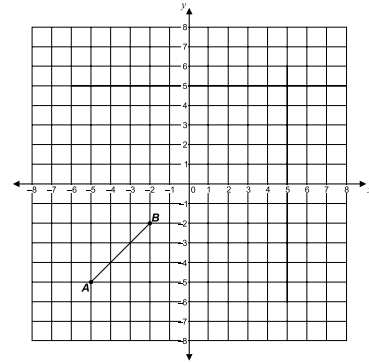


# Mathematics, Grade 10

## Session 1, Multiple-Choice Questions

Use the graph to answer question 1.

- Suppose that  $\overline{AB}$  is translated 6 units to the right. What are the coordinates of the image of point  $B$ ?
  - $(-4, -2)$
  - $(-4, 2)$
  - $(4, -2)$
  - $(4, 2)$



Reporting Category/Substrand for Item 1: **Geometry and Measurement/Geometry from an Algebraic Perspective (p. 173)**

- Mark drives 25% of the time in the city and 75% of the time on the highway. Which of the four cars listed below will give him the greatest number of miles per gallon of gasoline?

	average miles per gallon in the city	average miles per gallon on the highway
A. Car #1	20	35
B. Car #2	25	30
<input checked="" type="checkbox"/> C. Car #3	24	34
D. Car #4	26	31

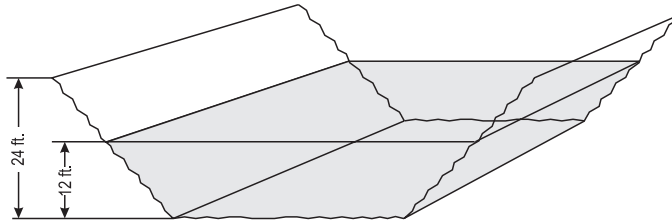
Reporting Category/Substrand for Item 2: **Number Sense/Mathematical Structure (p. 171)**

- If  $3(2r - 5) = 27$ , then  $2r - 5$  equals
  - 30.
  - 24.
  - 81.
  - 9.

Reporting Category/Substrand for Item 3: **Number Sense/Discrete Mathematics (p. 171)**

## Mathematics, Grade 10

Use the diagram below to answer question 4.

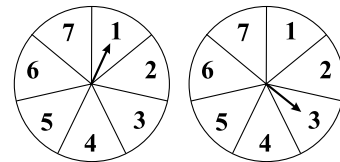


4. A canal is 24 feet deep and has slanted sides as shown in the cross section of the canal above. The water level is at 12 feet now. How does the amount of water in the canal now compare to the amount in the canal when it is full?
- A. It is more than half as much.
  - B. It is half as much.
  - ✓ C. It is less than half as much.
  - D. It is twice as much.

*Reporting Category/Substrand for Item 4: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)***

Use the spinners to answer question 5.

5. When playing a board game, you spin two spinners with congruent sectors numbered 1 through 7 as shown. If the **sum** of the two numbers you spin is 12, 13, or 14, you win. What is the probability of winning?



- A.  $\frac{21}{49}$
- B.  $\frac{10}{49}$
- C.  $\frac{15}{49}$
- ✓ D.  $\frac{6}{49}$

*Reporting Category/Substrand for Item 5: **Statistics and Probability/Probability (p. 174)***

## Mathematics, Grade 10

6. The lawn in Lori's backyard is a 30-foot by 50-foot rectangle. Lori converts part of the lawn to a circular garden 8 feet in diameter. What fractional part of her backyard is garden space?

- ✓ A.  $\frac{16\pi}{1,500}$
- B.  $\frac{64\pi}{1,500}$
- C.  $\frac{8\pi}{1,500}$
- D.  $\frac{8\pi}{1,550 - 8\pi}$

*Reporting Category/Substrand for Item 6: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)***

7. Haynes High School chartered buses for 60 students to go on a field trip. Valley High School chartered buses for 80 students.

- The total cost of the buses was the same for the two schools.
- Students from Valley High School paid \$5 less than students from Haynes High School.

What was the cost per student for Haynes High School?

- A. \$5
- B. \$15
- ✓ C. \$20
- D. \$40

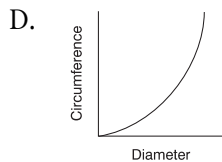
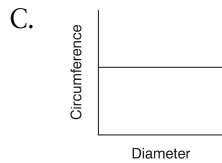
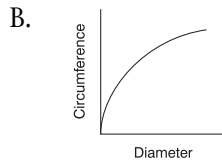
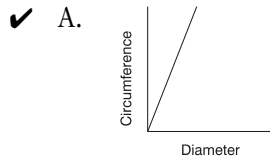
*Reporting Category/Substrand for Item 7: **Patterns, Relations, and Functions/Algebra (p. 172)***

## Mathematics, Grade 10

8. The circumference,  $C$ , of a circle is found by using the formula

$$C = \pi d, \text{ where } d \text{ is the diameter.}$$

Which graph **best** shows the relationship between the diameter of a circle and its circumference?



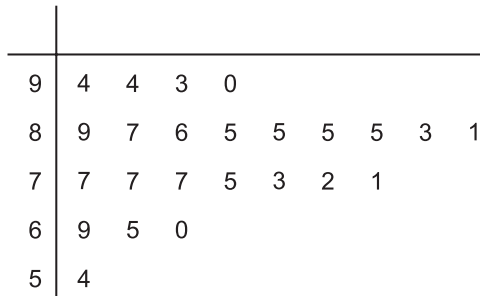
*Reporting Category/Substrand for Item 8: **Patterns, Relations, and Functions/Functions** (p. 172)*

9. A movie projector positioned 28 feet from a wall creates an image that is 7 feet wide on the wall. If a screen is placed 5 feet in front of the projector, what will be the width of the image on the screen?
- A. less than 1 foot
- ✓ B. between 1 and 2 feet
- C. between 3 and 4 feet
- D. greater than 4 feet

*Reporting Category/Substrand for Item 9: **Geometry and Measurement/Geometry and Spatial Sense** (p. 173)*

## Mathematics, Grade 10

10. Mr. Spruce displayed the student scores in math class using the stem-and-leaf plot shown below.



Note:  $8|9 = 89$

The median student score is

- A. 82.
- B. 81.
- C. 88.
- D. 85.

*Reporting Category/Substrand for Item 10: **Statistics and Probability/Statistics (p. 174)***

## Mathematics, Grade 10

### Session 1, Short-Answer Questions

11. Solve the following equation for  $x$ .

$$0.5(x - 8) = 0.2x + 11$$

Correct Answer:  $x=50$

*Reporting Category/Substrand for Item 11: Patterns, Relations, and Functions/Algebra (p. 172)*

12. What is the missing term in the quadratic expression below?

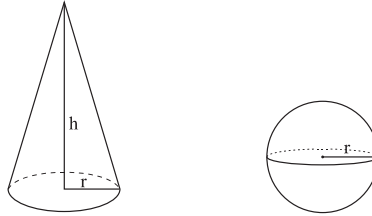
$$(2x - 3)(x + 4) = 2x^2 + \underline{\quad} - 12$$

Correct Answer:  $5x$

*Reporting Category/Substrand for Item 12: Patterns, Relations, and Functions/Algebra (p. 172)*

Session 1, Open-Response Question

Use the cone and sphere below to answer question 13.



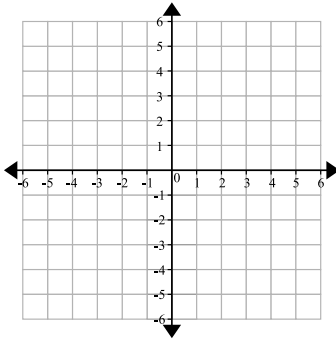
13. a. If the height of the cone is **doubled**, the volume of the cone is how many times larger?
- b. If the radius of the cone is **doubled**, the volume of the cone is how many times larger?
- c. If the radius of the sphere is **doubled**, the volume of the sphere is how many times larger?
- d. A manufacturing company wants to make one cone-shaped container and one sphere-shaped container that each have the **same** radius and the **same** volume. What must be the height of the cone in terms of its radius? Explain your reasoning.

Reporting Category/Substrand for Item 13: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)**

# Mathematics, Grade 10

## Session 1, Short-Answer Questions

You may want to use the following grid to help you answer question 14.

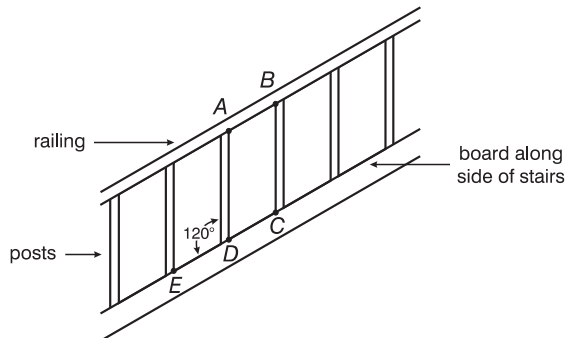


14. What are the coordinates of the midpoint of a line segment with endpoints  $(-3,-1)$  and  $(5,3)$ ?

Correct Answer: (1,1)

Reporting Category/Substrand for Item 14: **Geometry and Measurement/Geometry from an Algebraic Perspective (p. 173)**

Use the figure below to answer question 15.



15. Ms. Barnes is building a railing for her stairs. The board along the side of the stairs, the railing, and the posts form parallelograms. If  $\angle EDA$  shown in the figure measures  $120^\circ$ , what is the measure of  $\angle ABC$ ?

Correct Answer:  $60^\circ$

Reporting Category/Substrand for Item 15: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)**



### Session 1, Open-Response Question

16. A 15-player tournament consists of a series of matches between two contestants. A contestant is eliminated after losing one match. When there is an odd number of players, one player is **not** paired with a partner and automatically advances to the next round as though he/she had won a match.
- Draw a diagram to show how the tournament could be set up.
  - What is the smallest number of two-contestant matches that the winner must play in order to become the champion?
  - What is the **total** number of matches that must be played in the tournament to determine a winner?
  - Suppose 63 people entered a similar tournament. What is the total number of matches that must be played in the tournament to determine a winner?

*Reporting Category/Substrand for Item 16: **Statistics and Probability/Probability** (p. 174)*

# Mathematics, Grade 10

## Session 2, Multiple-Choice Questions

Use the table on the right to answer question 17.

$x$	2	6	8	12	14
$y$	3	27	39	63	75

17. Which equation shows the relationship between  $x$  and  $y$  in the table?

- A.  $y = 9x - 6$
- ✓ B.  $y = 6x - 9$
- C.  $y = -6x - 9$
- D.  $y = -9x + 6$

Reporting Category/Substrand for Item 17: **Patterns, Relations, and Functions/Functions (p. 172)**

18. The identity element for the operation of addition is 0 since  $0 + x = x$  and  $x + 0 = x$  for any real number  $x$ . The operation  $\otimes$  is defined by the following table.

$\otimes$	a	b	c	d
a	d	c	b	a
b	c	d	a	b
c	b	a	d	c
d	a	b	c	d

What is the identity element for the operation  $\otimes$ ?

- A. a
- B. b
- C. c
- ✓ D. d

Reporting Category/Substrand for Item 18: **Number Sense/Discrete Mathematics (p. 171)**

## Mathematics, Grade 10

Use the picture of the cards to answer question 19.



19. Each of the letters **M**, **A**, **T**, and **H** appear on the reverse side of one of the four cards on the right (one letter per card), but not necessarily in that order. If the cards are turned over, what is the probability that they will be ordered so that they spell the word **MATH**?

- A.  $\frac{1}{4}$
- B.  $\frac{1}{12}$
- ✓ C.  $\frac{1}{24}$
- D.  $\frac{1}{48}$

Reporting Category/Substrand for Item 19: **Statistics and Probability/Probability (p. 174)**

20. Which of the following is an irrational number?

- A.  $\frac{1}{3}$
- B.  $0.\overline{304}$
- C.  $\sqrt{0.9216}$
- ✓ D.  $\frac{\pi}{10}$

Reporting Category/Substrand for Item 20: **Number Sense/Discrete Mathematics (p. 171)**

## Mathematics, Grade 10

### Session 2, Open-Response Questions

21. An automobile is purchased for \$18,000. Its value decreases each year according to the following schedule:
- The car's value decreases by 30% in the first year.
  - After the first year, its value decreases by 20% each year.
- a. What is the value of this car at the end of one year? Explain or show how you found your answer.
- b. During which year will the car's value decrease to less than half its original price? Explain or show how you found your answer.
- c. Suppose the value of another car, which also costs \$18,000, decreases at the rate of 25% each year. Which car would have the greater value 3 years after it was purchased? Explain or show how you found your answer.

*Reporting Category/Substrand for Item 21: **Number Sense/Mathematical Structure** (p. 171)*

22. The power,  $P$ , generated in an hour by the windmill on Jones's farm is proportional to the cube of the wind speed,  $V$ , as shown by the formula

$$P = 0.015V^3$$

where  $P$  is measured in watts and  $V$  is measured in miles per hour.

- a. Calculate the amount of power that the Jones's windmill would generate in an hour with a steady wind of 8 mph.
- b. What wind speed is needed for the windmill to produce 120 watts of power in an hour? Explain or show how you found your answer.
- c. Matt says that if the wind blew at 4 mph for one hour and then 12 mph for another hour the amount of power generated by the windmill would be the same as the amount generated by an 8 mph wind in two hours. Laurel disagrees. Who is correct? Justify your answer mathematically.

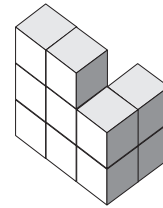
*Reporting Category/Substrand for Item 22: **Patterns, Relations, and Functions/Functions** (p. 172)*

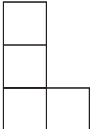
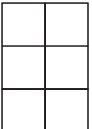
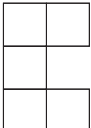
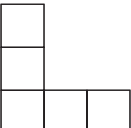
# Mathematics, Grade 10

## Session 3, Multiple-Choice Questions

Use the figure on the right to answer question 23.

23. Which diagram could **not** possibly show how the figure looks when it is viewed directly from above?



- A.       B. 
- C.       ✓ D. 

Reporting Category/Substrand for Item 23: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)**

24. Which of the following is true for all possible values of  $x$ ?

- A.  $3(x + 1) = 3x + 1$
- ✓ B.  $2(x + 3) = 2x + 6$
- C.  $4(2x + 1) = 6x + 5$
- D.  $5(3x - 2) = 15x - 7$

Reporting Category/Substrand for Item 24: **Patterns, Relations, and Functions/Algebra (p. 172)**

25. The following table shows the total number of line segments that can be drawn connecting two points in a set of coplanar, noncollinear points.

Number of Points	3	4	5	6	...	10	11
Number of Line Segments	3	6	10	15	...	45	?

How many line segments can be drawn connecting two points in a set of 11 noncollinear points?

- ✓ A. 55
- B. 50
- C. 48
- D. 110

Reporting Category/Substrand for Item 25: **Number Sense/Estimation (p. 172)**

## Mathematics, Grade 10

26. Four hundred deer were captured in Milltown Forest, tagged, and released back into the forest. Several weeks later, a forest ranger captured a number of deer at a random location in Milltown Forest, recorded the number of tagged and nontagged deer, and released the deer back into the forest. She did this over two trials as shown below.

Record of Deer Captured in Milltown Forest

	Total of Deer	Tagged	Nontagged
Trial 1	65	10	55
Trial 2	75	15	60

Approximately how many deer could you expect to find in the entire forest?

- A. 2,600
- B. 1,600
- ✓ C. 2,300
- D. 1,000

Reporting Category/Substrand for Item 26: **Statistics and Probability/Statistics (p. 174)**

Use the matrix equation on the right to answer question 27.

27. The matrix equation represents which system of equations?

$$\begin{bmatrix} 1 & -3 \\ 3 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 12 \\ 18 \end{bmatrix}$$

- ✓ A.  $x - 3y = 12$   
 $3x + y = 18$
- B.  $x + 3y = 12$   
 $-3x + y = 18$
- C.  $1 - 3x = 12$   
 $3 + y = 18$
- D.  $-3x = 12$   
 $3y = 18$

Reporting Category/Substrand for Item 27: **Number Sense/Discrete Mathematics (p. 171)**

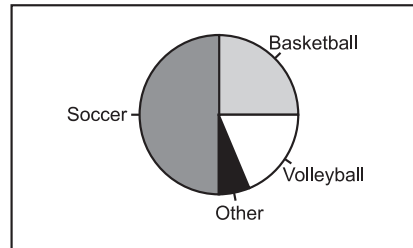
## Mathematics, Grade 10

Use the graph that shows the results of a survey to answer question 28.

28. Based on the graph, which is the best estimate of the percent of the students choosing volleyball?

- A. 10%
- B. 30%
- ✓ C. 20%
- D. 80%

**Students' Choices for Gym**



Reporting Category/Substrand for Item 28: **Number Sense/Mathematical Structure (p. 171)**

29. An article is on sale for 20% off its original price. What percent of increase is needed to return the sale item to its original price?

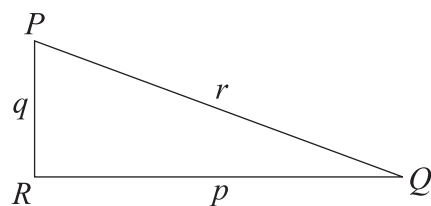
- A. 50%
- ✓ B. 25%
- C. 20%
- D. 75%

Reporting Category/Substrand for Item 29: **Number Sense/Mathematical Structure (p. 171)**

Use the triangle to answer question 30.

30. Triangle  $PQR$  is a scalene right triangle. Which of the following is correct?

- A.  $\cos P = \frac{r}{p}$
- B.  $\sin Q = \frac{q}{p}$
- C.  $\cos P = \frac{p}{r}$
- ✓ D.  $\tan Q = \frac{q}{p}$



Reporting Category/Substrand for Item 30: **Patterns, Relations, and Functions/Trigonometry (p. 172)**

## Mathematics, Grade 10

31. The same six students rated two science fiction movies on a scale of 1 to 10. The results are shown in the table on the right.

STUDENT	MOVIE 1 RATING	MOVIE 2 RATING
A	3	6
B	5	7
C	6	6
D	7	6
E	8	5
F	8	7

The ratings for the two movies have the same

- A. median.
- ✓ B. mean.
- C. mode.
- D. range.

*Reporting Category/Substrand for Item 31: **Statistics and Probability/Statistics (p. 174)***

32. If 4 notebooks and 3 packages of pens cost \$7.43 and 5 notebooks and 2 packages of pens cost \$7.03, what is the cost of 1 notebook?

- ✓ A. \$0.89
- B. \$0.79
- C. \$1.29
- D. \$1.09

*Reporting Category/Substrand for Item 32: **Patterns, Relations, and Functions/Algebra (p. 172)***

33. According to the 1990 U.S. Census, 27.2% of Massachusetts residents over the age of 25 had graduated from a 4-year college. In a circle graph representing all Massachusetts residents over the age of 25, about how many degrees should be in the sector representing these 4-year college graduates?

- A.  $27^\circ$
- B.  $17^\circ$
- ✓ C.  $98^\circ$
- D.  $68^\circ$

*Reporting Category/Substrand for Item 33: **Statistics and Probability/Statistics (p. 174)***



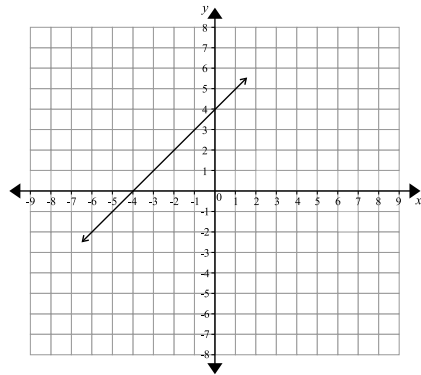
## Mathematics, Grade 10

34. In Jackson High School, 28% of all students play a musical instrument, and 75% of those students are in the marching band. What percent of all students in the school are in the marching band?
- A. 103%
  - ✓ B. 21%
  - C. 47%
  - D. 3%

Reporting Category/Substrand for Item 34: **Statistics and Probability/Statistics (p. 174)**

Use the graph to answer question 35.

35. Which of the following equations is represented by the graph on the right?
- A.  $y - x = -4$
  - B.  $x + y = 4$
  - ✓ C.  $y - x = 4$
  - D.  $x + y = -4$



Reporting Category/Substrand for Item 35: **Patterns, Relations, and Functions/Algebra (p. 172)**

## Mathematics, Grade 10

Use the information in the box below to answer question 36.

**SALE** Roger's Lumberyard

**Landscaping Timbers**

5-foot timber **\$6.00 ea.**  
8-foot timber **\$9.00 ea.**

Sale starts next Saturday at 9 A.M.

Roger's Lumberyard  
375 Oakwood Rd.  
Woodpark, MA 00110

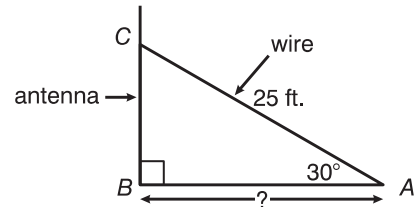
36. Misha and his sister are using 5-foot and 8-foot landscaping timbers to enclose a vegetable garden. They bought 40 timbers. The total cost for the timbers was \$288. Which pair of equations could be used to find the number of timbers of each size that they bought?
- A.  $6x + 9y = 40$  and  $x + y = 288$
  - B.  $x + y = 40$  and  $5x + 8y = 288$
  - C.  $5x + 8y = 40$  and  $6x + 9y = 288$
  - ✓ D.  $x + y = 40$  and  $6x + 9y = 288$

Reporting Category/Substrand for Item 36: **Patterns, Relations, and Functions/Algebra (p. 172)**

## Mathematics, Grade 10

37. A 25-foot wire attached to an antenna makes a  $30^\circ$  angle with the level ground, as shown on the right.

What is the approximate distance from the base of the antenna to the place where the wire is staked to the ground?



- ✓ A. 22 ft.  
B. 18 ft.  
C. 13 ft.  
D. 28 ft.

*Reporting Category/Substrand for Item 37: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)***

38. Six candidates are running for two open school board seats. How many different pairs of candidates can be elected?

- ✓ A. 15  
B. 12  
C. 11  
D. 30

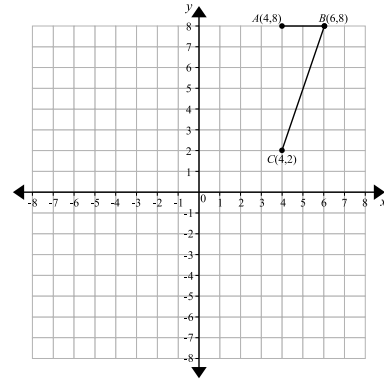
*Reporting Category/Substrand for Item 38: **Statistics and Probability/Probability (p. 174)***

## Mathematics, Grade 10

Use the diagram to answer question 39.

39. Suppose that the figure  $ABC$  is reflected over the  $y$ -axis. What are the coordinates of the image of point  $A$ ?

- A.  $(4,-8)$
- ✓ B.  $(-4,8)$
- C.  $(-8,4)$
- D.  $(8,-4)$



Reporting Category/Substrand for Item 39: **Geometry and Measurement/Geometry from an Algebraic Perspective (p. 173)**

40. Triangles  $ABC$  and  $DEF$  are similar. The lengths of the sides of  $\triangle DEF$  are 3 times the lengths of the corresponding sides of  $\triangle ABC$ . How do the areas of the triangles compare?
- A. The area of  $\triangle DEF$  is 3 times the area of  $\triangle ABC$ .
  - B. The area of  $\triangle DEF$  is 4 times the area of  $\triangle ABC$ .
  - C. The area of  $\triangle DEF$  is 6 times the area of  $\triangle ABC$ .
  - ✓ D. The area of  $\triangle DEF$  is 9 times the area of  $\triangle ABC$ .

Reporting Category/Substrand for Item 40: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)**

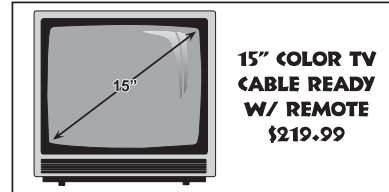
## Mathematics, Grade 10

### Session 3, Open-Response Questions

Use the graphic to answer question 41.

41. The size of a television screen is measured by the diagonal distance across the screen.

- A 15" diagonal screen has a horizontal width of 12". What is the vertical height of the screen? Show or explain how you found your answer.
- A 50" diagonal screen is to have its dimensions proportional to those of the screen in part a. What are its width and height? Show or explain how you found your answers.
- Suppose that the ratio of a television's width to its height was 3 to 2. What would be the dimensions of a 17" diagonal screen? Show or explain how you found your answer.



*Reporting Category/Substrand for Item 41: **Geometry and Measurement/Geometry and Spatial Sense (p. 173)***

42. The Main Street Cinema is planning to add a coffee bar. The owners estimate that the fixed monthly expenses will be \$2,700. Additionally, each cup of coffee will cost \$0.25 to make and will be sold for \$0.95. The owners estimate that they will sell 3,000 cups of coffee each month.

- What would be their monthly profit or loss on selling coffee? Explain or show how you found your answer.
- What price per cup would they have to charge to break even (neither a profit nor a loss)? Explain or show how you found your answer.
- The owners need a formula to calculate monthly profit or loss. Using the variables listed below, write a formula to determine their monthly profit or loss.
  - Fixed monthly expenses:  $F$
  - Cost to make each cup:  $C$
  - Selling price of each cup:  $S$
  - Number of cups sold in a month:  $N$
  - Monthly profit or loss:  $P$

*Reporting Category/Substrand for Item 42: **Patterns, Relations, and Functions/Algebra (p. 172)***