New England Common Assessment Program

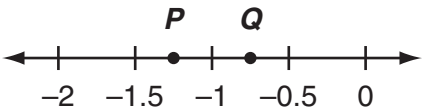
Released Items
2009

Grade 11
Mathematics

Mathematics

Items with this symbol were selected from Session One—no calculators or other mathematics tools allowed.

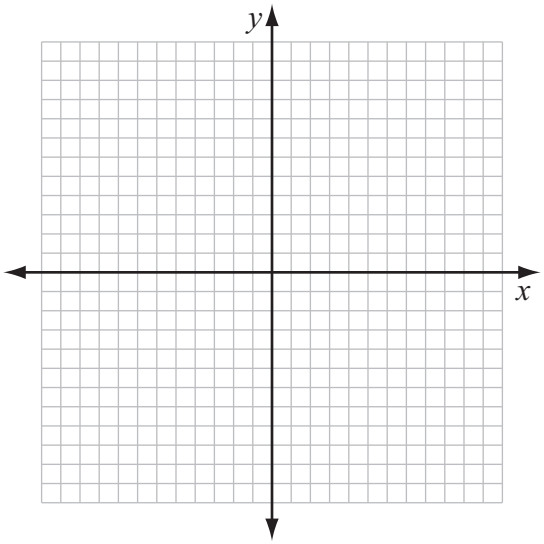
1 Look at this number line.



Between which two consecutive integers is the value of $\frac{Q}{P}$?

A. –2 and –1
B. –1 and 0
C. 0 and 1
D. 1 and 2

2 You may use this blank grid to help you answer this question.



This list shows the coordinates of ΔRST and its image $\Delta R'S'T'$.

- R (–4, 6), S (–4, 9), T (–9, 6)
- R' (2, 6), S' (2, 9), T' (7, 6)

Which transformation maps ΔRST to $\Delta R'S'T'$?

A. a reflection over the line $x = -1$
B. a reflection over the line $y = -1$
C. a 90° clockwise rotation about the origin
D. a 180° clockwise rotation about the origin

3 Courtney walks three laps around a $\frac{1}{4}$-mile track. How many feet does she walk?

[1 mi = 5280 ft]

A. 440 ft
B. 1320 ft
C. 3960 ft
D. 7040 ft

4 Andrea draws $\overline{PQ}$ with endpoints $P(4, -3)$ and $Q(2, 6)$. She then draws $\overline{PR}$ so that it is perpendicular to $\overline{PQ}$. What is the slope of $\overline{PR}$?

A. $-\frac{9}{2}$

B. $-\frac{2}{9}$

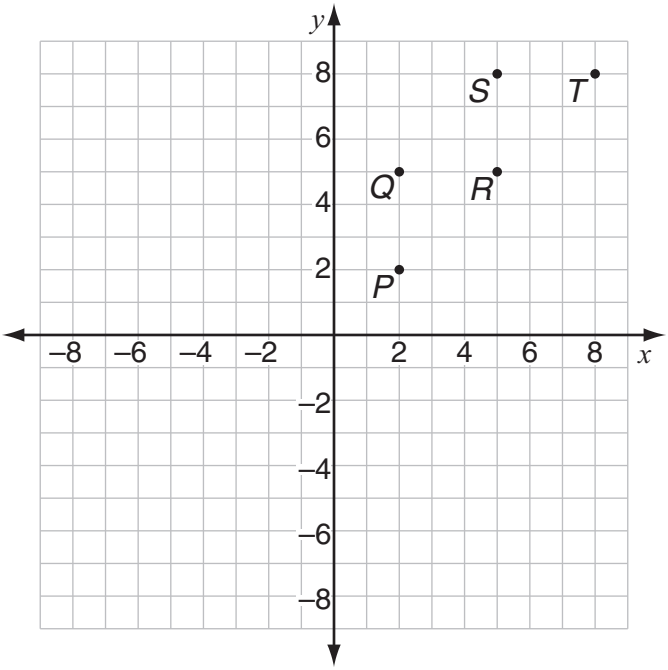
C. $\frac{2}{9}$

D. $\frac{9}{2}$

5 The diameter of circle P is $\overline{RT}$. The center of the circle, P, has coordinates $(-4, 1)$. The coordinates of point R are $(2, -3)$. What are the coordinates of point T?

A. $(-12, 8)$
B. $(-10, 5)$
C. $(-6, 4)$
D. $(-1, -1)$

6 Look at this graph of a relation.



Which two points could be removed to make this relation a function?

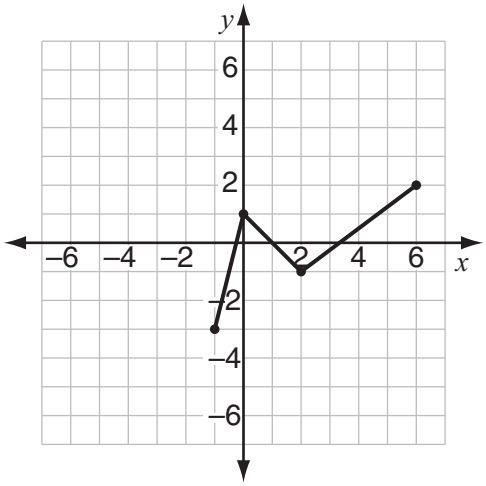
A. points P and Q
B. points Q and R
C. points Q and T
D. points R and S

7 Bert graphs a function.

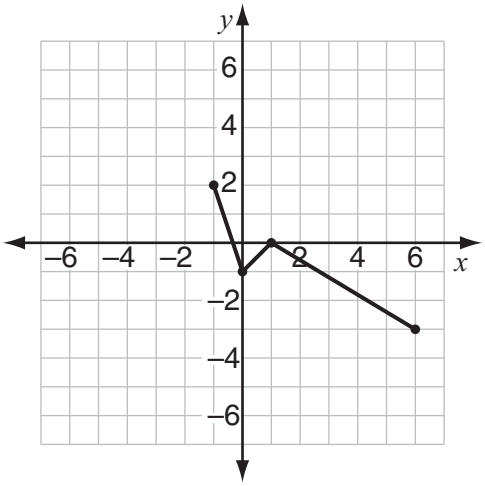
- The domain of the function is $-3 \le x \le 2$.
- The range of the function is $-1 \le y \le 6$.
- The y-intercept of the function is 1.

Which graph could represent Bert's function?

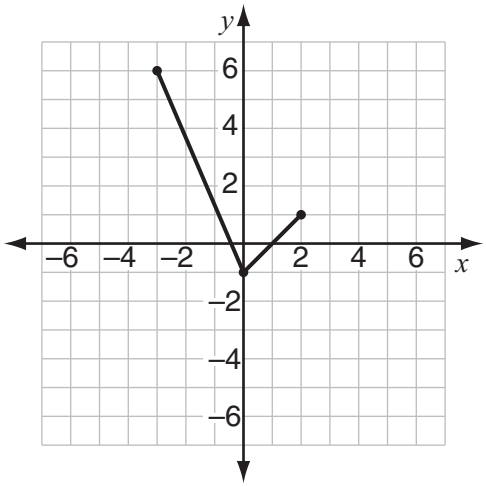
A.



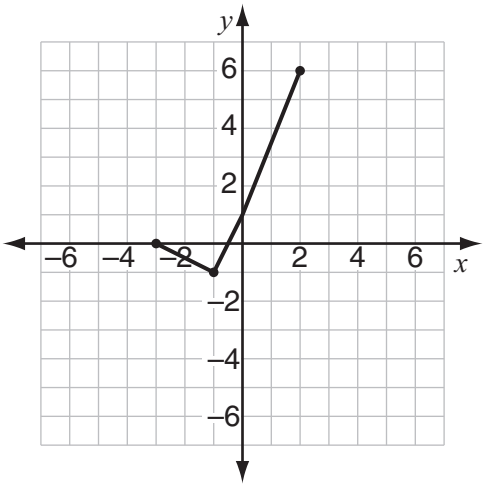
B.



C.



D.



8 Which expression is equivalent to $2x(x^2 + 9) - 2x$?

A. $x^2 + 9$

B. $2x^3 + 16x$

C. $3x^2 - 2x + 9$

D. $2x^3 - 2x + 9$

9 If x is an integer, which expression must be divisible by 3?

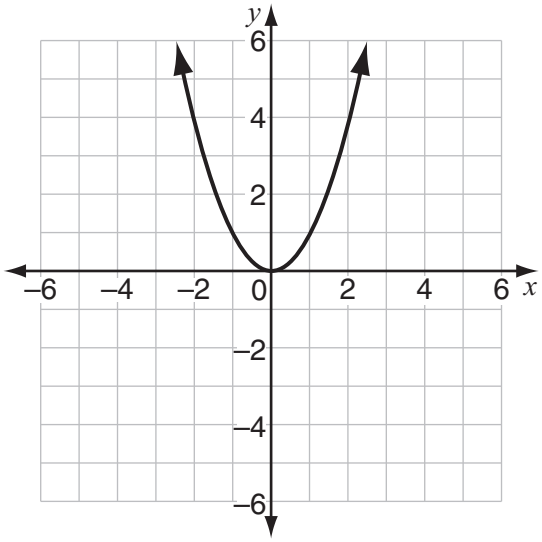
A. $3x + 1$

B. $4x - 1$

C. $8x + 6$

D. $12x - 9$

10 Look at this graph of $y = x^2$.



If $y = x - 2$ is graphed on the same coordinate plane, at how many points would the two graphs intersect?

A. 0

B. 1

C. 2

D. 3

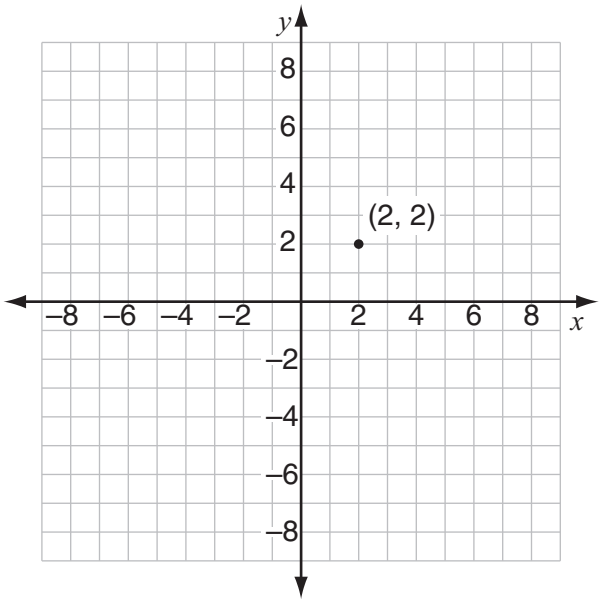
11 Look at this system of equations.

$$2y + 12 = 8x$$

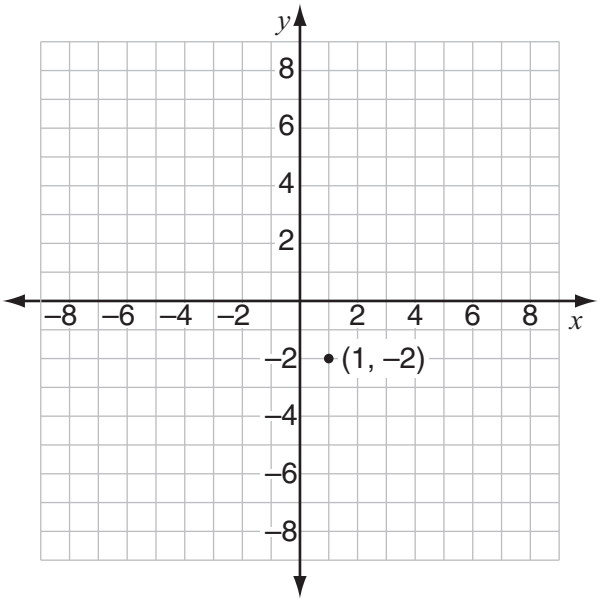
$$12x - 3y = 18$$

Which graph shows the solution set of the system of equations?

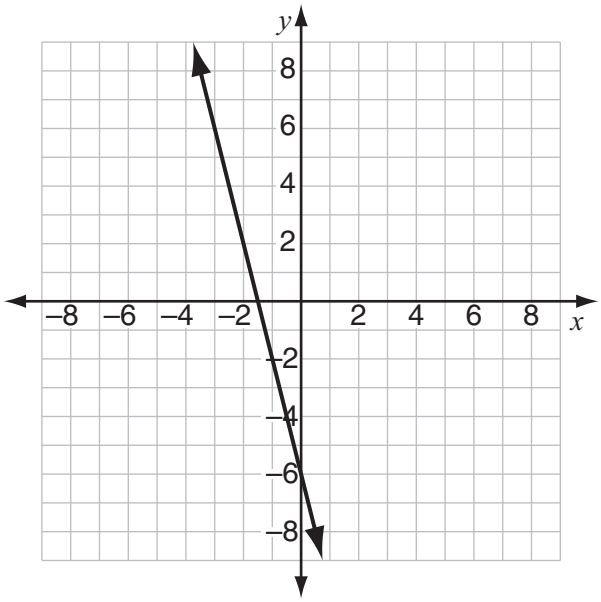
A.



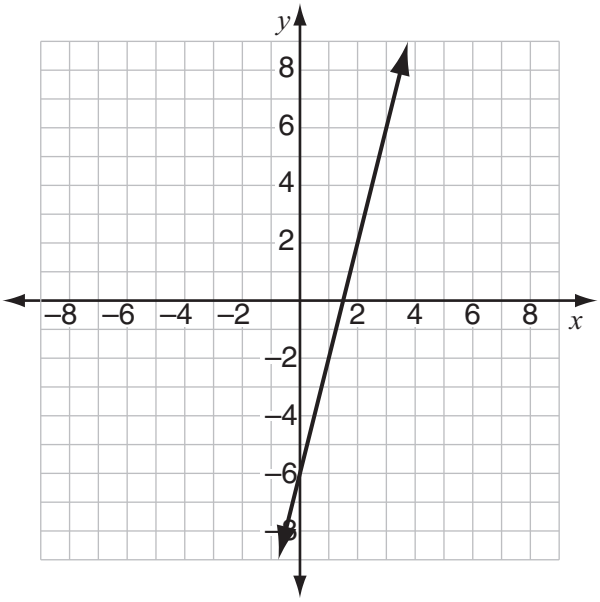
B.



C.



D.



12 Luigi will roll two cubes with faces numbered 1 through 6.

- Each face of each cube has one number on it.
- No number repeats on a cube.

Luigi records the product of the numbers that land face up. What is the probability that the product of the two numbers will be an odd number **less than** 20?

A. $\frac{2}{9}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

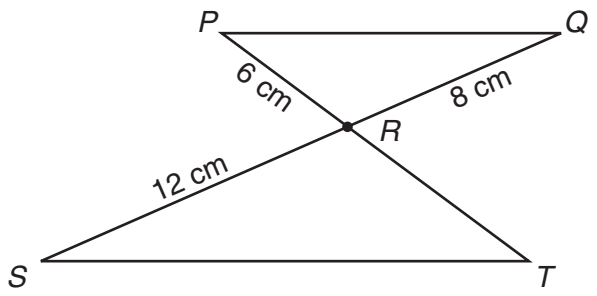
D. $\frac{8}{9}$

13 This list shows the values of x, y, and z.

- $x = 4.03 \bullet 10^{-9}$
- $y = 5.12 \bullet 10^{-8}$
- $z = xy$

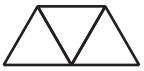
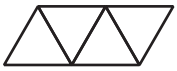
Write an inequality that orders x, y, and z from **least to greatest**.

14 Look at this diagram.



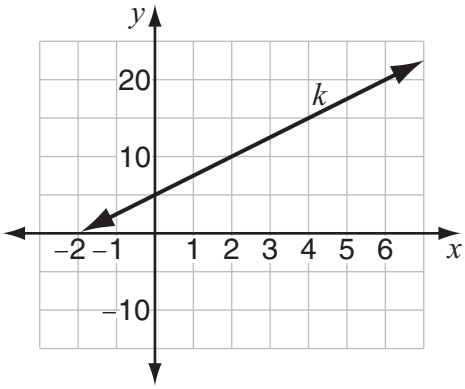
In this diagram, $\overline{PQ}$ is parallel to $\overline{ST}$. What is the length, in centimeters, of $\overline{RT}$?

15 A pattern of triangles is shown below.

Step 1	Step 2	Step 3	Step 4
			
3 line segments	5 line segments	7 line segments	9 line segments

If this pattern continues, how many line segments will be in Step k? Write your answer in terms of k.

16 Look at this graph.

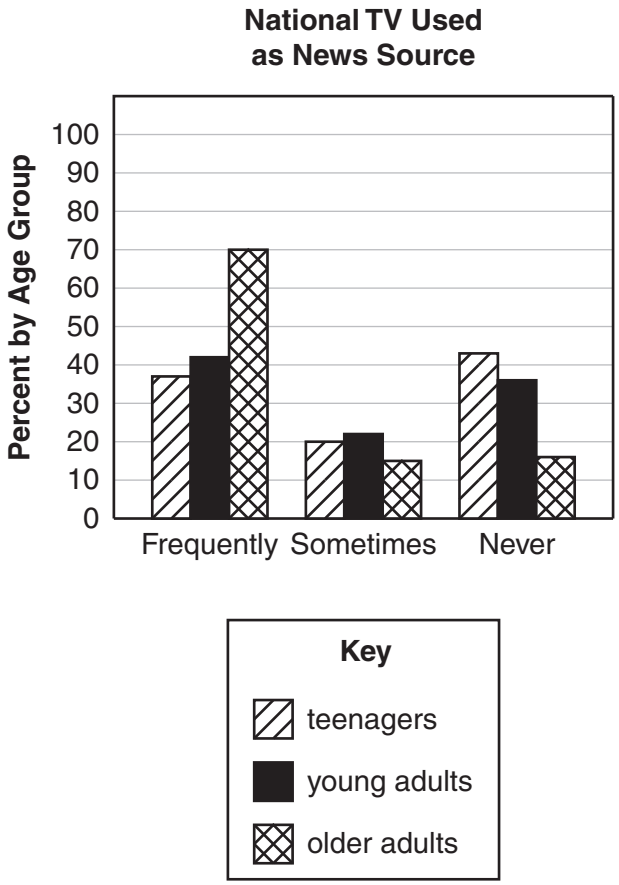


What is the slope of line *k*?

17 This parabola shows the relationship between the amount of money a baker earns from bread sales each day and the price the baker charges for each loaf of bread.

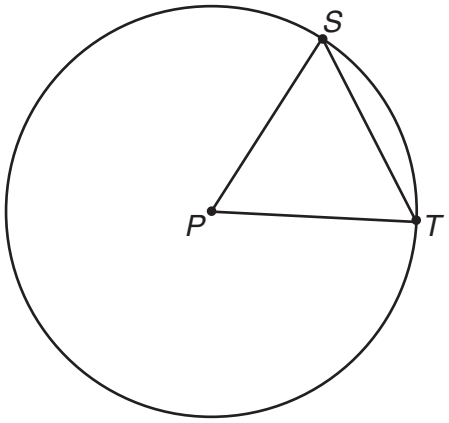
Based on the parabola, what price should the baker charge for each loaf of bread to earn the greatest amount of money from bread sales each day?

18 This graph shows the results of a study about how much people of different ages use national TV as a source of news.



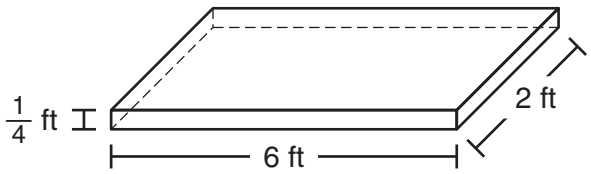
What percent of the teenagers surveyed make **at least** some use of national TV for news?

19 Look at this diagram.



The center of the circle is point P. The measure of $\angle SPT$ is 60°. Use geometric reasoning to explain why $\overline{ST}$ is congruent to $\overline{PT}$.

20 A board foot is a piece of wood 1 foot wide, 1 foot long, and 1 **inch** thick. A lumberyard sells the pine board shown below for a price of $3.40 per board foot.



What is the total cost, in dollars, of the pine board? Show your work or explain how you know.

21 Coach Murphy records the weight of each person who tries out for the football team and the number of push-ups each person completes in one minute. This table shows the data.

Weight (in lb)	Number of Push-ups	Weight (in lb)	Number of Push-ups
221	27	143	18
175	25	150	21
180	36	153	12
202	19	165	30
173	37	171	14
184	33	188	20
199	22	207	16
209	20	210	35
159	31	225	18
232	26	236	12
280	30	187	39

Coach Murphy wants to display these data using a bar graph, a line graph, or a scatter plot. Use mathematical reasoning to explain which of these data displays is most appropriate for Coach Murphy to use.

22 A coach will order baseball caps from one of two companies.

- Creative Caps charges a one-time fee of $50, plus $5 per baseball cap.
- Happy Hats charges a one-time fee of $30, plus $6 per baseball cap.

a. How much does Creative Caps charge for an order of 15 baseball caps?

b. Write an algebraic expression to represent the amount that Creative Caps charges for an order of x baseball caps.

c. The coach wants to buy baseball caps from the least expensive company. In terms of the number of baseball caps, when should the coach order the baseball caps from Creative Caps? Show your work or explain how you know.

23 Greg wants to buy a computer chess game with a regular price of $40. A hobby shop sells the computer chess game at a discounted price of 30% off the regular price.

a. What is the discounted price, in dollars, of the computer chess game at the hobby shop?

A department store sells the same computer chess game at a discounted price of 20% off the regular price of $40. On Saturday, the department store will take an additional 10% off the already discounted price of this computer chess game.

b. Explain whether it is less expensive for Greg to buy the computer chess game at the hobby shop or at the department store on Saturday.

On Saturday, Greg buys a computer baseball game at the department store. The department store sells the computer baseball game at a discounted price of 20% off the regular price. The store takes an additional 10% off the already discounted price. After both discounts, Greg pays $18 for the game.

c. What is the regular price of the computer baseball game? Show your work or explain how you know.

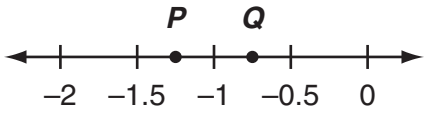
New England Common Assessment Program

Released Items Support Materials 2009

Grade 11 Mathematics

N&O 10.2 Demonstrates understanding of the relative magnitude of real numbers by solving problems involving ordering or comparing rational numbers, common irrational numbers (e.g., $\sqrt{2}$, π), rational bases with integer exponents, square roots, absolute values, integers, or numbers represented in scientific notation using number lines or equality and inequality symbols.

1 Look at this number line.



Between which two consecutive integers is the value of $\frac{Q}{P}$?

A. –2 and –1

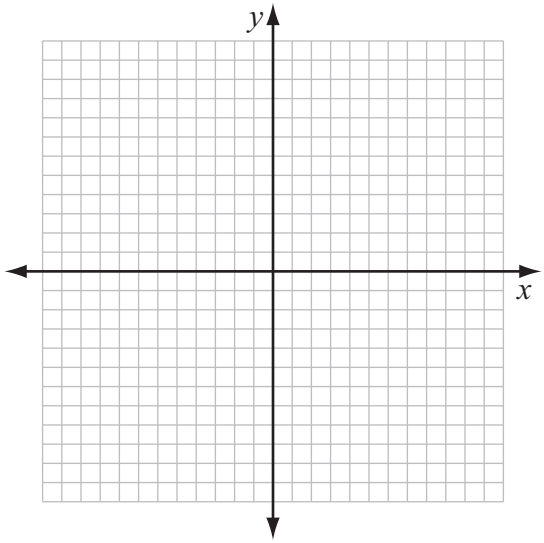
B. –1 and 0

C. 0 and 1

D. 1 and 2

G&M 10.4 Applies the concepts of congruency by solving problems on or off a coordinate plane involving reflections, translations, or rotations; or solves problems using congruency involving problems within mathematics or across disciplines or contexts.

2 You may use this blank grid to help you answer this question.



This list shows the coordinates of ΔRST and its image $\Delta R'S'T'$.

- R (−4, 6), S (−4, 9), T (−9, 6)
- R' (2, 6), S' (2, 9), T' (7, 6)

Which transformation maps ΔRST to $\Delta R'S'T'$?

A. a reflection over the line $x = -1$

B. a reflection over the line $y = -1$

C. a 90° clockwise rotation about the origin

D. a 180° clockwise rotation about the origin

G&M 10.7 Uses units of measure appropriately and consistently when solving problems across content strands; makes conversions within or across systems and makes decisions concerning an appropriate degree of accuracy in problem situations involving measurement in other GRs.

3 Courtney walks three laps around a $\frac{1}{4}$-mile track. How many feet does she walk?

[1 mi = 5280 ft]

A. 440 ft
B. 1320 ft
C. 3960 ft
D. 7040 ft

G&M 10.9 Solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines, or slope.

4 Andrea draws $\overline{PQ}$ with endpoints $P(4, -3)$ and $Q(2, 6)$. She then draws $\overline{PR}$ so that it is perpendicular to $\overline{PQ}$. What is the slope of $\overline{PR}$?

A. $-\frac{9}{2}$

B. $-\frac{2}{9}$

C. $\frac{2}{9}$

D. $\frac{9}{2}$

G&M 10.9 Solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines, or slope.

5 The diameter of circle P is $\overline{RT}$. The center of the circle, P, has coordinates (–4, 1). The coordinates of point R are (2, –3). What are the coordinates of point T?

A. (–12, 8)

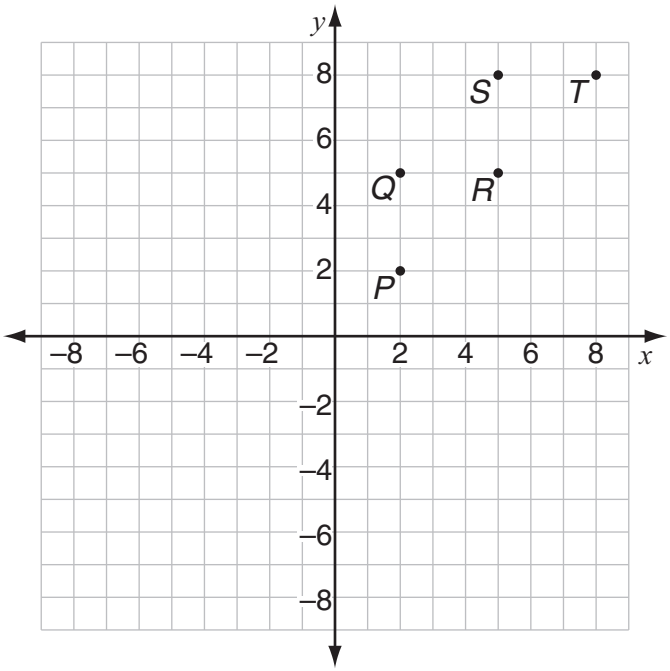
B. (–10, 5)

C. (–6, 4)

D. (–1, –1)

F&A 10.2 Demonstrates conceptual understanding of linear and nonlinear functions and relations (including characteristics of classes of functions) through an analysis of constant, variable, or average rates of change, intercepts, domain, range, maximum and minimum values, increasing and decreasing intervals and rates of change (e.g., the height is increasing at a decreasing rate); describes how change in the value of one variable relates to change in the value of a second variable; or works between and among different representations of functions and relations (e.g., graphs, tables, equations, function notation).

6 Look at this graph of a relation.



Which two points could be removed to make this relation a function?

A. points P and Q
B. points Q and R
C. points Q and T
D. points R and S

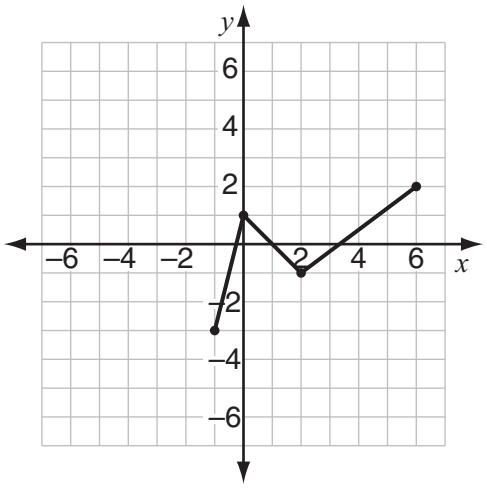
F&A 10.2 Demonstrates conceptual understanding of linear and nonlinear functions and relations (including characteristics of classes of functions) through an analysis of constant, variable, or average rates of change, intercepts, domain, range, maximum and minimum values, increasing and decreasing intervals and rates of change (e.g., the height is increasing at a decreasing rate); describes how change in the value of one variable relates to change in the value of a second variable; or works between and among different representations of functions and relations (e.g., graphs, tables, equations, function notation).

7 Bert graphs a function.

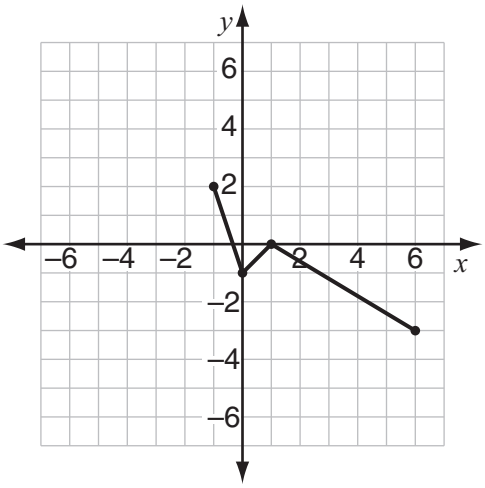
- The domain of the function is $-3 \leq x \leq 2$.
- The range of the function is $-1 \leq y \leq 6$.
- The y-intercept of the function is 1.

Which graph could represent Bert's function?

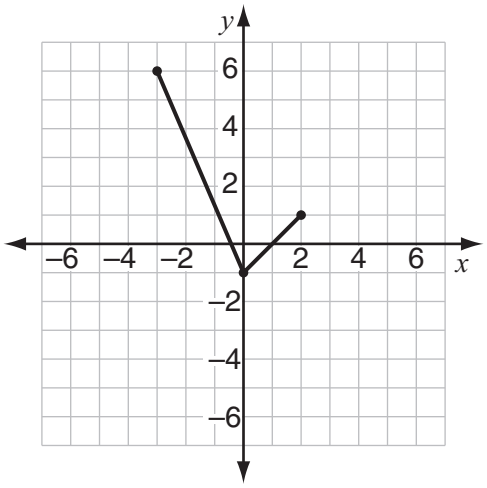
A.



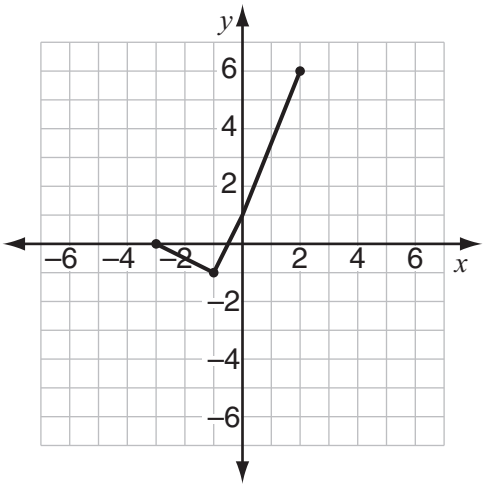
B.



C.



D.



F&A 10.3 **Demonstrates conceptual understanding of algebraic expressions** by solving problems involving algebraic expressions, by simplifying expressions (e.g., simplifying polynomial or rational expressions, or expressions involving integer exponents, square roots, or absolute values), by evaluating expressions, or by translating problem situations into algebraic expressions.

8 Which expression is equivalent to $2x(x^2 + 9) - 2x$?

A. $x^2 + 9$

B. $2x^3 + 16x$

C. $3x^2 - 2x + 9$

D. $2x^3 - 2x + 9$

F&A 10.3 **Demonstrates conceptual understanding of algebraic expressions** by solving problems involving algebraic expressions, by simplifying expressions (e.g., simplifying polynomial or rational expressions, or expressions involving integer exponents, square roots, or absolute values), by evaluating expressions, or by translating problem situations into algebraic expressions.

9 If x is an integer, which expression must be divisible by 3?

A. $3x + 1$

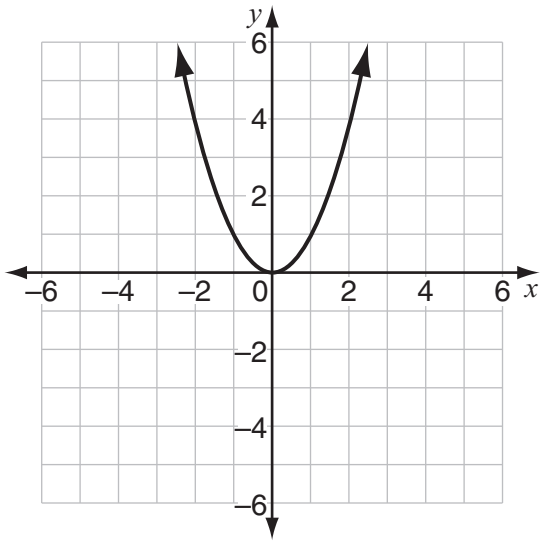
B. $4x - 1$

C. $8x + 6$

D. $12x - 9$

F&A 10.4 **Demonstrates conceptual understanding of equality** by solving problems involving algebraic reasoning about equality; by translating problem situations into equations; by solving linear equations (symbolically and graphically) and expressing the solution set symbolically or graphically, or provides the meaning of the graphical interpretations of solution(s) in problem-solving situations; or by solving problems involving systems of linear equations in a context (using equations or graphs) or using models or representations.

10 Look at this graph of $y = x^2$.



If $y = x - 2$ is graphed on the same coordinate plane, at how many points would the two graphs intersect?

A. 0

B. 1

C. 2

D. 3

F&A 10.4 **Demonstrates conceptual understanding of equality** by solving problems involving algebraic reasoning about equality; by translating problem situations into equations; by solving linear equations (symbolically and graphically) and expressing the solution set symbolically or graphically, or provides the meaning of the graphical interpretations of solution(s) in problem-solving situations; or by solving problems involving systems of linear equations in a context (using equations or graphs) or using models or representations.

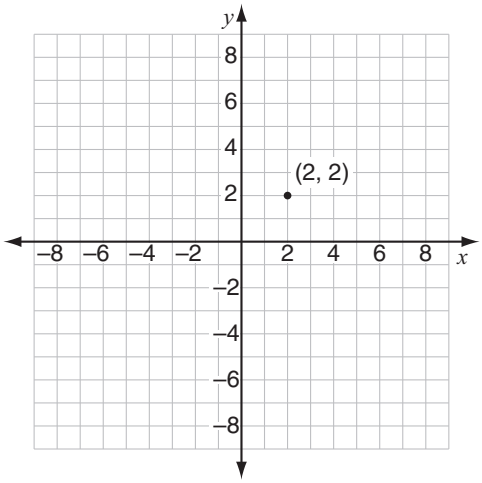
11 Look at this system of equations.

$$2y + 12 = 8x$$

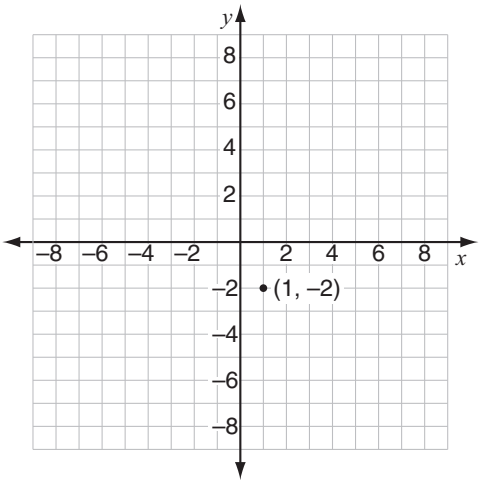
$$12x - 3y = 18$$

Which graph shows the solution set of the system of equations?

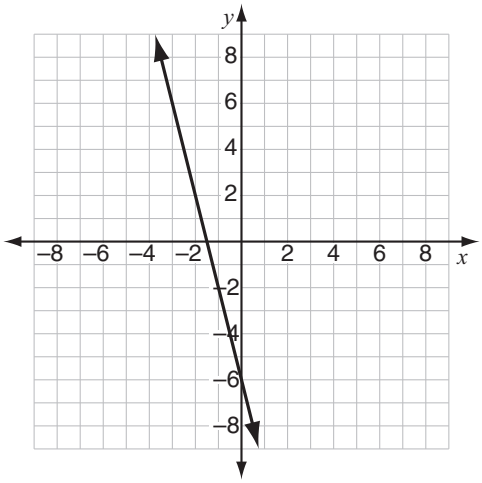
A.



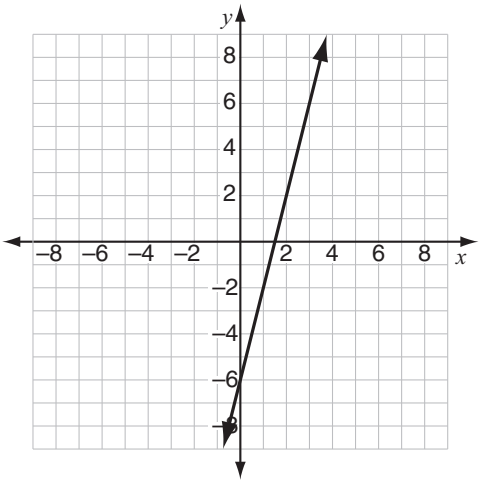
B.



C.



D.



DSP 10.5 Solves problems involving experimental or theoretical probability.

12 Luigi will roll two cubes with faces numbered 1 through 6.

- Each face of each cube has one number on it.
- No number repeats on a cube.

Luigi records the product of the numbers that land face up. What is the probability that the product of the two numbers will be an odd number **less than** 20?

A. $\frac{2}{9}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. $\frac{8}{9}$

N&O 10.2 Demonstrates understanding of the relative magnitude of real numbers by solving problems involving ordering or comparing rational numbers, common irrational numbers (e.g., $\sqrt{2}$, π), rational bases with integer exponents, square roots, absolute values, integers, or numbers represented in scientific notation using number lines or equality and inequality symbols.

13 This list shows the values of x, y, and z.

- $x = 4.03 \bullet 10^{-9}$
- $y = 5.12 \bullet 10^{-8}$
- $z = xy$

Write an inequality that orders x, y, and z from **least to greatest**.

Scoring Guide

Score	Description
1	For correct answer, $z < x < y$ **or equivalent**
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 1
(Example A)

13

$z < x < y$

The student's response is correct.

Score Point 0
(Example A)

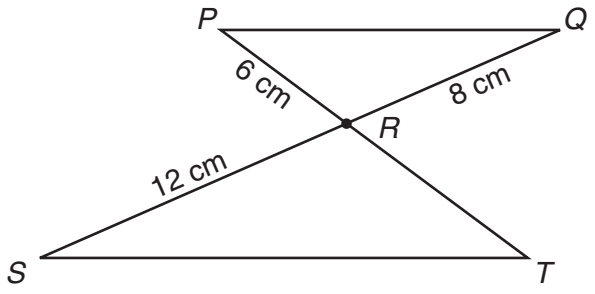
13

$z > x > y$

The student's response is incorrect.

G&M 10.5 Applies concepts of similarity by solving problems within mathematics or across disciplines or contexts.

14 Look at this diagram.



In this diagram, $\overline{PQ}$ is parallel to $\overline{ST}$. What is the length, in centimeters, of $\overline{RT}$?

Scoring Guide

Score	Description
1	For correct answer, **9** (cm)
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 1
(Example A)

14

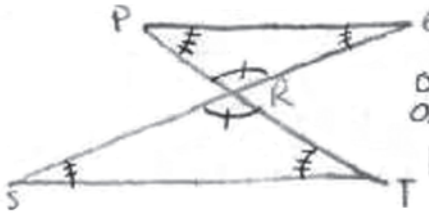
PR = 6
QR = 8
SR = 12

$\triangle RRQ \cong \triangle TRS$

$\frac{PR}{TR} = \frac{QR}{SR}$

$\frac{6}{x} = \frac{8}{12}$

$72 = 8x$
$9 = x$



$\overline{RT} = 9$

opposite Angle on transversal thru parallel lines are ≅

The student's response is correct. (Showing work is not required.)

Score Point 1
(Example B)

14

RT = 9

The student's response is correct.

Score Point 0
(Example A)

14

$\overline{PR} = 6$ $\overline{QR} = 8$

$\overline{SR} = 12$ $\overline{TR} = 14$

The student's response is incorrect.

Score Point 0
(Example B)

14

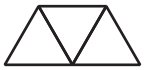
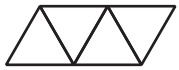
L=16

just double the numbers

The student's response is incorrect.

F&A 10.1 Identifies, extends, and generalizes a variety of patterns (linear and nonlinear) represented by models, tables, sequences, or graphs in problem solving situations.

15 A pattern of triangles is shown below.

Step 1	Step 2	Step 3	Step 4
			
3 line segments	5 line segments	7 line segments	9 line segments

If this pattern continues, how many line segments will be in Step k? Write your answer in terms of k.

Scoring Guide

Score	Description
1	For correct answer, **$2k + 1$ or equivalent**
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 1
(Example A)

15

$2k+1$

The student's response is correct.

Score Point 1
(Example B)

15

$3k-(k-1)$

The student's response is correct.

Score Point 0
(Example A)

15

Step K = previous line segment + 2

The student's response is not written in terms of *k*.

Score Point 0
(Example B)

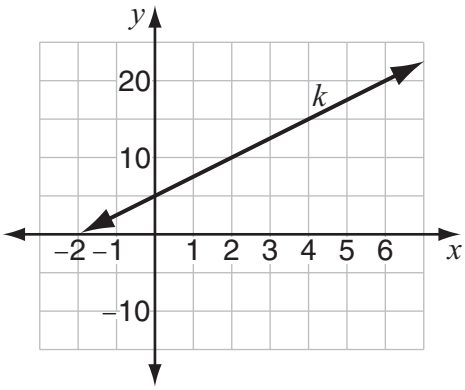
15

$k=(k-1)+2$

The student's response is incorrect.

F&A 10.2 Demonstrates conceptual understanding of linear and nonlinear functions and relations (including characteristics of classes of functions) through an analysis of constant, variable, or average rates of change, intercepts, domain, range, maximum and minimum values, increasing and decreasing intervals and rates of change (e.g., the height is increasing at a decreasing rate); describes how change in the value of one variable relates to change in the value of a second variable; or works between and among different representations of functions and relations (e.g., graphs, tables, equations, function notation).

16 Look at this graph.



What is the slope of line k?

Scoring Guide

Score	Description
1	For correct answer, $\frac{5}{2}$ **or equivalent**
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 1
(Example A)

16

$\frac{5}{2}$

The student's response is correct.

Score Point 1
(Example B)

16

(0,5)
up 10 over four
(4,15)

$\frac{10}{4}$

The student's response is correct. (Showing work is not required.)

Score Point 0
(Example A)

16

(4,15) (0,5)

$m = \frac{5-15}{0-4} = \frac{-10}{4} = \frac{-5}{2}$

The student's response is incorrect.

Score Point 0
(Example B)

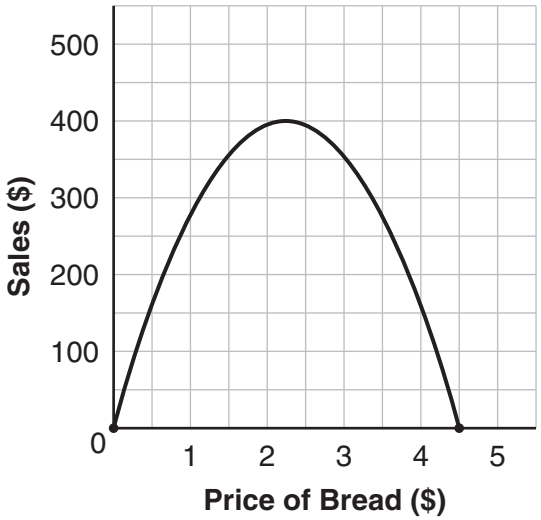
16

The slope of $\overline{KL}$ is 32°

The student's response is incorrect.

F&A 10.2 Demonstrates conceptual understanding of linear and nonlinear functions and relations (including characteristics of classes of functions) through an analysis of constant, variable, or average rates of change, intercepts, domain, range, maximum and minimum values, increasing and decreasing intervals and rates of change (e.g., the height is increasing at a decreasing rate); describes how change in the value of one variable relates to change in the value of a second variable; or works between and among different representations of functions and relations (e.g., graphs, tables, equations, function notation).

17 This parabola shows the relationship between the amount of money a baker earns from bread sales each day and the price the baker charges for each loaf of bread.



Based on the parabola, what price should the baker charge for each loaf of bread to earn the greatest amount of money from bread sales each day?

Scoring Guide

Score	Description
1	For correct answer, ($)**2.25 or equivalent**
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Score Point 1
(Example A)

17

$\frac{4.5}{2} = 2.25$

vertex=(2.25,400)

He should charge $2.25 for each loaf of bread.

The student's response is correct. (Explanation is not required.)

Score Point 0
(Example A)

17

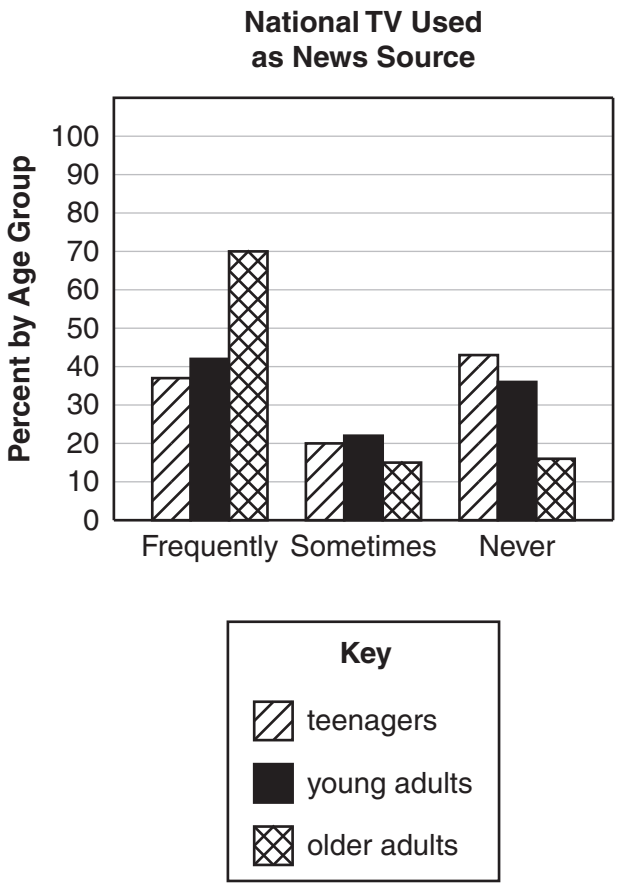
2.5 ÷ 2 = 1.25

$ 1.25

The student's response is incorrect.

DSP 10.1 **Interprets a given representation(s)** (e.g., box-and-whisker plots, scatter plots, bar graphs, line graphs, circle graphs, histograms, frequency charts) to make observations, to answer questions, to analyze the data to formulate or justify conclusions, critique conclusions, make predictions, or to solve problems within mathematics or across disciplines or contexts (e.g., media, workplace, social and environmental situations). (IMPORTANT: *Analyzes data consistent with concepts and skills in M(DSP)-10-2.*)

18 This graph shows the results of a study about how much people of different ages use national TV as a source of news.



What percent of the teenagers surveyed make **at least** some use of national TV for news?

Scoring Guide

Score	Description
1	For correct answer, **57** (%)
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Note: Accept answers greater than or equal to 55% but less than 60%.

Score Point 1
(Example A)

18 about 57% of the teenagers surveyed

The student's response is correct.

Score Point 1
(Example B)

18 56%

The student's response is correct.

Score Point 0
(Example A)

18 20%

The student's response is incorrect.

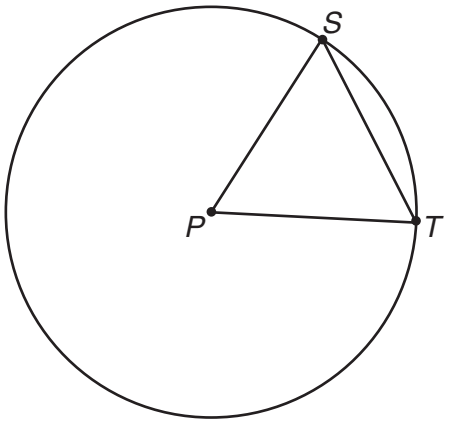
Score Point 0
(Example B)

18 ,58 %

The student's response is incorrect.

G&M 10.2 Makes and defends conjectures, constructs geometric arguments, uses geometric properties, or uses theorems to solve problems involving angles, lines, polygons, circles, or right triangle ratios (sine, cosine, tangent) within mathematics or across disciplines or contexts (e.g., Pythagorean Theorem, Triangle Inequality Theorem).

19 Look at this diagram.



The center of the circle is point P. The measure of $\angle SPT$ is 60°. Use geometric reasoning to explain why $\overline{ST}$ is congruent to $\overline{PT}$.

Scoring Guide

Score	Description
2	For correct geometric reasoning that is sufficient to explain why the segments are congruent
1	For explanation that is partially correct and/or partially complete
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Sample Response:

$\overline{PS} \cong \overline{PT}$ since they are each a radius of the circle.
Therefore, ΔPST is an isosceles triangle and $\angle PST \cong \angle PTS$.
Since the sum of the angles must be 180°, we can solve for the measure of the congruent angles using the equation $x + x + 60 = 180 \rightarrow 2x = 120 \rightarrow x = 60$.
Therefore, ΔPST is an equilateral triangle so all sides are congruent.
In particular, $\overline{ST}$ is congruent to $\overline{PT}$.

Note: Correct geometric reasoning must include a reason that $\angle PST \cong \angle PTS$ and also state that ΔPST is equilateral.

Score Point 2
(Example A)

19 Every line drawn from the center to the edge of a circle is equal to every other line of the same creation. Therefore $\overline{SP}$ and $\overline{PT}$ are equal. This means the triangle is at least isosoleces, meaning $\angle PST$ and $\angle PTS$ are equal. If $\angle SPT$ is 60° and the other two angles are equal, they have to be 60° also. Triangles can only have 180° of interior angles. This makes ΔSPT an equilateral, and all sides are equal.

The student's reasoning is correct and sufficient.

Score Point 2
(Example B)

19 If $\overline{PS}$ and $\overline{PT}$ are radii then they are congruent, if $\overline{PS}$ and $\overline{PT}$ are congruent then $\angle S = \angle T$ If $\angle S = \angle T$ and $\angle P$ is 60° then $\angle S$ and $\angle T$ must be 60°. which means ΔPST is an equilateral, then $\overline{ST}$ must be congruent to $\overline{PT}$

The student's reasoning is correct and sufficient.

Score Point 1
(Example A)

19 Since P is the center, of the circle, then $\overline{PT} \cong \overline{PS}$ because all radii of a Circle are $\cong$. This makes the sides $\overline{PS}$ and $\overline{PT}$ of $\triangle PST$ $\cong$ as well. Therefore, $\triangle PST$ is an equilateral triangle, making $\overline{ST} \cong \overline{PT}$.

The student's explanation is partially complete.

Score Point 1
(Example B)

19 If m∡SPT = 60 then all the angle measures = 60. due to the theroM that states all the measures of the interior angles added together equal 180. Since all the angles are congruent, then all the sides are equal.

The student's explanation is partially complete.

Score Point 0
(Example A)

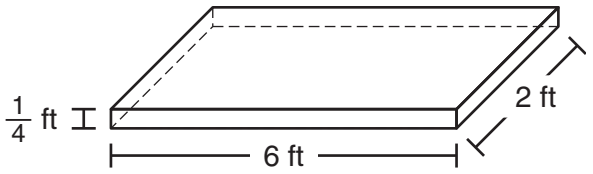
19

$\overline{ST}$ and $\overline{PT}$ are both the radius of the circle so they are equal

The student's explanation is incorrect.

G&M 10.6 Solves problems involving perimeter, circumference, or area of two-dimensional figures (including composite figures) or **surface area or volume** of three-dimensional figures (including composite figures) within mathematics or across disciplines or contexts.

20 A board foot is a piece of wood 1 foot wide, 1 foot long, and 1 **inch** thick. A lumberyard sells the pine board shown below for a price of $3.40 per board foot.



What is the total cost, in dollars, of the pine board? Show your work or explain how you know.

Scoring Guide

Score	Description
2	For correct answer, ($)**122.40**, with sufficient work or explanation to indicate correct strategy
1	For correct answer with insufficient or no work or explanation or For appropriate strategy with incorrect or no answer
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Sample Responses:

I figured $6 \times 2 = 12$ board-foot pieces of 1 foot by 1 foot by 1 inch would fit inside the bottom of this board. Since it is $\frac{1}{4}$ foot thick, it is 3 inches thick. So there are 3 layers of 12.

$3 \times 12 \times \$3.40 = \$122.40$ for the cost of the pine board.

OR

One board foot = 1 foot × 1 foot × 1 inch = 12 inches × 12 inches × 1 inch = 144 cubic inches

6 feet × 2 feet × $\frac{1}{4}$ foot = 3 cubic feet

3 cubic feet = $3 \times 12 \times 12 \times 12 = 5184$ cubic inches = board's volume

5184 cubic inches ÷ 144 = 36 board feet

$36 \times \$3.40 = \$122.40$ for the cost of the pine board.

Score Point 2
(Example A)

20

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

$3 \cdot 72 \cdot 24 = \frac{5184}{144}$

$^{1\,2}36$ BF
$\times\ 3.40$
1440
10800
122.40

$122.40

The student's response is correct, with sufficient work shown.

Score Point 2
(Example B)

20

The pine board costs $122.40. This is because the pine board is 3 inches thick, therefore the cost of each board foot is tripled. I then took that cost, $10.20, and multiplied it by 12 because the pine board contained 12 board feet.

The student's response is correct, with sufficient explanation.

Score Point 1
(Example A)

20

$122.40

The student's response is correct, with no explanation or work shown.

Score Point 1
(Example B)

20

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

$1 \cdot 1 \cdot \frac{1}{12} = \frac{1}{12}$

$3 \cdot \frac{12}{1} = 24$ bd ft

$24 \cdot 3.40 = \$81.60$

The student's strategy is appropriate, with incorrect answer.

Score Point 0
(Example A)

20

$V = 5184\ in^2$

5184×3.4

$17,625.60

The student's strategy is incorrect.

Score Point 0
(Example B)

20

$3.40 \cdot \frac{1}{4} = .85$

$3.40 \cdot 6 = 20.40$

$3.40 \cdot 2 = 6.80$

$6.80 + .85 + 20.40 = 28.05$

$28.05

The student's strategy is incorrect.

DSP 10.3 Identifies or describes representations or elements of representations that best display a given set of data or situation, consistent with the representations required in M(DSP)-10-1.

21 Coach Murphy records the weight of each person who tries out for the football team and the number of push-ups each person completes in one minute. This table shows the data.

Weight (in lb)	Number of Push-ups	Weight (in lb)	Number of Push-ups
221	27	143	18
175	25	150	21
180	36	153	12
202	19	165	30
173	37	171	14
184	33	188	20
199	22	207	16
209	20	210	35
159	31	225	18
232	26	236	12
280	30	187	39

Coach Murphy wants to display these data using a bar graph, a line graph, or a scatter plot. Use mathematical reasoning to explain which of these data displays is most appropriate for Coach Murphy to use.

Scoring Guide

Score	Description
2	For choosing a scatter plot and for a correct and reasonable justification why a scatter plot is most appropriate
1	For choosing a scatter plot with incomplete or no reasonable justification why it is most appropriate or For choosing a scatter plot with an incorrect justification why it is most appropriate
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Sample Responses:

The table shows two different pieces of data, weight and number of push-ups. A scatter plot is most appropriate for comparing this type of data.

OR

The scatter plot is most appropriate because scatter plots are best used to compare two different sets of data. Line graphs are best for identifying rates of change. Bar graphs are best used to compare data that can be organized by categories.

Score Point 2
(Example A)

21

A scatter plot graph because there is no definite corilation between weight and push-ups, so a line graph would show nothing useful. The bar graph could show a trend w/ weight v. push-ups, but not as effectivly as a scatter plot w/ y-axis being push-ups and x-axis weight.

The student's response is correct, with reasonable justification.

Score Point 2
(Example B)

21

Coach Murphy should use a scatter plot to display his data because scatter plots allow you to plot data easily and determine any trends. On the other hand, Line graphs are usually for sets of data that occur over time, and bar graphs are not usually used for data sets with two numeric variables. For these reasons, Coach Murphy should use a scatter plot.

The student's response is correct, with reasonable justification.

Score Point 1
(Example A)

21

A scatter plot would be most useful, because you can plot how many pushups someone can do based on their weight.

The student's response is correct, with insufficient justification.

SCORE POINT 0
(EXAMPLE A)

21

Bar Graph

The student's response is incorrect.

F&A 10.4 Demonstrates conceptual understanding of equality by solving problems involving algebraic reasoning about equality; by translating problem situations into equations; by solving linear equations (symbolically and graphically) and expressing the solution set symbolically or graphically, or provides the meaning of the graphical interpretations of solution(s) in problem-solving situations; or by solving problems involving systems of linear equations in a context (using equations or graphs) or using models or representations.

22 A coach will order baseball caps from one of two companies.

- Creative Caps charges a one-time fee of $50, plus $5 per baseball cap.
- Happy Hats charges a one-time fee of $30, plus $6 per baseball cap.

a. How much does Creative Caps charge for an order of 15 baseball caps?

b. Write an algebraic expression to represent the amount that Creative Caps charges for an order of x baseball caps.

c. The coach wants to buy baseball caps from the least expensive company. In terms of the number of baseball caps, when should the coach order the baseball caps from Creative Caps? Show your work or explain how you know.

Scoring Guide

Score	Description
4	5 points
3	4 points or 3 points with at least one point for each part
2	2–3 points
1	1 point
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes

Part a: 1 point for correct answer, **$125**

Part b: 1 point for correct expression, **$5x + 50$ or equivalent**

Part c: 1 point for correct answer, **number of baseball caps > 20**

AND

2 points for finding the point where both costs are equal with work or explanation addressing which company costs less when x is greater or less than 20

OR

1 point for finding the point where both costs are equal

Sample Responses:

Part c: $5x + 50 = 6x + 30 \rightarrow x = 20$

$x = 15$: Creative Caps charges $125, Happy Hats charges $120

$x = 25$: Creative Caps charges $175, Happy Hats charges $180

The charges are equal when $x = 20$ and Creative Caps is cheaper for $x > 20$.

OR

Student correctly graphs the linear equations to show that the charges are equal when $x = 20$ and Creative Caps is cheaper for $x > 20$.

SCORE POINT 4
(EXAMPLE A)

22

a.) Creative Caps = 5x+50

5(15)+50=
75+50=
$125.00

a) The student's response is correct. (Showing work is not required.)

b.)

5x+50

b) The student's response is correct.

c.) 15 Hats
6(15)+30=120 ✓
5(15)+50=125 ✗

20 Hats
6(20)+30=150 ✓
5(20)+50=150 ✓

18 Hats
6(18)+30=138 ✓
5(18)+50=140 ✓

21 Hats
6(21)+30=156 ✗
5(21)+50=155 ✓

He should buy the hats from Creative Caps if he buys 21 or more hats.

c) The student's response is correct, with sufficient work shown.

SCORE POINT 3
(EXAMPLE A)

22

A $125

$50 + ($5 × 15)

a) The student's response is correct.

B 50+5x

b) The student's response is correct.

C 50 + 5x = 30 + 6x
−5x −5x
50 = 30 + x
−30 −30
20 = x

c) The student correctly determined the point where the costs are equal.

SCORE POINT 2
(EXAMPLE A)

22

a) The student's response is correct.

(A) 50 + 5(15)
Creative caps charges $125 for 15 caps

(B.) 50 + 5x

b) The student's response is correct.

(C.) 50 + 5(10) = 50 + 50 = $100 — creative
30 + 6(10) = 30 + 60 = $90 - Happy

Creative Caps costs more so Happy hats costs the least to make hats.

c) The student's strategy is insufficient.

SCORE POINT 1
(EXAMPLE A)

22

A.) $50 + (5 \cdot 15)$

$\$ \underline{125}$

a) The student's response is correct.

B.) $\underline{30 + (6 \cdot x)}$

b) The student's response is incorrect.

C.) $30 + (6 \times 45) = 300$

$50 + (5 \times 45) = 275$

$30 + (6 \times 46) = 306$

$50 + (5 \times 46) = 280$

When 46 caps are being ordered, you should switch to Creative caps, because it becomes less expensive after 45 caps.

46+ caps

c) The student's strategy is incorrect.

SCORE POINT 0
(EXAMPLE A)

22

creative caps
$50.00 + $5.00 per cap
x 15 caps
$75 for 15 caps

$5n + 50 = x

creative caps - should order when needed all at one time so he doesn't get charged more.

The student's response to each part is incorrect.

N&O 10.4 Accurately solves problems involving rational numbers within mathematics, across content strands, disciplines or contexts (with emphasis on, but not limited to, proportions, percents, ratios, and rates).

23 Greg wants to buy a computer chess game with a regular price of $40. A hobby shop sells the computer chess game at a discounted price of 30% off the regular price.

a. What is the discounted price, in dollars, of the computer chess game at the hobby shop?

A department store sells the same computer chess game at a discounted price of 20% off the regular price of $40. On Saturday, the department store will take an additional 10% off the already discounted price of this computer chess game.

b. Explain whether it is less expensive for Greg to buy the computer chess game at the hobby shop or at the department store on Saturday.

On Saturday, Greg buys a computer baseball game at the department store. The department store sells the computer baseball game at a discounted price of 20% off the regular price. The store takes an additional 10% off the already discounted price. After both discounts, Greg pays $18 for the game.

c. What is the regular price of the computer baseball game? Show your work or explain how you know.

Scoring Guide

Score	Description
4	5 points
3	4 points
2	2–3 points
1	1 point
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes

Part a:	1 point	for correct answer, ($)**28**
Part b:	2 points	for correct and complete explanation of why the game is cheaper at the hobby shop
		OR
	1 point	for appropriate explanation with computation error
Part c:	2 points	for correct answer, ($)**25**, with sufficient explanation or work shown to indicate correct strategy
		OR
	1 point	for correct answer with insufficient or no explanation or work shown
		or
		for appropriate strategy with incorrect or no answer

Sample Responses:

Part b: Price at hobby shop = \$28

Price at department store = \$40 − (\$40 × 0.20) = \$32 after first discount

\$32 − (\$32 × 0.10) = \$28.80 after final discount

The hobby shop sells the computer chess game for \$28 and the department store, after both discounts, sells it for \$28.80. The computer chess game is cheaper at the hobby shop.

OR

The hobby shop is cheaper because \$28 is less than \$28.80.

Part c: Let p = regular price

$p \times 20\%$ discount $\times$ 10% discount = 18

$p \times (1 - 0.20) \times (1 - 0.10) = 18$

$p \times (0.80) \times (0.90) = 18$

$0.72p = 18$

$p = 25$, so the regular price of the computer baseball game is \$25.

OR

$$\frac{18}{p} = \frac{9}{10}$$

$$9p = 180$$

$$p = 20, \text{ then}$$

$$\frac{20}{p} = \frac{8}{10}$$

$$8p = 200$$

$$p = 25$$

SCORE POINT 4
(EXAMPLE A)

23

a.) $.7 \times 40 = 28$

$28

b.) $.8 \times 40 = 32$

$.9 \times 32 = 28.80$

It is less expensive to buy the game at the hobby shop because there it is $28 and at the dept. store it is $28.80

c.) $18 = \frac{9}{10} x$

$\frac{180}{9} = x$

$20 = x$

$20 = \frac{8}{10} y$

$\frac{200}{8} = y$

$25 = y$

the regular price is $25.

a) The student's response is correct. (Showing work is not required.)

b) The student's explanation is correct.

c) The student's response is correct, with sufficient work shown.

SCORE POINT 4
(EXAMPLE B)

23

a) 30% of 40
$12
discanted price = $28

b) 20% of 40
10% of 20% of 40
$8
10% of $32
$3.00
discanted price = $28.80
It is less expensive at the hobby shop

c) $18
$\frac{90}{100} = \frac{18}{x}$
$\frac{9}{10} = \frac{18}{x}$
$9x = 180$
$x = 20$
$\frac{80}{100} = \frac{20}{x}$
$\frac{4}{5} = \frac{20}{x}$
$4x = 100$
$x = 25$
$\boxed{\$25}$

$11
$32.00
- 3.20
$28.80

a) The student's response is correct. (Showing work is not required.)

b) The student's explanation is correct.

c) The student's response is correct, with sufficient work shown.

SCORE POINT 3
(EXAMPLE A)

23

a. 40 x .3 = 12
40 - 12 = 28

b. 40 x .2 = 8
40 - 8 = 32 x .1 = 3.2
32 - 3.2 = 28.8

U.S. winner Hobby Shop!

c. $25

a) The student's response is correct. (Correct units are not required.)

b) The student's explanation is correct.

c) The student's response is correct, with no work shown.

SCORE POINT 3
(EXAMPLE B)

23

a) The student's response is correct.

b) The student's explanation is appropriate, but contains a computation error.

(a) $40 X .3 $28

40 · 3 = 120

$40-12

(b) $32 $32-3.2

40 · .2 = 8.0

32 · .1 = 3.2

$29.8

It is less expensive at the hobby shop

(c) $25 · .2 = 5.0

$20

$20 · .1 = 2.0

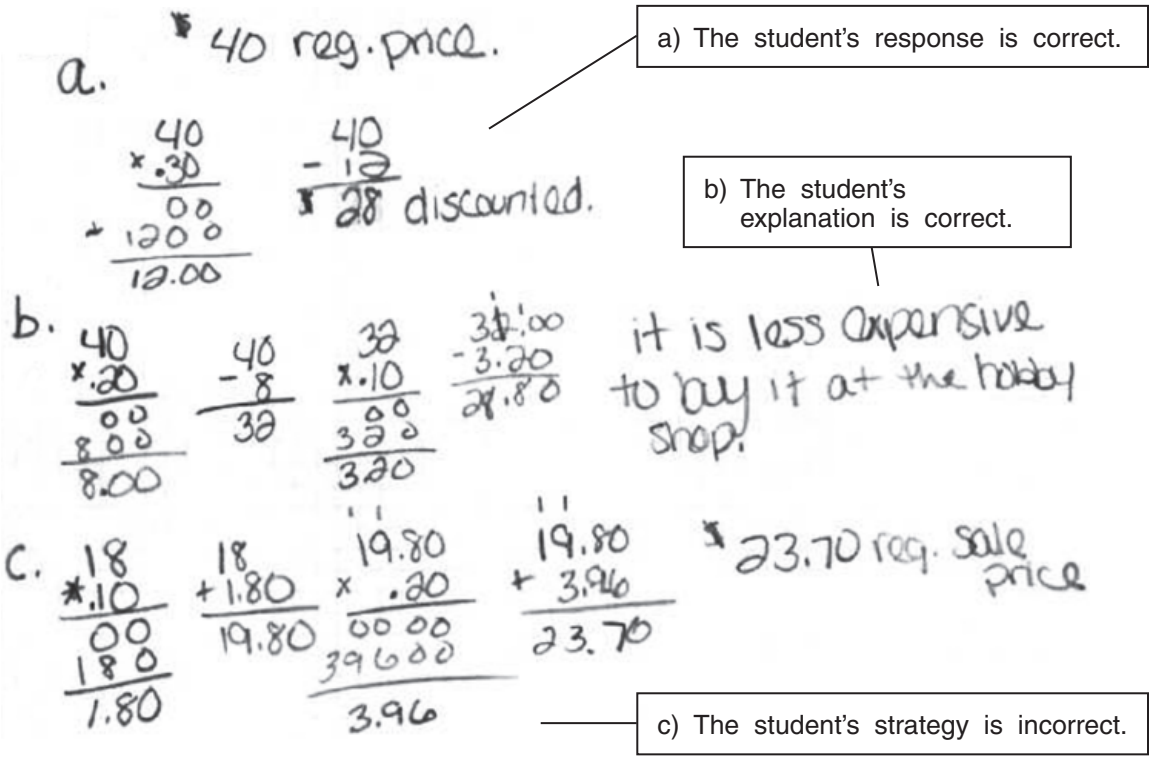
$20 -$2 = 18$

The regular price was $25

c) The student's response is correct, with sufficient work shown.

SCORE POINT 2
(EXAMPLE A)

23



a) The student's response is correct.

b) The student's explanation is correct.

c) The student's strategy is incorrect.

SCORE POINT 2
(EXAMPLE B)

23

a: $26.67

a) The student's response is incorrect.

b: It's less expensive to buy the chess game at the hobby shop because they take more money out all together during the 30% off, rather than after the discounted price.

b) The student's explanation is insufficient.

c: $25

20% off 25 dollars is $5 off.
Additional 10% off is $2 off.
$25 - $7 = $18

c) The student's response is correct, with sufficient explanation.

SCORE POINT 1
(EXAMPLE A)

23

a) $28.00

a) The student's response is correct.

b) it is less expensive for Greg to get the game at the hobby shop

c) The regular price was about $30, I know this because I just did basically the same problem before this question and it makes sense

b) The student did not provide an explanation. (Selecting the correct store is not sufficient for credit.)

c) The student's strategy is incorrect.

SCORE POINT 0
(EXAMPLE A)

23

a. $40 \div .3 = 2.4$ $\quad 40 \times 2.4 = 9.6$

$40 - 9.6 = 30.4$ $\quad \boxed{\$30.40}$

b. It becomes 30% on Saturday, so the prices are equal.

c. $18.00 + 2.40 = 26.40$ $\quad \boxed{\$26.40}$

The student's response to each part is incorrect.

Grade 11 Mathematics Released Item Information

Released Item Number	1	2	3	4	5	6	7	8	9	10	11	12
No Tools Allowed	✓								✓	✓	✓	
Content Strand[1]	NO	GM	GM	GM	GM	FA	FA	FA	FA	FA	FA	DP
GSE Code	10-2	10-4	10-7	10-9	10-9	10-2	10-2	10-3	10-3	10-4	10-4	10-5
Depth of Knowledge Code	2	2	1	1	2	1	1	1	2	2	1	2
Item Type[2]	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC	MC
Answer Key	C	A	C	C	B	B	D	B	D	A	D	A
Total Possible Points	1	1	1	1	1	1	1	1	1	1	1	1

Released Item Number	13	14	15	16	17	18	19	20	21	22	23
No Tools Allowed	✓		✓	✓			✓		✓		✓
Content Strand[1]	NO	GM	FA	FA	FA	DP	GM	GM	DP	FA	NO
GSE Code	10-2	10-5	10-1	10-2	10-2	10-1	10-2	10-6	10-3	10-4	10-4
Depth of Knowledge Code	2	2	2	1	1	2	3	2	2	2	2
Item Type[2]	SA	SA	SA	SA	SA	SA	SA	SA	SA	CR	CR
Answer Key											
Total Possible Points	1	1	1	1	1	1	2	2	2	4	4

[1]Content Strand: NO = Numbers & Operations, GM = Geometry & Measurement, FA = Functions & Algebra, DP = Data, Statistics, & Probability

[2]Item Type: MC = Multiple Choice, SA = Short Answer, CR = Constructed Response