

- 1** Which problem can be solved using the number sentence shown below?

$$6 \times 2 = \square$$

- There are 6 children in a swimming pool. Two more children are getting in. How many children are in the pool?
- There are 6 children eating lunch. Each child ate 2 slices of cheese. How many slices of cheese were eaten?
- There are 6 children playing basketball. Two left to get a drink of water. How many children are left playing basketball?
- There are 6 children walking to the library. They are walking in groups of 2. How many groups of 2 are there?

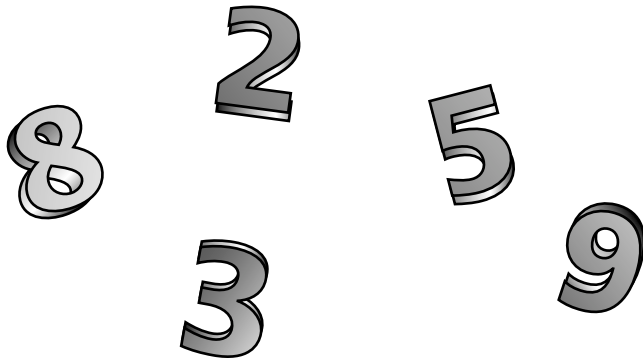
**This item appeared at only one grade level.**

**Grade 5**

Standard 6.4c: Operations and Calculations

Subcontent Area: not assigned

- 2 Study the digits shown below.



**Part A** Arrange the digits to make the largest number possible. On the line below, write your answer.

---

**Part B** In the number you wrote, what is the value of the digit 8? On the line below, write your answer.

---

arrange—put items in order  
according to some rule

**Rubric**

**Exemplary Response**

***Part A***

- 98,532

***Part B***

- 8 thousand(s)

**OR**

- thousands

**Note:** If Part A is incorrect, but the student has the correct value for the digit 8 in Part B, then the student receives one point.

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 5**

Standard 1.2a: Number Sense

Subcontent Area: numbers and operations

**3** Using plain and striped tiles, Angie created the 3 figures shown below.

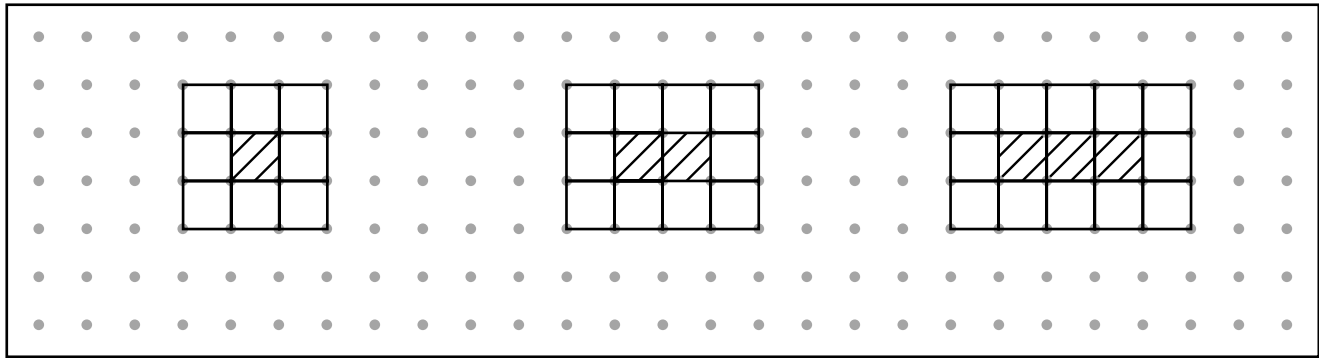


Figure 1

Figure 2

Figure 3

**Part A** In the spaces below, draw **Figure 4** and **Figure 5** using Angie’s pattern.

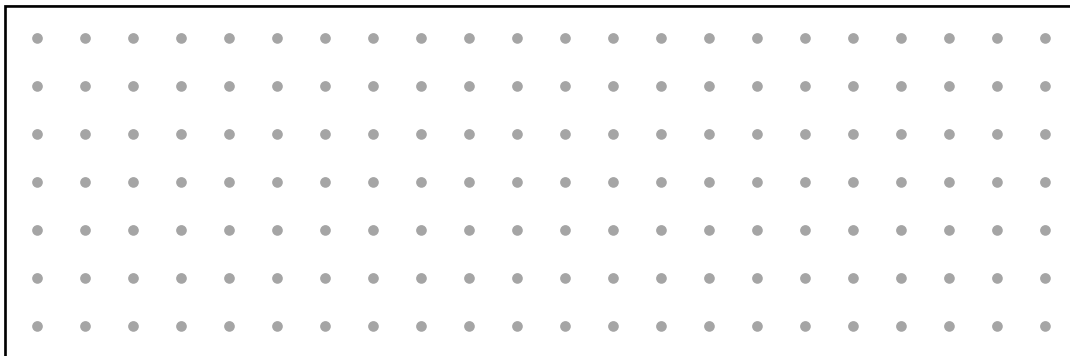


Figure 4

Figure 5

**Part B** On the lines below, explain the rule Angie used to make the pattern.

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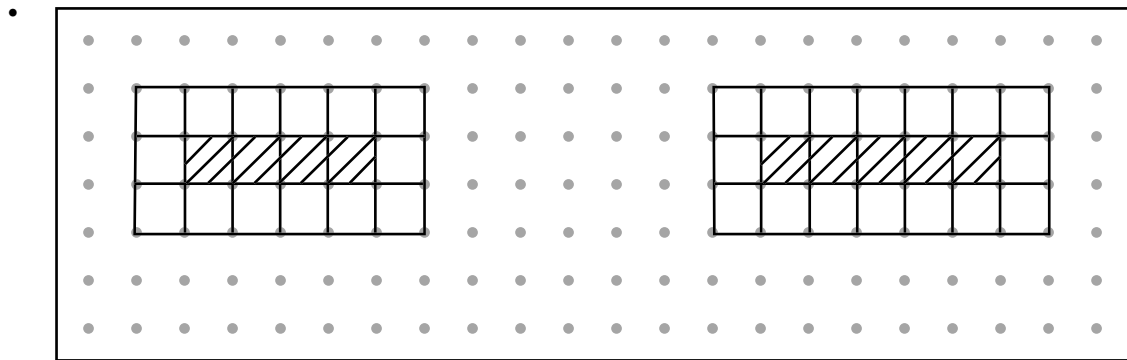
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explain—give reasons for, tell

**Rubric**

**Exemplary Response**

**Part A**



**Figure 4**

**Figure 5**

**Part B**

- Every time 1 striped tile is added, 2 plain tiles are added around the striped tile.
- OR**
- Other valid explanation

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

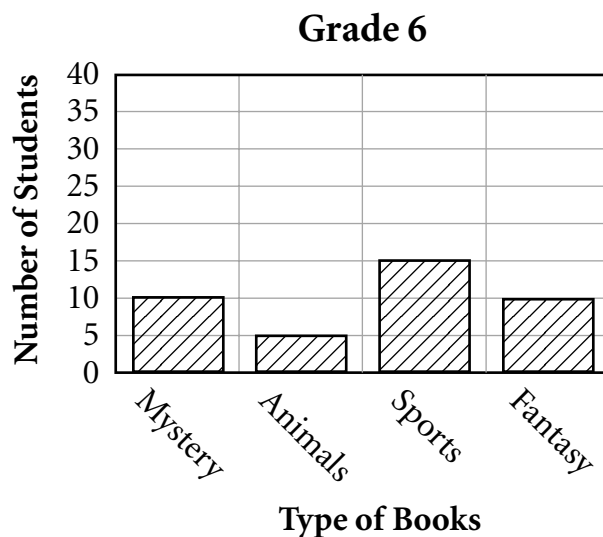
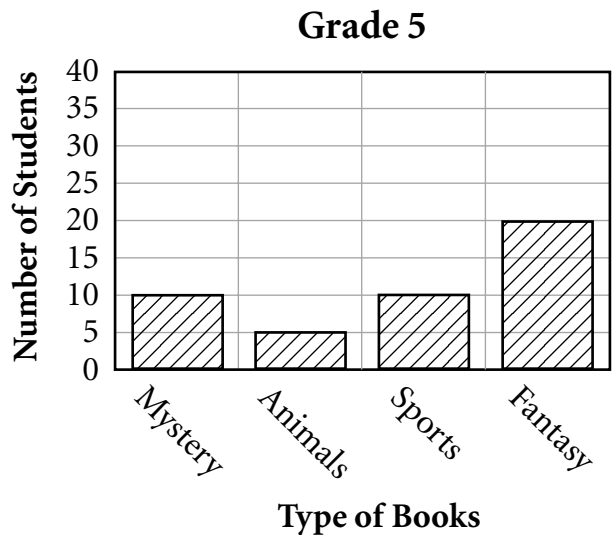
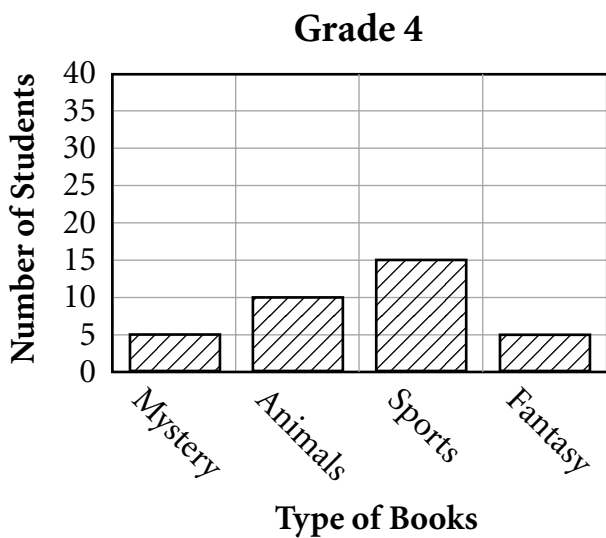
**Grade 5**

Standard 2.1a: Patterns, Functions, and Algebra

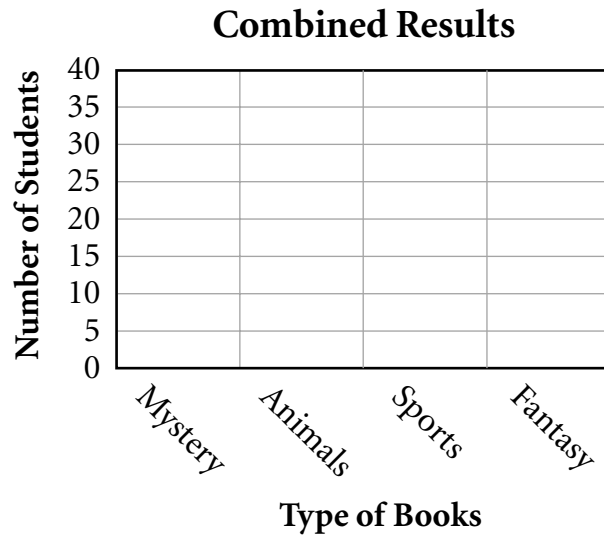
Subcontent Area: patterns

- 4** Ms. Jones is using some of the money in the school budget to purchase additional books for the library. The students in grades 4, 5, and 6 voted for their favorite types of books.

Study the graphs below, which show the results.



**Part A** Combine the information from all 3 grade levels. Use this information to complete the graph below.



**Part B** Using the results from the graph, Ms. Jones should order the **fewest** of which type of book? On the line below, write your answer.

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**Part C** Using the results from the graph, write a note to Ms. Jones, telling which 2 types of books to order. **Be sure to give reasons for your choice.**

Dear Ms. Jones,

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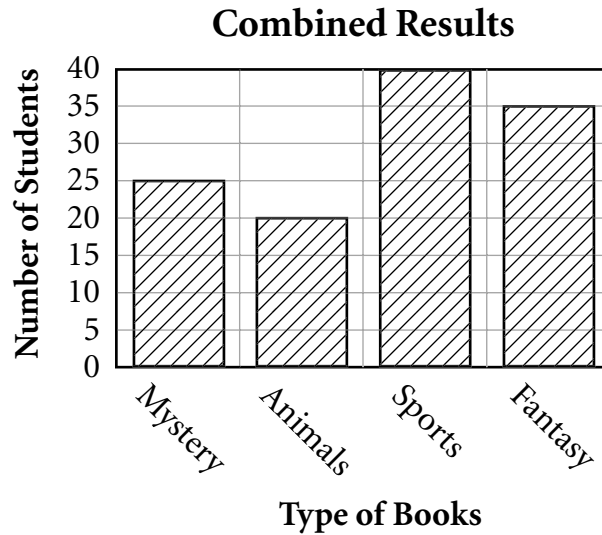
complete—finish what is missing

**Rubric**

**Exemplary Response**

**Part A**

- 



**Part B**

- Animals

**Part C**

- The 2 types of books to order are sports and fantasy. They received the most votes from the 3 grade levels combined, since they have the highest bars on the graph.

**OR**

- Other valid explanation

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

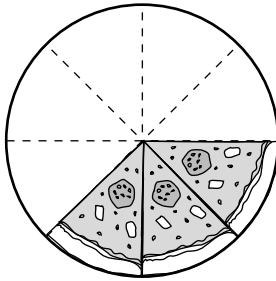
**Grade 5**

Standard 3.4b: Data Analysis, Probability, and Statistics

Subcontent Area: data display



- 5 Ricardo brought home part of a pizza from the class party, as shown below.



What fraction of the pizza did Ricardo bring home?

- $\frac{3}{5}$
- $\frac{1}{4}$
- $\frac{3}{8}$
- $\frac{1}{2}$

This item appeared at two adjacent grade levels.

**Grade 5**

Standard 1.1b: Number Sense

Subcontent Area: numbers and operations

**Grade 6**

Standard 1.1b: Number Sense

Subcontent Area: not assigned

**6** Mark returned a video 3 days late and paid \$6 in late charges. Linda returned a video 5 days late and paid \$10. Their friend Eric returned a video 9 days late. How much did Eric pay in late charges?

- \$4
- \$8
- \$14
- \$18

**This item appeared at two adjacent grade levels.**

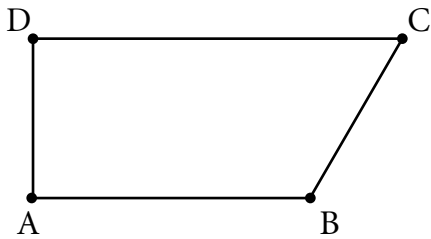
**Grade 5**

Standard 2.3a: Patterns, Functions, and Algebra  
Subcontent Area: not assigned

**Grade 6**

Standard 2.3a: Patterns, Functions, and Algebra  
Subcontent Area: not assigned

7 Study the figure below.



Which angle in the figure is an acute angle?

- $\angle A$
- $\angle B$
- $\angle C$
- $\angle D$

This item appeared at two adjacent grade levels.

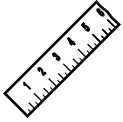
**Grade 5**

Standard 4.2a: Geometry and Spatial Sense  
Subcontent Area: not assigned

**Grade 6**

Standard 4.2a: Geometry and Spatial Sense  
Subcontent Area: not assigned

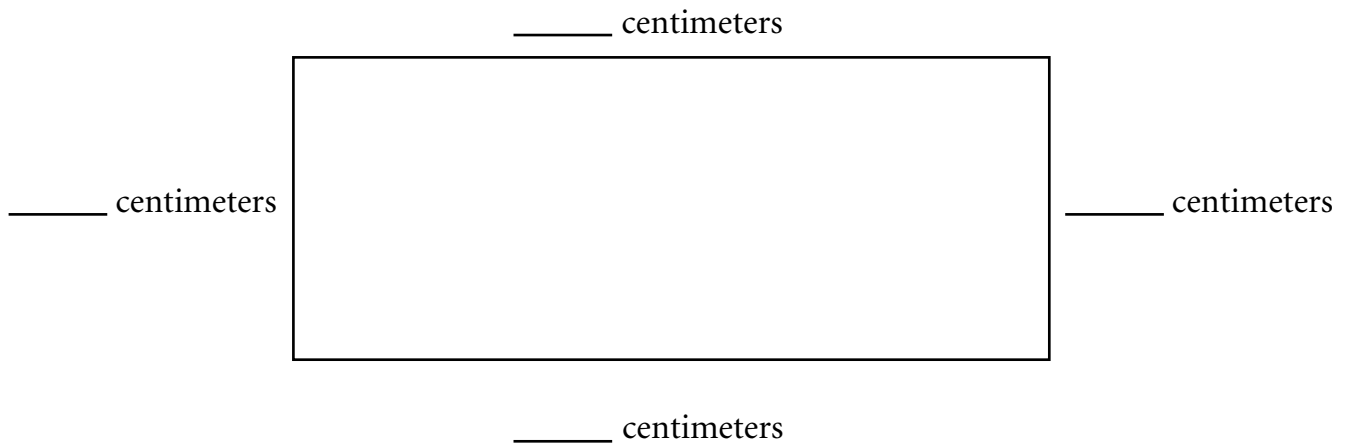
8



From your punch-out tools, use the ruler to help you solve this problem.

Study the rectangle shown below.

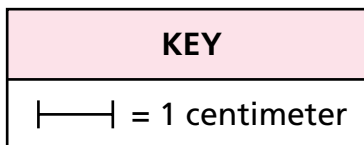
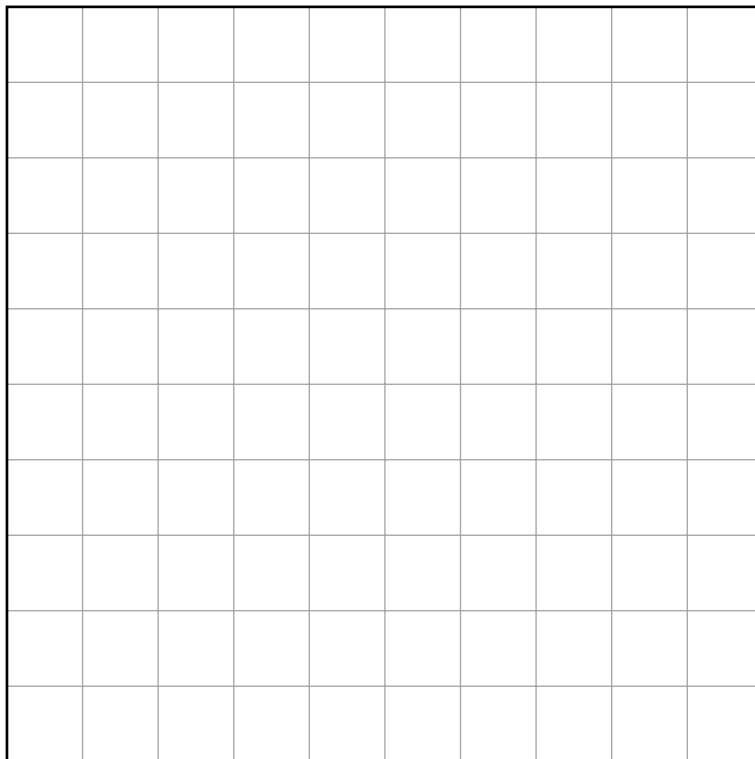
**Part A** Using the centimeter side of your ruler, measure the length of each side of the rectangle. Write your answers on the lines below.



**Part B** On the line below, write the perimeter of the rectangle.

\_\_\_\_\_ centimeters

**Part C** On the grid below, draw a **square** with the same perimeter as the rectangle and label each side in centimeters.



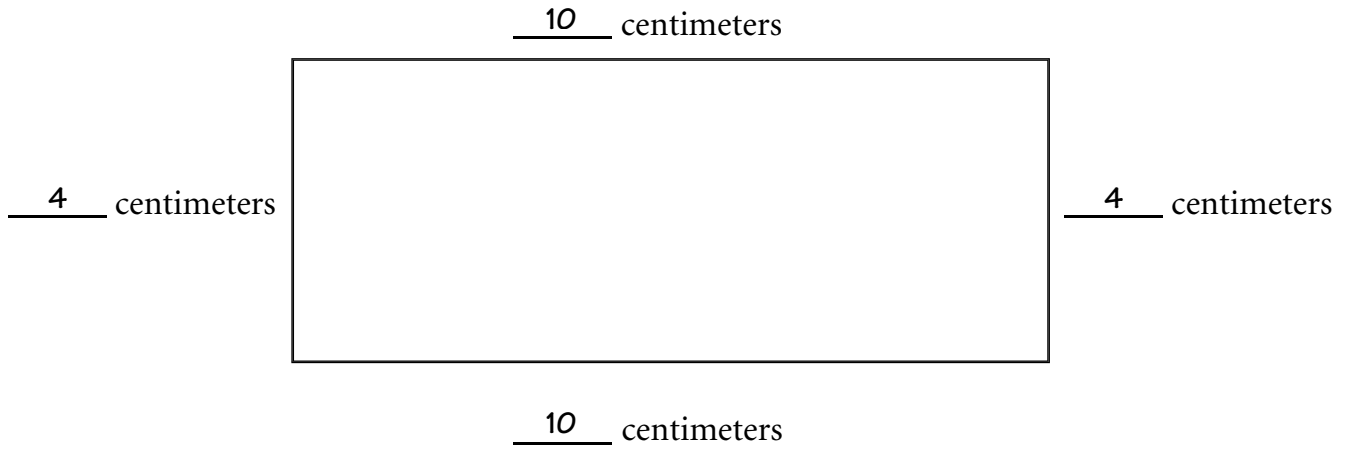
grid—pattern of lines that form squares

**Rubric**

**Exemplary Response**

**Part A**

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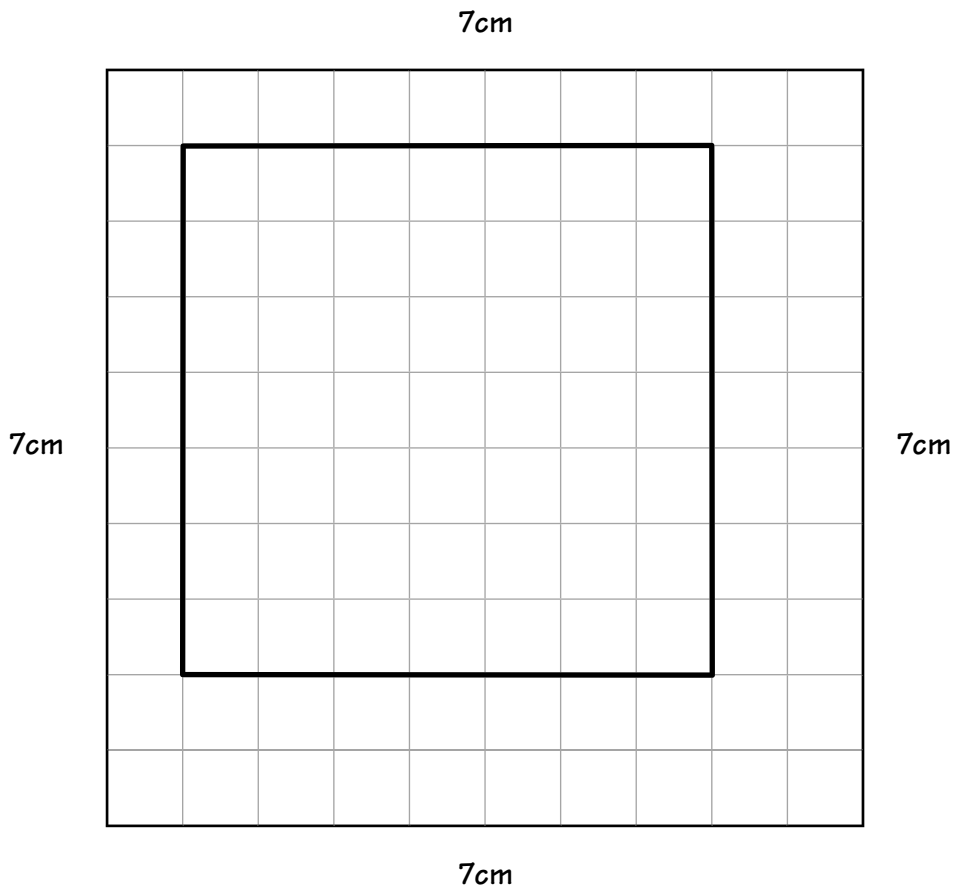


**Part B**

• 28 centimeters

**Part C**

- 



**Score Points:** Apply 3-point holistic rubric.

**This item appeared at two adjacent grade levels.**

**Grade 5**

Standard 4.5a: Geometric and Spatial Sense

Subcontent Area: not assigned

**Grade 6**

Standard 4.5a: Geometry and Spatial Sense

Subcontent Area: geometry

9

$$\begin{array}{r} 275 \\ \times 28 \\ \hline \end{array}$$

- 2,750
- 5,764
- 6,060
- 7,700

This item appeared at only one grade level.

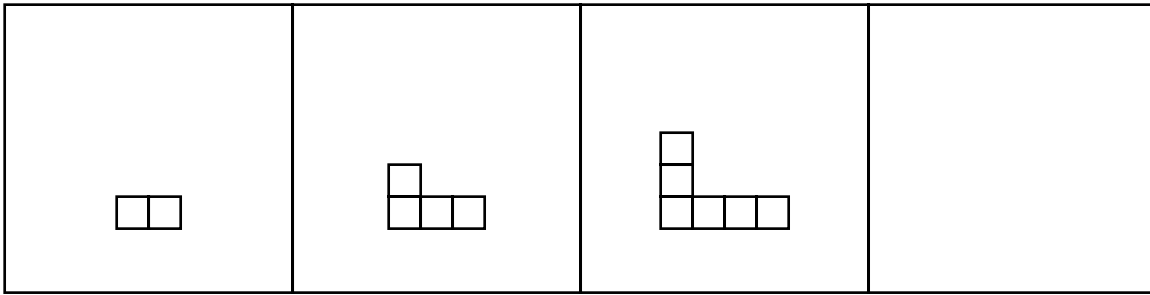
Grade 6

Standard 6.2d: Operation and Calculation

Subcontent Area: not assigned



**10** Study the figures below.



**Figure 1**

**Figure 2**

**Figure 3**

**Figure 4**

**Part A** In the space above, draw Figure 4.

**Part B** Complete the table with the number of blocks needed to form each figure.

Figure	1	2	3	4	5	6	7	8
Number of Blocks	2	4	6					

**Part C** In the space below, show or explain how you would find the number of blocks in Figure 20 and write your answer on the line.

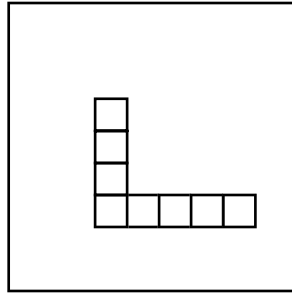
\_\_\_\_\_ blocks

**Rubric**

**Exemplary Response**

**Part A**

•



**Figure 4**

**Part B**

•

<b>Figure</b>	1	2	3	4	5	6	7	8
<b>Number of Blocks</b>	2	4	6	8	10	12	14	16

**Part C**

- 40 blocks

**AND**

- Since the number of blocks is equal to two times the number of the figure, I would double the number 20 to get 40 blocks.

**OR**

- Other valid explanation

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 6**

Standard 2.2a: Patterns, Functions, and Algebra

Subcontent Area: patterns

11

A school basketball team practices at least 2 times a week for five weeks. Each practice is 45 minutes long. The coach uses the table below to keep a record of the number of practices and the amount of time practiced each week.

Practice Schedule

Week	Number of Practices	Time
1	2	$1\frac{1}{2}$ hours
2	3	$2\frac{1}{4}$ hours
3	2	$1\frac{1}{2}$ hours
4	4	3 hours
5		

How many practices must the team have in Week 5 to have a total of  $10\frac{1}{2}$  hours of practice for all 5 weeks? Show your work in the space below and write your answer on the line.

\_\_\_\_\_ practices

record—written information

**Rubric**

**Exemplary Response**

- 3 practices

**AND**

- $1\frac{1}{2} + 2\frac{1}{4} + 1\frac{1}{2} + 3 = 8\frac{1}{4}$  hours

$$10\frac{1}{2} - 8\frac{1}{4} = 10\frac{2}{4} - 8\frac{1}{4} = 2\frac{1}{4} \text{ hours}$$

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

**OR**

- Other valid method

**Score Points:** Apply 2-point holistic rubric.

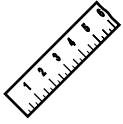
**This item appeared at only one grade level.**

**Grade 6**

Standard 6.2b: Operation and Calculation

Subcontent Area: numbers and operations

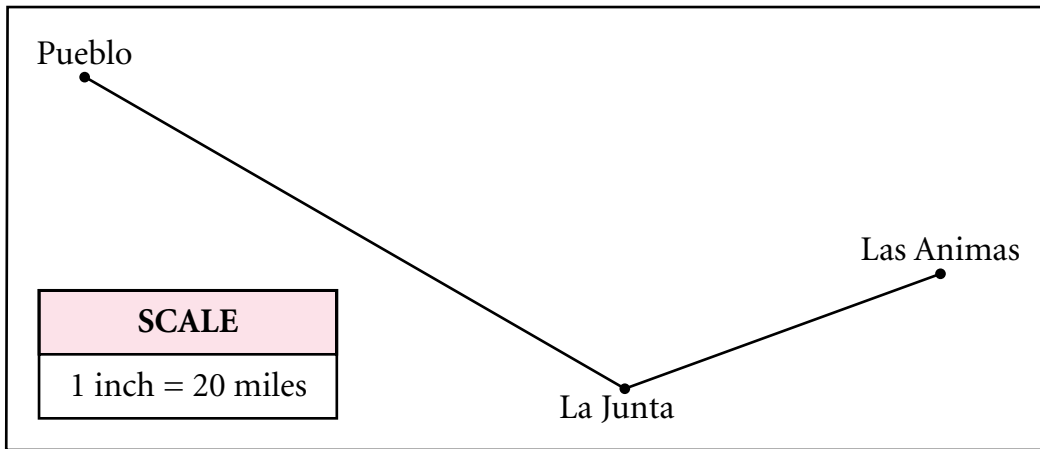
12



From your punch-out tools, use the ruler to help you solve this problem.

Juan and his family drove from Pueblo to Las Animas. On their trip they stopped in La Junta to visit the Koshare Indian Museum and Kiva. Juan made the map below as part of a class report about the trip.

**Family Trip**



**Part A** Use Juan’s map to find the total distance driven from Pueblo through La Junta to Las Animas.

\_\_\_\_\_ miles

**Part B** On the lines below, use words, numbers, or symbols to explain how you found your answer.

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**Rubric**

**Exemplary Response**

**Part A**

- 100 miles

**Part B**

- I measured from Pueblo to La Junta and got  $3\frac{1}{4}$  inches. I measured from La Junta to Las Animas and got  $1\frac{3}{4}$  inches. These add up to 5 inches and since an inch is equal to 20 miles, the distance would be 5 times 20 or 100 miles.

**OR**

- Other valid explanation

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at two adjacent grade levels.**

**Grade 6**

Standard 5.3a: Measurement

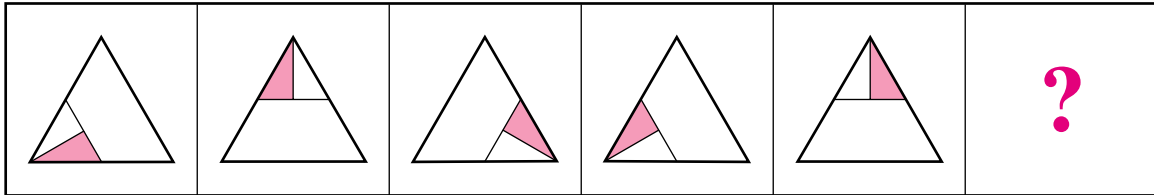
Subcontent Area: not assigned

**Grade 7**

Standard 5.3a: Measurement

Subcontent Area: not assigned

**13** Study the pattern of triangles below.



What triangle will continue the pattern?

- 
- 
- 
- 

This item appeared at only one grade level.

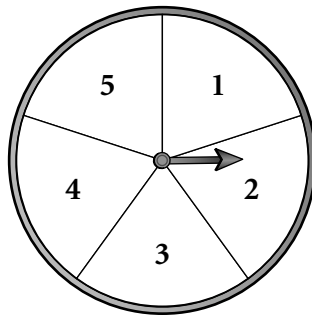
Grade 7

Standard 2.1a: Patterns, Functions, and Algebra

Subcontent Area: not assigned

- 14** Study the spinner with 5 evenly spaced numbers, shown below.

Spinner



What is the probability of spinning the arrow and landing on 5?

- 25%
- $\frac{1}{4}$
- 0.20
- $\frac{5}{1}$

**This item appeared at only one grade level.**

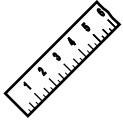
**Grade 7**

Standard 3.6b: Data Analysis, Probability, and Statistics

Subcontent Area: number sense

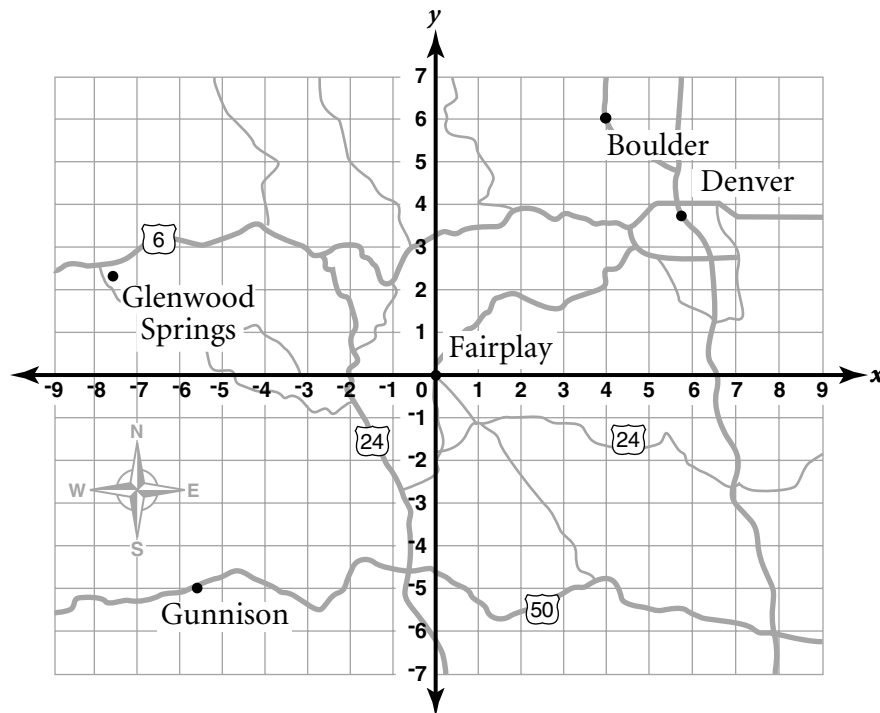


15



From your punch-out tools, use the ruler to help you solve this problem.

Study the map and grid below. The origin of the grid is located at Fairplay.



Two airplanes depart and both will fly a straight course.

**Part A** Airplane A departs from Glenwood Springs and flies over a place located on the map at coordinates  $(1, 5)$  on the grid. Plot these coordinates and label them as Point R. Draw a straight line from Glenwood Springs through Point R to the edge of the map.

**Part B** A day later, Airplane B departs from Gunnison and flies over a place located on the map at coordinates  $(-3, -2)$  on the grid. Plot these coordinates and label them as Point S. Draw a straight line from Gunnison through Point S to the edge of the map.

**Part C** On the lines below, write the coordinates of the point on the grid where your 2 straight lines intersect.

( \_\_\_\_\_ , \_\_\_\_\_ )

**Rubric**

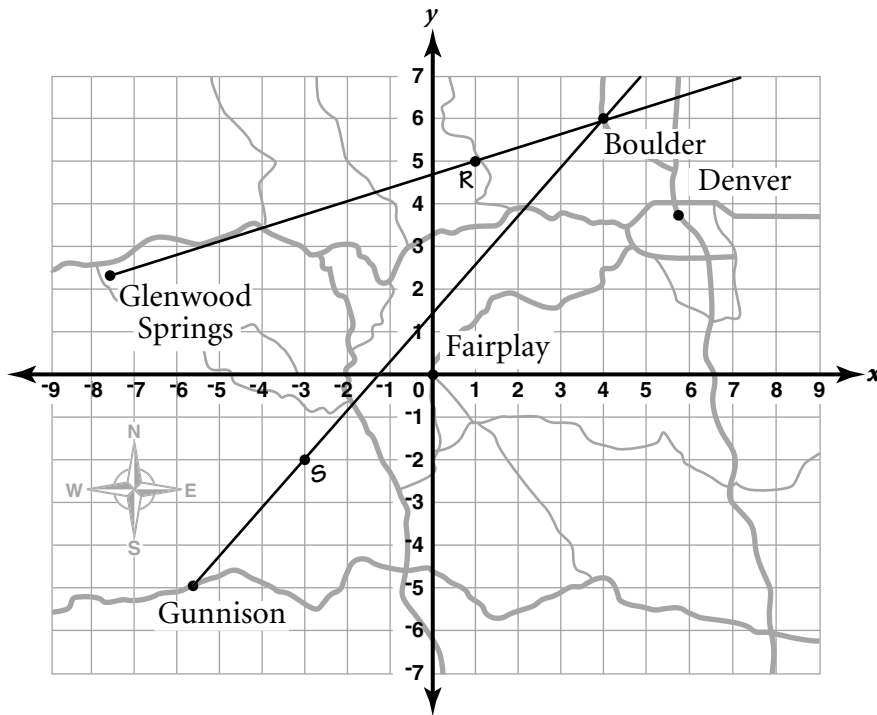
**Exemplary Response**

**Part A**

- Plot (1, 5) correctly and label R.

**Part B**

- Plot (-3, -2) correctly and label S.



**Part C**

- (4, 6)

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at only one grade level.**

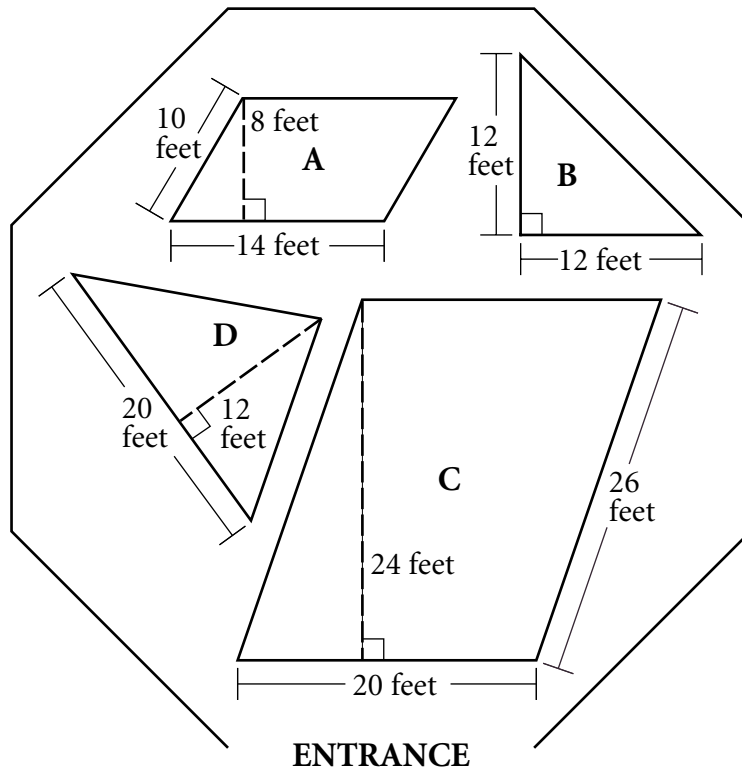
**Grade 7**

Standard 4.4a: Geometry and Spatial Sense

Subcontent Area: not assigned

16

An amusement park has opened a new food court. A diagram of the food court is shown below. Each space (A, B, C, D) is labeled with measurements.



**Part A** Space C will be tiled and used as an eating area. Each tile measures 1 square foot and costs \$2.

How much will it cost to tile the floor of the eating area? In the space below, show your work and write your answer on the line.

\$ \_\_\_\_\_

**Part B** Lickity-Splits wants to rent Space B to sell ice cream. The amusement park charges \$20 rent per month for each square foot of Space B.

How much will it cost Lickity-Splits to rent Space B for a year? In the space below, show your work and write your answer on the line.

\$ \_\_\_\_\_

**Part C** Ned's Nachos is deciding whether to rent Space A or Space D. The amusement park owners will rent Space A for \$2,800 per month and Space D for \$2,400 per month.

Help Ned decide whether Space A or Space D is the better value for his money. In the space below, show your work. Explain your reasoning and write your answer on the line.

\_\_\_\_\_ is the better value.

**Rubric**

**Exemplary Response**

**Part A**

- \$960

**AND**

- Space C is a parallelogram with area equal to base times height, so 20 feet times 24 feet is 480 square feet. Each tile measures 1 square foot and costs \$2, so \$2 per square foot times 480 square feet is \$960.

**Part B**

- \$17,280

**AND**

- Space B is a triangle with area equal to one half base times height, so  $\frac{1}{2}$  times 12 feet times 12 feet is 72 square feet. A monthly cost of \$20 per square foot times 72 square feet is \$1,440 per month. The rent for 1 year is 12 months times \$1,440 per month, which is \$17,280.

**Part C**

- Space D is the better value.

**AND**

- Space A is a parallelogram with area equal to base times height, so 14 feet times 8 feet is 112 square feet. Rent for Space A is \$2,800 per month, so \$2,800 per month divided by 112 square feet is \$25 per square foot.

Space D is a triangle with area equal to one half base times height, so  $\frac{1}{2}$  times 20 feet times 12 feet is 120 square feet. Rent for Space D is \$2,400 per month, so \$2,400 per month divided by 120 square feet is \$20 per square foot. Space D costs less per square foot than Space A.

**OR**

- Other valid response

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 7**

Standard 5.4a: Measurement

Subcontent Area: area and perimeter

- 17** Pixie Playland is building a small carousel with a radius of 7 feet and a large carousel with a radius of 14 feet.

**Part A** Find the circumferences of the small and large carousels to the nearest foot. In the space below, show your work and write your answers on the lines.

Circumference of small carousel \_\_\_\_\_ feet

Circumference of large carousel \_\_\_\_\_ feet

**Part B** Find the ratio of the circumference of the small carousel to the circumference of the large carousel. In the space below, show your work and write your answer on the line.

Ratio \_\_\_\_\_

**Part C** A third carousel has a circumference of 176 feet. Find the radius of this carousel. In the space below, show your work and write your answer on the line.

Radius \_\_\_\_\_ feet

**Rubric**

**Exemplary Response**

**Part A**

- Circumference of small carousel 44 feet  
Circumference of large carousel 88 feet

**AND**

- Circumference of small carousel is  $\pi d$ , so  $3.14(14 \text{ ft.}) = 43.96 \text{ ft.} \cong 44 \text{ feet.}$   
Circumference of large carousel is  $\pi d$ , so  $3.14(28 \text{ ft.}) = 87.92 \text{ ft.} \cong 88 \text{ feet.}$

**Part B**

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

**AND**

- The circumference of the small carousel is 44 feet and the circumference of the large carousel is 88 feet, which is a ratio of  $\frac{44}{88} = \frac{1}{2}$ .

**OR**

- Other valid response

**Part C**

- Radius 28 feet

**AND**

- Circumference =  $3.14d$ , so  $176 \text{ ft.} = 3.14d$ , and  $d = 56 \text{ ft.}$ , radius =  $\frac{1}{2}d$ , then  
radius =  $\frac{1}{2}(56 \text{ ft.}) = 28 \text{ feet.}$

**OR**

- Other valid response

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 7**

Standard 5.5a: Measurement

Subcontent Area: area and perimeter



**18**

Bill will make pancakes for 20 members of his Boy Scout troop. He will use the pancake recipe that serves 4 people, shown in the table below. Complete the table to show the amount of each ingredient Bill will use to make pancakes to serve 20 people.

Ingredient	Amount to Serve 4 People	Amount to Serve 20 People
Flour	$1\frac{1}{3}$ cups	
Salt	$\frac{1}{8}$ teaspoon	
Sugar	$2\frac{1}{2}$ tablespoons	
Baking powder	$1\frac{1}{4}$ teaspoons	
Eggs	1	
Melted butter	3 tablespoons	
Milk	$\frac{3}{4}$ cup	

**Rubric**

**Exemplary Response**

•

Ingredient	Amount to Serve 4 People	Amount to Serve 20 People
Flour	$1\frac{1}{3}$ cups	$6\frac{2}{3}$ cups
Salt	$\frac{1}{8}$ teaspoon	$\frac{5}{8}$ teaspoon
Sugar	$2\frac{1}{2}$ tablespoons	$12\frac{1}{2}$ tablespoons
Baking powder	$1\frac{1}{4}$ teaspoons	$6\frac{1}{4}$ tablespoons
Eggs	1	5
Melted butter	3 tablespoons	15 tablespoons
Milk	$\frac{3}{4}$ cup	$3\frac{3}{4}$ cups

**Score Points:** Apply 3-point holistic rubric.

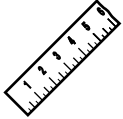
**This item appeared at only one grade level.**

**Grade 7**

Standard 6.4b: Operation and Calculation

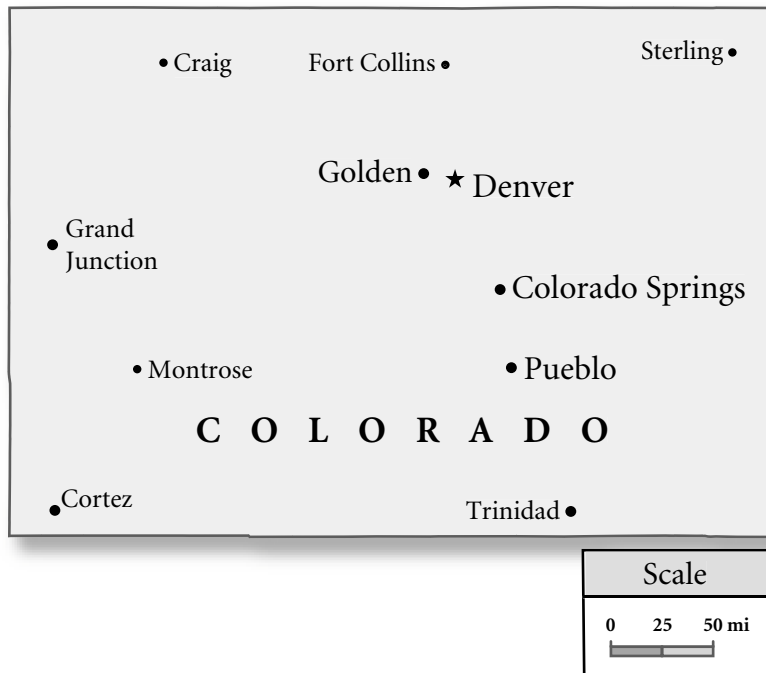
Subcontent Area: number sense

19



From your punch-out tools, use the ruler to help you solve this problem.

Study the map below.



What is the approximate straight-line distance between Cortez and Grand Junction?

- 80 miles
- 100 miles
- 130 miles
- 170 miles

**This item appeared at two adjacent grade levels.**

**Grade 7**

Standard 5.3a: Measurement

Subcontent Area: not assigned

**Grade 8**

Standard 5.3a: Measurement

Subcontent Area: proportional thinking

20

Students are going on a field trip to the Colorado History Museum. They will ride on 3 buses. Each bus seats a maximum of 40 students. Study the table below, which shows the proportion of seats occupied on each bus.

Bus	Seats Occupied
1	60%
2	0.85
3	$\frac{7}{8}$

How many students are on each bus? In the space below, show your work and write your answers on the lines.

Bus 1 \_\_\_\_\_ Bus 2 \_\_\_\_\_ Bus 3 \_\_\_\_\_

**Rubric**

**Exemplary Response**

- Bus 1 = 24

$$\text{Bus 2} = 34$$

$$\text{Bus 3} = 35$$

**AND**

- On Bus 1, 60% of the 40 seats are occupied, and 60% is equal to .60, so .60 times 40 seats is 24 seats. On Bus 2, .85 of the 40 seats are occupied, so .85 times 40 seats is 34 seats. On Bus 3,  $\frac{7}{8}$  of the 40 seats are occupied, so  $\frac{7}{8}$  times 40 seats is 35 seats.

**OR**

- Other valid response

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at two adjacent grade levels.**

**Grade 7**

Standard 1.4a: Number Sense

Subcontent Area: number sense

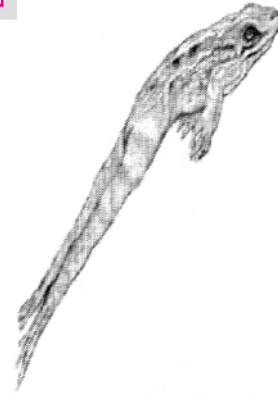
**Grade 8**

Standard 1.4a: Number Sense

Subcontent Area: not assigned

21

A tree frog is 10 feet ahead of a bullfrog. Every time the tree frog jumps 1 foot, the bullfrog jumps 3 feet. How many times will the bullfrog have to jump to catch up with the tree frog?



In the space below, explain or show how you found your answer and write your answer on the line. You may use charts, diagrams, or words in your explanation.

\_\_\_\_\_ jumps



**Rubric**

**Exemplary Response**

- 5 jumps

**AND**

- The bullfrog is 10 feet behind the tree frog and gains 2 feet on the tree frog each time they jump. Two feet per jump times 5 jumps is 10 feet. So, the bullfrog will catch up to the tree frog in 5 jumps.

**OR**

- Other valid response

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at two adjacent grade levels.**

**Grade 7**

Standard 2.1a: Patterns, Functions, and Algebra

Subcontent Area: not assigned

**Grade 8**

Standard 2.1a: Patterns, Functions, and Algebra

Subcontent Area: linear pattern representation

22

A bag contains 2 green cubes, 3 blue cubes, and 5 red cubes. Nick places his hand in the bag and picks a cube without looking. What is the probability that he picks either a blue or a red cube?

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

This item appeared at only one grade level.

Grade 8

Standard 3.6b: Data Analysis, Probability, and Statistics

Subcontent Area: not assigned

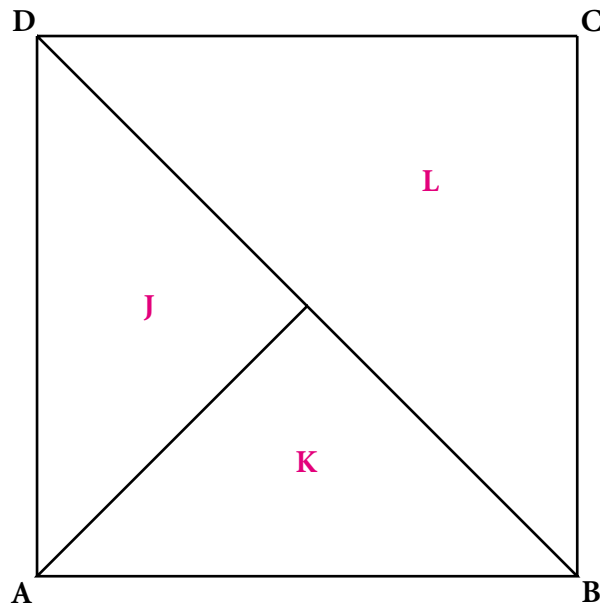


23



From your punch-out tools, use the tangrams to help you solve this problem.

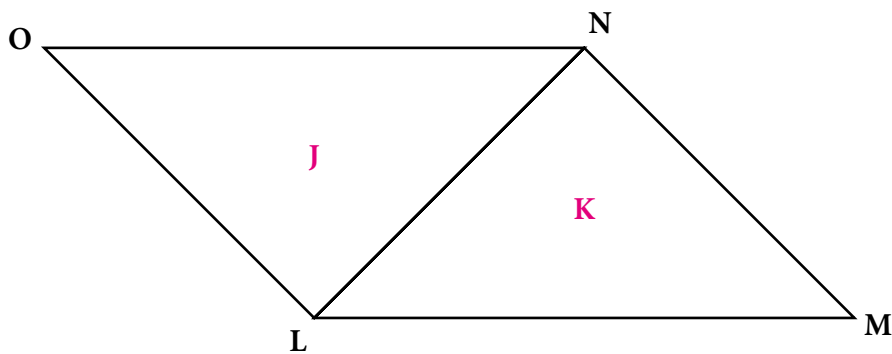
Study the square below.



**Part A** The area of triangle K is 9 square inches. Find the perimeter of square ABCD. In the space below, show your work and write your answer on the line.

Perimeter of square \_\_\_\_\_

**Part B** Triangles J and K are arranged into parallelogram LMNO shown below.



What is the ratio of the area of parallelogram LMNO to the area of square ABCD? In the space below, show your work and write your answer on the line.

Ratio \_\_\_\_\_

**Rubric**

**Exemplary Response**

**Part A**

- Perimeter of square 24 inches

**AND**

- The area of triangle K is 9 square inches and the area of triangle K is  $\frac{1}{4}$  the area of the square. The area of the square is then 9 square inches  $\times 4 = 36$  square inches. The sides of a square with an area of 36 square inches must be 6 inches, and  $4 \times 6$  inches = 24 inches.

**OR**

- Other valid response

**Part B**

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

**AND**

- The area of triangles K and J makes up one half the area of square ABCD. Parallelogram LMNO consists of triangles K and J, so the area of parallelogram LMNO makes up one half the area of square ABCD. This is a ratio of  $\frac{1}{2}$ .

**OR**

- The area of triangle K is 9 square inches and the area of triangle K is equal to the area of triangle J. The area of parallelogram LMNO is then 18 square inches. Square ABCD has an area of 36 square inches, so the ratio of the area of parallelogram LMNO to the area of square ABCD is  $\frac{18}{36} = \frac{1}{2}$ .

**OR**

- Other valid response

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

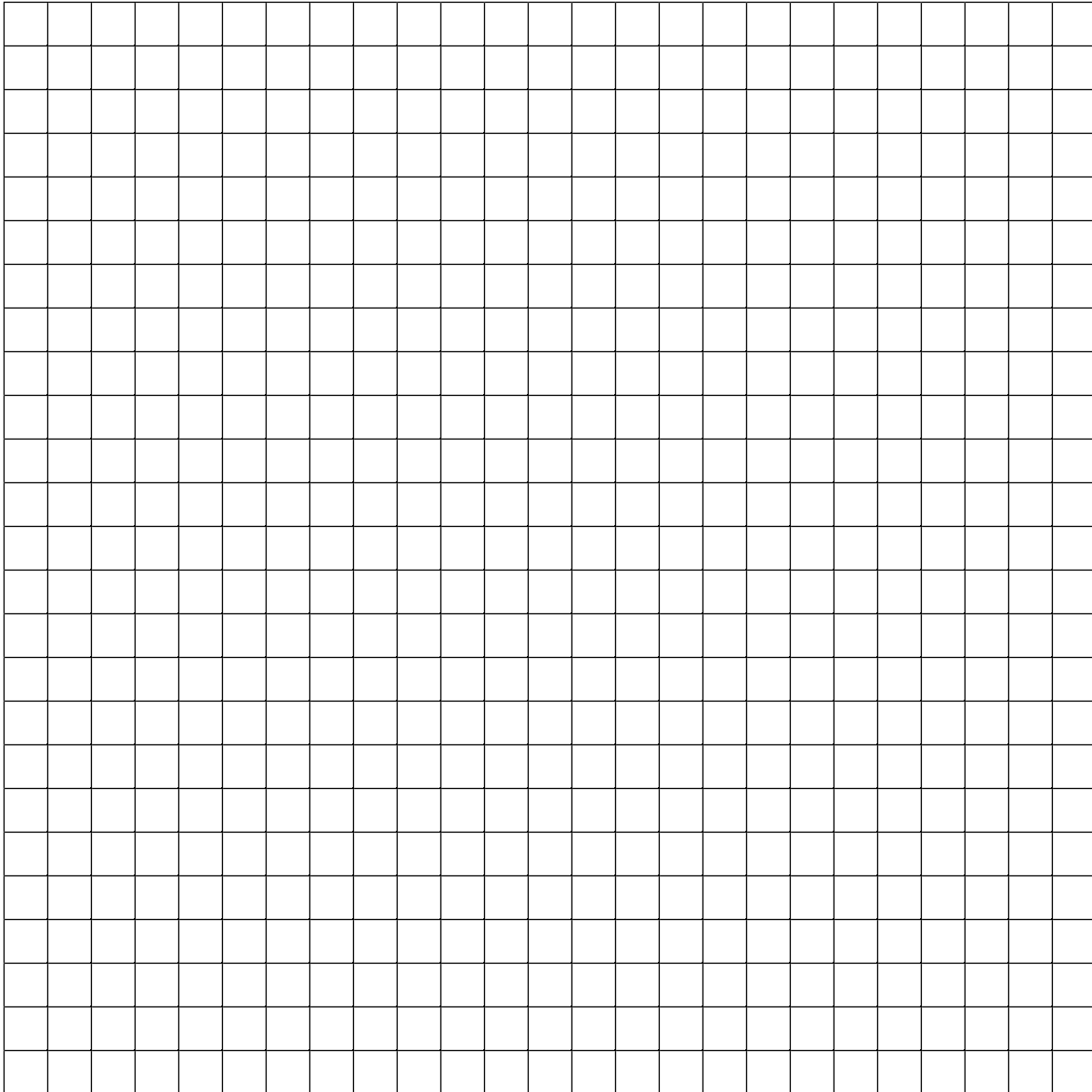
**Grade 8**

Standard 4.5a: Geometry and Spatial Sense


Subcontent Area: geometry

**24** Jerry is planning a rectangular garden with an area of 24 square feet.

**Part A** On the grid below, draw as many differently shaped rectangles as possible with areas of 24 square feet. Label the length and width of each rectangle you draw. Use only whole numbers for the length and width.



**KEY**

 = 1 square foot

**Part B** Find the perimeter of each rectangle you drew for Part A on page 5. On the grid for Part A, record the perimeter inside each rectangle you drew.

Check your work on the grid.

- Did you label the length and width of each rectangle?
- Did you record the perimeter inside each rectangle?

**Part C** Jerry needs to purchase fencing materials for his rectangular garden. Around which rectangular garden would building a fence cost the least? In the space below, explain or show how you found your answers and write your answers on the lines. You may use charts, diagrams, or words in your explanation.

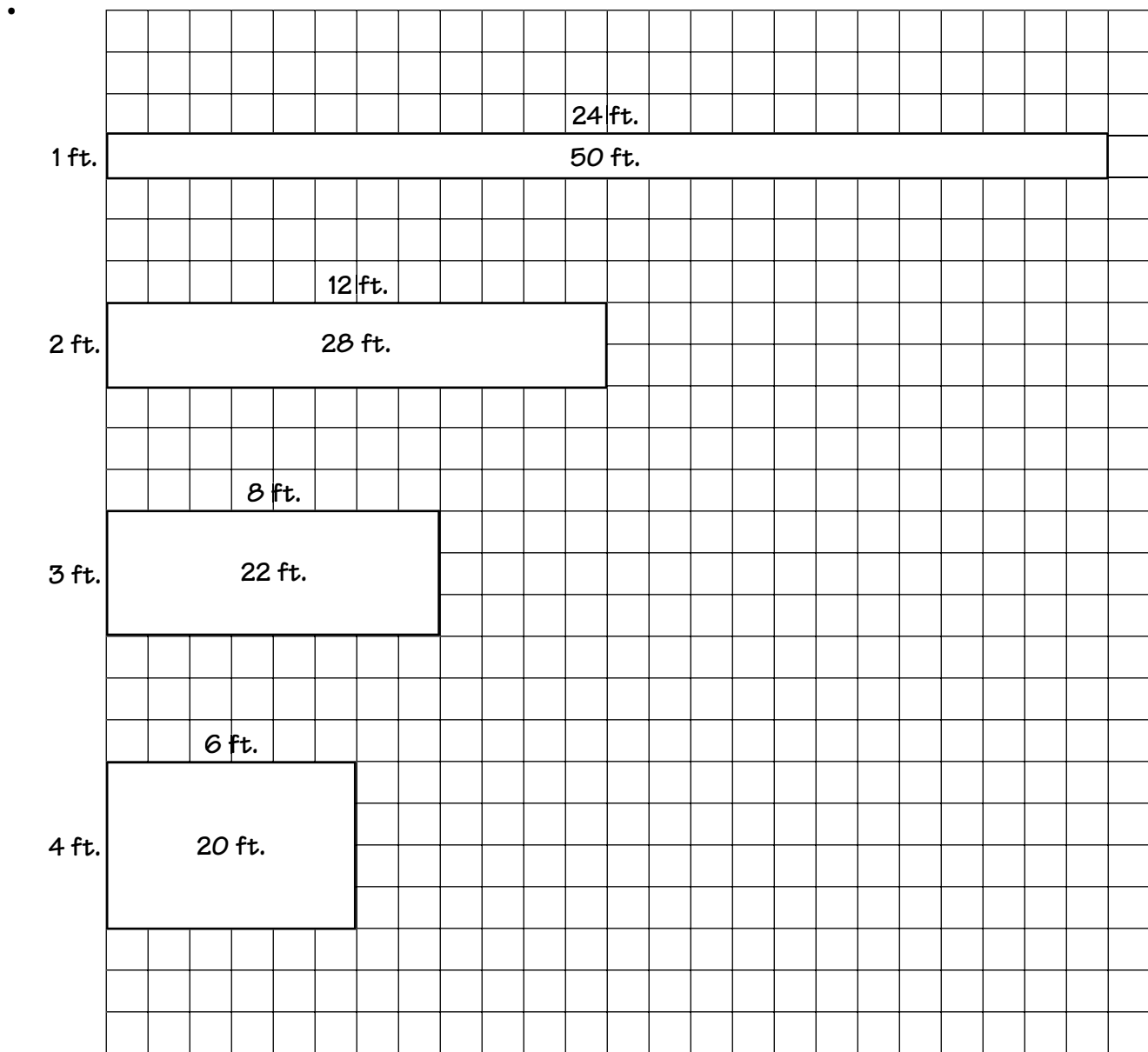
Length \_\_\_\_\_ Width \_\_\_\_\_


record—write down

**Rubric**

**Exemplary Response**

**Part A and Part B**



<b>KEY</b>	
	= 1 square foot

**Part C**

- **Length** 6 feet      **Width** 4 feet

**AND**

- The 4-foot by 6-foot fence would cost the least to build because it has the smallest perimeter.

**OR**

- Other valid response that corresponds to the student's drawings

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 8**

Standard 5.4a: Measurement

Subcontent Area: not assigned

25

Study the information below.

- While exercising, a person should maintain a heart rate that ranges between 70% and 80% of his or her **maximum** heart rate.
- Maximum heart rate =  $220 - \text{age}$ , in years (of person exercising)
- Heart rate is measured in heartbeats per minute.

**Part A** Jennifer, who is 24 years old, is beginning an exercise program. Using the information, find the approximate range within which Jennifer should attempt to maintain her heart rate while exercising. In the space below, show your work and write your answer on the lines.

between \_\_\_\_\_ and \_\_\_\_\_ heartbeats per minute

**Part B** While exercising, Charlie should attempt to maintain a heart rate between 112 and 128 heartbeats per minute. Using the information, find Charlie's age. In the space below, show your work and write your answer on the line.

\_\_\_\_\_ years old



**Rubric**

**Exemplary Response**

**Part A**

- between 137 and 157 heartbeats per minute

**OR**

- between 140 and 160 heartbeats per minute

**AND**

- Jennifer's maximum heart rate =  $220 - 24$  (Jennifer's age) = 196 heartbeats per minute

70% of 196 beats per minute =  $.70$  (196 beats per minute) = 137 heartbeats per minute, accept estimate  $.70$  ( $\approx 200$  beats per minute)  $\approx 140$  heartbeats per minute

80% of 196 beats per minute =  $.80$  (196 beats per minute) = 157 heartbeats per minute, accept estimate  $.80$  ( $\approx 200$  beats per minute)  $\approx 160$  heartbeats per minute

**OR**

- Other valid response

**Part B**

- 60 years old

**AND**

- Charlie's heart rate of 112 heartbeats per minute = 70% of his maximum heart rate

Charlie's maximum heart rate =  $\frac{112 \text{ beats per minute}}{.70} = 160$  heartbeats per minute

160 heartbeats per minute =  $220 - \text{age}$

Charlie's age =  $220 - 160$ , Charlie's age = 60

**OR**

- Other valid response

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 8**

Standard 6.4a: Operation and Calculation

Subcontent Area: not assigned

- 26** Erik arranged his 12 test scores on a number line, as shown below.



He wants to mark the median and mean scores on the line. Which of these statements must be true?

- The mean is to the left of the median.
- The mean is to the right of the median.
- The mean and the median are in the same place.
- The mean and the median have 4 test scores between them.

**This item appeared at only one grade level.\***

**Grade 9**

Standard 3.4a: Data Analysis, Probability, and Statistics

Subcontent Area: not assigned

\*Please note: This item appeared on the grade 8 test but was not used in scoring.

## Mathematics

- 27** The pressure of salt water, in atmospheres, depends on the depth below the water's surface, in feet, as shown in the following equation.

$$\text{Pressure} = 1 + \frac{\text{depth}}{33}$$

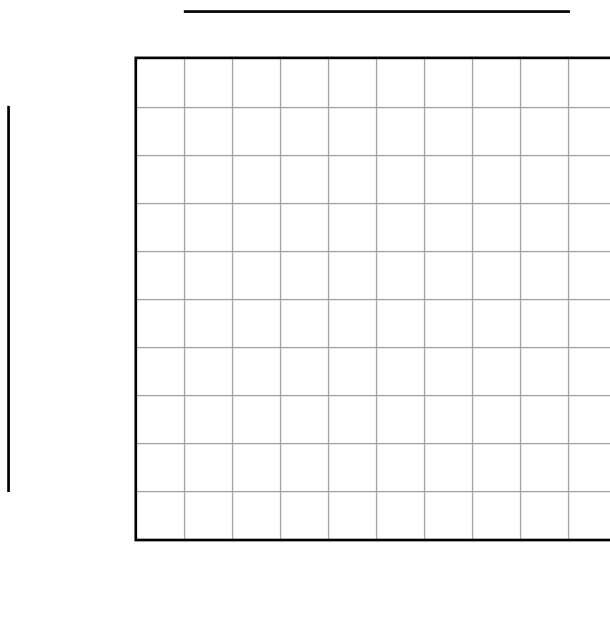
**Part A** Complete the table below.

Pressure (in atmospheres)	Depth (in feet)
1	
2	
3	
4	

**Part B** On the grid below, graph the data from the table.

Be sure to

- title the graph
- label each axis
- use appropriate scales



**Rubric**

**Exemplary Response**

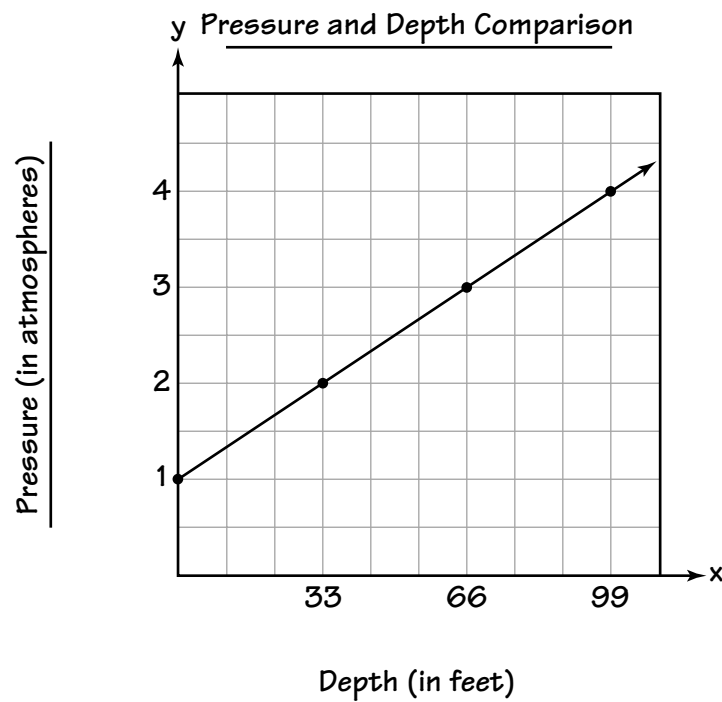
**Part A**

•

Pressure (in atmospheres)	Depth (in feet)
1	0
2	33
3	66
4	99

**Part B**

•



**Score Points:** Apply 2-point holistic rubric.

**This item appeared at two adjacent grade levels.**

**Grade 8**

Standard 2.2.a: Patterns, Functions, and Algebra  
 Subcontent Area: linear pattern representation

**Grade 9**

Standard 2.2.a: Patterns, Functions, and Algebra  
 Subcontent Area: multiple representations of linear/nonlinear functions

28

Amelia recorded the time it took for candles of different lengths to burn out. Her results are shown in the table below.

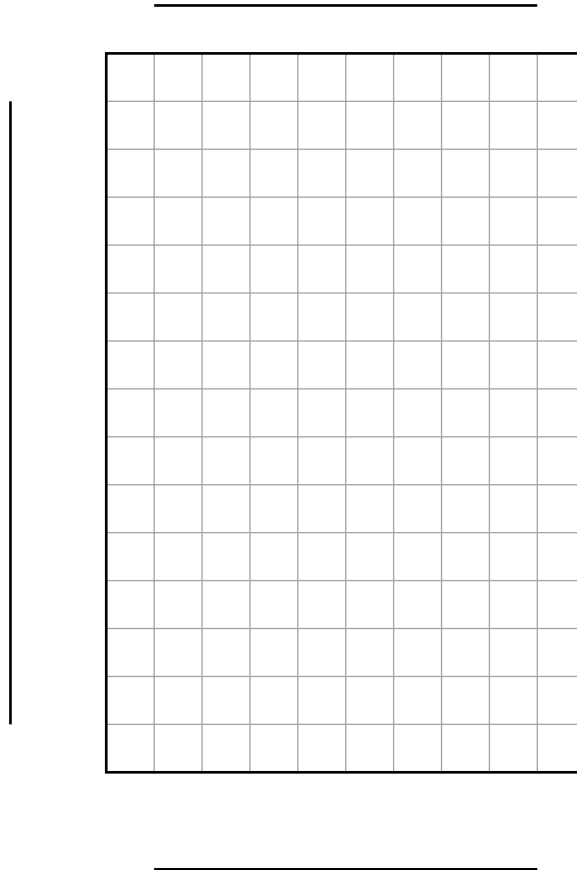
Candle Burning Times

Candle Length (in inches)	2.1	2.4	3.8	3.2	3.7	3.1	2.7
Burning Time (in minutes)	18	18	30	24	29	26	24

**Part A** On the grid below, create a scatterplot of her data and draw a line of best fit for the data.

Be sure to

- title the scatterplot
- label each axis
- use appropriate scales



**Part B** On the line below, write the equation for your line of best fit.

---

**Part C** The next candle that Amelia tested burned for one hour. According to your line of best fit, how long was the candle? In the space below, explain or show how you found your answer and write your answer on the line.

\_\_\_\_\_ inches

**Part D** On the lines below, explain what the slope represents within the context of this problem.

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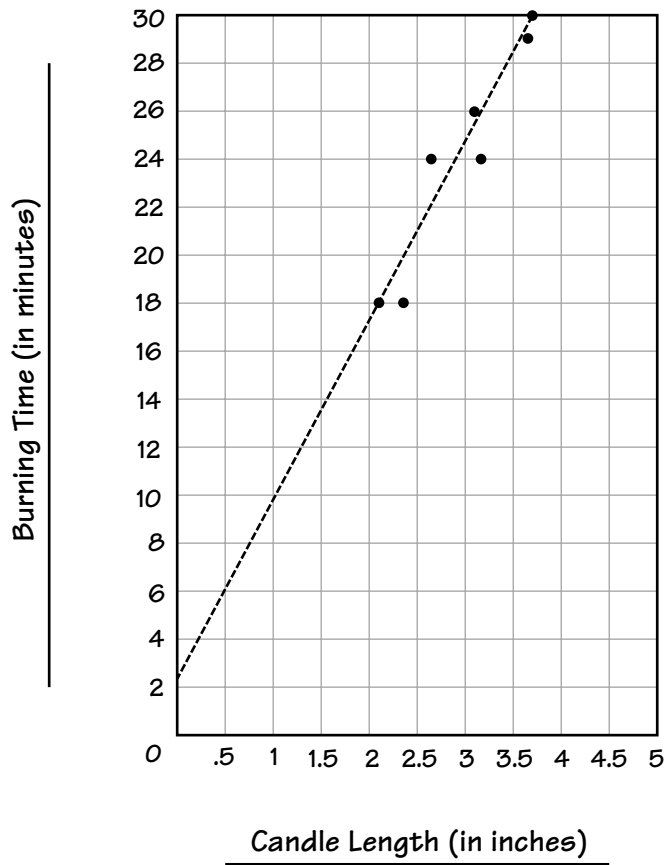
Rubric

Exemplary Response

Part A

- 

Candle Lengths and Burning Times



**Part B**

- $y = 7.17x + 2.63$  (by linear regression)  
**OR**
- $y = 8x$  (by median-median method)  
**OR**
- $y = 7x + 3.5$  (by visual fit of the line of best fit)

**Part C**

- 8 inches (by linear regression)  
**OR**
- 7.5 inches (by median-median method)  
**OR**
- 8.1 inches (by visual fit of the line of best fit)

**AND**

- $60 = 7.17x + 2.63$   
 $57.37 = 7.17x$   
 $x = 8.00$

**OR**

- Other valid process

**Part D**

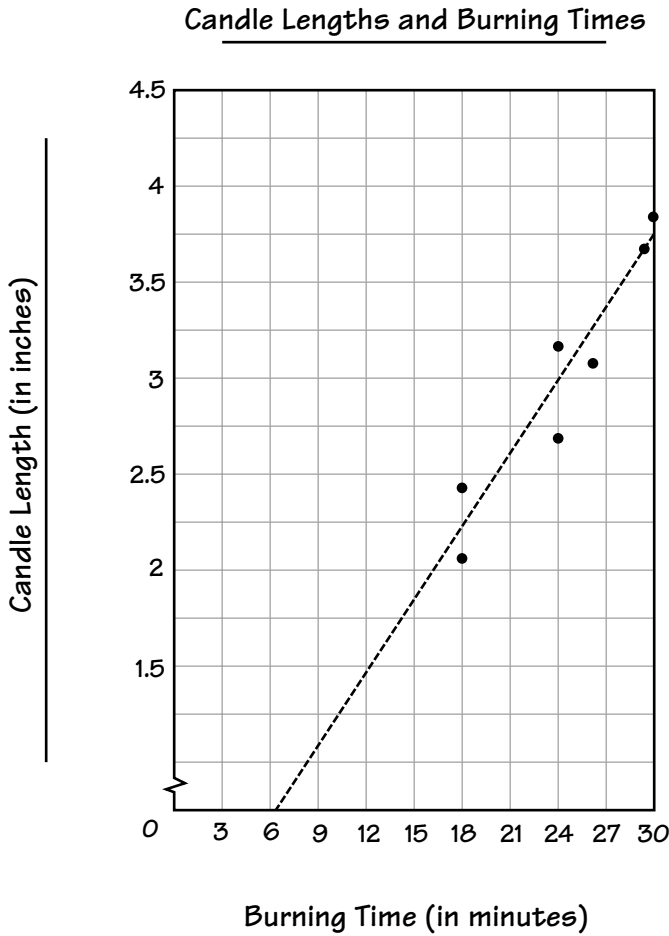
- The slope represents the expected burning time per inch of candle length. As calculated, the slope of 7.17 indicates that a candle would be expected to burn for 7.17 minutes for every inch of candle length.  
**OR**
- Other valid response



**Note:** Students may switch the axes of their graphs in Part A. In that case, all other responses must agree with the graph from Part A. The exemplary response for a student who switches the axes is shown starting below.

**Part A (alternative)**

- 



CSAP Mathematics Scoring Guide

**Part B (alternative)**

- $y = 0.128x - 0.087$  (by linear regression)

**OR**

- $y = 0.125x$  (by median-median method)

**OR**

- $y = 0.143x - 0.5$  (by visual fit of the line of best fit)

**Part C (alternative)**

- 7.59 inches (by linear regression)

**OR**

- 7.5 inches (by median-median method)

**OR**

- 7.54 inches (by visual fit of the line of best fit)

**AND**

- $y = 0.128(60) - 0.087$

$$y = 7.680 - 0.087$$

$$y = 7.59$$

**OR**

- Other valid process

**Part D (alternative)**

- The slope represents the expected number of inches of candle length that will be burned per minute. As calculated, the slope of 0.128 indicates that 0.128 inches of candle would be expected to burn for every minute the candle stays lit.

**OR**

- Other valid response

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 9**

Standard 3.3a: Data Analysis, Probability, and Statistics

Subcontent Area: multiple representations of linear/nonlinear functions

29

For her science experiment, Ann combined the solutions in the amounts shown below.

- 2 ounces of pure water
- 2 ounces of a 10% blue dye solution
- 4 ounces of a 15% blue dye solution
- 4 ounces of a 50% blue dye solution

How many ounces are in the final mixture?

\_\_\_\_\_ ounces

What proportion of the final mixture is blue dye? In the space below, show your work and write your answer on the line.

Proportion \_\_\_\_\_

**Rubric**

**Exemplary Response:**

- 12 ounces

**AND**

- 2.8 blue dye to 9.2 water

**OR**

- $\frac{2.8 \text{ blue dye}}{12 \text{ solution}}$

**OR**

- $\frac{14}{60}$

**OR**

- $23\frac{1}{3}\%$

**AND**

<u>Solution</u>	<u>Amount of Solution</u>	<u>Amount of Blue Dye</u>
water	2 ounces	$2 \times 0 = 0$ ounces
10%	2 ounces	$2 \times 0.10 = 0.2$ ounces
15%	4 ounces	$4 \times 0.15 = 0.6$ ounces
50%	4 ounces	$4 \times 0.5 = 2$ ounces

**OR**

- The total amount of dye is 2.8 ounces and the amount of solution is 12 ounces. The dye concentration is  $\frac{2.8}{12} = 23\frac{1}{3}\%$ .

**OR**

- Other valid response

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 9**

Standard 6.1a: Operation and Calculation

Subcontent Area: proportional thinking

- 30** Aaron measured the heights of his plants. The heights, in inches, are shown below.

10, 11, 13, 15, 17, 18, 19, 20, 20, 23, 25, 27

What is the value of the lower quartile?

- 14.0 inches
- 18.5 inches
- 21.5 inches
- 20.0 inches

**This item appeared at two adjacent grade levels.**

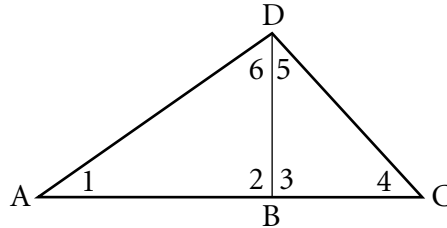
**Grade 9**

Standard 3.4a: Data Analysis, Probability and Statistics  
Subcontent Area: not assigned

**Grade 10**

Standard 3.4a: Data Analysis, Probability and Statistics  
Subcontent Area: not assigned

- 31** Triangle ACD is divided into 2 smaller triangles by segment DB, as shown below.



Drawing **not** to scale

Angle 1 measures  $35^\circ$ . What is the **sum** of the measures of angles 4, 5, and 6?

- $125^\circ$
- $145^\circ$
- $180^\circ$
- $215^\circ$

**This item appeared at two adjacent grade levels.**

**Grade 9**

Standard 4.2a: Geometry and Spatial Sense  
Subcontent Area: not assigned

**Grade 10**

Standard 4.2a: Geometry and Spatial Sense  
Subcontent Area: not assigned

**32** Janet and Karen left work at the same time. After driving in the same direction on the highway for 25 minutes, Janet had traveled 7 miles farther than Karen. During this time, Janet's average speed was 60 miles per hour. What was Karen's average speed?

- 17 miles per hour
- 43 miles per hour
- 59 miles per hour
- 77 miles per hour

**This item appeared at two adjacent grade levels.**

**Grade 9**

Standard 5.1b: Measurement

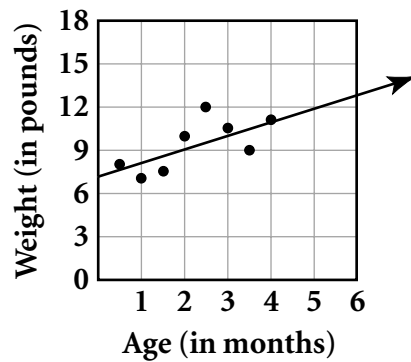
Subcontent Area: not assigned

**Grade 10**

Standard 5.1b: Measurement

Subcontent Area: not assigned

- 33** Thomas recorded the weight, in pounds, of several infants of different ages for his science experiment. He made a scatterplot of the data, as shown in the figure below.



He drew a line of best fit through the points. According to his line of best fit, at approximately what age, in months, should a typical infant weigh 17 pounds?

- 6 months
- 10 months
- 13 months
- 16 months

This item appeared at only one grade level.

Grade 10

Standard 3.3c: Data Analysis, Probability, and Statistics

Subcontent Area: not assigned



34

Wilson Credit has a total of 327 employees. The company made a profit of \$4,120,000 last year. The profit was equal to  $\frac{3}{5}$  of the total amount paid to its employees during the year. What was the average amount paid to each employee at Wilson Credit last year?

In the space below, show your work and write your answer on the line.

\$ \_\_\_\_\_

**Rubric**

**Exemplary Response**

- \$20,999

**OR**

- \$21,000

**AND**

- $\frac{3}{5}$ (total salary) = \$4,120,000

total salary  $\approx$  \$6,866,666.67

$\$6,866,666.67 \div 327$  employees  $\approx$  \$20,999 per employee

**OR**

- Other valid response

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 10**

Standard 1.3a: Number Sense

Subcontent Area: not assigned

35

John needs to read a 535-page book for a class. The word count averages 421 words per page. He can read about 119 words per minute. He plans to read the book for at most 4 hours per day.

**Part A** Estimate how many days it will take John to read the book. In the space below, show your work and write your answer on the line.

Estimate \_\_\_\_\_ days

**Part B** John estimates that he will require 6 days to read the book. Is John's estimate reasonable? \_\_\_\_\_

On the lines below, explain how you arrived at your conclusion.

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**Rubric**

**Exemplary Response**

**Part A**

- 8 days

**OR**

- 8.33 days

**OR**

- 9 days

**AND**

- $500 \text{ pages} \times \frac{400 \text{ words}}{\text{page}} \times \frac{1 \text{ minute}}{100 \text{ words}} = 2,000 \text{ minutes}$

$$2,000 \text{ minutes} \times \frac{1 \text{ hour}}{60 \text{ minutes}} = 33.33 \text{ hours}$$

$$33.33 \text{ hours} \times \frac{1 \text{ day}}{4 \text{ hours}} = 8.33 \text{ days}$$

**Part B**

- No

**AND**

- John's estimate is too low. I estimate that John will need at least 8 days to read the book. In order to reasonably estimate that he can read the book in six days, he will need to increase his reading speed considerably or read for more than four hours per day.

**OR**

- Other valid method to show inaccuracy of John's estimate

**Score Points:** Apply 3-point holistic rubric.

**This item appeared at only one grade level.**

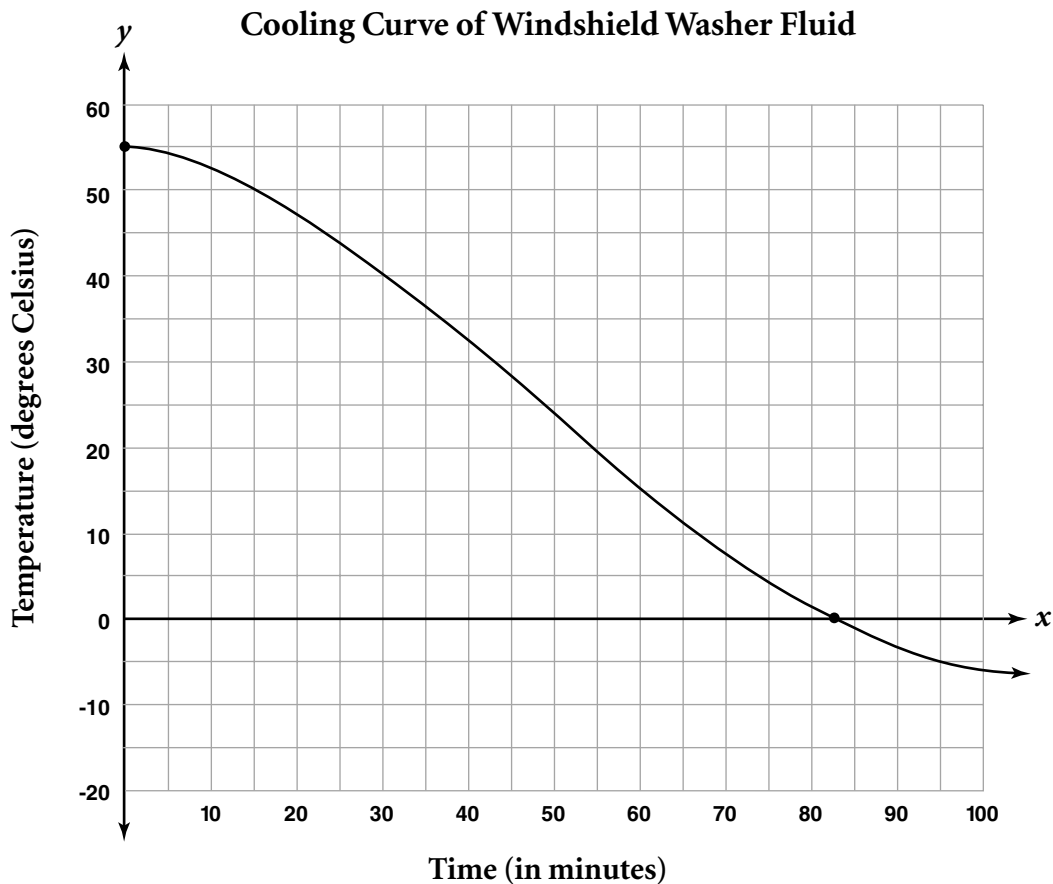
**Grade 10**

Standard 1.3a: Number Sense

Subcontent Area: not assigned

36

As part of a science experiment, Bailey is cooling in her freezer a cup of windshield washer fluid from her car. The windshield washer fluid freezes at  $-10^{\circ}$  Celsius. The temperature of the washer fluid is shown on the graph below.



On the lines below, explain what the  $x$ -intercept represents in the context of this experiment.

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On the lines below, explain what the  $y$ -intercept represents in the context of this experiment.

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**Rubric**

**Exemplary Response**

- The  $x$ -intercept represents the number of minutes it takes for the windshield washer fluid to reach a temperature of  $0^{\circ}\text{C}$ .

**AND**

- The  $y$ -intercept represents the temperature of the windshield washer fluid at the start of the experiment.

**Score Points:** Apply 2-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 10**

Standard 2.4a: Patterns, Functions, and Algebra

Subcontent Area: multiple representation of function

37

Number cubes are the basis for many games. Each face of a number cube is identified by a number from 1 to 6. Some games use one number cube and some games use multiple number cubes.

**Part A** A game played with one number cube has six equally likely outcomes. For games using two number cubes, how many equally likely outcomes exist? In the space below, show or explain why you think your answer is correct and write your answer on the line.

\_\_\_\_\_ outcomes

**Part B** Complete the table below to show how many outcomes are possible for each of the results that are listed.

Result	Number of Outcomes
The sum of the numbers on the two cubes is 7.	
Each cube shows the same value.	
Exactly one of the cubes shows a 1.	

**Part C** Complete the table below to show the number of possible outcomes when 2, 3, 4, and 5 number cubes are used.

<b>Number of cubes</b>	1	2	3	4	5
<b>Number of possible outcomes</b>	6				

**Part D** In one game that uses 5 number cubes, the most desired result is to have all number cubes show the same value. What is the probability that this can happen on a given try? In the space below, show how you found your answer and write your answer on the line.

<p>Probability _____</p>
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**Rubric**

**Exemplary Response**

*Part A*

- 36 outcomes

**AND**

- $6 \times 6 = 36$

*Part B*

- 

Result	Number of Outcomes
The sum of the numbers on the two cubes is 7.	6
Each cube shows the same value.	6
Exactly one of the cubes shows a 1.	10

*Part C*

- 

Number of cubes	1	2	3	4	5
Number of possible outcomes	6	36	216	1296	7776

**Part D**

- Probability  $\frac{6}{7776}$

**OR**

- Probability  $\frac{1}{1296}$

**AND**

- The probability of having all 5 number cubes show a specific number is  $\frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} = \frac{1}{7776}$ . Since there are 6 specific numbers that can appear, the probability of having all 5 cubes show any one of the 6 numbers at the same time is  $\frac{6}{7776}$ .

**OR**

- Other valid process

**Score Points:** Apply 4-point holistic rubric.

**This item appeared at only one grade level.**

**Grade 10**

Standard 3.5a: Data Analysis, Probability, and Statistics

Subcontent Area: probability and counting techniques