadrilaterals and not blue.
Probability of drawing a shape that is not a quadrilateral and not blue (outside section): 40%

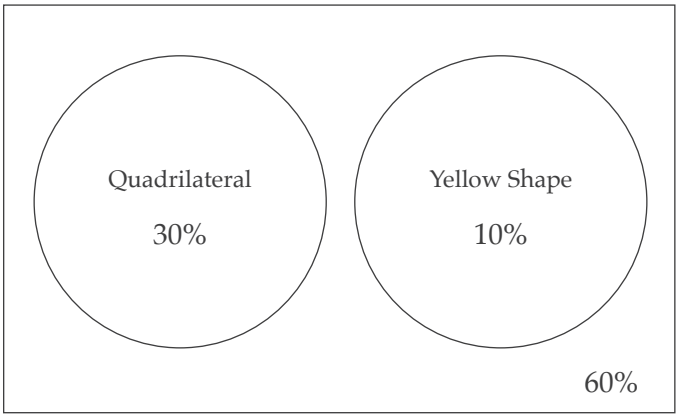


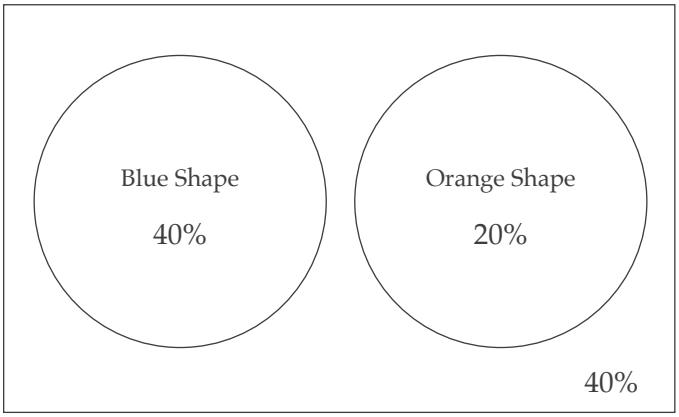
14. Answers may vary, and there are multiple correct answers. Some examples are given below.

- Drawing a triangle and a purple shape
- Drawing a quadrilateral and a yellow shape
- Drawing any two different shapes (circle and square, hexagon and quadrilateral, etc.)
- Drawing any two different colors (blue and purple, orange and blue, etc.)
- Drawing two cards from any non-overlapping categories (yellow and hexagon, octagon and orange, etc.)

15. Answers may vary. The labels of the circles should be the two categories the student picked as mutually exclusive in Problem 14. The three percentages written should add to 100%. Some examples are given.







Unit 4 Review

1. a. $4 \text{ in} \bullet 6 \text{ in} = 24 \text{ in}^2$

   b. $4 \text{ in} \bullet 2 = 8 \text{ in}$ and $6 \text{ in} \bullet 2 = 12 \text{ in}$

   c. $8 \text{ in} \bullet 12 \text{ in} = 96 \text{ in}^2$

   d. $96 \text{ in}^2 \div 24 \text{ in}^2 = 4$

2. a. $x^2y + 3x - 2x^2y - 1 - x$
   $= x^2y - 2x^2y + 3x - x - 1$
   $= -x^2y + 2x - 1$

   b. $ab^2(b - 2a)$
   $= ab^2 \bullet b - ab^2 \bullet 2a$
   $= a \bullet b \bullet b \bullet b - a \bullet b \bullet b \bullet 2 \bullet a$
   $= ab^3 - 2 \bullet a \bullet a \bullet b \bullet b$
   $= ab^3 - 2a^2b^2$

   c. $\dfrac{4n^2m}{6nm^2}$
   $= \dfrac{\cancel{2} \bullet 2 \bullet \cancel{n} \bullet n \bullet \cancel{m}}{\cancel{2} \bullet 3 \bullet \cancel{n} \bullet m \bullet \cancel{m}}$
   $= \dfrac{2n}{3m}$

3. $12x^2y = \cancel{2} \bullet \cancel{2} \bullet 3 \bullet \cancel{x} \bullet x \bullet y$
   $8xz = \cancel{2} \bullet \cancel{2} \bullet 2 \bullet \cancel{x} \bullet z$
   $\text{GCF} = 2 \bullet 2 \bullet x = 4x$
   $4x(3 \bullet x \bullet y + 2 \bullet z)$
   $= 4x(3xy + 2z)$

4. a. no

   The sample does not represent all kids in the neighborhood.

   b. yes

   Sampling kids who are at an ice cream shop may include bias.

5. a. The median is the middle line on the box plot.

   150 min

   b. The mode is where the graph peaks (highest point).

   120 min

   c. The range of the maximum amount of time is the right-most interval on the histogram.

   240–270 min

   d. Posey's graph appears to have one main peak.

   unimodal

   e. Winston's graph

   The graph appears to have two peaks.

   f. 60–90 minutes

   g. left

   h. no

6. a. $\dfrac{45°}{360°} = \dfrac{1}{8}$

   b. $\dfrac{1}{8} \bullet 153.94 \approx 19.24$

   Sector area: 19.24 ft^2

   $\dfrac{1}{8} \bullet 43.98 \approx 5.5$

   Arc length: 5.5 ft

7. a. Name: sphere

$$SA = \frac{4}{3}\pi r^3$$
$$= \frac{4}{3}\pi(3)^3$$
$$= \frac{4}{\cancel{3}_{1}}\pi \bullet \cancel{27}^{9}$$
$$= 36\pi$$
$$\approx 113.1$$

Volume: 113.1 in^3

$$V = 4\pi r^2$$
$$= 4\pi(3)^2$$
$$= 4\pi \bullet 9$$
$$= 36\pi$$
$$\approx 113.1$$

Surface area: 113.1 in^2

b. Name: cylinder

$$V = Bh$$
$$= \pi r^2 h$$
$$= \pi(3 \div 2)^2(5)$$
$$= \pi(1.5)^2(5)$$
$$= \pi(2.25)(5)$$
$$= 11.25\pi$$
$$\approx 35.34$$

Volume: 35.34 in^3

Area of circular bases of cylinder:

$$A = \pi r^2$$
$$= \pi(3 \div 2)^2$$
$$= 1.5^2\pi$$
$$= 2.25\pi$$
$$\approx 7.07$$

Area of two circular bases:

$7.07\ in^2 \bullet 2 = 14.14\ in^2$

Area of cylinder curved side (rectangle shape):

Width is 5 in. Length is the circumference of the circle (pi times the diameter).

$$C = \pi d$$
$$= \pi(3) \approx 9.42$$
$$A = lw$$
$$= 9.42 \bullet 5 = 47.1$$

Area of cylinder side: 47.1 in^2

Surface area:

$14.14\ in^2 + 47.1\ in^2 = 61.24\ in^2$

8. Volume of rectangular portion of house:

$V = lwh = 6\ cm \bullet 5\ cm \bullet 6\ cm = 180\ cm^3$

Volume of rectangular pyramid on top:

$$V = \frac{1}{3}Bh$$
$$= \frac{1}{3}(5 \bullet 6) \bullet 2$$
$$= \frac{1}{3}(30) \bullet 2$$
$$= 10 \bullet 2$$
$$= 20$$

20 cm^3

Volume of composite solid:

$180\ cm^3 + 20\ cm^3 = 200\ cm^3$

9. a. Mode: 39 and 52

b. ~~35~~, ~~39~~, ~~39~~, ~~42~~, 46, 47, ~~52~~, ~~52~~, ~~62~~, ~~63~~

The median is halfway between 46 and 47.

Median: 46.5

c. $(35+47+39+52+62+46+52+63+42+39+x)\div 11=48$

$$(477+x)\div 11\bullet 11=48\bullet 11$$
$$477+x=528$$
$$477+x-477=528-477$$
$$x=51$$

51 crackers

10. 15 children – 8 children under age six = 7 children age six or older

Probability: $\frac{7}{15}$

11. $4+5=9$

Nine children did only one activity.

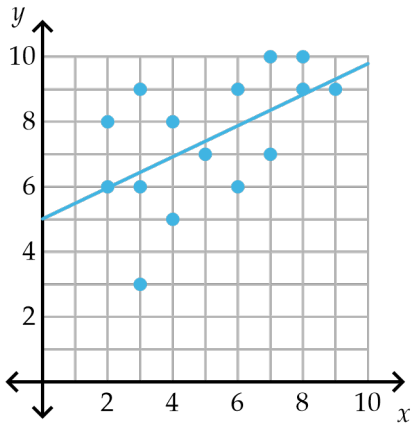
Total children: $4+6+5=15$

Probability: $\frac{9}{15}=\frac{3}{5}$

12. a. positive

The points increase from left to right.

b. The line of best fit should be near the plotted data points and should be increasing.



Course Review

1. c

$$2.6 = 2\frac{6}{10}$$
$$= 2\frac{3}{5}$$

2. b

$$\frac{2}{7} = 0.\overline{285714}$$

3. d

$$2\overline{)132}$$
$$2\overline{)66}$$
$$3\overline{)33}$$
$$11$$

4. a

$$3^2\left(1-2\bullet(-4)\right)$$
$$= 3^2\left(1+8\right)$$
$$= 3^2\left(9\right)$$
$$= 9\left(9\right)$$
$$= 81$$

5. b

$$\frac{\frac{3}{4}-\frac{1}{2}}{2}$$
$$= \frac{\frac{3}{4}-\frac{2}{4}}{2}$$
$$= \frac{\frac{1}{4}}{2}$$
$$= \frac{1}{4}\div 2$$
$$= \frac{1}{4}\bullet\frac{1}{2} = \frac{1}{8}$$

6. b

$$3\left(2\right)+\left(5\right)^2$$
$$= 3\left(2\right)+25$$
$$= 6+25$$
$$= 31$$

7. d

$$2t-1 = 1.8$$
$$2t-1+1 = 1.8+1$$
$$2t = 2.8$$
$$\frac{2t}{2} = \frac{2.8}{2}$$
$$t = 1.4$$

8. a

$$-\frac{2}{3}\left(p+1\right) = 4$$
$$\left(-\frac{3}{2}\right)\bullet\left(-\frac{2}{3}\right)\left(p+1\right) = 4\bullet\left(-\frac{3}{2}\right)$$
$$p+1 = -6$$
$$p+1-1 = -6-1$$
$$p = -7$$

9. a

$$4x \geq x+6$$
$$4x-x \geq x+6-x$$
$$3x \geq 6$$
$$\frac{3x}{3} \geq \frac{6}{3}$$
$$x \geq 2$$

solid circle at 2, shaded to the right

10. b

There are 3 oranges for every 2 apples, which means there are 3 oranges for every 5 total pieces of fruit.

$$\frac{3}{5} = \frac{x}{30}$$
$$3 \bullet 30 = 5x$$
$$90 = 5x$$
$$\frac{90}{5} = \frac{5x}{5}$$
$$18 = x$$

11. a

12. d

$$\frac{3}{8} = 0.375 = 37.5\%$$

13. c

$$3.25 \text{ lb} \bullet \frac{16 \text{ oz}}{1 \text{ lb}} = 52 \text{ oz}$$

14. b

$$\begin{array}{r} \cancel{5}^{4} \text{ gal } \cancel{1}^{5} \text{ qt} \\ -\ 3 \text{ gal } 3 \text{ qt} \\ \hline 1 \text{ gal } 2 \text{ qt} \end{array}$$

15. b

Starting at the origin, the point is plotted left 2 units and up 5 units.

16. a

Graph A contains all ordered pairs in the chart.

17. d

The slope is up 1, right 2.

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

The y-coordinate of the y-intercept is –1.

$$b = -1$$

18. a

The graph is a straight line.

19. b

Angles AXB and BXD form a line, so their measures add to 180°.

20. d

Angles AXB and FXD are vertical angles, so

$$67° = m\angle AXB = m\angle FXD = m\angle FXE + m\angle EXD$$
$$67° = 28° + m\angle EXD$$
$$m\angle EXD = 67° - 28° = 39°$$

21. a

22. b

Circumference of circle:

$$C = \pi d$$
$$= 3\pi$$
$$\approx 9.42$$

Perimeter is three sides of the rectangle part and half the circumference.

$$P = 12 + 3 + 12 + \frac{1}{2}(9.42) = 31.71$$

23. c

Area of semicircle (half of circle):

$$A = \pi r^2 = \pi(1.5)^2 = 2.25\pi \approx 7.07$$
$$7.07 \div 2 \approx 3.54$$

Area of rectangle:

$$3 \bullet 12 = 36$$

Total area: $36 + 3.54 = 39.54$

24. b

Area of two circular bases:

$A = \pi r \ = \pi(5) \ = 25\pi \approx 78.54$

$2 \bullet 78.54 = 157.08$

Area of cylinder side (rectangle part):
Width is 20 in. Length is the circumference of the circle (pi times the diameter).

$A = lw = 2\pi r \bullet 20 = 2\pi(5) \bullet 20 = 200\pi \approx 628.32$

Surface area: $157.08 + 628.32 = 785.4$

25. a

$V = Bh$

$= (\pi r^2)h$

$= \pi(5)^2(20)$

$= \pi(25)(20)$

$= 500\pi$

≈ 1570.8

26. d

$36x^2 = 4 \bullet 9 \bullet x \bullet x$

$9xy = 9 \bullet x \bullet y$

GCF: $9x$

Remaining factors from first term: 4, x

Remaining factor from second term: y

27. d

$2(a + 3b) - 5b + 3$

$= 2 \bullet a + 2 \bullet 3b - 5b + 3$

$= 2a + 6b - 5b + 3$

$= 2a + b + 3$

28. c

$20 + 21 + 21 + 22 + 34 + 37 + 41 + 46 + 50 + 50 + 50 = 392$

$392 \div 11 \approx 35.64$

29. a

~~20~~, ~~21~~, ~~21~~, ~~22~~, ~~34~~, 37, ~~41~~, ~~46~~, ~~50~~, ~~50~~, ~~50~~

30. d

50 appears most often in the data set.

31. a

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

32. d

Chart shows the possible sums of rolling two four-sided dice.

Die 1 → / ↓ Die 2	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8

There are 16 possible outcomes, 2 of which result in a sum of 3.

$\frac{2}{16} = \frac{1}{8}$

33. a

$\frac{1 \text{ cm}}{200 \text{ km}} = \frac{x \text{ cm}}{500 \text{ km}}$

$1 \bullet 500 = 200 \bullet x$

$x = \frac{500}{200} = 2.5$

34. c

$(-2)(-2)(-2) = -8$

Course Assessment

Note to parent/teacher: This assessment covers concepts taught throughout the course. Corresponding lesson numbers are listed in the course book at the end of each problem.

1. $\frac{224}{672} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{7}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 3 \cdot \cancel{7}} = \frac{1}{3}$

2. a.
$$\begin{array}{r} 0.125 \\ 8\overline{)1.000} \\ -8 \\ \hline 20 \\ -16 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

b.
$$\begin{array}{r} 0.015 \\ 200\overline{)3.000} \\ -200 \\ \hline 1000 \\ -1000 \\ \hline 0 \end{array}$$

3. a. $0.145 = \frac{145}{1000} = \frac{29}{200}$

b. $0.08 = \frac{8}{100} = \frac{2}{25}$

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

b. $\left(\frac{1}{2}\right)^3 = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$

c. $3^{-4} = \frac{1}{3^4} = \frac{1}{3 \cdot 3 \cdot 3 \cdot 3} = \frac{1}{81}$

5. a.
$$\begin{aligned} &\left(5 + 11^2\right) \div 3 \\ &= \left(5 + 121\right) \div 3 \\ &= 126 \div 3 \\ &= 42 \end{aligned}$$

b.
$$\begin{aligned} &6 \cdot 4 - 19 + 2^3 \\ &= 6 \cdot 4 - 19 + 8 \\ &= 24 - 19 + 8 \\ &= 5 + 8 \\ &= 13 \end{aligned}$$

6. a.
$$\begin{aligned} &17z - 4z + 16 + 13 \\ &= 13z + 29 \end{aligned}$$

b.
$$\begin{aligned} &4t^2 + 3s - 7t^2 + 5s \\ &= 4t^2 - 7t^2 + 3s + 5s \\ &= -3t^2 + 8s \end{aligned}$$

7. a. $\frac{10(3)}{3(-5)} = \frac{30}{-15} = -2$

b. $3(3) - 4(-5) = 9 + 20 = 29$

8. $30m + 30k$

9. a.
$$\begin{aligned} 12x - 5 &= 43 \\ 12x - 5 + 5 &= 43 + 5 \\ 12x &= 48 \\ \frac{12x}{12} &= \frac{48}{12} \\ x &= 4 \end{aligned}$$

b. $\frac{3}{5}v+4=13-3v$

$\frac{3}{5}v+4-4=13-3v-4$

$\frac{3}{5}v=9-3v$

$\frac{3}{5}v+3v=9-3v+3v$

$\frac{3}{5}v+\frac{15}{5}v=9$

$\frac{18}{5}v=9$

$\frac{5}{18}\bullet\frac{18}{5}v=9\bullet\frac{5}{18}$

$v=\frac{5}{2}=2\frac{1}{2}$

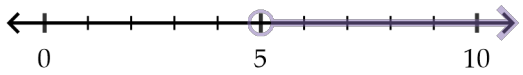
10. a. $11r-3>52$

$11r-3+3>52+3$

$11r>55$

$\frac{11r}{11}>\frac{55}{11}$

$r>5$



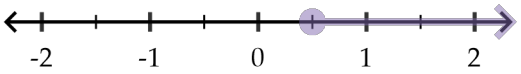
b. $18-4p\le 16$

$18-4p-18\le 16-18$

$-4p\le -2$

$\frac{-4p}{-4}\le\frac{-2}{-4}$

$p\ge\frac{1}{2}$



11. 3 chickens + 2 goats = 5 total

$\frac{5\text{ total}}{2\text{ goats}}=\frac{15\text{ total}}{x\text{ goats}}$

$\frac{5}{2}=\frac{15}{x}$

$5x=30$

$\frac{5x}{5}=\frac{30}{5}$

$x=6$

6 goats

12. $0.4\bullet 320=128$

13. $x\bullet 144=18$

$\frac{x\bullet 144}{144}=\frac{18}{144}$

$x=0.125$

12.5%

14. Amount of increase:

$1350-1000=350$

$x\bullet 1000=350$

$\frac{x\bullet 1000}{1000}=\frac{350}{1000}$

$x=0.35$

35%

15. 1 L = 1,000 mL

$18000\div 1000=18$

18 liters

16. $8640\text{ in}\bullet\text{in}\bullet\frac{1\text{ft}}{12\text{ in}}\bullet\frac{1\text{ ft}}{12\text{ in}}=\frac{8460\text{ ft}\bullet\text{ft}}{144}=60\text{ ft}^2$

17. a.
$$\begin{array}{r} 5 \text{ hr } 42 \text{ min } 28 \text{ sec} \\ +\ 3 \text{ hr } 21 \text{ min } 36 \text{ sec} \\ \hline 8 \text{ hr } 63 \text{ min } 64 \text{ sec} \end{array}$$

$64 \text{ sec} = 1 \text{ min } 4 \text{ sec}$

$63 \text{ min} = 1 \text{ hr } 3 \text{ min}$

$$\begin{array}{r} 8 \text{ hr} \\ 1 \text{ hr } 3 \text{ min} \\ +\quad 1 \text{ min } 4 \text{ sec} \\ \hline 9 \text{ hr } 4 \text{ min } 4 \text{ sec} \end{array}$$

b.
$$\begin{array}{r} \overset{3}{\cancel{4}} \text{ ft } \overset{20}{\cancel{8}} \text{ in} \\ -\ 2 \text{ ft } 10 \text{ in} \\ \hline 1 \text{ ft } 10 \text{ in} \end{array}$$

18. $\dfrac{2 \text{ cm}}{1 \text{ ft}} = \dfrac{75 \text{ cm}}{x \text{ ft}}$

$\dfrac{2}{1} = \dfrac{75}{x}$

$2x = 75$

$\dfrac{2x}{2} = \dfrac{75}{2}$

$x = 37.5$

37.5 ft

19. $y = x^2 + 2$

x	y
-2	6
-1	3
0	2
1	3
2	6

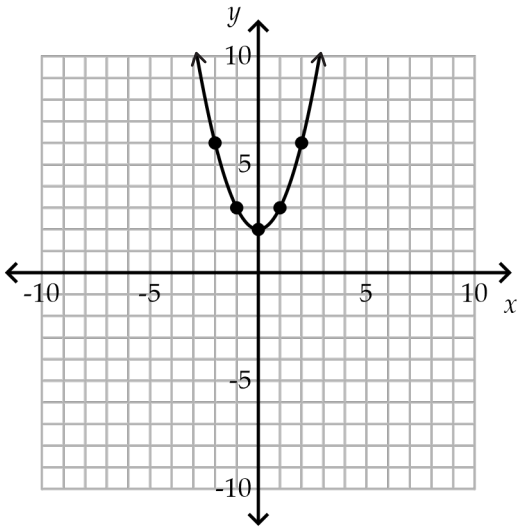
$y = (-2)^2 + 2 = 4 + 2 = 6$

$y = (-1)^2 + 2 = 1 + 2 = 3$

$y = (0)^2 + 2 = 0 + 2 = 2$

$y = (1) + 2 = 1 + 2 = 3$

$y = (2)^2 + 2 = 4 + 2 = 6$



20. The x-coordinates stay the same, and the y-coordinates change signs.

Preimage	$(-4,2)$	$(-9,2)$	$(-4,7)$	$(-9,7)$
Image	$(-4,-2)$	$(-9,-2)$	$(-4,-7)$	$(-9,-7)$

21. Rule: Add 4.

Missing value: 6

22. The y-intercept is $(0,-2)$.

The slope is down 3, right 4. $m = -\dfrac{3}{4}$

$y = -\dfrac{3}{4}x - 2$

d

23. $77° + 22° + x = 180°$

$99° + x = 180°$

$99° + x - 99° = 180° - 99°$

$x = 81°$

24. $73° + 73° + x + x = 360°$

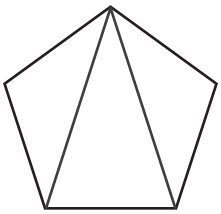
$146° + 2x = 360°$

$146° + 2x - 146° = 360° - 146°$

$2x = 214°$

$\frac{2x}{2} = \frac{214°}{2}$

$x = 107°$

25. 

$3 \bullet 180° = 540°$

26. a. 69°

b. 111°

c. 69°

d. 69°

e. 111°

f. 111°

g. 69°

27.

Vertical angles	c, e
Supplementary angles	a, b
Alternate interior angles	b, e
Adjacent angles	b, f
Alternate exterior angles	c, d
Corresponding angles	d, g

28. Angle x and the 131° angle are supplementary.

$131° + x = 180°$

$131° + x - 131° = 180° - 131°$

$x = 49°$

All four angles to the right of line PT form a line.

$41° + y + 71° + 49° = 180°$

$161° + y = 180°$

$161° + y - 161° = 180° - 161°$

$y = 19°$

All four angles above line OS form a line.

$z + 41° + 19° + 71° = 180°$

$z + 131° = 180°$

$z + 131° - 131° = 180° - 131°$

$z = 49°$

29. The scale factor of the radii is 2, so the scale factor of the area is 2^2 or 4.

30. $3 + 5 + b + 5 = 22$

$13 + b = 22$

$13 + b - 13 = 22 - 13$

$b = 9$

9 cm

31. $A = \frac{1}{2}(b_1 + b_2)h$

$24 = \frac{1}{2}(3 + 9)h$

$24 = \frac{1}{2}(12)h$

$24 = 6h$

$\frac{24}{6} = \frac{6h}{6}$

$4 = h$

$h = 4$

4 cm

32. a. $\frac{60°}{360°} = \frac{1}{6}$

$28.27 \bullet \frac{1}{6} = 4.71$

4.71 cm^2

b. $3.14 \bullet 6 = 18.84$

18.84 cm

33. $3pq^2 + 17p^2q - 14pq^2 + 38p^2q$

$= 3pq^2 - 14pq^2 + 17p^2q + 38p^2q$

$= -11pq^2 + 55p^2q$

34. Sphere cut in half

Triangular pyramid cut through the apex

Cylinder (standing upright) cut in half

Cube sitting on a flat surface cut in half

35. Solid: square pyramid

Area of square base:

$A = s^2$

$A = 6^2$

$A = 36$

Area of one triangular face:

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(6 \cdot 8)$

$A = \frac{1}{2}(48)$

$A = 24$

Surface area:

$SA = 36 + 4 \cdot 24 = 132$

132 in^2

36. $B = 12 \qquad h = 9$

$V = \frac{1}{3}Bh$

$V = \frac{1}{3}(12)(9)$

$V = 4(9)$

$V = 36$

36 in^3

37. a. $6vw = 2 \cdot 3 \cdot v \cdot w$

$9v^2 = 3 \cdot 3 \cdot v \cdot v$

GCF: $3v$

$6vw + 9v^2 = 3v(2w + 3v)$

b. $11fg^2h^3 = 11 \cdot f \cdot g \cdot g \cdot h \cdot h \cdot h$

$13f^3g^2h = 13 \cdot f \cdot f \cdot f \cdot g \cdot g \cdot h$

GCF: fg^2h

$11fg^2h^3 + 13f^3g^2h = fg^2h(11h^2 + 13f^2)$

38. a. $3ab \cdot 2a^2b^3$

$= 3 \cdot a \cdot b \cdot 2 \cdot a \cdot a \cdot b \cdot b \cdot b$

$= 6a^3b^4$

b. $6(st - 3s^5) = 6st - 18s^5$

39. $\frac{48j^4k^6}{6j^6k^4} = \frac{\overset{8}{\cancel{48}} \cdot \cancel{j} \cdot \cancel{j} \cdot \cancel{j} \cdot \cancel{j} \cdot k \cdot k \cdot \cancel{k} \cdot \cancel{k} \cdot \cancel{k} \cdot \cancel{k}}{\underset{1}{\cancel{6}} \cdot \cancel{j} \cdot \cancel{j} \cdot \cancel{j} \cdot \cancel{j} \cdot j \cdot j \cdot \cancel{k} \cdot \cancel{k} \cdot \cancel{k} \cdot \cancel{k}} = \frac{8k^2}{j^2}$

40. a. biased

The sample is at a specific sporting event (baseball game), so people are more likely to pick baseball than other sports.

b. unbiased

The survey is random to any people in the neighborhood.

41. $30\% + 15\% + 10\% + 5\% + 22\% + x = 100\%$

$82\% + x = 100\%$

$82\% + x - 82\% = 100\% - 82\%$

$x = 18\%$

42. $\frac{60}{180} = \frac{1}{3}$

43. left skewed

There is a tail on the left.

44. positive

The points increase from left to right.

45. a. no

These events could happen at the same time.

b. yes

These events cannot happen at the same time.

46. Numerical order:

7, 7, 8, 9, 9, 10, 11, 11, 11, 12, 13, 13, 14, 15, 15, 63

Mean:

$7+7+8+9+9+10+11+11+11+12+13+13+14+15+15+63=228$

$228 \div 16 = 14.25$

Median:

~~7~~, ~~7~~, ~~8~~, ~~9~~, ~~9~~, ~~10~~, ~~11~~, 11, 11, ~~12~~, ~~13~~, ~~13~~, ~~14~~, ~~15~~, ~~15~~, ~~63~~

Since both middle values are 11, the median is 11.

Mode:

11 appears 3 times in the data, which is more than any other data point.

Range: 63 – 7 = 56

47. median

The median is a better measure of center because there is an outlier in the data set.

48. Data set without outlier:

7, 7, 8, 9, 9, 10, 11, 11, 11, 12, 13, 13, 14, 15, 15

Minimum: 7 Maximum: 15

Q1: ~~7~~, ~~7~~, ~~8~~, 9, ~~9~~, ~~10~~, ~~11~~

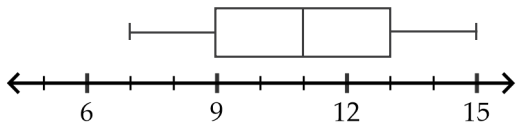
The middle value of the first half is 9.

Q2: ~~7~~, ~~7~~, ~~8~~, ~~9~~, ~~9~~, ~~10~~, ~~11~~, 11, ~~11~~, ~~12~~, ~~13~~, ~~13~~, ~~14~~, ~~15~~, ~~15~~

The middle value is 11.

Q3: ~~11~~, ~~12~~, ~~13~~, 13, ~~14~~, ~~15~~, ~~15~~

The middle value of the second half is 13.



49. Letters to represent each chore can be written in any order, as long as each one is represented once in the first column and three times in the second.

Morning Chore	Afternoon Chore
F	E
	C
	W
E	F
	C
	W
C	F
	E
	W
W	F
	E
	C

50. Possible outcomes: 12

Feeding goats in the morning and collecting eggs in the afternoon is one outcome.

Probability: $\frac{1}{12}$

Enrichment: Patterns with Divisibility

This is an enrichment lesson. Students are not expected to master content in the enrichment lessons at this level.

1. Groups: 3 Remaining: 1

2. Groups: 6 Remaining: 2

   The number of groups and ones remaining are multiplied by 2.

3. Remaining: 0

   Answers may vary. Sample answer:

   All of the items can be grouped into groups of 3. With each group of 10, there is 1 left over, so 3 groups will have 3 left over, making another group of 3.

4. Remaining: 1

   Answers may vary. Sample answer:

   With each group of 10, there is 1 left over when making groups of 3. The remaining 7 (1 from each group of 10) can be grouped into 2 groups of 3, with 1 remaining.

5. no

   Answers may vary. Sample answer:

   The first 70 will have 1 remaining. This remaining 1 and the last 2 in 72 can be put into a group of 3.

6. Remaining: 1

   Answers may vary. Sample answer:

   Three tens have 0 remaining, and 1 ten has 1 remaining.

7. a. Remaining: 1

   Each group of 10 has 1 remaining. In 4 groups of 10 (40), there will be 4 remaining, which can be put into 1 group of 3, with 1 leftover. This 1 can be combined with the last 6 from 46 to make 2 more groups of 3, with 1 left over.

   b. Remaining: 0

   Each group of 10 has 1 remaining. In 8 groups of 10 (80), there will be 8 remaining, which can be put into 2 groups of 3, with 2 left over. These 2 can be combined with the last 4 from 84 to make 2 more groups of 3.

   c. Remaining: 0

   Each group of 10 has 1 remaining. In 5 groups of 10 (50), there will be 5 remaining, which can be put into 1 group of 3, with 2 left over. These 2 can be combined with the last 1 from 51 to make 1 more group of 3.

8. Answers may vary. Sample answer:

Each group of 10 has 1 remaining. When groups of 10 are multiples of 3, the remaining ones can be grouped into additional groups of 3. The number of groups of 10 is the number that will be left before regrouping the remaining ones into additional groups of 3. For example, 40 has 4 remaining before regrouping, and 50 has 5 remaining before regrouping.

9. Groups: 3 Remaining: 1

10. Groups: 33 Remaining: 1

There are 30 groups from the first 90, with 10 left over. The 10 left over make 3 more groups, with 1 left over. 30 + 3 = 33

11. Groups: 333 Remaining: 1

There are 300 groups from the first 900, with 100 left over. The remaining 100 makes 30 + 3 = 33 groups, with 1 left over. 300 + 30 + 3 = 333

12. a. 1110

b. 333 + 33 + 3 = 369

c. 1 + 1 + 1 = 3

13. a. yes

b. Groups: 1 Remaining: 0

14. Groups: 369 + 1 = 370 Remaining: 0

15. yes

1,110 can be split into groups of 3 with none remaining.

16. a. Groups of 3: 666 Remaining: 2

There are 333 groups and 1 remaining from each 1,000.

b. Groups of 3: 99 Remaining: 3

There are 33 groups and 1 remaining from each 100.

c. Groups of 3: 12 Remaining: 4

There are 3 groups and 1 remaining from each 10.

d. Groups of 3: 0 Remaining: 2

There are not enough for a group of 3, so these 2 are remaining.

17. Total groups of 3: 666 + 99 + 12 + 0 = 777

Total remaining: 2 + 3 + 4 + 2 = 11

18. Groups of 3: 3 Remaining: 2

The 11 remaining can be split into 3 groups of 3, with 2 remaining.

19. Groups of 3: $777 + 3 = 780$ Remaining: 2

20. no

There are still 2 left over.

21. a. 8000 Remaining: 8

b. 100 Remaining: 1

c. 20 Remaining: 2

d. 4 Remaining: 1

e. yes

There are a total of $8 + 1 + 2 + 1 = 12$ remaining. All 12 can be divided into groups of 3, with none remaining.

22. a. 15

b. yes

c. yes

23. a. 11

b. no

c. no

24. a. 3

b. yes

c. yes

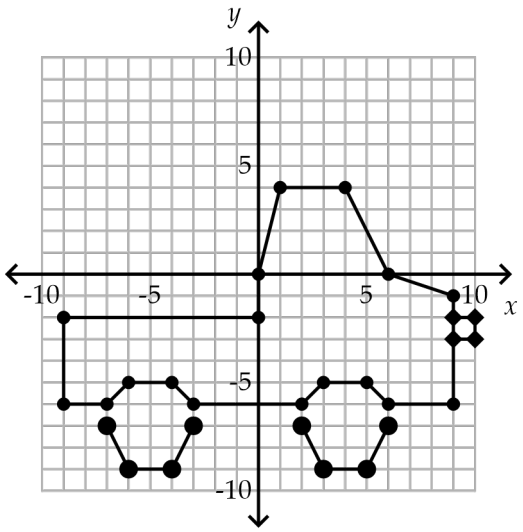
25. a. Sum of digits: $5 + 4 + 3 + 2 + 1 = 15$ yes

b. Sum of digits: $6 + 9 + 4 = 19$ no

c. Sum of digits: $1 + 2 + 9 + 6 = 18$ yes

Fun with Graphing

1.



2.