

## 7.RP.1 Answers

1. A
2. A
3. D
4. C
5. B, D, E
6. B
7. D
8. A
9. C
10.  $\frac{2}{3} = \frac{2}{5} + \frac{3}{4} = \frac{2}{5} \times \frac{4}{3} = \frac{8}{15}$  acre per hour

**Rubric**

1 point

11. The price per pound of one brand is  $\frac{\$1.50}{\frac{1}{3}$  pound, or \$4.50 per pound.

The price per pound of the other brand is  $\frac{\$2.15}{\frac{1}{2}$  pound, or \$4.30 per pound.

Since \$4.30 is less than \$4.50, the brand that costs \$2.15 for  $\frac{1}{2}$  pound has a lower price per pound.

**Rubric**

1 point for correct answer;

2 points for explanation

12. The first bucket has a unit rate of  $\frac{5}{6} = \frac{5}{6} + \frac{3}{4} = \frac{5}{6} \times \frac{4}{3} = \frac{10}{9} = 1\frac{1}{9}$  gallons per hour.

The second bucket has a unit rate of

$$\frac{3}{8} = \frac{3}{8} + \frac{1}{3} = \frac{3}{8} \times \frac{3}{1} = \frac{9}{8} = 1\frac{1}{8} \text{ gallons per hour.}$$

Compare the unit rates. Since  $\frac{1}{9}$  is less than  $\frac{1}{8}$ ,  $1\frac{1}{9}$  is less than  $1\frac{1}{8}$ .

Thus, the first bucket is leaking water less rapidly than the second bucket.

**Rubric**

1 point for correct answer;

2 points for explanation

13. a. Divide  $1\frac{1}{2}$ , the number of miles, by  $\frac{3}{5}$ , the number of hours.

$$1\frac{1}{2} \div \frac{3}{5} = \frac{2}{3} = \frac{2}{3} + \frac{3}{5} = \frac{2}{3} \times \frac{5}{3} = \frac{5}{2}$$

Thus, Laura walks  $\frac{5}{2}$  miles per hour.

- b. Yes, she can walk 5 miles in 2 hours.

Because  $4\frac{1}{2}$  miles is less than

5 miles, she can arrive at her job on time if she starts walking at 9:00 a.m.

**Rubric**

a. 1 point

b. 1 point for answer;

1 point for explanation

14. a. The unit rate for liquid A is found by dividing  $\frac{5}{9}$ , the number of cups, by  $\frac{2}{5}$ , the number of hours.

$$\frac{\frac{5}{9}}{\frac{2}{5}} = \frac{5}{9} \times \frac{5}{2} = \frac{25}{18} = 1\frac{7}{18} \text{ cups per hour}$$

b. The unit rate for liquid B is found by dividing  $\frac{8}{9}$ , the number of cups, by  $\frac{1}{3}$ , the number of hours.

$$\frac{\frac{8}{9}}{\frac{1}{3}} = \frac{8}{9} \times 3 = \frac{24}{9} = \frac{8}{3} = 2\frac{2}{3} \text{ cups per hour}$$

c. Since  $2\frac{2}{3}$  is greater than  $1\frac{7}{18}$ , liquid B evaporated faster than liquid A.

To find the difference, subtract  $1\frac{7}{18}$  from  $2\frac{2}{3}$ .

$$2\frac{2}{3} - 1\frac{7}{18} = 2\frac{12}{18} - 1\frac{7}{18} = 1\frac{5}{18}$$

Liquid B evaporated  $1\frac{5}{18}$  cups per hour faster than liquid A.

#### Rubric

- 1 point
- 1 point
- 1 point for determining which liquid is evaporating faster; 1 point for finding the difference

15. The unit rate for water filling container A

$$\text{is } \frac{\frac{2}{3}}{\frac{1}{2}} = \frac{2}{3} \div \frac{1}{2} = \frac{2}{3} \times \frac{2}{1} = \frac{4}{3} \text{ cups per minute.}$$

The unit rate for water leaking from

$$\text{container A is } \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{4} \div \frac{3}{4} = \frac{1}{4} \times \frac{4}{3} = \frac{1}{3} \text{ cup}$$

per minute. Container A gains

$$\frac{4}{3} - \frac{1}{3} = \frac{3}{3} = 1 \text{ cup per minute.}$$

The unit rate for water filling container B

$$\text{is } \frac{\frac{3}{4}}{\frac{1}{2}} = \frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1} = \frac{6}{4} = \frac{3}{2} \text{ cups per}$$

minute. The unit rate for water leaking from container B is

$$\frac{\frac{1}{2}}{\frac{3}{4}} = \frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3} = \frac{4}{6} = \frac{2}{3} \text{ cup per}$$

minute. Container B gains

$$\frac{3}{2} - \frac{2}{3} = \frac{9}{6} - \frac{4}{6} = \frac{5}{6} \text{ cup per minute.}$$

Since container A is gaining more water per minute, container B needs to be filled faster. To find how much more water per minute container B needs to be filled,

subtract  $\frac{5}{6}$  from 1.

The rate water enters container B needs

to increase by  $\frac{1}{6}$  cup per minute.

#### Rubric

1 point for finding the unit rates for containers A and B; 1 point for finding the net gain per minute for containers A and B; 1 point for correct container and determining additional water per minute needed; 2 points for explanation

## 7.RP.2a Answers

1. D
2. A
3. B, C, D
4. A, B, D
5. No;  $\frac{64 \text{ ft per sec}}{2 \text{ sec}}$  and  $\frac{144 \text{ ft per sec}}{3 \text{ sec}}$  are

not equivalent ratios, so the relationship is not proportional.

### Rubric

1 point for correct answer;

1 point for explanation

6. 45; the ratio of weight to number of items in the table is 4.5, so you need to multiply the number of items by 4.5 to find the associated weight:  $(10)(4.5) = 45$ .

### Rubric

1 point for correct answer;

1 point for explanation

7. Find the ratio of the number of feet to the number of seconds.

$$\frac{134}{2} = \frac{201}{3} = \frac{268}{4} = \frac{335}{5} = \frac{402}{6} = 67.$$

Since there is a common ratio of 67 feet per second, the relationship is proportional.

To find how far the cheetah travels in 14 seconds, multiply 14 seconds by 67 feet per second:  $14 \times 67 = 938$ .

Therefore, the cheetah travels 938 feet in 14 seconds.

### Rubric

1 point for determining the relationship is proportional; 1 point for finding the common ratio; 1 point for finding the distance

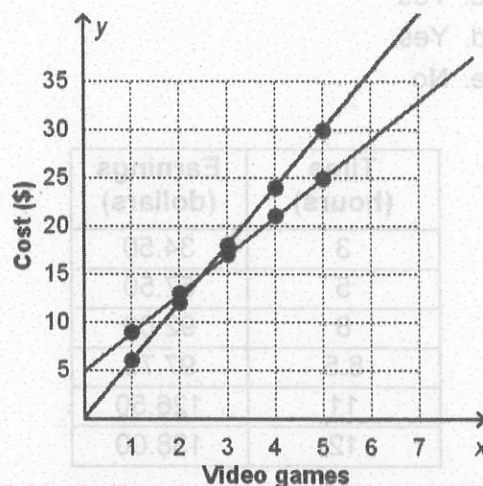
8. a.

Video games	Cost (\$)
1	6
2	12
3	18
4	24
5	30

- b.

Video games	Cost (\$)
1	9
2	13
3	17
4	21
5	25

- c.



- d. The first relationship is proportional because the points from the first table can be connected with a straight line that also goes through the origin. The second relationship is not proportional because, although the points from the second table can be connected with a straight line, that line does not go through the origin.

### Rubric

a. 1 point

b. 1 point

c. 1 point for graph of first table;  
1 point for graph of second table

d. 1 point for stating the first relationship is proportional and the second relationship is not proportional;  
1 point for explanations

## 7.RP.2b Answers

1. B
2. D
3. D
4. A, B, D
5. a. Yes  
b. No  
c. Yes  
d. Yes  
e. No

6.

Time (hours)	Earnings (dollars)
3	34.50
5	57.50
8	92.00
8.5	97.75
11	126.50
12	138.00

The constant of proportionality is 11.50. This is the number of dollars per hour that Antwan earns mowing lawns.

### Rubric

0.5 point for each correct value added to the table; 1 point for giving the constant of proportionality; 1 point for explaining the meaning of the constant in the context

7. a. The ratio of  $y$  to  $x$  is not the same in every row of the table. Therefore, the table does not show a proportional relationship.

$x$	$y$	$y \div x$
10	16.0	1.6
14	28.0	2
18	28.8	1.6

- b. If only one number can be changed in the table, it must be changed in the second row to make the ratio of  $y$  to  $x$  equal to 1.6 in that row. Then, the equation  $y = 1.6x$  would represent the proportional relationship of  $x$  and  $y$ .

One way to change just one number in the second row is to keep  $x = 14$  and use the equation  $y = 1.6x$  to find the changed value for  $y$  in the second row:

$$y = 1.6x; y = 1.6(14); y = 22.4.$$

$x$	$y$	$y \div x$
10	16.0	1.6
14	22.4	1.6
18	28.8	1.6

Another way to change just one number in the second row is to keep  $y = 28.0$  and use the equation  $y = 1.6x$  to find the correct value for  $x$  in the second row:

$$y = 1.6x; 28.0 = 1.6x; x = \frac{28.0}{1.6};$$

$$x = 17.5.$$

$x$	$y$	$y \div x$
10	16.0	1.6
17.5	28.0	1.6
18	28.8	1.6

### Rubric

- a. 1 point
- b. 1 point for finding that changing 28.0 to 22.4 works; 1 point for finding that changing 14 to 17.5 works; 2 points for providing explanation

8.

Teams	Players
3	42
4	56
5	70
6	84
8	112

**Rubric**

0.5 point for each correct value

9. a. This is a proportional relationship because the price-to-weight ratios are equal.

$$\frac{\$29.25}{3 \text{ pounds}} = \frac{\$48.75}{5 \text{ pounds}}$$

$$= \frac{\$78.00}{8 \text{ pounds}}$$

$$= \$9.75 / \text{pound}$$

- b. The constant of proportionality is \$9.75 per pound. This is the unit price, the price per pound of salmon.

c.

Weight, <i>w</i>	Price, <i>p</i>
3 lb.	\$19.25
5 lb.	\$38.75
8 lb.	\$68.00

The relationship is no longer proportional, because the price-to-weight ratios are not equal.

$$\frac{\$19.25}{3 \text{ pounds}} = \$6.42 / \text{pound};$$

$$\frac{\$38.75}{5 \text{ pounds}} = \$7.75 / \text{pound};$$

$$\frac{\$68.00}{8 \text{ pounds}} = \$8.50 / \text{pound}$$

**Rubric**

- a. 1 point  
 b. 1 point  
 c. 1 point for making a correct table of new prices; 1 point for determining that the new relationship is not proportional; 1 point for a valid explanation

1. B  
 2. D  
 3. B  
 4. B, E

5. Let *b* be the distance the car travels in miles

Let *f* be the amount of diesel fuel used in gallons

The fuel efficiency of the car is

$$\frac{663 \text{ miles}}{13 \text{ gallons}} \text{ or } 51 \text{ miles per gallon}$$

So, an equation for this relationship is

$$b = 51f$$

**Rubric**

1 point for defining variables for distance and amount of fuel; 1 point for writing an

equation with a correct constant of proportionality, such as  $b = 51f$  or

$$f = \frac{1}{51}b$$

6. a.

Frozen yogurt (dollars)	Earnings
2	7
4	14
6	21
8	28
10	35

b. Because the earnings are \$21 when Marsha sells 6 frozen yogurts, a

constant of proportionality for this

situation is  $\frac{21}{6}$  or 3.5. So, an equation

for the relationship is  $y = 3.5x$ .

## 7.RP.2c Answers

1. B
2. D
3. B
4. B, E
5. Let  $d$  be the distance the car travels in miles.

Let  $f$  be the amount of diesel fuel used, in gallons.

The fuel efficiency of the car is  $\frac{663 \text{ miles}}{13 \text{ gallons}}$ , or 51 miles per gallon.

So, an equation for this relationship is  $d = 51f$ .

### Rubric

1 point for defining variables for distance and amount of fuel; 1 point for writing an equation with a correct constant of proportionality, such as  $d = 51f$  or

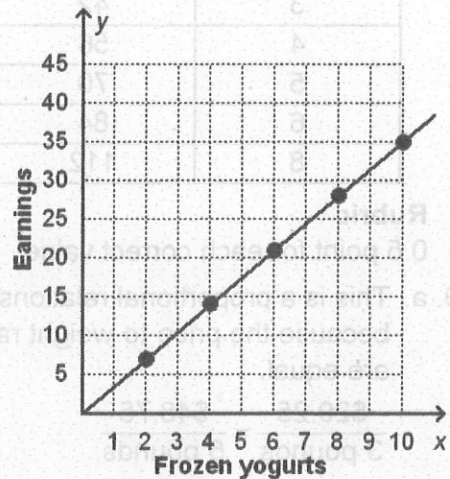
$$f = \frac{1}{51}d$$

6. a.

Frozen yogurts	Earnings (dollars)
2	7
4	14
6	21
8	28
10	35

- b. Because the earnings are \$21 when Marsha sells 6 frozen yogurts, a constant of proportionality for this situation is  $\frac{21}{6}$ , or 3.5. So, an equation for the relationship is  $y = 3.5x$ .

c.



- d. Use the equation  $y = 3.5x$  to find the number of yogurts Marsha has to sell. Substitute 245 for  $y$  in the equation.

$$245 = 3.5x$$

$$\frac{245}{3.5} = x$$

$$70 = x$$

Marsha would have to sell 70 yogurts to raise \$245 for the library.

### Rubric

- a. 1 point
- b. 1 point for correct equation:  
either  $y = 3.5x$  or  $x = \frac{y}{3.5}$
- c. 1 point for plotting correct points;  
1 point for correct line
- d. 1 point for answer;  
1 point for explanation

7. a. Since the price per pound for cheddar is \$6.25, the constant of proportionality is 6.25. The equation that gives the cost  $y$  of buying  $x$  pounds of cheddar is  $y = 6.25x$ .

b. Divide the cost by the weight to find the constant of proportionality for mozzarella.

$$\frac{\text{Cost}}{\text{Weight}} = \frac{11.00}{2} = 5.50$$

$$\frac{\text{Cost}}{\text{Weight}} = \frac{16.50}{3} = 5.50$$

$$\frac{\text{Cost}}{\text{Weight}} = \frac{22.00}{4} = 5.50$$

$$\frac{\text{Cost}}{\text{Weight}} = \frac{27.50}{5} = 5.50$$

Since the constant of proportionality is 5.50, the equation that gives the cost  $y$  of buying  $x$  pounds of mozzarella is  $y = 5.5x$ .

c. The order from the least expensive to the most expensive cheese is mozzarella, provolone, and cheddar. The constants of proportionality in the equations are the unit prices, and  $5.50 < 5.75 < 6.25$ .

**Rubric**

a. 1 point

b. 1 point

c. 1 point for correct ordering;  
1 point for explanation

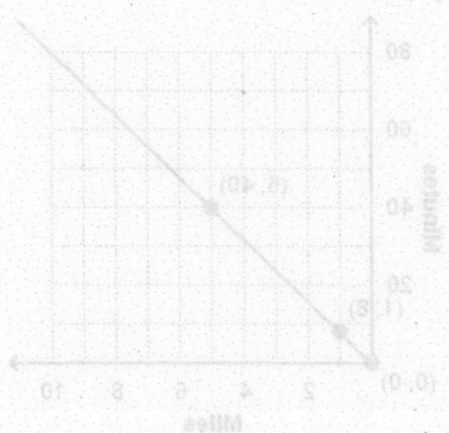
- 1. B
- 2. C
- 3. B
- 4. C, E

5. The constant of proportionality for this graph is  $\frac{75}{5} = 15$ , so the ordered pair that has an x-coordinate of 1 is (1, 15). It represents 15 dollars per theater ticket, which is the unit rate of the relationship.

**Rubric**

1 point for ordered pair;  
1 point for explanation

6. Possible answer: An equation that reasonably represents this relationship is  $y = 8x$ .



The point (0, 0) means that it took 0 minutes for Kim to run 0 miles. The point (1, 8) means that it took 8 minutes for Kim to run 1 mile. The point (5, 40) means that it took 40 minutes for Kim to run 5 miles.

**Rubric**

1 point for reasonable equation;  
1 point for line; 1 point for describing meaning for each point

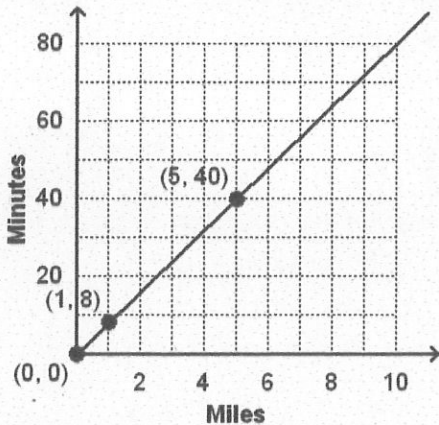
## 7.RP.2d Answers

- B
- C
- B
- C, E
- The constant of proportionality for this graph is  $\frac{75}{5} = 15$ , so the ordered pair that has an x-coordinate of 1 is (1, 15). It represents 15 dollars per theater ticket, which is the unit rate of the relationship.

### Rubric

1 point for ordered pair;  
1 point for explanation

- Possible answer: An equation that reasonably represents this relationship is  $y = 8x$ .



The point (0, 0) means that it took 0 minutes for Kim to run 0 miles.

The point (1, 8) means that it took 8 minutes for Kim to run 1 mile.

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### Rubric

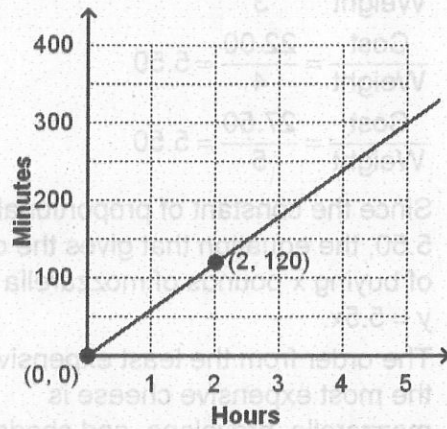
1 point for reasonable equation;  
1 point for line; 1 point for describing meaning for each point

- The line going through the point (0, 0) makes sense because it costs \$0 to buy 0 square yards of fabric.

### Rubric

1 point for answer;  
2 points for explanation

- Possible answer: A reasonable relationship is the number of minutes to the number of hours. The graph of this relationship is shown below.



The ordered pair (2, 120) means that there are 120 minutes in 2 hours and the ordered pair (0, 0) means that there are 0 minutes in 0 hours.

The ordered pair on the graph that has an x-coordinate of 1 is (1, 60). It means that there are 60 minutes per hour, which is the unit rate.

### Rubric

1 point for situation; 1 point for correct labels; 1 point for explanation of (2, 120); 1 point for explanation of (0, 0); 1 point for naming (1, 60) as the ordered pair with 1 for an x-coordinate; 1 point for explanation



## 7.RP.3 Answers

1. C
2. B
3. C
4. A
5. C, D
6. F
7. A
8. D
9. C
10. Saul needs to sell \$2,750 in order to earn \$275, which is equivalent to earning \$12.50 per hour for 22 hours.

### Rubric

1 point for answer; 1 point for explanation

11. Tennessee's 7% sales tax is greater than Iowa's 6% sales tax.

Iowa's sales tax is

$$\frac{(47.70 - 45.00)}{45.00} = 0.06.$$

Tennessee's sales tax is

$$\frac{37.45 - 35.00}{35.00} = 0.07.$$

### Rubric

1 point for answer; 1 point for explanation

12. Amanda's percent of error is greater than Dwayne's.

$$\text{Amanda's error is } \frac{(82.4 - 80)}{80} = 0.03.$$

$$\text{Dwayne's error is } \frac{(140 - 137.2)}{140} = 0.02.$$

### Rubric

1 point for answer; 1 point for explanation

13. Chelsea would have \$1,169.30 after 7 years. The account earns \$21.60 in 4 years, or \$5.40 per year when \$600 is invested at the start. Thus, the rate of simple interest is  $\frac{5.40}{600} = 0.009$ .

If she instead invested \$1,100 at the start, the amount of interest after 7 years would be  $I = Prt = \$1,100(0.009)(7) = \$69.30$ , so the total in her account would be  $\$1,100 + \$69.30 = \$1,169.30$ .

### Rubric

1 point for answer; 1 point for explanation

14. a. 12%;  $\frac{49.84 - 44.50}{44.50} = 0.12 = 12\%$

b. 18%; 50% of 0.12 is 0.06, and  $0.12 + 0.06 = 0.18$ .

Carlos gave 18% for a tip during dinner.

c. The tip for dinner was \$10.35, and the total bill was \$67.85.

Tip calculation:

$$0.18(57.50) = 10.35;$$

Total bill calculation:

$$57.50 + 10.35 = 67.85.$$

### Rubric

a. 1 point

b. 1 point

c. 1 point for amount of tip;  
1 point for total bill

15. a. 2%;  $\frac{3,280}{164,000} = 0.02$

b. 2.2%; 10% of 0.02 is 0.002, so the new rate is  $0.02 + 0.002 = 0.022$ .

c. \$2,970;  $0.022(135,000) = 2,970$

d. Ray's property value decreased so much this year that his tax bill went down even though the tax rate went up.

### Rubric

a. 1 point

b. 1 point

c. 1 point

d. 1 point

16. a. Find the range of percents Jasmine can mark up the necklace.

Find the percentage that \$40 is of \$100.

$$\frac{40}{100} = 0.4 = 40\%$$

Find the percentage that \$80 is of \$100.

$$\frac{80}{100} = 0.8 = 80\%$$

Jasmine can mark up the necklace between 40% and 80%.

Find the range of percents Jasmine can mark up the pair of earrings.

Find the percentage that \$40 is of \$130.

$$\frac{40}{130} \approx 0.31 = 31\%$$

Find the percentage that \$80 is of \$130.

$$\frac{80}{130} \approx 0.62 = 62\%$$

Jasmine can mark up the pair of earrings between 31% and 62%.

Find the range of percents Jasmine can mark up the ring.

Find the percentage that \$40 is of \$160.

$$\frac{40}{160} = 0.25 = 25\%$$

Find the percentage that \$80 is of \$160.

$$\frac{80}{160} = 0.5 = 50\%$$

Jasmine can mark up the ring between 25% and 50%.

- b. If Jasmine wants to mark up all 3 items using the same percent, she must choose a value between 40% (the greatest of the low ends of the ranges calculated) and 50% (the least of the high ends). The percent that will maximize her profit is the largest value in this range, or 50%.

- c. The marked up prices are 150% of \$100, \$130, and \$160.

$$150\%(\$100) = \$150;$$

$$150\%(\$130) = \$195;$$

$$150\%(\$160) = \$240$$

The marked up price for the necklace is \$150, the marked up price for the earrings is \$195, and the marked up price for the ring is \$240.

- d. Her profit:

$$(\$150 - \$100) + (\$195 - \$130) + (\$240 - \$160) = \$50 + \$65 + \$80 = \$195$$

#### Rubric

- a. 1 point for correct range of markup percents for each item  
b. 1 point  
c. 1 point  
d. 1 point

## 7.NS.1a, 7.NS.1b Answers

1. C
2. A
3. B
4. C, D
5. E
6. C
7. B
8. H
9. Yes, because walking forward 80 feet and walking backward 80 feet are opposite actions. The result of adding two opposite actions is 0.

**Rubric**

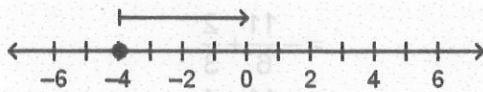
1 point for answer;  
1 point for explanation

10. The pitcher's ERA is 3.17 the next year. He gave up 0.74 fewer runs per 9 innings.

**Rubric**

1 point for sum;  
1 point for interpretation

11. Possible answer: One number on the number line is  $-4$  and its opposite is  $4$ . To find the sum  $-4 + 4$ , start at  $-4$ . Then move 4 units in the positive direction. The sum  $-4 + 4$  is 0.



The sum of  $-4$  and  $4$  is 0.

**Rubric**

0.5 points each for a number and its opposite; 2 points for correct number line;  
1 point for sum

12. a. Possible answer: Corey fills a  $\frac{3}{4}$ -cup measuring cup with sugar to bake a recipe.
- b. Possible answer: Corey uses the entire  $\frac{3}{4}$  cup of sugar for the recipe.

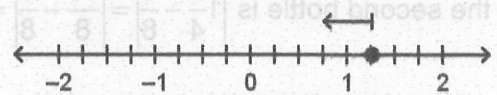
- c. Possible answer: The amount of sugar Corey adds to the measuring cup,  $\frac{3}{4}$  cup, and then uses,  $\frac{3}{4}$  cup, leaves the same amount of sugar in the cup as before both actions, 0.

**Rubric**

- a. 1 point
- b. 1 point
- c. 2 points

13. The expression  $\frac{5}{4} + \left(-\frac{1}{2}\right)$  represents this

situation. To find the sum, start at  $\frac{5}{4}$  and move  $\frac{1}{2}$  unit to the left.



The sum of  $\frac{5}{4} + \left(-\frac{1}{2}\right)$  is  $\frac{3}{4}$ . It means that Jayce is  $\frac{3}{4}$  mile away from home when he meets Macy.

**Rubric**

1 point for expression; 1 point for correct number line; 1 point for sum; 1 point for meaning of sum

14. Becky's fuel tank is not empty because she still has  $\frac{3}{4} - \frac{1}{4} - \frac{1}{4} = \frac{1}{4}$  gallon remaining. Possible answer: Becky could add  $\frac{1}{2}$  gallon of gasoline into the empty fuel tank instead of  $\frac{3}{4}$  gallon. The fuel tank would be empty again after adding  $\frac{1}{2}$  gallon and using  $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$  gallon.

**Rubric**

1 point for answer; 1 point for explanation; 1 point for correct change of action; 1 point for explanation

## 7.NS.1c Answers

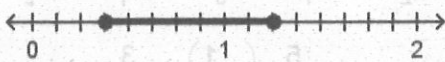
1. B
2. D
3. B
4. B, E
5. D
6. A
7. C
8. B
9. Yes,  $-5$  is the additive inverse of 5 and subtracting a number is the same as adding the additive inverse of the number.

### Rubric

1 point for answer; 1 point for explanation

10. The number of cups Asher needs from

the second bottle is  $\left|1\frac{1}{4} - \frac{3}{8}\right| = \left|\frac{10}{8} - \frac{3}{8}\right| = \frac{7}{8}$ .



The distance between  $\frac{3}{8}$  and  $1\frac{1}{4}$  on the number line is also  $\frac{7}{8}$ . So, the number of cups Asher needs from the second bottle is equal to the distance between  $\frac{3}{8}$  and  $1\frac{1}{4}$ .

### Rubric

1 point for finding the number of cups; 1 point for showing the difference is equal to the distance on the number line

$$11. 23\frac{1}{4} - 15\frac{7}{8} = 23\frac{1}{4} + \left(-15\frac{7}{8}\right) = 7\frac{3}{8}$$

The remaining piece of board is  $7\frac{3}{8}$  inches long, which is long enough.

### Rubric

1 point for determining the length of the remaining piece of board; 1 point for determining that the remaining piece of board is long enough

12. Tony needs to deposit \$30.48 into his checking account to reach the minimum balance.

With the fee, Tony needs to deposit \$45.47 into his checking account to reach the minimum balance.

### Rubric

1 point for each answer

13. Emily's error is that she added  $-\frac{2}{3}$

instead of adding the opposite of  $-\frac{2}{3}$ , which is  $\frac{2}{3}$ .

$$\begin{aligned} -\frac{11}{6} - \left(-\frac{2}{3}\right) &= -\frac{11}{6} + \left[-\left(-\frac{2}{3}\right)\right] \\ &= -\frac{11}{6} + \frac{2}{3} \\ &= -\frac{11}{6} + \frac{4}{6} \\ &= -\frac{7}{6} \end{aligned}$$

The correct difference is  $-\frac{7}{6}$ .

### Rubric

1 point for identifying error; 1 point for correcting error; 1 point for difference; 1 point for showing work

14. a. Possible answer: Guy's house is

$\frac{7}{10}$  mile west of the library and

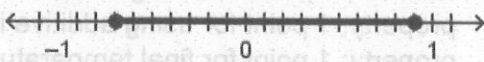
Stacie's house is  $\frac{9}{10}$  mile east of the

library. How far does Guy have to walk from his house to Stacie's house?

b. On the number line, the library is represented by 0. Guy's house is

represented by  $-\frac{7}{10}$  and Stacie's

house by  $\frac{9}{10}$  on the number line.



The distance between the points on

the number line is  $\frac{8}{5}$ . So Guy has to

walk  $\frac{8}{5}$  miles to get to Stacie's house.

$$\begin{aligned} \text{c. } \left| -\frac{7}{10} - \left( \frac{9}{10} \right) \right| &= \left| -\frac{7}{10} + \left( -\frac{9}{10} \right) \right| \\ &= \left| -\frac{16}{10} \right| \\ &= \left| -\frac{8}{5} \right| \\ &= \frac{8}{5} \end{aligned}$$

d. The distance between two points on the number line is the difference between the greater value and the lesser value. Finding the absolute value of the difference ensures that the difference is positive no matter which value is subtracted from the other. The difference must always be positive because distance cannot be negative.

### Rubric

- 1 point for a word problem that satisfies the criteria
- 0.5 point for plotting each number on the number line correctly; 1 point for answering the question from part a correctly
- 1 point for the correct distance
- 1 point for any reasonable explanation

## 7.NS.1d Answers

1. C
2. A
3. C, E, F
4. A, B, D
5. a. Commutative  
b. Additive inverse  
c. Additive identity  
d. Associative  
e. Additive inverse  
f. Additive identity
6. The commutative property of addition is

used to rewrite  $-\frac{3}{2} + \frac{4}{3} + \left(-\frac{5}{2}\right) + \left(-\frac{4}{3}\right)$  as

$$-\frac{3}{2} + \left(-\frac{5}{2}\right) + \frac{4}{3} + \left(-\frac{4}{3}\right).$$

Since  $\frac{4}{3}$  and  $-\frac{4}{3}$  are additive inverses,

the additive inverse property is used to

rewrite  $-\frac{3}{2} + \left(-\frac{5}{2}\right) + \frac{4}{3} + \left(-\frac{4}{3}\right)$  as

$$-\frac{3}{2} + \left(-\frac{5}{2}\right) + 0.$$

The additive identity property is used to

rewrite  $-\frac{3}{2} + \left(-\frac{5}{2}\right) + 0$  as  $-\frac{3}{2} + \left(-\frac{5}{2}\right)$ ,

which equals  $-4$ .

### Rubric

1 point for using commutative property of addition; 1 point for using additive inverse property; 1 point for final value

7. The commutative property of addition is used.

$$-7.1 + 5.4 + 7.1 = -7.1 + 7.1 + 5.4$$

The additive inverse property is used.

$$-7.1 + 7.1 + 5.4 = 0 + 5.4$$

The additive identity property is used.

$$0 + 5.4 = 5.4$$

The final temperature is  $5.4^\circ\text{C}$ .

### Rubric

1 point for using commutative property of addition; 1 point for using additive inverse property; 1 point for using additive identity property; 1 point for final temperature

8.  $\frac{7}{3}$ ;

$$-\frac{5}{3} + \left(\frac{4}{3} + \frac{5}{2}\right) + \frac{8}{3} - \frac{5}{2}$$

$$= \left(-\frac{5}{3} + \frac{4}{3}\right) + \frac{5}{2} + \frac{8}{3} - \frac{5}{2}$$

$$= -\frac{1}{3} + \frac{5}{2} + \frac{8}{3} - \frac{5}{2}$$

$$= -\frac{1}{3} + \frac{8}{3} + \frac{5}{2} - \frac{5}{2}$$

$$= -\frac{1}{3} + \frac{8}{3} + 0$$

$$= -\frac{1}{3} + \frac{8}{3}$$

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

### Rubric

1 point for answer; 1 point for showing work

9. Use the commutative property of addition and the additive inverse property to

simplify  $\frac{1}{2} - \frac{5}{4} + \frac{6}{5} + \left(\frac{2}{3} - \frac{6}{7}\right) + \frac{4}{7} + \frac{5}{4}$  as

$\frac{1}{2} + \frac{6}{5} + \left(\frac{2}{3} - \frac{6}{7}\right) + \frac{4}{7}$ . Use the associative

property of addition to simplify the

expression as  $\frac{1}{2} + \frac{6}{5} + \frac{2}{3} - \frac{2}{7}$ . There is no

more simplifying, so the minimum number of denominators that need to be used to find a common denominator is 4.

**Rubric**

1 point for answer; 2 points for explanation

10. No, because the commutative property of addition and the additive identity property are also needed to simplify the expression.

Use the associative property of addition to move the set of parentheses.

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

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

Use the commutative property of addition

to move  $-\frac{2}{5}$  next to  $\frac{2}{5}$ .

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

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

Use the additive inverse property to

simplify  $-\frac{9}{4} + \frac{9}{4}$  and  $\frac{2}{5} - \frac{2}{5}$ .

$$\left(-\frac{9}{4} + \frac{9}{4}\right) + \frac{2}{5} - \frac{2}{5} + \frac{5}{6} = 0 + 0 + \frac{5}{6}$$

Use the additive identity property to simplify the expression to one term.

$$0 + 0 + \frac{5}{6} = \frac{5}{6}$$

**Rubric**

1 point for answer; 1 point for identifying that commutative property of addition is needed; 1 point for identifying that additive identity property is needed; 1 point for correctly simplifying result

11. Possible answer:

$$-\frac{5}{4} + \left( \frac{5}{4} + \frac{10}{3} \right) + \frac{7}{6} - \frac{2}{3}$$

Use the associative property of addition to move the set of parentheses.

$$-\frac{5}{4} + \left( \frac{5}{4} + \frac{10}{3} \right) + \frac{7}{6} - \frac{2}{3} =$$

$$\left( -\frac{5}{4} + \frac{5}{4} \right) + \frac{10}{3} + \frac{7}{6} - \frac{2}{3}$$

Use the additive inverse property to

simplify  $-\frac{5}{4} + \frac{5}{4}$ .

$$\left( -\frac{5}{4} + \frac{5}{4} \right) + \frac{10}{3} + \frac{7}{6} - \frac{2}{3} =$$

$$0 + \frac{10}{3} + \frac{7}{6} - \frac{2}{3}$$

Use the additive identity property to simplify the expression.

$$0 + \frac{10}{3} + \frac{7}{6} - \frac{2}{3} = \frac{10}{3} + \frac{7}{6} - \frac{2}{3}$$

Use the commutative property of addition

to move  $-\frac{2}{3}$  to the right of  $\frac{10}{3}$ .

$$\frac{10}{3} + \frac{7}{6} - \frac{2}{3} = \frac{10}{3} - \frac{2}{3} + \frac{7}{6}$$

Use common denominators to simplify

$$\frac{10}{3} - \frac{2}{3} + \frac{7}{6}$$

$$\frac{10}{3} - \frac{2}{3} + \frac{7}{6} = \frac{20}{6} - \frac{4}{6} + \frac{7}{6}$$

$$= \frac{23}{6}$$

### Rubric

1 point for writing an expression that requires all four properties; 1 point for each property used in simplifying; 1 point for correctly simplifying result

12. a.  $5\frac{1}{4} - 4\frac{3}{4} + 1\frac{1}{4} + 4\frac{3}{4}$

b.  $6\frac{1}{2}$  cups; Use the commutative property of addition.

$$5\frac{1}{4} - 4\frac{3}{4} + 1\frac{1}{4} + 4\frac{3}{4} =$$

$$5\frac{1}{4} + 1\frac{1}{4} - 4\frac{3}{4} + 4\frac{3}{4}$$

Use the additive inverse property to

simplify  $-4\frac{3}{4} + 4\frac{3}{4}$ .

$$5\frac{1}{4} + 1\frac{1}{4} - 4\frac{3}{4} + 4\frac{3}{4} = 5\frac{1}{4} + 1\frac{1}{4} + 0$$

Use the additive identity property.

$$5\frac{1}{4} + 1\frac{1}{4} + 0 = 5\frac{1}{4} + 1\frac{1}{4}$$

Then add the fractions.

$$5\frac{1}{4} + 1\frac{1}{4} = 6\frac{1}{2}$$

### Rubric

- a. 1 point
- b. 1 point for answer; 1 point for using commutative property of addition; 1 point for using additive inverse property; 1 point for using additive identity property



## 7.NS.2a, 7.NS.2b Answers

1. C
2. D
3. C
4. B
5. C, E
6. A, C

7. Rewrite  $3\frac{1}{2}$  as  $3 + \frac{1}{2}$  and substitute the new expression for  $3\frac{1}{2}$ .

$$\begin{aligned} \frac{2}{3}\left(3\frac{1}{2}\right) &= \frac{2}{3}\left(3 + \frac{1}{2}\right) \\ &= \frac{2}{3}(3) + \frac{2}{3}\left(\frac{1}{2}\right) \\ &= \frac{6}{3} + \frac{2}{6} \\ &= 2 + \frac{1}{3} \\ &= 2\frac{1}{3} \end{aligned}$$

### Rubric

- 1 point for product;
- 1 point for using distributive property

8.  $1\frac{1}{2} \times 2\frac{1}{2} = \frac{3}{2} \times \frac{5}{2} = \frac{15}{4} = 3\frac{3}{4}$ ; you need  $3\frac{3}{4}$  cups of water when cooking  $2\frac{1}{2}$  cups of rice.

### Rubric

- 1 point for product;
- 1 point for interpretation

$$9. 2\frac{1}{2} + \frac{3}{4} = \frac{5}{2} + \frac{3}{4} = \frac{10}{4} + \frac{3}{4} = \frac{13}{4} = 3\frac{1}{4}$$

Kendall can feed her cat for 3 days but does not have enough food to feed the cat on the fourth day.

### Rubric

- 1 point for quotient;
- 1 point for interpretation

10. Yes, because integers can be divided as long as the divisor is not zero. Because the divisor, 6, is not 0, the quotient

$$\frac{19}{6} = 3\frac{1}{6} \text{ is a rational number.}$$

### Rubric

- 1 point for answer; 1 point for explanation

11. a. Gary's error is saying  $-\frac{5}{24}$  is equal to

$$\frac{-5}{-24}. \text{ The quotient } \frac{-5}{-24} \text{ is positive}$$

because it is a quotient of two integers with the same sign. The quotient  $\frac{5}{24}$

is also positive because it is a quotient of two integers with the same sign.

However, the opposite of this quotient,

$$-\frac{5}{24}, \text{ is negative. So, the expression}$$

$$-\frac{5}{24} \text{ is not equal to } \frac{-5}{-24}.$$

- b.  $\frac{-5}{24}$  and  $\frac{5}{-24}$ ; the quotient of two

integers with opposite signs is

$$\text{negative. So, } \frac{-5}{24} = \frac{5}{-24} = -\frac{5}{24}.$$

### Rubric

- a. 1 point for identifying error;
- 1 point for explanation
- b. 0.5 point for each answer;
- 1 point for explanation

12. a. Possible answer: Pick  $-3$  as the negative integer and  $3\frac{1}{2}$  as the positive mixed number.

$$\begin{aligned} -3\left(3\frac{1}{2}\right) &= -1(3)\left(3\frac{1}{2}\right) \\ &= -1(3)\left(3 + \frac{1}{2}\right) \\ &= -1\left[3(3) + 3\left(\frac{1}{2}\right)\right] \\ &= -1\left(9 + 1\frac{1}{2}\right) \\ &= -1\left(10\frac{1}{2}\right) \\ &= -10\frac{1}{2} \end{aligned}$$

So, the sign of the product of  $-3$  and  $3\frac{1}{2}$  is negative.

- b. The opposite of  $3\frac{1}{2}$  is  $-3\frac{1}{2}$ .

$$\begin{aligned} -3\left(-3\frac{1}{2}\right) &= (-1)(3)(-1)\left(3\frac{1}{2}\right) \\ &= (-1)(-1)(3)\left(3 + \frac{1}{2}\right) \\ &= 1(3)\left(3 + \frac{1}{2}\right) \\ &= 1\left(10\frac{1}{2}\right) \\ &= 10\frac{1}{2} \end{aligned}$$

So, the sign of the product of  $-3$  and  $-3\frac{1}{2}$  is positive.

- c. The product in part b,  $10\frac{1}{2}$ , is the opposite of the product in part a,  $-10\frac{1}{2}$ .

#### Rubric

- a. 1 point  
b. 1 point  
c. 1 point

13. a. Since 2 and  $-2$  are opposites, their sum is 0, so  $2 + (-2) = 0$ . The product of any integer and 0 is 0, so  $-3[2 + (-2)] = -3(0) = 0$ .

- b.  $-3[2 + (-2)] = -3(2) + (-3)(-2) = -6 + (-3)(-2)$ ; use the result from part a to conclude that  $-6 + (-3)(-2) = 0$ , so the expression  $(-3)(-2)$  must equal 6.

- c. Because the sum  $k + (-k) = 0$ ,  $-j[k + (-k)] = -j(0) = 0$ .

By the distributive property,

$$\begin{aligned} -j[k + (-k)] &= -j(k) + (-j)(-k) \\ &= -jk + (-j)(-k) \\ &= 0 \end{aligned}$$

Because  $-jk$  and  $(-j)(-k)$  have a sum of 0, they are opposites, so

$$(-j)(-k) = -(-jk) = jk.$$

#### Rubric

- a. 1 point  
b. 1 point  
c. 1 point for using a generalized expression such as  $-j[k + (-k)]$  or  $-k[j + (-j)]$ ; 1 point for a valid argument establishing  $(-j)(-k) = jk$ .

## 7.NS.2c Answers

1. D
2. C
3. D, E, F
4. A, C
5. a. Associative
  - b. Inverse
  - c. Identity
  - d. Commutative
  - e. Inverse
  - f. Identity
6. The commutative property of multiplication is used to rewrite  $\frac{8}{3} \cdot \frac{4}{5} \cdot \frac{3}{8} \div \frac{4}{9}$  as  $\frac{8}{3} \cdot \frac{3}{8} \cdot \frac{4}{5} \div \frac{4}{9}$ . Since  $\frac{8}{3}$  and  $\frac{3}{8}$  are multiplicative inverses, the multiplicative inverse property is used to rewrite  $\frac{8}{3} \cdot \frac{3}{8} \cdot \frac{4}{5} \div \frac{4}{9}$  as  $1 \cdot \frac{4}{5} \div \frac{4}{9}$ . The multiplicative identity property is used to rewrite  $1 \cdot \frac{4}{5} \div \frac{4}{9}$  as  $\frac{4}{5} \div \frac{4}{9}$ , which equals  $\frac{4}{5} \cdot \frac{9}{4} = \frac{9}{5}$ .
- Rubric**  
1 point for using commutative property of multiplication; 0.5 point for using multiplicative inverse property; 0.5 point for using multiplicative identity property; 1 point for final value
7. The multiplicative inverse property can help you simplify the expression because  $\frac{7}{8} \cdot \frac{12}{5} \div \frac{12}{5} \cdot \frac{10}{7}$  equals  $\frac{7}{8} \cdot \frac{12}{5} \cdot \frac{5}{12} \cdot \frac{10}{7}$ . The fractions  $\frac{12}{5}$  and  $\frac{5}{12}$  are multiplicative inverses, so their product is 1.  
 $\frac{7}{8} \cdot \frac{12}{5} \cdot \frac{5}{12} \cdot \frac{10}{7} = \frac{7}{8} \cdot 1 \cdot \frac{10}{7}$

Also, the multiplicative identity property reduces the number of factors in the expression.

$$\frac{7}{8} \cdot 1 \cdot \frac{10}{7} = \frac{7}{8} \cdot \frac{10}{7}$$

### Rubric

- 1 point for using multiplicative inverse property; 1 point for using multiplicative identity property; 1 point for explanation
8. No, because the associative property of multiplication is being used to simplify the expression.

$$4.8 \cdot (0.5 \cdot 2.95) = (4.8 \cdot 0.5) \cdot 2.95 \\ = (2.4) \cdot 2.95$$

### Rubric

- 1 point for answer; 1 point for explanation
9. When multiplying a number  $a$  by 1, the result is  $a$ . The multiplicative identity is not 0, because multiplying  $a$  by 0 results in 0 and not  $a$ .

The multiplicative identity is used to

simplify  $\frac{9}{4} \cdot \frac{5}{14} \div \frac{5}{14}$  because the

expression can be rewritten as

$\frac{9}{4} \cdot \frac{5}{14} \cdot \frac{14}{5}$ . Notice that  $\frac{5}{14}$  and  $\frac{14}{5}$  are multiplicative inverses and their product is

1. So,  $\frac{9}{4} \cdot \frac{5}{14} \cdot \frac{14}{5} = \frac{9}{4} \cdot 1$ . By the

multiplicative identity property,  $\frac{9}{4} \cdot 1 = \frac{9}{4}$ .

### Rubric

- 1 point for explaining why 1 is the multiplicative identity; 1 point for explaining why 0 is not the multiplicative identity; 1 point for simplifying expression using multiplicative inverse and identity; 1 point for explanation

10. Use the associative property of multiplication to regroup the factors.

$$\left(\frac{4}{5} \cdot \frac{15}{11}\right) \cdot \frac{11}{15} \cdot \frac{13}{3} \div \frac{4}{5} =$$

$$\frac{4}{5} \cdot \left(\frac{15}{11} \cdot \frac{11}{15}\right) \cdot \frac{13}{3} \div \frac{4}{5}$$

Use the multiplicative inverse property to

simplify the expression  $\frac{15}{11} \cdot \frac{11}{15}$ .

$$\frac{4}{5} \cdot \left(\frac{15}{11} \cdot \frac{11}{15}\right) \cdot \frac{13}{3} \div \frac{4}{5} =$$

$$\frac{4}{5} \cdot 1 \cdot \frac{13}{3} \div \frac{4}{5}$$

Use the multiplicative identity property to simplify the expression.

$$\frac{4}{5} \cdot 1 \cdot \frac{13}{3} \div \frac{4}{5} = \frac{4}{5} \cdot \frac{13}{3} \div \frac{4}{5}$$

Use the commutative property of multiplication.

$$\frac{4}{5} \cdot \frac{13}{3} \div \frac{4}{5} = \frac{13}{3} \cdot \frac{4}{5} \div \frac{4}{5}$$

Change division to multiplication by an inverse.

$$\frac{13}{3} \cdot \frac{4}{5} \div \frac{4}{5} = \frac{13}{3} \cdot \frac{4}{5} \cdot \frac{5}{4}$$

Use the multiplicative inverse property to

simplify the expression  $\frac{4}{5} \cdot \frac{5}{4}$ .

$$\frac{13}{3} \cdot \frac{4}{5} \cdot \frac{5}{4} = \frac{13}{3} \cdot 1$$

Use the multiplicative identity property to simplify the expression.

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

**Rubric**

1 point for using associative property of multiplication; 1 point for using commutative property of multiplication; 1 point for using multiplicative inverse property; 1 point using multiplicative identity property

11. Possible answer:  $\frac{4}{7} \cdot \left(\frac{7}{12} \cdot \frac{8}{5}\right) \cdot \frac{3}{11} \div \frac{8}{5}$

Use the associative property of multiplication to regroup the factors.

$$\frac{4}{7} \cdot \left(\frac{7}{12} \cdot \frac{8}{5}\right) \cdot \frac{3}{11} \div \frac{8}{5} =$$

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{8}{5} \cdot \frac{3}{11} \div \frac{8}{5}$$

Use the commutative property of multiplication.

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{8}{5} \cdot \frac{3}{11} \div \frac{8}{5} =$$

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} \cdot \frac{8}{5} \div \frac{8}{5}$$

Change division to multiplication by an inverse. Then use the multiplicative inverse property to simplify.

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} \cdot \frac{8}{5} \div \frac{8}{5} =$$

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} \cdot \frac{8}{5} \cdot \frac{5}{8} =$$

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} \cdot 1$$

Use the multiplicative identity property to simplify the expression.

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} \cdot 1 = \left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11}$$

Simplify.

$$\left(\frac{4}{7} \cdot \frac{7}{12}\right) \cdot \frac{3}{11} = \frac{1}{3} \cdot \frac{3}{11}$$

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

**Rubric**

1 point for writing an expression that requires all four properties; 1 point for each property used in simplifying; 1 point for correctly simplifying result

## 7.NS.2d Answers

1. B
2. C
3. A
4. C, E
5. A, D
6. a. Terminating
- b. Repeating
- c. Repeating
- d. Terminating
- e. Repeating

$$\begin{array}{r}
 0.8125 \\
 7. 16 \overline{) 13.0000} \\
 \underline{-128} \phantom{00} \\
 20 \phantom{00} \\
 \underline{-16} \phantom{00} \\
 40 \phantom{00} \\
 \underline{-32} \phantom{00} \\
 80 \phantom{00} \\
 \underline{-80} \phantom{00} \\
 0
 \end{array}$$

0.8125; the decimal equivalent of  $\frac{13}{16}$  is a terminating decimal because there is no remainder after the 5 is evaluated.

**Rubric**

1 point for answer; 1 point for showing long division

$$8. 4.625; 4\frac{5}{8} = \frac{37}{8}$$

$$\begin{array}{r}
 4.625 \\
 8 \overline{) 37.000} \\
 \underline{-32} \phantom{00} \\
 50 \phantom{00} \\
 \underline{-48} \phantom{00} \\
 20 \phantom{00} \\
 \underline{-16} \phantom{00} \\
 40 \phantom{00} \\
 \underline{-40} \phantom{00} \\
 0
 \end{array}$$

(Accept answers that instead show

$$4\frac{5}{8} = 4 + 0.625 = 4.625.)$$

**Rubric**

1 point for answer; 1 point for showing long division

9. The second table has a greater cost per person (about \$3.83) than the first table (\$3.80).

$$\begin{array}{r}
 3.8 \\
 5 \overline{) 19.0} \\
 \underline{-15} \phantom{00} \\
 40 \phantom{00} \\
 \underline{-40} \phantom{00} \\
 0
 \end{array}
 \qquad
 \begin{array}{r}
 3.833 \\
 6 \overline{) 23.000} \\
 \underline{-18} \phantom{00} \\
 50 \phantom{00} \\
 \underline{-48} \phantom{00} \\
 20 \phantom{00} \\
 \underline{-18} \phantom{00} \\
 20 \phantom{00} \\
 \underline{-18} \phantom{00} \\
 2
 \end{array}$$

**Rubric**

1 point for correct answer; 1 point for showing each long division

10.

$$\begin{array}{r}
 0.31818 \\
 22 \overline{) 7.00000} \\
 \underline{-66} \phantom{00} \\
 40 \phantom{00} \\
 \underline{-22} \phantom{00} \\
 180 \phantom{00} \\
 \underline{-176} \phantom{00} \\
 40 \phantom{00} \\
 \underline{-22} \phantom{00} \\
 180 \phantom{00} \\
 \underline{-176} \phantom{00} \\
 4
 \end{array}$$

$$\begin{array}{r}
 0.311 \\
 45 \overline{) 14.000} \\
 \underline{-135} \phantom{00} \\
 50 \phantom{00} \\
 \underline{-45} \phantom{00} \\
 50 \phantom{00} \\
 \underline{-45} \phantom{00} \\
 5
 \end{array}$$

$$\begin{array}{r}
 0.3518518 \\
 54 \overline{) 19.0000000} \\
 \underline{-162} \phantom{0000} \\
 280 \phantom{0000} \\
 \underline{-270} \phantom{0000} \\
 100 \phantom{0000} \\
 \underline{-54} \phantom{0000} \\
 460 \phantom{0000} \\
 \underline{-432} \phantom{0000} \\
 280 \phantom{0000} \\
 \underline{-270} \phantom{0000} \\
 100 \phantom{0000} \\
 \underline{-54} \phantom{0000} \\
 460 \phantom{0000} \\
 \underline{-432} \phantom{0000} \\
 28
 \end{array}$$

Since  $\frac{7}{22} = 0.\overline{318}$ ,  $\frac{14}{45} = 0.\overline{31}$ ,

$\frac{19}{54} = 0.\overline{3518}$ , and  $0.\overline{31} < 0.\overline{318} < 0.\overline{3518}$ ,  
the rational numbers in ascending order  
are  $\frac{14}{45}$ ,  $\frac{7}{22}$ , and  $\frac{19}{54}$ .

**Rubric**

- 1 point for all decimal equivalents;
- 1 point for using long division;
- 1 point for decimals in ascending order;
- 1 point for explanation

11. Todd's calculation for  $\frac{7}{12}$  is correct.

While calculating the decimal equivalent  
for  $\frac{13}{24}$ , Todd multiplied 5 by 24  
incorrectly;  $5 \times 24 = 120$ , not 110.

$$\begin{array}{r}
 0.54166 \\
 24 \overline{) 13.00000} \\
 \underline{-120} \phantom{0000} \\
 100 \phantom{0000} \\
 \underline{-96} \phantom{0000} \\
 40 \phantom{0000} \\
 \underline{-24} \phantom{0000} \\
 160 \phantom{0000} \\
 \underline{-144} \phantom{0000} \\
 160 \phantom{0000} \\
 \underline{-144} \phantom{0000} \\
 16
 \end{array}$$

The decimal equivalent of  $\frac{13}{24}$  is  $0.54\overline{16}$ .

**Rubric**

- 1 point for determining  $\frac{7}{12}$  is the correct  
calculation;
- 1 point for identifying error;
- 2 points for finding correct decimal  
equivalent

## 7.NS.3 Answers

1. D
2. A
3. A
4. B, E
5. A, E
6. C
7. A
8. F
9. D
10.  $2(0.10) + 3(0.25) + 6(0.05) - 2(0.25) - 5(0.10) = 0.20 + 0.75 + 0.30 - 0.50 - 0.50 = 0.25$

The overall amount of money in the jar increased by \$0.25.

### Rubric

- 1 point for expression;
- 1 point for answer

11. The stack of sheets is  $2\frac{5}{8}$  inches tall.

$$\begin{aligned} \frac{3}{16} \times 14 &= \frac{42}{16} \\ &= \frac{21}{8} \\ &= 2\frac{5}{8} \end{aligned}$$

### Rubric

- 1 point for answer;
- 1 point for showing work

12. Four photos can fit in the picture frame.

$$\begin{aligned} 14\frac{1}{2} + 3\frac{1}{4} &= \frac{29}{2} + \frac{13}{4} \\ &= \frac{29}{2} \times \frac{4}{4} \\ &= \frac{116}{2} \\ &= \frac{58}{1} \\ &= \frac{58}{13} \\ &= 4\frac{6}{13} \end{aligned}$$

The number of photos that can fit in the frame is different than the quotient of  $14\frac{1}{2}$  and  $3\frac{1}{4}$  because only whole photos can fit in the picture frame. It would not make sense for  $\frac{6}{13}$  of a photo to be inside the picture frame.

### Rubric

- 1 point for answer; 1 point for showing work; 1 point for explanation

13. There are 576 bolts in the collection.

Convert the weight of the box from pounds to ounces.

$$\begin{aligned} 6\frac{3}{4} \times 16 &= \frac{27}{4} \times 16 \\ &= \frac{432}{4} \\ &= 108 \end{aligned}$$

The box has 108 ounces of bolts.

Now divide 108 by  $\frac{3}{16}$ .

$$\begin{aligned} 108 \div \frac{3}{16} &= 108 \times \frac{16}{3} \\ &= \frac{1,728}{3} \\ &= 576 \end{aligned}$$

### Rubric

- 1 point for answer;
- 2 points for explanation

14. a. 
$$\frac{50.7 + 49.4 + 52.3 + 48.9 + 51.6}{5} =$$

$$\frac{252.9}{5} = 50.58$$

The average of the 5 attempts is 50.58 meters.

- b. The sixth attempt would have to travel 52.5 meters because 52.5 is the difference between the sum of the five attempts and what the sum of the six attempts has to be in order for the average to be 50.9 meters.

$$50.9 \times 6 = 305.4$$

$$305.4 - 252.9 = 52.5$$

**Rubric**

- a. 1 point for answer;  
1 point for showing work
- b. 1 point for answer;  
1 point for explanation

15. Peter did not follow the order of

operations; he should have divided  $10\frac{1}{2}$  by  $3\frac{3}{4}$  first instead of adding  $4\frac{1}{4}$  and  $10\frac{1}{2}$ .

$$4\frac{1}{4} + 10\frac{1}{2} + 3\frac{3}{4} = \frac{17}{4} + \frac{21}{2} + \frac{15}{4}$$

$$= \frac{17}{4} + \frac{21}{2} \times \frac{2}{2} + \frac{15}{4}$$

$$= \frac{17}{4} + \frac{84}{4} + \frac{15}{4}$$

$$= \frac{255}{4} + \frac{168}{4}$$

$$= \frac{423}{4}$$

$$= 7\frac{3}{4}$$

$$= 7\frac{1}{20}$$

**Rubric**

- 1 point for identifying Peter's error;  
1 point for finding the correct value of the expression; 1 point for showing work



## 7.EE.1 Answers

1. C  
 2. C  
 3. A, C  
 4. C, E  
 5. Use the associative property of addition to rewrite  $\left(-\frac{1}{2}x + \frac{3}{5}y\right) + \frac{7}{5}x$  as

$$-\frac{1}{2}x + \left(\frac{3}{5}y + \frac{7}{5}x\right).$$

Then use the

distributive property to rewrite

$$-\frac{1}{2}x + \left(\frac{3}{5}y + \frac{7}{5}x\right) \text{ as } -\frac{1}{2}x + \frac{1}{5}(3y + 7x).$$

### Rubric

- 1 point for using associative property;  
 1 point for using distributive property

6. a. Nadine:  $9.50h + 15$ ;  
 Walt:  $10.25h + 12$   
 b.  $9.50h + 15 + 10.25h + 12 =$   
 $9.50h + 10.25h + 15 + 12 =$   
 $19.75h + 27$

The commutative property of addition allows 15 and 10.25h to be switched. This allows 9.50h and 10.25h to be added together and 15 and 12 to be added together.

The distributive property is used to add the terms with the variable:

$$9.50h + 10.25h = (9.50 + 10.25)h = 19.75h.$$

### Rubric

- a. 1 point for each expression  
 b. 1 point for answer; 1 point for explanation of properties used  
 7.  $0.3(24.40a + 14.50c)$ ;  
 $0.3(24.40a + 14.50c) =$   
 $0.3(24.40a) + 0.3(14.50c) =$   
 $7.32a + 4.35c$

### Rubric

- 1 point for expression with parentheses;  
 1 point for using distributive property;  
 1 point for simplified expression

8. No.  $\left(-\frac{1}{2}x + \frac{6}{7}\right) - \left(\frac{7}{2}x - \frac{4}{7}\right)$  is equal to

$$\left(-\frac{1}{2}x + \frac{6}{7}\right) + \left[-\left(\frac{7}{2}x - \frac{4}{7}\right)\right] \text{ because}$$

subtracting is adding the opposite.

Distribute the negative sign to each term in the parentheses.

$$\left(-\frac{1}{2}x + \frac{6}{7}\right) + \left[-\left(\frac{7}{2}x - \frac{4}{7}\right)\right] =$$

$$\left(-\frac{1}{2}x + \frac{6}{7}\right) + \left(-\frac{7}{2}x\right) + \frac{4}{7}$$

Drop the parentheses and use the commutative property of addition to move

$$-\frac{7}{2}x \text{ to the left of } \frac{6}{7}.$$

$$-\frac{1}{2}x + \frac{6}{7} + \left(-\frac{7}{2}x\right) + \frac{4}{7} =$$

$$-\frac{1}{2}x + \left(-\frac{7}{2}x\right) + \frac{6}{7} + \frac{4}{7}$$

Combine like terms and simplify.

$$-\frac{1}{2}x + \left(-\frac{7}{2}x\right) + \frac{6}{7} + \frac{4}{7} = -\frac{8}{2}x + \frac{10}{7}$$

$$= -4x + \frac{10}{7}$$

So,  $\left(-\frac{1}{2}x + \frac{6}{7}\right) - \left(\frac{7}{2}x - \frac{4}{7}\right)$  is equivalent

to  $-4x + \frac{10}{7}$ , not  $-4x + \frac{2}{7}$ .

### Rubric

- 1 point for answer; 1 point for using distributive property; 1 point for using commutative property of addition;  
 1 point for simplified expression

9. Possible answer:

$$\left(\frac{5}{8}-\frac{9}{4}y\right)+\frac{3}{4}(3y-5)-\frac{3}{8}=\left(\frac{5}{8}-\frac{9}{4}y\right)+\frac{9}{4}y-\frac{15}{4}-\frac{3}{8} \quad \text{Distributive property}$$

$$=\frac{5}{8}+\left(-\frac{9}{4}y+\frac{9}{4}y\right)-\frac{15}{4}-\frac{3}{8} \quad \text{Associative property of addition}$$

$$=\frac{5}{8}+0-\frac{15}{4}-\frac{3}{8} \quad \text{Additive inverse property}$$

$$=\frac{5}{8}-\frac{15}{4}-\frac{3}{8} \quad \text{Additive identity property}$$

$$=\frac{5}{8}-\frac{3}{8}-\frac{15}{4} \quad \text{Commutative property of addition}$$

$$=-\frac{7}{2} \quad \text{Simplify.}$$

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

**Rubric**

1 point for writing an expression that requires all five properties;

1 point for each property used in simplifying; 1 point for correctly simplifying result

10. Possible answer:

$$\frac{2}{5}(a+b)+\frac{3}{5}(a+c)=\frac{2}{5}a+\frac{2}{5}b+\frac{3}{5}a+\frac{3}{5}c \quad \text{Distributive property}$$

$$=\frac{2}{5}a+\frac{3}{5}a+\frac{2}{5}b+\frac{3}{5}c \quad \text{Commutative property of addition}$$

$$=a\left(\frac{2}{5}+\frac{3}{5}\right)+\frac{2}{5}b+\frac{3}{5}c \quad \text{Distributive property}$$

$$=a(1)+\frac{2}{5}b+\frac{3}{5}c \quad \text{Simplify.}$$

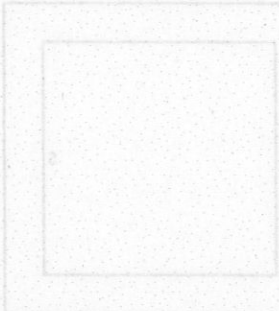
$$=a+\frac{2}{5}b+\frac{3}{5}c \quad \text{Multiplicative identity property}$$

**Rubric**

1 point for each property used; 1 point for simplified result

11. a.  $5a + 3a + 14 + 4(a - 6) + 10$

b. Possible answer:

	$5a + 3a + 14 + 4(a - 6) + 10 = 5a + 3a + 14 + 4a - 24 + 10$	Distributive property
	$= 5a + 3a + 4a + 14 - 24 + 10$	Commutative prop. of addition
	$= 5a + 3a + 4a + 14 + 10 - 24$	Commutative prop. of addition
	$= 5a + 3a + 4a + 24 - 24$	Simplify.
	$= 5a + 3a + 4a + 0$	Additive inverse property
	$= 5a + 3a + 4a$	Additive identity property
	$= (5 + 3 + 4)a$	Distributive property
	$= 12a$	Simplify.

c. One side is 10 feet long.

Since  $12a = 120$ ,  $a = 10$ .

Substitute 10 for  $a$  for each of the unknown sides.

$5a = 5(10) = 50$

The side that has length  $5a$  is 50 feet long.

$3a + 14 = 3(10) + 14 = 30 + 14 = 44$

The side that has length  $3a + 14$  is 44 feet long.

$4(a - 6) = 4(10 - 6) = 4(4) = 16$

The side that has length  $4(a - 6)$  is 16 feet long.

**Rubric**

a. 1 point

b. 2 points for showing properties used; 1 point for correct simplified expression

c. 1 point for side lengths; 1 point for showing work

## 7.EE.2 Answers

1. B
2. D
3. B
4. A, C, D
5. No, because the expression  $1.016x$  can be rewritten as  $x + 0.016x$ , and  $0.016x$  means a 1.6% increase of  $x$ , which is less than 12%.

### Rubric

1 point for answer; 1 point for rewriting expression; 1 point for explanation

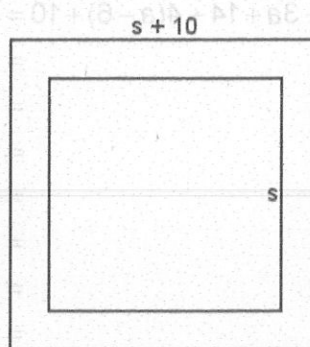
6. Tracy's expression makes it easier to see how the areas of rectangles are related because the area of the larger rectangle is  $bh$ . Since the area of the smaller rectangle is  $\frac{1}{6}bh$ , the area of the

smaller rectangle is  $\frac{1}{6}$  the area of the larger rectangle.

### Rubric

1 point for answer;  
2 points for explanation

7. a. Possible sketch:



- b. Perimeter of pool:  $4s$

Perimeter of the outside of the tile border:  $4(s + 10)$  or  $4s + 40$

- c. The perimeter of the tile border,  $4s + 40$ , is 40 feet longer than the perimeter of the pool,  $4s$ .

### Rubric

- a. 1 point
  - b. 1 point for each expression
  - c. 1 point
8. a.  $x + 3 + 4x + 12 = x + 4x + 3 + 12$   
 $= 5x + 15$
  - b.  $5x + 15 = 5(x + 3)$

The distance from Andre's house to the middle school is  $x + 3$ , and the distance from Andre's house to the library is  $5(x + 3)$ . This shows that the library is 5 times farther from Andre's house than the middle school is.

### Rubric

- a. 1 point for writing expression;  
1 point for simplifying expression
- b. 1 point for rewriting expression;  
1 point for explanation

$$9. \frac{A}{\ell} = \frac{\ell w}{\ell}$$

$$\frac{A}{\ell} = w$$

The width gets shorter when the area stays the same and the length gets longer because when the numerator stays the same in a fraction, and the denominator gets larger, the value of the fraction gets smaller.

**Rubric**

1 point for solving for  $w$ ; 2 points for stating the relationship between the length and the width

10. a. Possible answer:

$$s - 0.3s - 0.4(s - 0.3s);$$

Since Christopher is taking 30% of the seashells, he takes  $0.3s$  seashells. So, there are  $s - 0.3s$  seashells remaining.

Tamara is taking 40% of those remaining seashells, so the expression

$0.4(s - 0.3s)$  represents the number of seashells Tamara takes. So, there are

$s - 0.3s - 0.4(s - 0.3s)$  seashells for Jack.

b.  $s - 0.3s - 0.4(s - 0.3s)$

$$= s - 0.3s + [-0.4(s - 0.3s)]$$

$$= s - 0.3s - 0.4s + 0.12s$$

$$= (1 - 0.3 - 0.4 + 0.12)s$$

$$= 0.42s$$

Jack gets 42% of the seashells the group collects.

**Rubric**

a. 1 point for expression;

1 point for explanation

b. 1 point for simplified expression;

1 point for interpretation

1. D

2. A

3. B

4. C

5. A, B, C

6. a. Yes

b. No

c. Yes

d. Yes

e. No

7. Convert the mixed numbers to decimals.

$$110 \frac{5}{8} = 110.625; 28 \frac{3}{8} = 28.375$$

Subtract  $28.375$  from  $110.625$  to determine the length of the wall that is not covered by the painting.

$$110.625 - 28.375 = 82.25$$

Since the painting is centered on the wall, the length from the end of the wall to the edge of the painting for each side is the same. Divide  $82.25$  by 2.

$$\frac{82.25}{2} = 41.125$$

Convert  $41.125$  to a fraction.

$$41.125 = 41 \frac{125}{1000} = 41 \frac{1}{8}$$

The edges of the painting have to be

$41 \frac{1}{8}$  inches away from each end of the wall.

the wall.

Rubric

1 point for converting fractions to decimals; 1 point for showing work; 1 point for correct mixed number answer.

## 7.EE.3 Answers

1. D
2. A
3. B
4. C
5. A, B, C
6. a. Yes
- b. No
- c. Yes
- d. Yes
- e. No

7. Convert the mixed numbers to decimals.

$$110\frac{5}{8} = 110.625; 28\frac{3}{8} = 28.375$$

Subtract 28.375 from 110.625 to determine the length of the wall that is not covered by the painting.

$$110.625 - 28.375 = 82.25$$

Since the painting is centered on the wall, the length from the end of the wall to the edge of the painting for each side is the same. Divide 82.25 by 2.

$$\frac{82.25}{2} = 41.125$$

Convert 41.125 to a fraction.

$$41.125 = 41\frac{125}{1000} = 41\frac{1}{8}$$

The edges of the painting have to be  $41\frac{1}{8}$  inches away from each end of the wall.

### Rubric

1 point for converting fractions to decimals; 1 point for showing work; 1 point for correct mixed number answer

8. a. Possible answer: Round 252 to 300,  $25\frac{3}{4}$  to 25, and  $4\frac{1}{2}$  to 5. The first train travels  $25 \times 5 = 125$  miles.

So, the second train travels

$$300 - 125 = 175 \text{ miles and, thus, the second train travels } \frac{175}{5} = 35 \text{ miles}$$

per hour. (Accept answers that use different rounding, such as rounding

$$252 \text{ to } 250 \text{ and } 25\frac{3}{4} \text{ to } 30.)$$

b. The speed of the other train is

$$30\frac{1}{4} \text{ miles per hour.}$$

Convert  $25\frac{3}{4}$  and  $4\frac{1}{2}$  to decimals.

$$25\frac{3}{4} = 25.75; 4\frac{1}{2} = 4.5$$

The first train travels  $25.75 \times 4.5 =$

$$115.875 \text{ miles. So, the second train}$$

travels  $252 - 115.875 = 136.125$  miles.

Divide 136.125 by 4.5.

$$\frac{136.125}{4.5} = 30.25$$

Convert 30.25 to a mixed number.

$$30.25 = 30\frac{1}{4}$$

c. Yes, because the answer from part b,  $30\frac{1}{4}$ , is close to the estimate of 35.

### Rubric

- a. 2 points
- b. 1 point for answer; 1 point for showing work; 1 point for converting all fractions to decimals
- c. 0.5 point for answer; 0.5 point for explanation

9. a. Round 18,600 to 20,000. Subtract the product of 20,000 and 0.2 from 20,000.

$$20,000 - 20,000 \times 0.2 = 16,000$$

The value of the car is about \$16,000 after the first year.

Subtract the product of 16,000 and 0.15 from 16,000.

$$16,000 - 16,000 \times 0.15 = 13,600$$

The value of the car is \$13,600 after the second year.

b. Subtract the product of 18,600 and 0.2 from 18,600.

$$18,600 - 18,600 \times 0.2 = 14,880$$

The value of the car is \$14,880 after the first year.

Subtract the product of 14,880 and 0.15 from 14,880.

$$14,880 - 14,880 \times 0.15 = 12,648$$

The value of the car is \$12,648 after the second year.

c. No, because the car did not lose 20% of its initial value in the first year and then lose 15% of its initial value in the second year. The car's value lost 15% of a lower amount in the second year, so the car's value lost less than 35% of its initial value during the 2 years.

#### Rubric

- a. 1 point for answer; 0.5 point for rounding; 0.5 point for showing work
- b. 0.5 point for value after first year; 0.5 point for value after second year; 1 point for showing work
- c. 1 point for answer; 1 point for explanation

10. a. Possible answer: The expression  $9 \times 60 \times 24 \times 7$  represents the number of customers that the company serves per week. Notice that  $9 \times 60 \times 24 \times 7$  is less than  $10 \times 60 \times 24 \times 7$ , which is also less than  $10 \times 60 \times 25 \times 8$ . Notice that  $25 \times 8$  equals  $50 \times 4$ .

$$\begin{aligned} 10 \times 60 \times 25 \times 8 &= 10 \times 60 \times 50 \times 4 \\ &= 10 \times 60 \times 200 \\ &= 120,000 \end{aligned}$$

Since 130,000 is greater than 120,000 and 120,000 is greater than the customers served per week, the company's claim is inaccurate.

b. Possible answer: Since  $9 \times 60 \times 24 \times 7 = 90,720$ , the company should claim that it serves 90,000 customers per week.

c. Possible answer: The company should serve about 13 customers per minute so it can advertise that it serves 130,000 customers per week.

First, find how many minutes there are in a week.

$$60 \times 24 \times 7 = 1,440 \times 7 = 10,080$$

Then, divide 130,000 by 10,080 to find how many customers should be served per minute. Round up.

$$\frac{130,000}{10,080} \approx 12.90 \approx 13$$

#### Rubric

- a. 2 points
- b. 1 point for answer; 1 point for explanation
- c. 1 point for answer; 1 point for explanation

## 7.EE.4a Answers

1. A

2. D

3. B, C, E

4. a. No

b. Yes

c. Yes

d. No

e. No

5.  $y = -7$ ; Add  $\frac{21}{4}$  to both sides of the equation.

$$\frac{1}{2}y - \frac{21}{4} + \frac{21}{4} = -\frac{35}{4} + \frac{21}{4}$$

$$\frac{1}{2}y = -\frac{14}{4}$$

Multiply both sides of the equation by 2.

$$\frac{1}{2}y \cdot 2 = -\frac{14}{4} \cdot 2$$

$$y = -\frac{28}{4}$$

$$y = -7$$

### Rubric

1 point for solution; 1 point for adding  $\frac{21}{4}$

to both sides of the equation; 1 point for multiplying both sides of the equation by 2

6. Let  $t$  be the time, in hours, Cathy works over 40 hours. An equation that represents this situation is

$13.50 \cdot 40 + 20.25t = 661.50$ , which simplifies to  $540 + 20.25t = 661.50$ .

Subtract 540 from both sides of the equation.

$$540 - 540 + 20.25t = 661.50 - 540$$

$$20.25t = 121.50$$

$$\frac{20.25t}{20.25} = \frac{121.50}{20.25}$$

$$t = 6$$

Since 6 is the number of hours Cathy works over 40 hours, she works  $40 + 6 = 46$  hours that week.

### Rubric

1 point for equation; 1 point for solution; 1 point for interpretation

7. Each alternator weighs 13.25 pounds.

An equation that represents this situation is  $7a + 19.5 = 112.25$ . Solve the equation for  $a$ .

$$7a + 19.5 - 19.5 = 112.25 - 19.5$$

$$7a = 92.75$$

$$\frac{7a}{7} = \frac{92.75}{7}$$

$$a = 13.25$$

### Rubric

1 point for answer; 1 point for equation; 1 point for showing work

8.

$$96.25 = \frac{7(b_1 + 10.5)}{2}$$

$$\frac{2}{7} \cdot 96.25 = \frac{2}{7} \cdot \frac{7(b_1 + 10.5)}{2}$$

$$27.5 = b_1 + 10.5$$

$$27.5 - 10.5 = b_1 + 10.5 - 10.5$$

$$17 = b_1$$

Thus,  $b_1$  is 17 meters.

### Rubric

1 point for answer; 1 point for showing work

9. Add  $\frac{1}{4}$  to  $5\frac{3}{4}$  to find the amount of sugar needed for four recipes.

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

Divide 6 by 4 to find the amount of sugar in the original recipe.

$$\frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}$$

The original recipe calls for  $1\frac{1}{2}$  cups of sugar.

### Rubric

1 point for answer; 1 point for using arithmetic



10. a. The variable  $p$  is used to represent the number of pens Becky buys.

b.  $0.29p + 1.59 = 5.07$

c.  $0.29p + 1.59 = 5.07$

$0.29p + 1.59 - 1.59 = 5.07 - 1.59$

$0.29p = 3.48$

$p = \frac{3.48}{0.29}$

$p = 12$

The solution of the equation is  $p = 12$ , and it means that Becky buys 12 pens.

**Rubric**

a. 1 point

b. 1 point

c. 0.5 point for solution; 0.5 point for showing work; 1 point for meaning of solution

11. The difference between consecutive even integers is 2. Since  $n$  is the smaller consecutive even integer,  $n + 2$  is the larger consecutive even integer. An equation that represents two consecutive even integers whose sum is 114 is  $n + (n + 2) = 114$ , or  $2n + 2 = 114$ . Solve the equation for  $n$ .

$2n + 2 - 2 = 114 - 2$

$2n = 112$

$\frac{2n}{2} = \frac{112}{2}$

$n = 56$

Since  $n = 56$ , 56 is the smaller consecutive even integer and the larger consecutive even integer is  $56 + 2$ , or 58. The two consecutive even integers are 56 and 58.

**Rubric**

1 point for equation; 0.5 point for each consecutive even integer; 1 point for explanation; 1 point for showing work

12. a. A 6% sales tax increases the price of the two books by 6% and can be represented as multiplying by 1.06. So, divide the total cost, \$44.52, by 1.06.

$\frac{\$44.52}{1.06} = \$42.00$

Subtract the cost of book A, \$17.50, from \$42.00 to find the cost of book B.  
 $\$42.00 - \$17.50 = \$24.50$

The cost of book B is \$24.50.

b. The cost of book B can be represented as the variable  $b$  in an equation. An equation that represents this situation is  $1.06(b + 17.50) = 44.52$ .

c.  $\frac{1.06(b + 17.50)}{1.06} = \frac{44.52}{1.06}$

$b + 17.50 = 42.00$

$b + 17.50 - 17.50 = 42.00 - 17.50$

$b = 24.50$

The cost of book B is \$24.50.

d. The arithmetic solution divides \$44.52 by 1.06 and subtracts \$17.50 from the quotient. The algebraic solution divides both sides of the equation by 1.06 and subtracts 17.50 from both sides of the equation. The two solutions use the same operations in the same order.

**Rubric**

a. 1 point

b. 1 point for representing the cost of book B in an equation; 1 point for equation

c. 1 point for answer; 1 point for showing work

d. 1 point

## 7.EE.4b Answers

1. C
2. C
3. D
4. A
5. B, C, E
6. a. Yes
- b. No
- c. No
- d. Yes
- e. No

7. a.  $P \geq 2l + 2w$

$$115 \geq 2(28.5) + 2w$$

$$115 \geq 57 + 2w$$

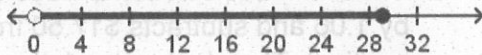
b.  $115 - 57 \geq 57 - 57 + 2w$

$$58 \geq 2w$$

$$\frac{58}{2} \geq \frac{2w}{2}$$

$$29 \geq w$$

c.



The solution means that the width of the frame is greater than 0 cm but at most 29 cm.

### Rubric

- a. 1 point
- b. 1 point
- c. 1 point for number line; 1 point for interpretation

8.  $8\frac{1}{2}t + 3\frac{7}{8} \geq 14\frac{1}{2}$ ; Rewrite  $8\frac{1}{2}$ ,  $3\frac{7}{8}$ , and  $14\frac{1}{2}$  as improper fractions and solve for  $t$ .

$$\frac{17}{2}t + \frac{31}{8} \geq \frac{29}{2}$$

$$\frac{17}{2}t + \frac{31}{8} - \frac{31}{8} \geq \frac{116}{8} - \frac{31}{8}$$

$$\frac{17}{2}t \geq \frac{85}{8}$$

$$\frac{2}{17} \cdot \frac{17}{2}t \geq \frac{2}{17} \cdot \frac{85}{8}$$

$$t \geq \frac{5}{4}$$

Erin needs to run at least another hour and fifteen minutes to meet her goal.

### Rubric

1 point for inequality; 1 point for solution; 1 point for showing work

9.  $0.08s + 275 \geq 560$ ;

$$0.08s + 275 - 275 \geq 560 - 275$$

$$0.08s \geq 285$$

$$\frac{0.08s}{0.08} \geq \frac{285}{0.08}$$

$$s \geq 3,562.5$$

Cliff must have at least \$3,562.50 in sales per week in order for him to earn at least \$560 per week.

### Rubric

1 point for inequality; 1 point for solution set; 1 point for interpretation

10. a. The variable  $p$  can be used to represent the number of people invited to Allison's party.

$$24p + 120 \leq 400$$

b.  $24p + 120 - 120 \leq 400 - 120$

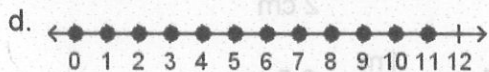
$$24p \leq 280$$

$$\frac{24p}{24} \leq \frac{280}{24}$$

$$p \leq \frac{35}{3}$$

$$p \leq 11\frac{2}{3}$$

- c. I would use a set of points because only whole numbers of people can be invited. The solution set is integers from 0 to 11 because Allison can invite no more than  $11\frac{2}{3}$  people and a negative number of people cannot be invited.



**Rubric**

- a. 1 point for using a variable to represent the number of invited people; 1 point for inequality  
 b. 1 point for solution; 1 point for showing work  
 c. 0.5 point for stating a set of points should be used; 0.5 point for explanation  
 d. 1 point

11. a. Possible answer: The variable  $s$  can be used to represent the length of the shorter unknown side, and  $2s$  can be used to represent the length of the longer unknown side.

- b. To write an inequality that represents the minimum perimeter, add  $s$ ,  $2s$ , and  $21$  and set it greater than  $42$ .

$$s + 2s + 21 > 42$$

$$3s + 21 > 42$$

To write an inequality that represents the maximum perimeter, add  $s$ ,  $2s$ , and  $21$  and set it less than  $84$ .

$$s + 2s + 21 < 84$$

$$3s + 21 < 84$$

c.  $3s + 21 - 21 > 42 - 21$

$$\frac{3s}{3} > \frac{21}{3}$$

$$s > 7$$

$$3s + 21 - 21 < 84 - 21$$

$$\frac{3s}{3} < \frac{63}{3}$$

$$s < 21$$

The length of the shorter unknown side is greater than  $7$  m and less than  $21$  m.

**Rubric**

- a. 1 point  
 b. 1 point for each inequality  
 c. 1 point for each solution

## 7.G.1 Answers

- C
- D
- C
- C
- C, E, F
- C
- A
- F
- D
- Find the perimeter of the blueprint.  
 $19\text{ cm} + 15\text{ cm} + 18\text{ cm} + 17\text{ cm} = 69\text{ cm}$

Multiply 69 cm by the ratio  $\frac{7\text{ m}}{2\text{ cm}}$ .

$$69\text{ cm} \times \frac{7\text{ m}}{2\text{ cm}} = 241.5\text{ m}$$

So, the length of the fence is 241.5 meters.

### Rubric

1 point for answer; 1 point for showing work

- Find the dimensions of the dining room.

Use the ratio  $\frac{1\text{ m}}{2\text{ cm}}$  to convert to meters.

$$8\text{ cm} \times \frac{1\text{ m}}{2\text{ cm}} = 4\text{ m}$$

$$14\text{ cm} \times \frac{1\text{ m}}{2\text{ cm}} = 7\text{ m}$$

Multiply the dimensions to find the area of the dining room.

$$4\text{ m} \times 7\text{ m} = 28\text{ m}^2$$

Multiply the area of the dining room by the cost per square meter for tile.

$$28\text{ m}^2 \times \frac{\$76}{1\text{ m}^2} = \$2,128$$

Find the dimensions of the bedroom.

Use the ratio  $\frac{1\text{ m}}{2\text{ cm}}$  to convert to meters.

$$7\text{ cm} \times \frac{1\text{ m}}{2\text{ cm}} = 3.5\text{ m}$$

$$12\text{ cm} \times \frac{1\text{ m}}{2\text{ cm}} = 6\text{ m}$$

Multiply the dimensions to find the area of the bedroom.

$$3.5\text{ m} \times 6\text{ m} = 21\text{ m}^2$$

Multiply the area of the bedroom by the cost per square meter for carpet.

$$21\text{ m}^2 \times \frac{\$52}{1\text{ m}^2} = \$1,092$$

Add the costs of installing carpet in the bedroom and installing tile in the dining room.

$$\$2,128 + \$1,092 = \$3,220$$

It costs \$3,220 to install tile in the dining room and to install carpet in the bedroom.

### Rubric

2 points for total cost; 2 points for showing work

$$12. a. \frac{269.5 \text{ km}}{9.8 \text{ cm}} = \frac{269.5 \text{ km} \div 9.8}{9.8 \text{ cm} \div 9.8}$$

$$= \frac{27.5 \text{ km}}{1 \text{ cm}}$$

So, 1 cm on the maps represents 27.5 km of actual distance.

- b. Add the distance from city Q to city R and from city R to city S on the map.

$$8.6 \text{ cm} + 7.8 \text{ cm} = 16.4 \text{ cm}$$

Use the ratio  $\frac{27.5 \text{ km}}{1 \text{ cm}}$  to find the

total distance.

$$\frac{27.5 \text{ km}}{1 \text{ cm}} = \frac{27.5 \text{ km} \times 16.4}{1 \text{ cm} \times 16.4}$$

$$= \frac{451 \text{ km}}{16.4 \text{ cm}}$$

The distance to travel from city Q to city S through city R is 451 km.

- c. Use the ratio  $\frac{27.5 \text{ km}}{1 \text{ cm}}$  to find the

distance from city Q to city S.

$$\frac{27.5 \text{ km}}{1 \text{ cm}} = \frac{27.5 \text{ km} \times 12.1}{1 \text{ cm} \times 12.1}$$

$$= \frac{332.75 \text{ km}}{12.1 \text{ cm}}$$

The distance to travel directly from city Q to city S is 332.75 km.

- d. Subtract 332.75 km from 451 km.

$$451 \text{ km} - 332.75 \text{ km} = 118.25 \text{ km}$$

Traveling from city Q to city S by going through city R is 118.25 km farther than traveling directly from city Q to city S.

(Also accept reasoning that uses the fact that the map distance is 4.3 cm farther, and

$$4.3 \text{ cm} \times \frac{27.5 \text{ km}}{1 \text{ cm}} = 118.25 \text{ km}.)$$

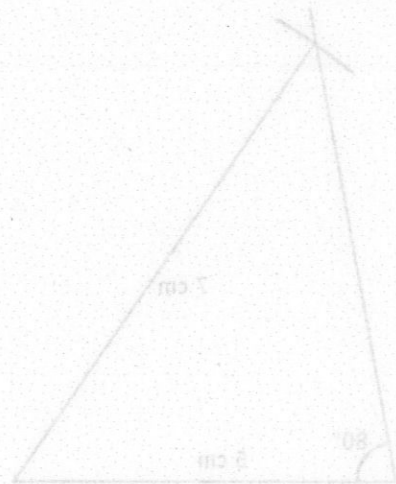
### Rubric

- 1 point
- 0.5 point for answer; 0.5 point for showing work
- 0.5 point for answer; 0.5 point for showing work
- 0.5 point for answer; 0.5 point for showing work



Line segments that are 1 cm, 3 cm, and 5 cm long do not form a triangle. The 1 cm and 3 cm sides cannot intersect when the included side is 5 cm long because the sum of 1 cm and 3 cm, 4 cm, is shorter than 5 cm.

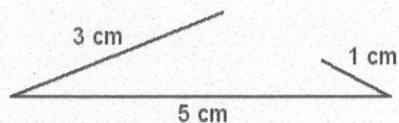
Rubric  
1 point for drawing a figure, 1 point for answer, 1 point for explanation



Rubric  
1 point for drawing a line segment that is 5 cm, 1 point for drawing an 80 degree angle, 1 point for drawing a line segment that is 7 cm

## 7.G.2 Answers

1. A
2. C
3. B, D
4. a. Unique triangle
- b. No triangle
- c. Unique triangle
- d. More than one triangle
- e. No triangle
- f. No triangle
- 5.

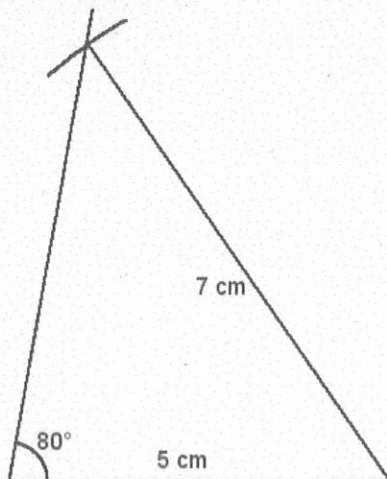


Line segments that are 1 cm, 3 cm, and 5 cm long do not form a triangle. The 1 cm and 3 cm sides cannot intersect when the included side is 5 cm long because the sum of 1 cm and 3 cm, 4 cm, is shorter than 5 cm.

### Rubric

1 point for drawing a figure; 1 point for answer; 1 point for explanation

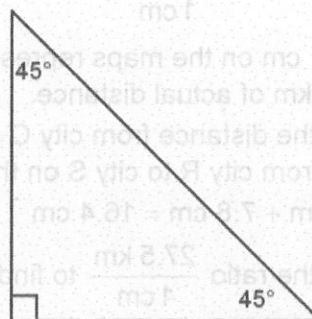
6. Possible answer:



### Rubric

1 point for drawing a line segment that is 5 cm; 1 point for drawing an 80° angle; 1 point for drawing a line segment that is 7 cm

7. Possible answer:



The sum of the angles in a triangle is  $180^\circ$ . Since the measure of a right angle is  $90^\circ$ , the measures of the remaining two angles add to  $90^\circ$  because  $180^\circ - 90^\circ = 90^\circ$ . Since the two remaining angles have the same measure, divide  $90^\circ$  by 2.

$$\frac{90^\circ}{2} = 45^\circ$$

The measure of the two other angles is  $45^\circ$ , so I made  $45^\circ$  angles with the perpendicular sides to form the third side.

The triangle I made is not a unique triangle because many triangles of different sizes have the same angle measures as the triangle I made above.

### Rubric

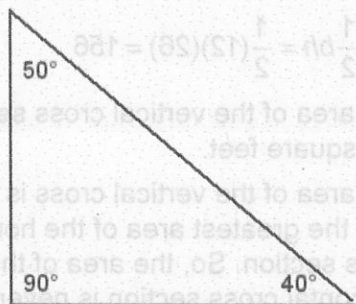
1 point for sketch; 1 point for explanation of drawing; 1 point for answer; 1 point for explanation

8. Possible answer: Use a straightedge to draw a line segment with one endpoint  $P$ . Copy  $\overline{AB}$  using a compass, and then place the point of the compass on  $P$  and draw an arc that intersects the segment. Label the point where the arc and segment intersect as  $Q$ . Copy  $\overline{CD}$  using a compass, and then place the point of the compass on  $P$  and draw an arc. Copy  $\overline{FG}$  using a compass, and then place the point of the compass on  $Q$  and draw an arc. The arcs intersect at two different points. Label one of the points where the arcs intersect as  $R$ . Use the straightedge to draw  $\overline{PR}$  and  $\overline{QR}$ . So,  $\triangle PQR$  has sides with the same length as  $\overline{AB}$ ,  $\overline{CD}$ , and  $\overline{FG}$ .

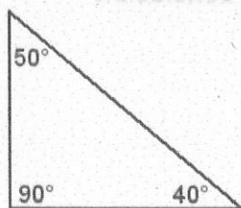
**Rubric**

1 point for describing using compass to copy segment length  $AB$  to form new segment; 1 point for each arc described; 1 point for mentioning that the arcs intersect at third point

9. a. Possible answer:



b. Yes. I can draw another triangle that has angles of  $40^\circ$ ,  $50^\circ$ , and  $90^\circ$ , like the one below whose side lengths are  $\frac{2}{3}$  the first triangle's side lengths.

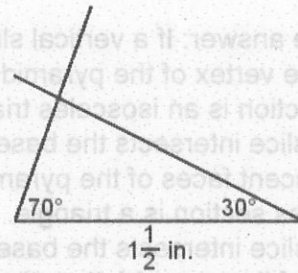
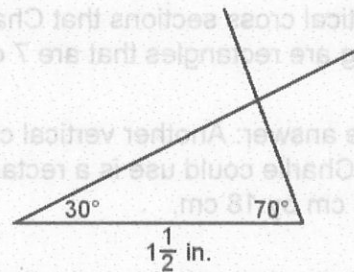


c. No. Many triangles of different sizes can be formed when any three angles are given because there is no restriction on the side lengths of the triangle.

**Rubric**

- a. 1 point
- b. 1 point for answer; 1 point for a different sized triangle
- c. 1 point for answer; 1 point for explanation

10.



Mason is incorrect. Every triangle with a  $30^\circ$  angle, a  $70^\circ$  angle, and an included side of  $1\frac{1}{2}$  inches will have the same side lengths for the other two sides.

**Rubric**

1 point for each constructed triangle; 1 point for answer; 2 points for explanation

## 7.G.3 Answers

1. B
2. C
3. D
4. C, E, F
5. a. No  
b. Yes  
c. Yes  
d. Yes  
e. Yes  
f. Yes
6. The vertical cross sections that Charlie is cutting are rectangles that are 7 cm by 5 cm.

Possible answer: Another vertical cross section Charlie could use is a rectangle that is 5 cm by 18 cm.

### Rubric

1 point for each vertical cross section description

7. No. Possible answer: If a vertical slice intersects the vertex of the pyramid, then the cross section is an isosceles triangle. If a vertical slice intersects the base and just two adjacent faces of the pyramid, then the cross section is a triangle. If a vertical slice intersects the base and three faces of the pyramid, then the cross section is a quadrilateral.

### Rubric

1 point for answer; 2 points for explanation

8. a. This cross section is a rectangle of length 32 meters and width 17 meters.
- b. This cross section is a rectangle of length 53 meters and width 9 meters.
- c. The vertical cross section of figure 1 is larger.

The area of the cross section from figure 1 is  $544 \text{ m}^2$ , and the area of the cross section from figure 2 is  $477 \text{ m}^2$ . Notice that  $544 \text{ m}^2$  is greater than  $477 \text{ m}^2$ .

### Rubric

- a. 1 point
- b. 1 point
- c. 1 point for answer; 1 point for justification

9. The horizontal cross section ranges from the vertex to the base. So, the horizontal cross section is a rectangle whose length is less than or equal to 12 feet and whose width is less than or equal to 9 feet. The horizontal cross section with the greatest area is taken at the base and is a rectangle with a length of 12 feet and a width of 9 feet. To find its area, use the formula for the area of a rectangle.

$$A = lw = (12)(9) = 108$$

The area of the horizontal cross section is greater than 0 square feet and less than or equal to 108 square feet.

The vertical cross section is a triangle whose base is 12 feet and height is 26 feet. To find its area, use the formula for the area of a triangle and substitute 12 for  $b$  and 26 for  $h$ .

$$A = \frac{1}{2}bh = \frac{1}{2}(12)(26) = 156$$

The area of the vertical cross section is 156 square feet.

The area of the vertical cross is greater than the greatest area of the horizontal cross section. So, the area of the horizontal cross section is never greater than the area of the vertical cross section for any height above the base.

### Rubric

- 1 point for each cross section description;
- 1 point for the area of each cross section;
- 1 point for conclusion





## 7.G.4 Answers

1. C

2. B

3. B

4. B, F

5. C

6. D

7. A

8. E

9. The wheel travels about 57 inches. The formula for the circumference of a circle is  $C = 2\pi r$ , where  $r$  is the radius.

Substitute 9 for  $r$ , and then evaluate.

$$\begin{aligned} C &= 2\pi r \\ &= 2\pi \cdot 9 \\ &= 18 \cdot \pi \\ &\approx 56.52 \end{aligned}$$

### Rubric

1 point for answer;

1 point for showing work

10. Since the diameter of a circle is twice its radius,  $d = 2r$ . Substitute  $d$  for  $2r$  in the formula.

$$\begin{aligned} C &= 2\pi r \\ &= 2r \cdot \pi \\ &= d \cdot \pi \\ &= \pi d \end{aligned}$$

So, the formula for the circumference of a circle in terms of its diameter  $d$  is  $C = \pi d$ .

### Rubric

1 point for rewritten formula; 1 point for showing work

11. Find the circumference of the circle.

$$\begin{aligned} C &= 2\pi r \\ &= 2\pi \cdot 5 \\ &= 2 \cdot 5\pi \\ &= 10\pi \\ &\approx 31.4 \end{aligned}$$

Find the area of the circle.

$$\begin{aligned} A &= \pi r^2 \\ &= \pi \cdot (5)^2 \\ &= \pi \cdot 25 \\ &\approx 78.5 \end{aligned}$$

Substitute 31.4 for  $C$  and 78.5 for  $A$  in  $C^2 = 4\pi A$ .

$$C^2 = 4\pi A$$

$$\begin{aligned} (31.4)^2 &= 4 \cdot 3.14 \cdot 78.5 \\ 985.96 &= 985.96 \end{aligned}$$

### Rubric

1 point for finding circumference; 1 point for finding area; 1 point for verifying the formula; 1 point for showing work

12. The area of the larger merry-go-round's platform is greater than the area of the smaller merry-go-round's platform by  $150.72 \text{ m}^2$ .

Find the radius of the larger merry-go-round.

$$19 \div 2 = 9.5$$

Substitute 9.5 for  $r$  in the formula for the area of a circle.

$$\begin{aligned} A &= \pi \cdot 9.5^2 \\ &= \pi \cdot 90.25 \\ &\approx 283.385 \end{aligned}$$

Find the radius of the smaller merry-go-round.

$$13 \div 2 = 6.5$$

Substitute 6.5 for  $r$  in the formula for the area of a circle.

$$\begin{aligned} A &= \pi \cdot 6.5^2 \\ &= \pi \cdot 42.25 \\ &\approx 132.665 \end{aligned}$$

Subtract the area of the smaller merry-go-round from the area of the larger merry-go-round.

$$283.385 - 132.665 = 150.72$$

### Rubric

1 point for answer; 2 points for showing work

13. The circle with the 96 cm diameter has a larger radius.

The circle with a 96 cm diameter has a  $96 \div 2 = 48$  cm radius.

Use the formula for the circumference of a circle to find the radius of the circle that has a 295.16 cm circumference.

$$\begin{aligned} C &= 2\pi r \\ 295.16 &= 2\pi r \\ 295.16 &\approx 2 \cdot 3.14 \cdot r \\ 295.16 &\approx 6.28 \cdot r \\ \frac{295.16}{6.28} &\approx \frac{6.28r}{6.28} \\ 47 &\approx r \end{aligned}$$

The radius of this circle is about 47 cm.

**Rubric**

1 point for answer; 2 points for explanation

14. a. Sprinkler A can water an area of 1,017 square feet.

$$\begin{aligned} A &= \pi r^2 \\ &= \pi(18)^2 \\ &= \pi \cdot 324 \\ &\approx 1,017.36 \end{aligned}$$

- b. Sprinkler B can water an area of 113 square feet.

$$\begin{aligned} A &= \pi r^2 \\ &= \pi(6)^2 \\ &= \pi \cdot 36 \\ &\approx 113.04 \end{aligned}$$

- c. Divide the area for sprinkler A by the area for sprinkler B.

$$\frac{1,017 \text{ square feet}}{113 \text{ square feet}} = 9$$

The area that sprinkler A can water is 9 times the area that sprinkler B can water.

**Rubric**

- a. 0.5 point for answer; 0.5 point for showing work  
 b. 0.5 point for answer; 0.5 point for showing work  
 c. 1 point for ratio; 1 point for interpretation

15. Find the radius of the stage using  $C = 2\pi r$ . Substitute 157 for C and 3.14 for  $\pi$ .

$$\begin{aligned} C &= 2\pi r \\ 157 &\approx 2 \cdot 3.14 \cdot r \\ 157 &\approx 6.28r \\ \frac{157}{6.28} &\approx \frac{6.28r}{6.28} \\ 25 &\approx r \end{aligned}$$

The radius of the stage is about 25 feet.

Use the formula for the area of a circle to find the area of the stage.

$$\begin{aligned} A &= \pi r^2 \\ &\approx \pi(25)^2 \\ &\approx \pi \cdot 625 \\ &\approx 1,962.5 \end{aligned}$$

Divide the area of the stage by the rate at which Katie can paint.

$$\frac{1,962.5}{400} \approx 5$$

Katie can paint the stage in about 5 hours.

**Rubric**

1 point for answer; 3 points for appropriate explanation

16. a. The formula for the circumference of a circle is  $C = 2\pi r$ .

$$C = 2\pi r$$

$$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$$

$$\frac{C}{2\pi} = r$$

- b. The formula for the area of a circle  $A$  in terms of its radius  $r$  is  $A = \pi r^2$ .

Substitute  $\frac{C}{2\pi}$  for  $r$ .

$$A = \pi r^2$$

$$A = \pi \left( \frac{C}{2\pi} \right)^2$$

c.

$$A = \pi \left( \frac{C}{2\pi} \right)^2$$

$$= \pi \left( \frac{C^2}{2^2 \cdot \pi^2} \right)$$

$$= \frac{\pi \cdot C^2}{4 \cdot \pi^2}$$

$$= \frac{C^2}{4 \cdot \pi}$$

Solve for  $C^2$ .

$$A = \frac{C^2}{4\pi}$$

$$(4\pi)A = 4\pi \cdot \frac{C^2}{4\pi}$$

$$4\pi A = C^2$$

**Rubric**

- a. 1 point
- b. 1 point
- c. 1 point for simplifying; 1 point for solving; 1 point for showing work

17. Raquel substituted the diameter of the circle instead of its radius for  $r$  in the formula. She found the area of a circle that has a 136 m diameter.

The radius of the circle is  $68 \div 2 = 34$  m. Substitute 34 for  $r$  in the formula.

$$A = \pi r^2$$

$$= \pi \cdot 34^2$$

$$= \pi \cdot 1,156$$

$$\approx 3,629.84$$

The area of the circle is about 3,629.84 m<sup>2</sup>.

**Rubric**

- 2 points for identifying error; 1 point for finding the correct area of the circle;
- 1 point for showing work

## 7.G.5 Answers

1. B

2. A

3. D

4. A, D

5. C

6. A

7. D

8. E

9.  $m\angle AFB = 72^\circ$ ;

$m\angle BFC + m\angle CFD = m\angle BFD$ . Substitute  $31^\circ$  for  $m\angle CFD$  and  $57^\circ$  for  $m\angle BFD$ , and then solve for  $m\angle BFC$ .

$$m\angle BFC + 31^\circ = 57^\circ$$

$$m\angle BFC + 31^\circ - 31^\circ = 57^\circ - 31^\circ$$

$$m\angle BFC = 26^\circ$$

Similarly,  $m\angle AFB + m\angle BFC = m\angle AFC$ .

Substitute  $26^\circ$  for  $m\angle BFC$  and  $98^\circ$  for  $m\angle AFC$ , and then solve for  $m\angle AFB$ .

$$m\angle AFB + 26^\circ = 98^\circ$$

$$m\angle AFB + 26^\circ - 26^\circ = 98^\circ - 26^\circ$$

$$m\angle AFB = 72^\circ$$

### Rubric

1 point for answer; 2 points for justification

10.  $m\angle DHE = 34^\circ$ . Since  $\angle AHG$  and  $\angle CHE$  are vertical angles,  $m\angle CHE = 56^\circ$ . Since  $m\angle CHE = m\angle CHD + m\angle DHE$ ,  $m\angle DHE = m\angle CHE - m\angle CHD = 56^\circ - 22^\circ = 34^\circ$ .

### Rubric

1 point for answer; 2 points for explanation

11.

$$m\angle AFB + m\angle BFD = 90^\circ$$

$$32^\circ + m\angle BFD = 90^\circ$$

$$m\angle BFD = 58^\circ$$

$$m\angle BFC + m\angle CFD = 58^\circ$$

$$(x + 9)^\circ + (2x - 8)^\circ = 58^\circ$$

$$x + 2x + 9 - 8 = 58$$

$$3x + 1 = 58$$

$$3x + 1 - 1 = 58 - 1$$

$$\frac{3x}{3} = \frac{57}{3}$$

$$x = 19$$

$$m\angle CFD = (2x - 8)^\circ = [2(19) - 8]^\circ = 30^\circ$$

### Rubric

1 point for answer; 1 point for showing work

12. a.  $m\angle ABD = 132^\circ$ . Since  $\angle ABD$  and  $\angle EBF$  are supplementary angles, the sum of their measures is  $180^\circ$ . To find  $m\angle ABD$ , write an equation that represents this relationship.

$$m\angle ABD + m\angle EBF = 180^\circ$$

$$m\angle ABD + 48^\circ = 180^\circ$$

$$m\angle ABD = 180^\circ - 48^\circ$$

$$m\angle ABD = 132^\circ$$

b.  $x^\circ + (x + 10)^\circ = (x^\circ + x^\circ) + 10^\circ = 2x^\circ + 10^\circ = (2x + 10)^\circ$

c.  $2x + 10 = 132$

d.

$$2x + 10 - 10 = 132 - 10$$

$$2x = 122$$

$$\frac{2x}{2} = \frac{122}{2}$$

$$x = 61$$

Since  $x = 61$ ,  $m\angle ABC = 61^\circ$ .

**Rubric**

- a. 1 point for answer; 1 point for explanation
- b. 0.5 point for expression; 0.5 point for simplified expression
- c. 1 point
- d. 1 point for answer; 1 point for showing work

13. No. Since  $\angle BAC$ ,  $\angle CAD$ , and  $\angle DAE$  form a straight line, the sum of their angle measures is  $180^\circ$ . Write an equation that relates their angle measures and solve for  $m\angle CAD$ .

$$m\angle BAC + m\angle CAD + m\angle DAE = 180^\circ$$

$$53^\circ + m\angle CAD + 76^\circ = 180^\circ$$

$$m\angle CAD + 53^\circ + 76^\circ = 180^\circ$$

$$m\angle CAD + 129^\circ = 180^\circ$$

$$m\angle CAD = 51^\circ$$

So,  $m\angle CAD = 51^\circ$ .

$$m\angle CAE = m\angle CAD + m\angle DAE$$

$$= 51^\circ + 76^\circ$$

$$= 127^\circ$$

Since  $m\angle CAE = 127^\circ$ , and  $\angle BAF$  and  $\angle CAE$  are vertical angles,

$$m\angle BAF = 127^\circ.$$

Since  $\angle BAC$  and  $\angle EAF$  are vertical angles, their measures are equal.

So,  $m\angle EAF = 53^\circ$ .

$$m\angle DAF = m\angle DAE + m\angle EAF$$

$$= 76^\circ + 53^\circ$$

$$= 129^\circ$$

So,  $m\angle DAF$  is not equal to  $m\angle BAF$ .

**Rubric**

- 1 point for answer; 1 point for writing appropriate equations; 1 point for solving appropriate equations correctly; 2 points for a reasonable explanation

## 7.G.6 Answers

1. B

2. C

3. D

4. B, C, E

5. D

6. A

7. C

8. E

9. Area of rectangle:

$$A = lw$$

$$= 25 \cdot 20$$

$$= 500$$

The area of the rectangle is 500 m<sup>2</sup>.

Area of parallelogram:

$$A = bh$$

$$= 18 \cdot 10$$

$$= 180$$

The area of the parallelogram is 180 m<sup>2</sup>.

Area of cafeteria:

$$500 + 180 = 680$$

The area of the cafeteria is 680 m<sup>2</sup>.

Multiply the area of the cafeteria by the cost per square meter.

$$680 \cdot 32.50 = 22,100$$

It will cost \$22,100 to install linoleum flooring for the whole cafeteria.

**Rubric**

1 point for answer; 2 points for showing work

10. a. 160 ft<sup>3</sup>; Since the base of the prism is a trapezoid, the formula for the area of the base is  $B = \frac{1}{2} \cdot h(b_1 + b_2)$ , where  $h$  is the height and  $b_1$  and  $b_2$  are the lengths of the bases. The height of the prism is 8 ft. The volume of a prism is the product of the base area and the height.

$$\begin{aligned} V &= \left[ \frac{1}{2} \cdot 5 \cdot (5+3) \right] \cdot 8 \\ &= (20) \cdot 8 \\ &= 160 \end{aligned}$$

The volume of the container is 160 ft<sup>3</sup>.

- b. Multiply the volume, 160 ft<sup>3</sup>, by the cost of each cubic foot, \$1.25.

$$160 \cdot 1.25 = 200$$

The cost of the sand is \$200.

**Rubric**

- a. 1 point for answer;

2 points for explanation

- b. 1 point for answer;

1 point for showing work

11. Mitchell found the volume of the prism, not the surface area. Find the area of each face of the prism.

Front face:

$$\begin{aligned} A &= \frac{1}{2} \cdot h \cdot (b_1 + b_2) \\ &= \frac{1}{2} \cdot 28 \cdot (33 + 25) \\ &= \frac{1}{2} \cdot 28 \cdot 58 \\ &= 812 \end{aligned}$$

The area of the back face,  $812 \text{ cm}^2$ , is the same as the area of the front face.

Left face:

$$\begin{aligned} A &= b \cdot h \\ &= 29 \cdot 17 \\ &= 493 \end{aligned}$$

The area of the left face is  $493 \text{ cm}^2$ .

Right face:

$$\begin{aligned} A &= b \cdot h \\ &= 28 \cdot 17 \\ &= 476 \end{aligned}$$

The area of the right face is  $476 \text{ cm}^2$ .

Top face:

$$\begin{aligned} A &= b \cdot h \\ &= 33 \cdot 17 \\ &= 561 \end{aligned}$$

The area of the top face is  $561 \text{ cm}^2$ .

Bottom face:

$$\begin{aligned} A &= b \cdot h \\ &= 25 \cdot 17 \\ &= 425 \end{aligned}$$

The area of the bottom face is  $425 \text{ cm}^2$ .

Add the areas of all of the faces.

$$\begin{aligned} S &= 812 + 812 + 493 + 476 + 561 + \\ &425 = 3,579 \end{aligned}$$

The surface area of the prism is  $3,579 \text{ cm}^2$ .

**Rubric**

1 point for identifying error; 0.5 point for finding area of each face; 1 point for total surface area

12. 7 hours; Find the area of each face of the barn that Jessie and Tim are painting.

Front rectangular face:

$$\begin{aligned} A &= \ell \cdot w \\ &= 10 \cdot 4 \\ &= 40 \end{aligned}$$

The area of the front rectangular face,  $40 \text{ m}^2$ , is the same as the back rectangular face.

Right rectangular face:

$$\begin{aligned} A &= \ell \cdot w \\ &= 14 \cdot 4 \\ &= 56 \end{aligned}$$

The area of the right rectangular face,  $56 \text{ m}^2$ , is the same as the left rectangular face.

Front triangular face:

$$\begin{aligned} A &= \frac{1}{2} \cdot b \cdot h \\ &= \frac{1}{2} \cdot 10 \cdot 1.5 \\ &= 7.5 \end{aligned}$$

The area of the front triangular face,  $7.5 \text{ m}^2$ , is the same as the back triangular face.

Add the areas of the faces they are painting.

$$S = 40 + 40 + 56 + 56 + 7.5 + 7.5 = 207$$

Divide the surface area they are painting,  $207 \text{ m}^2$ , by  $30 \text{ m}^2$  per hour to find how long it would take for them to paint the barn.

$$\frac{207}{30} \approx 7$$

It will take Jessie and Tim about 7 hours to paint the barn.

**Rubric**

1 point for finding areas of 4 rectangular regions; 1 point for finding areas of 2 triangular regions; 1 point for correct total surface area; 1 point for number of hours

## 7.SP.1 Answers

1. C
2. D
3. B
4. a. Yes  
b. No  
c. No  
d. Yes  
e. No
5. A, D
6. No. Asking every resident in the town is time consuming and unnecessary because a representative sample can provide information about which band is preferred by the residents of the town.  
**Rubric**  
1 point for answer; 1 point for explanation
7. Possible answer: The president of the company could randomly select a sample of workers from all departments and ask which shift they prefer to work.  
**Rubric**  
2 points for a reasonable method
8. No. The sample is not representative of the entire school population because each student is not equally likely to be chosen (unless everyone in school is on the girls' lacrosse team).  
**Rubric**  
1 point for answer; 1 point for explanation
9. a. Possible answer: Leah's method will not produce a representative sample because it does not include students who arrive either before 7:30 a.m. or after 8:00 a.m.  
b. Possible answer: Leah could assign a different number to each student at the school and then randomly pick numbers to get a representative sample.  
**Rubric**  
a. 1 point  
b. 1 point

10. a. Possible answer: A random sample of 200 customers will provide a representative sample that the manager can then use to make inferences about all of the customers. This is cheaper, less time consuming, and less likely to interfere with normal business than giving the survey to every customer who walks through the door.
- b. Possible answer: Randomly selecting a customer exiting a random store at a random time during the week would provide a representative sample. Each customer has different tastes and different free time in which to shop. So, to represent the average customer, it is necessary to randomly select the customer, store, time of day, and day of the week.

### Rubric

- a. 2 points
- b. 1 point for answer;  
1 point for explanation



## 7.SP.2 Answers

1. B

2. B

3. a.  $0 \leq P < 0.1$

b.  $0 \leq P < 0.1$

c.  $0.2 \leq P < 0.5$

d.  $0.1 \leq P < 0.2$

e.  $0 \leq P < 0.1$

4.  $\frac{2}{40} \cdot 6,000 = 300$ ; 300 CDs in the shipment are likely to be defective.

### Rubric

1 point for answer;

1 point for showing work

5. Mean:

$$\frac{17+12+14+9}{4} = \frac{52}{4} = 13$$

Mean absolute deviation:

$$\frac{4+1+1+4}{4} = \frac{10}{4} = 2.5$$

### Rubric

1 point for finding mean; 1 point for finding mean absolute deviation

6. First sample:  $\frac{14}{40} \cdot 2,500 = 875$

Second sample:  $\frac{18}{40} \cdot 2,500 = 1,125$

Third sample:  $\frac{12}{40} \cdot 2,500 = 750$

Subtract the lowest estimate from the highest estimate.

$$1,125 - 750 = 375$$

The difference between the highest estimate and the lowest estimate is 375.

### Rubric

1 point for answer;

2 points for showing work

7. Ann incorrectly stated that there are 6 small paper clips for every 10 paper clips. Since the sample is representative, there are 6 small paper clips for every  $6 + 10 = 16$  paper clips in the container.

$$\frac{6}{16} \cdot 120 = 45$$

So, there are about 45 small paper clips in the container.

### Rubric

2 points for identifying mistake;

1 point for finding the correct estimate;

1 point for explanation

8. a. First sample:  $\frac{3}{90} \cdot 450 = 15$

Second sample:  $\frac{1}{90} \cdot 450 = 5$

Third sample:  $\frac{4}{90} \cdot 450 = 20$

Fourth sample:  $\frac{2}{90} \cdot 450 = 10$

b. The least estimate for the number of defective chargers in a shipment is 5, and the greatest estimate for the number of defective chargers in a shipment is 20.

### Rubric

a. 0.5 point for each estimate

b. 1 point

## 7.SP.3 Answers

- C
- C, E
- The difference between the means is  $58.9 - 45.9 = 13$ . Divide 13 by 2.05 to express the distance between the means as a multiple of the mean absolute deviation.

$$\frac{13}{2.05} \approx 6.34$$

The difference between the means is about 6.34 times the mean absolute deviation.

### Rubric

1 point for difference between means;  
1 point for expressing difference as a multiple of MAD

- No. Only 4 of the 15 data points from each data set overlap the other set. At least 8 data points from one set would have to overlap the other set for more than half of the data points to overlap.

### Rubric

1 point for answer;  
1 point for explanation

- Liam: 40 min; Sandra: 28 min
- Liam: 8 min; Sandra: 8 min
- The distance between the medians is 12 min.

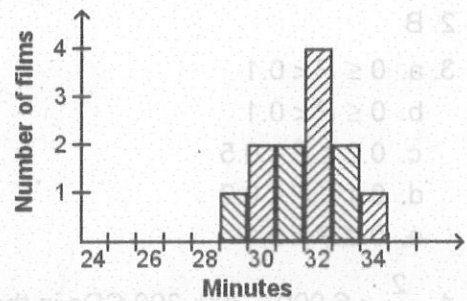
$$\frac{12}{8} = 1.5$$

So, the distance between the medians is 1.5 times the interquartile range.

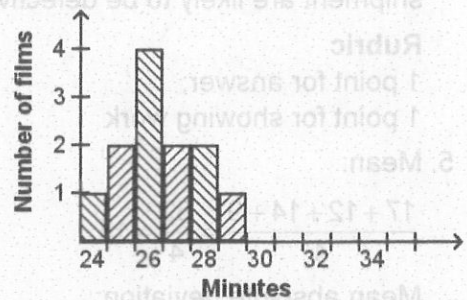
### Rubric

- 0.5 point for each answer
- 0.5 point for each answer
- 1 point for answer;  
1 point for showing work

- Drama:



- Comedy:



- Yes. The shapes of the distributions are about the same, but there is very little overlap; the only common value is the length 29 minutes.
  - Drama:  
Median is 32 min; interquartile range is  $32.5 - 30.5 = 2$  min.
  - Comedy:  
Median is 26 min; interquartile range is  $27.5 - 25.5 = 2$  min.
- The difference between the medians is  $32 - 26 = 6$  minutes.

$$\frac{32 - 26}{2} = \frac{6}{2} = 3$$

The difference between the median lengths is 3 times the interquartile range.

### Rubric

- 1 point for each histogram
- 1 point for answer;  
1 point for explanation
- 0.5 point for finding each median;  
0.5 point for finding each IQR;  
1 point for expressing the difference between the medians as a multiple of the IQR

## 7.SP.4 Answers

- A
- A, D, E
- No. There is a large area of overlap between the sample dot plot for School Street and the sample dot plot for Main Street. It is not unlikely that the means are the same.

### Rubric

- 1 point for answer;
  - 2 points for explanation
- Yes. The interval from the lower quartile to the upper quartile for the cars traveling at 11 a.m. is 40 mi/h to 44 mi/h and the interval for the cars traveling at 5 p.m. is 36 mi/h to 39 mi/h. Since the intervals from the lower quartile to the upper quartile do not overlap, it is not unlikely that the median speed of the cars traveling at 11 a.m. is faster than the median speed of the cars traveling at 5 p.m.

### Rubric

- 1 point for answer;
  - 2 points for justification
- a. Median morning:

$$\frac{19+20}{2} = 19.5 \text{ minutes}$$

Lower quartile morning:

$$\frac{18+18}{2} = 18 \text{ minutes}$$

Upper quartile morning:

$$\frac{21+21}{2} = 21 \text{ minutes}$$

Median afternoon:

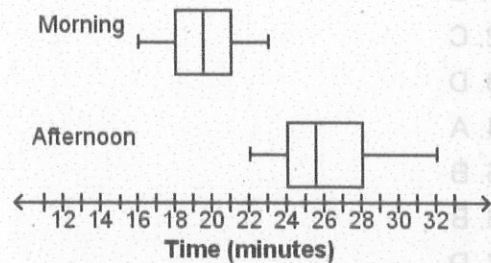
$$\frac{25+26}{2} = 25.5 \text{ minutes}$$

Lower quartile afternoon:

$$\frac{24+24}{2} = 24 \text{ minutes}$$

Upper quartile afternoon:

$$\frac{27+29}{2} = 28 \text{ minutes}$$



- Notice that there is no overlap of the interquartile intervals and the greatest value from the morning is less than the lower quartile value for the afternoon. It would be unlikely to have samples with such distinctness if the median bus times in the morning and the afternoon were the same. So, there is evidence to suggest that the median bus times are different.
- Possible answers: There could be more traffic in the afternoon than in the morning, causing the amount of time on the bus to be much longer in general. The bus route could be different in the afternoon than in the morning. Kendall could be one of the last students to be picked up by the bus in the morning and one of the last students to be dropped off from the bus in the afternoon.

### Rubric

- 1 point for each box plot;  
1 point for showing work
- 1 point for answer;  
1 point for explanation
- 0.5 point for each reason

## 7.SP.5 Answers

1. E
2. C
3. D
4. A
5. B
6. B
7. D
8. A, E
9. B, C, E, F
10. Possible answer:  
An event that has a probability of 0 is randomly picking a blue marble from a jar that has only orange marbles and red marbles.  
An event that has a probability of 1 is randomly picking a black or red card from a standard deck of cards.  
**Rubric**  
1 point for each description
11. The probability of an event is a number between 0 and 1, where 0 is the probability of an event that cannot occur and 1 is the probability of an event that is certain to occur. The probability of winning the game must be between 0 and 1, inclusive. Since  $1.5 > 1$ , the probability of winning the game cannot be 1.5.  
**Rubric**  
1 point for correct range; 2 points for explanation
12. Possible answers:
  - a. Selecting the queen of spades has a probability close to 0.
  - b. Selecting a red card has a probability of 0.5.
  - c. Selecting any card except the queen of spades has a probability close to 1.**Rubric**  
1 point for each description

13. a. Picking the 1 red marble from the bag is unlikely, so the probability of this event is close to 0, not close to 1.
- b. Less than  $\frac{1}{2}$ . There are 20 blue marbles and 21 marbles that are not blue (20 white and 1 red). Since fewer than half the marbles are blue, the probability of picking a blue marble is less than  $\frac{1}{2}$ . (Accept answers that give  $\frac{20}{41}$  as the exact theoretical probability.)

### Rubric

- a. 1 point
  - b. 1 point for answer;  
1 point for explanation
14. a. Greater probability indicates greater likelihood. Since the probability of selecting a blue disc is the greatest, selecting a blue disc is the most likely outcome.
  - b. Lesser probability indicates a less likely event. Since the probability of selecting a yellow disc is the least, selecting a yellow disc is the least likely outcome.
  - c. An event with a probability of occurring of about 0.5 is as likely to occur as not. Since the probability of selecting a blue disc is 0.5, the event of picking a blue disc and not picking a blue disc are equally likely. Not picking a blue disc is the same as picking a yellow or green disc, so the event of picking a blue disc and the event of picking a yellow or green disc are equally likely.

### Rubric

- a. 1 point for answer;  
1 point for explanation
- b. 1 point for answer;  
1 point for explanation
- c. 1 point for description;  
1 point for explanation

15. The events in order of increasing likelihood are  $E$ ,  $C$ ,  $A$ ,  $B$ , and  $D$ .

Since event  $E$  is impossible, the probability is 0.

Since event  $C$  is more unlikely than likely, the probability is between 0 and 0.5.

Since event  $A$  is as likely as not, the probability is 0.5.

Since event  $B$  is more likely than unlikely, the probability is between 0.5 and 1.

Since event  $D$  is certain, the probability is 1.

**Rubric**

1 point for ordering the events; 1 point for the classification of each probability

- 1. B
- 2. D
- 3. B
- 4. B, D
- 5. E
- 6. B
- 7. A
- 8. D

9. a. I would expect to roll a 3 about 25 times.

$$\frac{1}{6} \cdot 150 = 25$$

b. No. Probability doesn't guarantee an event will happen a certain number of times after a certain number of trials.

**Rubric**

- a. 1 point for answer; 1 point for showing work.
- b. 1 point for answer; 1 point for explanation.

## 7.SP.6 Answers

1. B
2. D
3. B
4. B, D
5. E
6. B
7. A
8. D

9.a. I would expect to roll a 3 about 25 times.

$$\frac{1}{6} \cdot 150 = 25$$

- b. No. Probability doesn't guarantee an event will happen a certain number of times after a certain number of trials.

### Rubric

- a. 1 point for answer;  
1 point for showing work
- b. 1 point for answer;  
1 point for explanation

10. Team A. The relative frequency is an approximation of the team's probability of winning its next game. Since  $\frac{17}{25} = 0.68$  is the relative frequency of team A winning its games and  $\frac{18}{30} = 0.6$  is the relative frequency of team B winning its games, team A has a higher probability of winning its games than team B.

### Rubric

- 1 point for answer;  
2 points for explanation

11. a.  $\frac{18}{18} = 1$
- b. No. Using the relative frequency as an approximation of the probability, the probability of Hermione kicking the ball into the goal is about 1. Since Hermione kicking the ball into the goal might not happen on the next trial, the probability is not exactly 1 and the relative frequency is just an approximation of the probability.

### Rubric

- a. 1 point for answer
- b. 1 point for answer;  
1 point for explanation

12. a. The relative frequency during the first

40 trials is  $\frac{24}{40} = 0.6$ . The relative frequency during the next 40 trials is

$\frac{14}{40} = 0.35$ . The relative frequency during the next 120 trials is

$$\frac{64}{120} \approx 0.533.$$

b. The number of times the coin landed heads up during the first 80 trials is  $24 + 14 = 38$ . So, the relative

frequency after 80 trials is  $\frac{38}{80} = 0.475$ .

c. The number of times the coin landed heads up after all 200 trials is  $38 + 64 = 102$ . So, the relative frequency after all 200 trials is

$$\frac{102}{200} = 0.51.$$

d. Possible answers: The relative frequencies are not always the same for the same number of trials. The relative frequencies are close to 0.5 but not exactly 0.5. The relative frequency for the greatest number of trials is the one that is closest to 0.5.

#### Rubric

a. 2 points

b. 1 point for answer; 1 point for work

c. 1 point for answer; 1 point for work

d. 1 point for reasonable answer

13. Dean would say about 157 or 158 because in his experiment, he found a relative frequency of  $\frac{63}{200}$ .

$$\frac{63}{200} \cdot 500 = 157.5$$

Jeanne would say about 135 because in her experiment, she found a relative

frequency of  $\frac{27}{100}$ .

$$\frac{27}{100} \cdot 500 = 135$$

Dean's prediction is different from Jeanne's prediction because they used relative frequencies based on different trials. Each of their relative frequencies is an approximation of the proportion of blocks in the container that are yellow. The actual proportion of blocks in the container that are yellow is not known exactly.

#### Rubric

1 point for each prediction;

2 points for explanation

## 7.SP.7a Answers

1. D

2. A

3. C

4. F

5. B

6. B

7. C

8. B, D, E, F

9. a. Since there are  $10 + 14 = 24$  students in the class, there are 24 equally likely outcomes. Since the probability of each outcome is  $\frac{1}{24}$ , the probability that Paige will be selected is  $\frac{1}{24}$ .

b. Since there are 14 girls, the probability that a girl will be selected is

$$14 \cdot \frac{1}{24} = \frac{14}{24} = \frac{7}{12}$$

### Rubric

- a. 1 point for answer;  
1 point for showing work
- b. 1 point for answer

10. Since there are 36 equal sections, there are 36 equally likely outcomes. So, the probability of each outcome is  $\frac{1}{36}$ .

Since there are 16 numbers that are greater than 20 from 1 to 36, the probability of the spinner landing on a number greater than 20 is

$$16 \cdot \frac{1}{36} = \frac{16}{36} = \frac{4}{9}$$

### Rubric

2 points for model; 1 point for probability

11. a. Since each section is the same size, each outcome is equally likely. Since there are 12 equally likely outcomes, the probability of each outcome is  $\frac{1}{12}$ . The probability of the spinner landing on red is  $\frac{5}{12}$ , the probability of the spinner landing on blue is  $\frac{3}{12} = \frac{1}{4}$ , the probability of the spinner landing on orange is  $\frac{2}{12} = \frac{1}{6}$ , and the probability of the spinner landing on green is  $\frac{2}{12} = \frac{1}{6}$ .

b. You can expect the spinner to

land on red  $\frac{5}{12} \cdot 60 = 25$  times,

land on blue  $\frac{1}{4} \cdot 60 = 15$  times,

land on orange  $\frac{1}{6} \cdot 60 = 10$  times, and

land on green  $\frac{1}{6} \cdot 60 = 10$  times.

c. The expected frequency is  $25 - 24 = 1$  more than the observed frequency for red.

The expected frequency is  $16 - 15 = 1$  less than the observed frequency for blue.

The expected frequency is  $10 - 8 = 2$  more than the observed frequency for orange.

The expected frequency is  $12 - 10 = 2$  less than the observed frequency for green.



The discrepancy between the expected and observed frequencies could occur because of random variation. Sometimes the expected frequency is higher than the observed frequency, sometimes the expected frequency is lower than the observed frequency, and sometimes the expected frequency is equal to the observed frequency. There is also a possibility that the spinner areas are not exactly equal.

**Rubric**

- a. 2 points
  - b. 0.5 point for each expected frequency
  - c. 0.5 point for each comparison;  
1 point for reason
12. Lyn made the mistake thinking that if each individual marble is equally likely to be randomly selected, then the probability of selecting each type of marble is the same. However, the number of marbles of each type is not the same. So, the probability of randomly selecting each type of marble is not the same.

Since the marbles are being randomly selected, each outcome is equally likely. Since there are  $50 + 32 + 24 + 14 = 120$  marbles, there are 120 equally likely outcomes and the probability of each outcome is  $\frac{1}{120}$ .

The probability of randomly selecting a marble with a solid color is

$$50 \cdot \frac{1}{120} = \frac{50}{120} = \frac{5}{12}$$

The probability of randomly selecting a marble with stripes is

$$32 \cdot \frac{1}{120} = \frac{32}{120} = \frac{4}{15}$$

The probability of randomly selecting a marble with polka dots is

$$24 \cdot \frac{1}{120} = \frac{24}{120} = \frac{1}{5}$$

The probability of randomly selecting a marble with stars is  $14 \cdot \frac{1}{120} = \frac{14}{120} = \frac{7}{60}$ .

**Rubric**

2 points for identifying Lyn's error; 1 point for finding each of the four probabilities

13. If the number cube is fair, then each outcome is equally likely. Since there are 6 equally likely outcomes, the probability of each outcome is  $\frac{1}{6}$ . So, the probability of rolling a 1 is the same as the probability of rolling a 2, 3, 4, 5, or 6. So, Loretta should expect to roll each number  $48 \cdot \frac{1}{6} = 8$  times.

The observed frequency is less than the expected frequency for all outcomes except for rolling a 3. The observed frequency for rolling a 3 is 3 times the expected frequency.

There is a discrepancy between the expected frequencies and Loretta's results because the observed frequency of rolling a 3 is more than 3 times the observed frequency of the second most frequent number.

Possible answer:

The discrepancy could happen because the expected frequencies are based on the assumption that the number cube is fair and the number cube Loretta used isn't fair. The number cube could be weighted to favor rolling a 3 more than rolling any other number.

**Rubric**

2 points for probability model; 1 point for expected frequency of each outcome; 1 point for comparison; 1 point for stating there is a discrepancy; 1 point for reasonable explanation

## 7.SP.7b Answers

1. C
2. C
3. C
4. A, C, F
5. Since the spinner landed on red 15 times, the approximate probability of the spinner landing on red is  $\frac{15}{45}$ , or  $\frac{1}{3}$ .  
Since the spinner landed on orange 6 times, the approximate probability of the spinner landing on orange is  $\frac{6}{45}$ , or  $\frac{2}{15}$ .  
Since the spinner landed on yellow 3 times, the approximate probability of the spinner landing on yellow is  $\frac{3}{45}$ , or  $\frac{1}{15}$ .  
Since the spinner landed on green 21 times, the approximate probability of the spinner landing on green is  $\frac{21}{45}$ , or  $\frac{7}{15}$ .

### Rubric

0.5 point for each probability;  
1 point for explanation

6. a.  $P(\text{red}) = \frac{12}{70} = \frac{6}{35}$ ;

$$P(\text{green}) = \frac{38}{70} = \frac{19}{35}$$

$$P(\text{purple}) = \frac{20}{70} = \frac{10}{35} = \frac{2}{7}$$

- b. The sum of the probabilities is

$$\frac{6}{35} + \frac{19}{35} + \frac{10}{35} = \frac{35}{35} = 1.$$

Possible answer: This makes sense because the experimental probabilities are calculated by counting the frequencies of the outcomes and dividing by the number of trials. The sum of the frequencies equals the number of trials, so the sum of the experimental probabilities is a fraction with the same numerator and denominator, which equals 1.

### Rubric

- 0.5 point for each event
- 1 point for sum; 0.5 for answering that it makes sense; 1 point for explanation

7. The approximate probability that the ball goes into the pail and stays is  $\frac{8}{50}$ , or  $\frac{4}{25}$ .  
The approximate probability that the ball goes into the pail and bounces out is  $\frac{6}{50}$ , or  $\frac{3}{25}$ . The approximate probability that the ball misses the pail is  $\frac{36}{50}$ , or  $\frac{18}{25}$ .

### Rubric

1 point for each probability

8. a.  $P(\text{yes}) = \frac{25}{80} = \frac{5}{16}$ ;  $P(\text{no}) = \frac{55}{80} = \frac{11}{16}$

- b. Possible answer: The discrepancy could come from random variation. The same number of people are not likely to say yes or no every time 80 people are randomly selected.

**Rubric**

- a. 1 point for each probability  
b. 1 point for reasonable explanation

9. a. Since 18 out of 80 arrivals were early, the experimental probability of an arrival being early is  $\frac{18}{80}$ , or  $\frac{9}{40}$ .

Since 52 out of 80 arrivals were on time, the experimental probability of an arrival being on time is  $\frac{52}{80}$ , or  $\frac{13}{20}$ .

Since 10 out of 80 arrivals were late, the experimental probability of an arrival being late is  $\frac{10}{80}$ , or  $\frac{1}{8}$ .

These three probabilities are not equal, so it appears that the outcomes are not equally likely.

- b. No. Since  $\frac{9}{40} \cdot 60 = 13.5$  and  $13.5 > 3$ , the observed frequency is lower than expected for the number of arrivals being early.

Since  $\frac{13}{20} \cdot 60 = 39$  and  $39 > 21$ , the observed frequency is lower than expected for the number of arrivals being on time.

Since  $\frac{1}{8} \cdot 60 = 7.5$  and  $7.5 < 36$ , the observed frequency is higher than expected for the number of arrivals being late.

**Rubric**

- a. 1 point for answer;  
1 point for explanation  
b. 1 point for answer;  
2 points for explanation

1. C  
2. D  
3. F  
4. B  
5. D  
6. A, D

7.  $\frac{5}{8}$ . There are 2 outcomes where Ricardo selects a suit jacket and a shirt that are the same color (black, black) and (white, white). There are 9 possible outcomes. So, the probability is  $\frac{2}{9}$ .

**Rubric**  
1 point for answer;  
2 points for explanation

8.  $\frac{1}{2}$ . There are 6 outcomes where Fay selects boat four 1 or bus four B, (1, A), (1, B), (1, C), (1, D), (2, B), and (2, B). There are 12 possible outcomes. So, the probability is  $\frac{6}{12}$ , or  $\frac{1}{2}$ .

**Rubric**  
1 point for answer;  
2 points for explanation

## 7.SP.8a Answers

1. C

2. D

3. F

4. B

5. D

6. A, D

7.  $\frac{2}{9}$ . There are 2 outcomes where

Ricardo selects a suit jacket and a shirt that are the same color, (black, black) and (white, white). There are 9 possible outcomes. So, the probability is  $\frac{2}{9}$ .

### Rubric

1 point for answer;

2 points for explanation

8.  $\frac{1}{2}$ . There are 6 outcomes where Fay selects boat tour 1 or bus tour B, (1, A), (1, B), (1, C), (1, D), (2, B), and (3, B). There are 12 possible outcomes. So, the probability is  $\frac{6}{12}$ , or  $\frac{1}{2}$ .

### Rubric

1 point for answer;

2 points for explanation

9. a. (H, H, H), (H, H, T), (H, T, H), (T, H, H), (T, T, H), (T, H, T), (H, T, T), (T, T, T)

b.  $\frac{1}{4}$ . There are 2 outcomes in the sample space that have the coin landing heads up on the first flip and tails up on the second flip: (H, T, H) and (H, T, T). There are a total of

8 outcomes. So, the probability is  $\frac{2}{8}$ ,

or  $\frac{1}{4}$ .

c.  $\frac{1}{2}$ . There are 4 outcomes in the sample space that have all three flips landing heads up or exactly one flip landing heads up: (H, H, H), (T, T, H), (T, H, T), and (H, T, T). So, the probability is  $\frac{4}{8}$ , or  $\frac{1}{2}$ .

d.  $\frac{7}{8}$ . There are 7 outcomes in the sample space that have at most two flips landing tails up: (H, H, H), (H, H, T), (H, T, H), (T, H, H), (T, T, H), (T, H, T), and (H, T, T). There are a total of 8 outcomes. So, the probability is  $\frac{7}{8}$ .

### Rubric

a. 1 point for answer

b. 1 point for answer;  
1 point for explanation

c. 1 point for answer;  
1 point for explanation

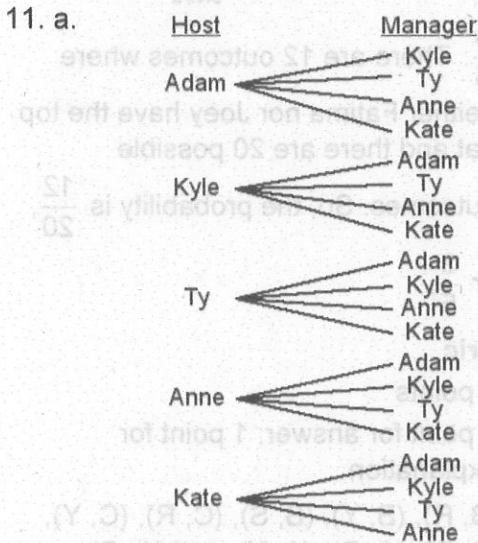
d. 1 point for answer;  
1 point for explanation

10. a. (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6),  
 (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),  
 (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),  
 (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)

- b.  $\frac{1}{4}$ . There are 6 outcomes where the total of the 2 rolls is greater than or equal to 8: (2, 6), (3, 5), (3, 6), (4, 4), (4, 5), and (4, 6). There are 24 possible outcomes. So, the probability is  $\frac{6}{24}$ , or  $\frac{1}{4}$ .

**Rubric**

- a. 1 point  
 b. 1 point for answer;  
 2 points for explanation



- b.  $\frac{1}{20}$ . There is 1 outcome where a girl will host the event and Anne will manage the event: (Kate, Anne). There are 20 possible outcomes. So, the probability is  $\frac{1}{20}$ .

- c.  $\frac{7}{10}$ . There are 14 outcomes where a boy will host the event or a girl will manage the event:  
 (Adam, Kyle), (Adam, Ty),  
 (Adam, Anne), (Adam, Kate),  
 (Kyle, Adam), (Kyle, Ty),  
 (Kyle, Anne), (Kyle, Kate),  
 (Ty, Adam), (Ty, Kyle),  
 (Ty, Anne), (Ty, Kate),  
 (Anne, Kate), and (Kate, Anne).  
 So, the probability is  $\frac{14}{20}$ , or  $\frac{7}{10}$ .

- d.  $\frac{1}{10}$ . If Adam, Kyle, and Ty are the ones decorating the gym, then the positions of host and manager must go to Anne and Kate. So, there are 2 outcomes in which Adam, Kyle, and Ty will decorate the gym: (Anne, Kate) and (Kate, Anne). So, the probability is  $\frac{2}{20}$ , or  $\frac{1}{10}$ .

**Rubric**

- a. 1 point for tree diagram  
 b. 1 point for answer;  
 1 point for explanation  
 c. 1 point for answer;  
 1 point for explanation  
 d. 1 point for answer;  
 1 point for explanation

## 7.SP.8b Answers

1. D
2. F
3. A
4. H
5. C
6. C
7. C
8. B
9. C, D, E, F

10. Possible table:

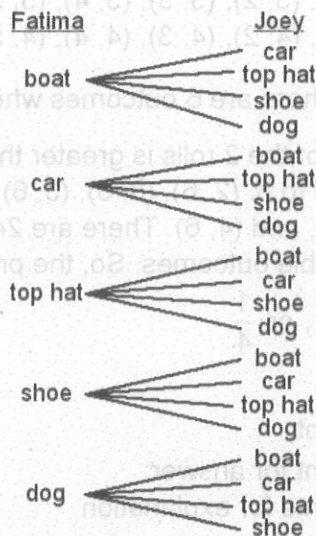
	S1	S2	S3
E1	(E1, S1)	(E1, S2)	(E1, S3)
E2	(E2, S1)	(E2, S2)	(E2, S3)
E3	(E3, S1)	(E3, S2)	(E3, S3)
E4	(E4, S1)	(E4, S2)	(E4, S3)

There are 6 outcomes where Ilana goes to office supply store S2 or electronics store E3: (E1, S2), (E2, S2), (E3, S2), (E4, S2), (E3, S1), and (E3, S3).

### Rubric

- 2 points for the table;
- 1 point for correct outcomes

11. a.



- b.  $\frac{3}{5}$ . There are 12 outcomes where neither Fatima nor Joey have the top hat and there are 20 possible

outcomes. So, the probability is  $\frac{12}{20}$ ,

or  $\frac{3}{5}$ .

### Rubric

- a. 2 points
- b. 1 point for answer; 1 point for explanation

12. a. (B, R), (B, Y), (B, S), (C, R), (C, Y), (C, S), (A, R), (A, Y), and (A, S)
- b. The outcomes (B, R), (B, Y), (B, S), (C, Y), and (A, Y) have buttermilk pancakes or blueberry toppings.

### Rubric

- a. 2 points
- b. 1 point

13. a.

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

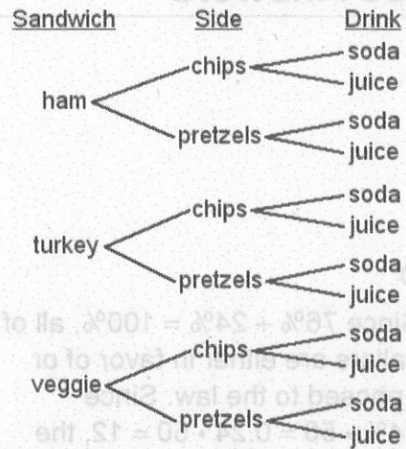
b. (4, 6), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)

c.  $\frac{1}{6}$ . There are 6 outcomes where the product of the two number cubes is at least 24, and there are 36 total outcomes in the sample space. So, the probability is  $\frac{6}{36}$ , or  $\frac{1}{6}$ .

**Rubric**

- a. 2 points
- b. 1 point
- c. 1 point for answer;  
1 point for explanation

14. a.



b. There are 12 possible outcomes in the sample space, because there are 12 paths through the tree diagram.

c.  $\frac{1}{4}$ . There are 3 outcomes that have pretzels and juice. So, the probability

is  $\frac{3}{12}$ , or  $\frac{1}{4}$ .

**Rubric**

- a. 2 points
- b. 1 point
- c. 1 point for answer;  
1 point for explanation

## 7.SP.8c Answers

1. D
2. B
3. E
4. E
5. A
6. C, D
7. a. Since  $76\% + 24\% = 100\%$ , all of the callers are either in favor of or opposed to the law. Since  $24\% \cdot 50 = 0.24 \cdot 50 = 12$ , the numbers 1 through 12 should be assigned to callers in favor of the new law. So, the value of  $N$  is 12.
- b.  $\frac{3}{7}$ . Trials 1, 6, 7, 8, 10, and 14 have exactly 2 numbers in the interval from 13 to 50. Since 6 of the 14 trials have exactly 2 numbers in the interval from 13 to 50, the experimental probability that exactly 2 of the next 3 callers are against the new law is  $\frac{6}{14}$ , or  $\frac{3}{7}$ .

### Rubric

- a. 1 point for answer;  
1 point for explanation
- b. 1 point for answer;  
1 point for explanation

8. a. 9 numbers. Multiply 45% by 20 to find the number of numbers that should be used to represent a customer paying with cash.

$$45\% \cdot 20 = 0.45 \cdot 20 = 9$$

- b. Possible answer: Customers paying with cash are represented by numbers 1 through 9; customers paying with a credit or debit card are represented by numbers 10 through 20.

- c. Possible answer: Trials 4 and 8 have exactly 2 numbers between 1 and 9. Since 2 of the 10 trials have exactly 2 customers paying with cash, the simulation suggests that an approximation of the probability that exactly 2 of the next 5 customers pay with cash is  $\frac{2}{10}$ , or  $\frac{1}{5}$ .

(Note: Answer will vary depending on assignments from part b.)

### Rubric

- a. 1 point for answer;  
1 point for explanation
- b. 1 point for each type of customer
- c. 1 point for answer;  
1 point for explanation