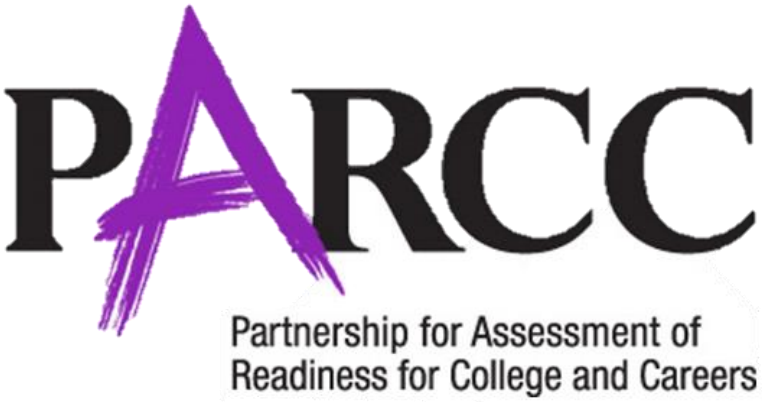


Math

Spring 2018

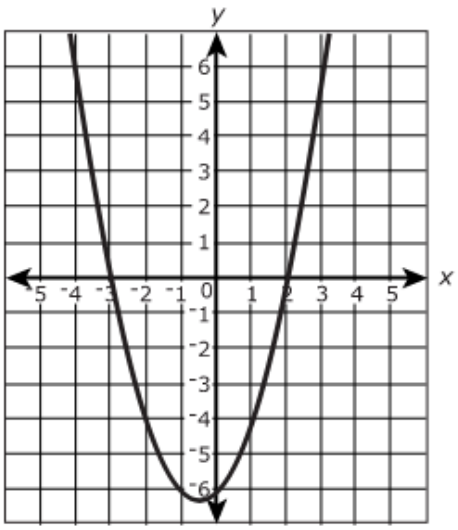
Algebra I

Released Items

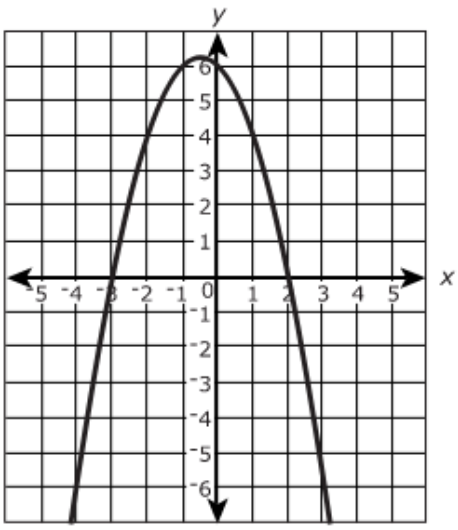
1. **VH025361**

What is the graph of the equation $y = x^2 - x - 6$ in the *xy*-coordinate plane?

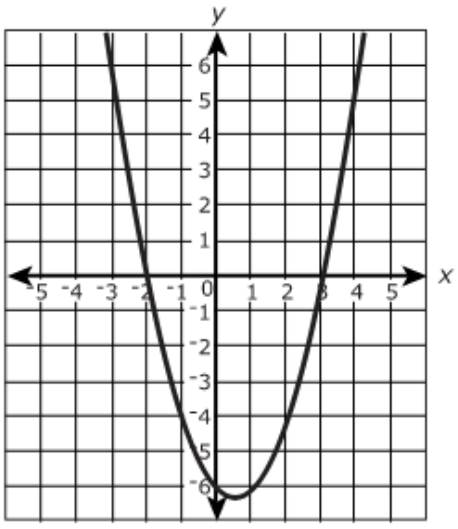
A.



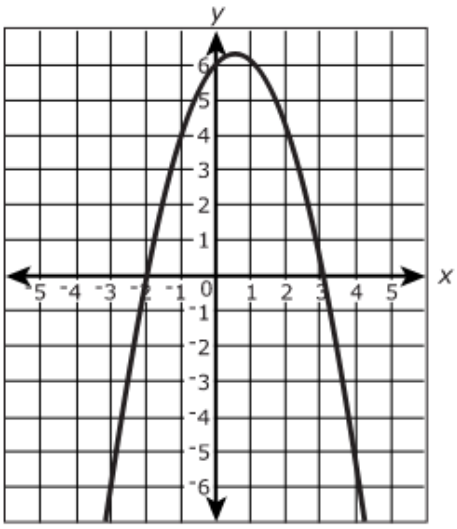
C.



B.



D.



2. **M40223**

Subtract $(4x^2 - x + 6)$ from $(3x^2 + 5x - 8)$.

A. $7x^2 + 6x - 14$

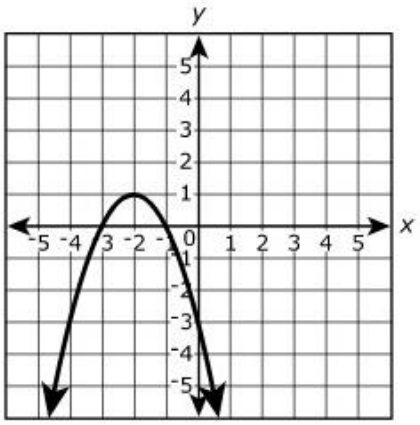
B. $-x^2 + 4x + 2$

C. $7x^2 + 4x - 2$

D. $-x^2 + 6x - 14$

3. **M46429P**

The graph shows the function $y = g(x)$, where $g(x)$ represents a transformation of $f(x) = x^2$.



What is the equation for $g(x)$?

A. $g(x) = (x-2)^2 - 1$

B. $g(x) = (x+2)^2 - 1$

C. $g(x) = -(x-2)^2 + 1$

D. $g(x) = -(x+2)^2 + 1$

4. **3233-M44883**

Consider the graph of the function $s(x) = x^2 + 6x + 9$.

Part A

The function $r(x)$ is defined as $r(x) = k \cdot s(x)$, where k is a constant. Which statements about the graphs of $s(x)$ and $r(x)$ are true?

Select **all** that apply.

- ☐ A. When $k < 0$, the vertex of the graph of $r(x)$ is a minimum.
- ☐ B. When $k < 0$, the vertex of the graph of $r(x)$ is a maximum.
- ☐ C. When $k > 1$, the graph of $r(x)$ is a vertical stretch of the graph of $s(x)$.
- ☐ D. When $k > 1$, the graph of $r(x)$ is a vertical compression of the graph of $s(x)$.
- ☐ E. When $0 < k < 1$, the graph of $r(x)$ is a vertical stretch of the graph of $s(x)$.
- ☐ F. When $0 < k < 1$, the graph of $r(x)$ is a vertical compression of the graph of $s(x)$.

Part B

The graph of $s(x)$ is translated to produce the graph of $t(x)$, where $t(x) = x^2 + 6x + 13$. Which is a correct description of the translation?

- ○ A. vertical shift 4 units up
- ○ B. vertical shift 4 units down
- ○ C. horizontal shift 4 units to the left
- ○ D. horizontal shift 4 units to the right

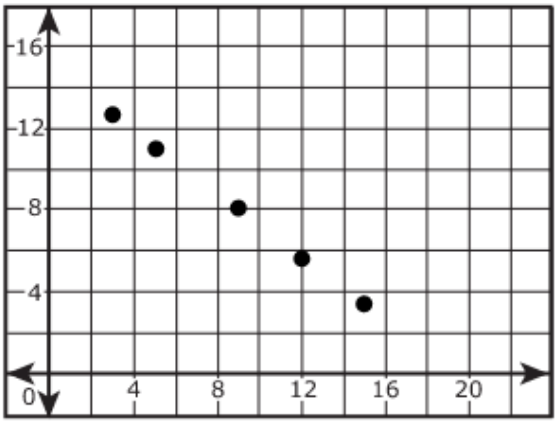
5. **M41509**

The two graphs and two descriptions each represent a sequence. Choose the equation that represents each sequence for $n = 1, 2, 3...$

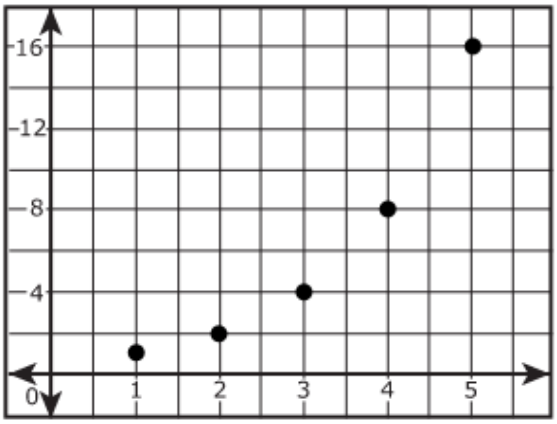
Drag and drop the letter of the graph or description to the correct box.

A B C D

A



B



C Begin with 5. Add −5 to each term in the sequence to get the next term.

D Begin with −2. Multiply each term in the sequence by −5 to get the next term.

$f(n) = (0.5)2^n$ ☐

$g(n) = -\frac{3}{4}n + \frac{59}{4}$ ☐

$h(n) = (-2)(-5)^{n-1}$ ☐

$k(n) = 5 - 5(n - 1)$ ☐

6. **M44323**

At the end of year 0, city M has a population of 23,500 that is growing at a rate of 5% per year. The population of city P at the end of year 0 is 23,000. The population of city P over a 4-year period is shown in the table.

Population of City P

Year	Population
0	23,000
1	24,380
2	25,843
3	27,393
4	29,037

If the growth rate for each city does not change, which statement about the populations of city M and city P is true?

A. City M has the greater growth rate and the larger population at the end of year 2.

B. City M has the greater growth rate and the smaller population at the end of year 2.

C. City P has the greater growth rate and the larger population at the end of year 2.

D. City P has the greater growth rate and the smaller population at the end of year 2.

7. **VH025943**

Members of a high school sports team are selling boxes of popcorn and boxes of pretzels for a fundraiser. They earn $2 for every box of popcorn they sell and $5 for every box of pretzels. The members want to earn at least $500 from all sales.

Let *x* represent the number of boxes of popcorn sold and let *y* represent the number of boxes of pretzels sold.

Part A

What inequality represents the number of boxes of popcorn and the number of boxes of pretzels that need to be sold to reach the goal of earning at least $500?

A. $2x + 5y \geq 500$

B. $5x + 2y \geq 500$

C. $(2 + x)(5 + y) \geq 500$

D. $(5 + x)(2 + y) \geq 500$

Part B

A line exists that serves as the boundary for the points making up the solution set of the inequality representing the numbers of boxes of popcorn and boxes of pretzels sold. Consider the line graphed in the *xy*-coordinate plane. What would be the interpretation, in context, of its slope?

A. For every increase of 2 boxes of popcorn sold, 5 more boxes of pretzels need to be sold to earn $500.

B. For every increase of 2 boxes of popcorn sold, 5 fewer boxes of pretzels need to be sold to earn $500.

C. For every increase of 5 boxes of popcorn sold, 2 more boxes of pretzels need to be sold to earn $500.

D. For every increase of 5 boxes of popcorn sold, 2 fewer boxes of pretzels need to be sold to earn $500.

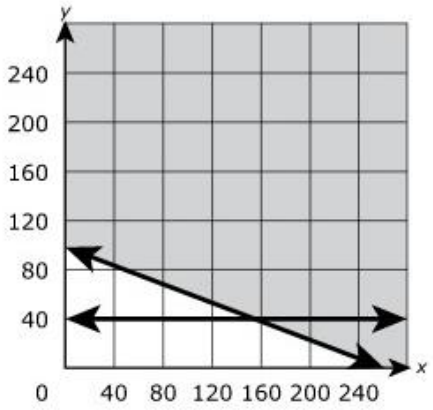
(continues on next page)

7. (continued from previous page) **VH025943**

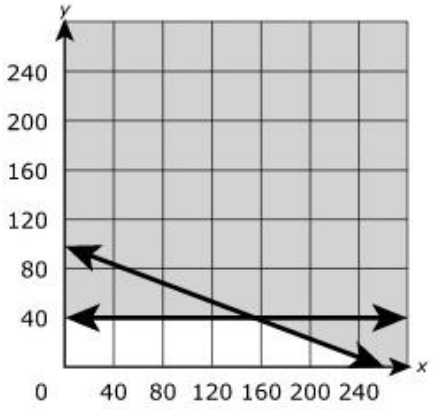
Part C

Members of the team believe they can sell at least 40 boxes of pretzels. Which graph represents the solution in the *xy*-coordinate plane of the system of inequalities that represents the numbers of boxes of popcorn and boxes of pretzels that need to be sold with the constraint that at least 40 boxes of pretzels will be sold?

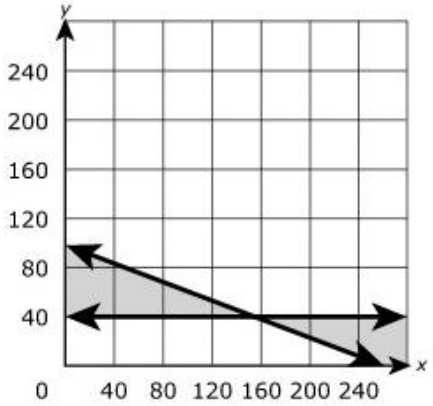
A.



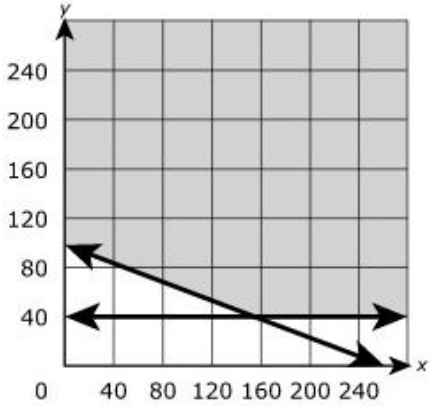
C.



B.



D.



Part D

For which combinations of boxes of popcorn and pretzels sold will the team meet the goal of earning at least $500?

Select **all** that apply.

- A. 30 boxes of popcorn and 80 boxes of pretzels
- B. 60 boxes of popcorn and 80 boxes of pretzels
- C. 75 boxes of popcorn and 70 boxes of pretzels
- D. 80 boxes of popcorn and 60 boxes of pretzels
- E. 100 boxes of popcorn and 60 boxes of pretzels

8. **VF741634**

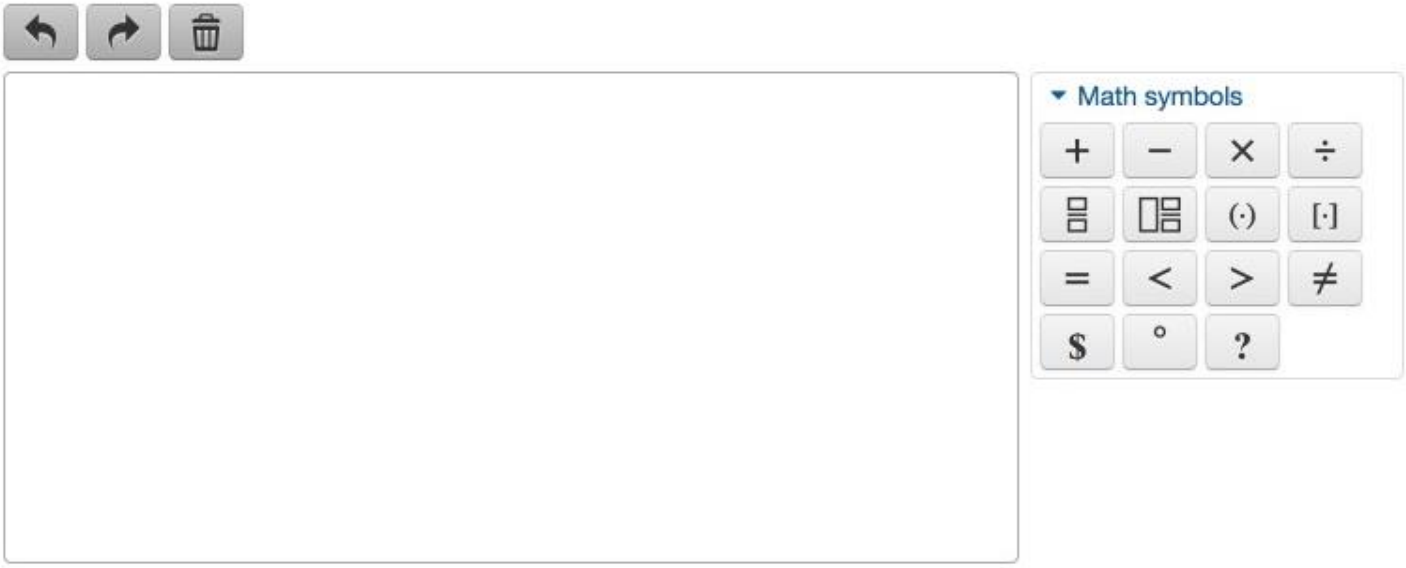
Part A

Bella has a tomato garden. The data in the table show the number of tomato seeds planted in her first and second years and the numbers of tomatoes harvested each year. Bella will plant 120 tomato seeds in her third year.

	First Year	Second Year	Third Year
Number of seeds planted	75	20	120
Total number of tomatoes harvested	2,025	540	

Bella predicts that she will harvest 3,240 tomatoes in the third year. Do you agree with her prediction? Justify your answer.

Enter your answer and your justification in the space provided.



(continues on next page)

8. (continued from previous page) **VF741634**

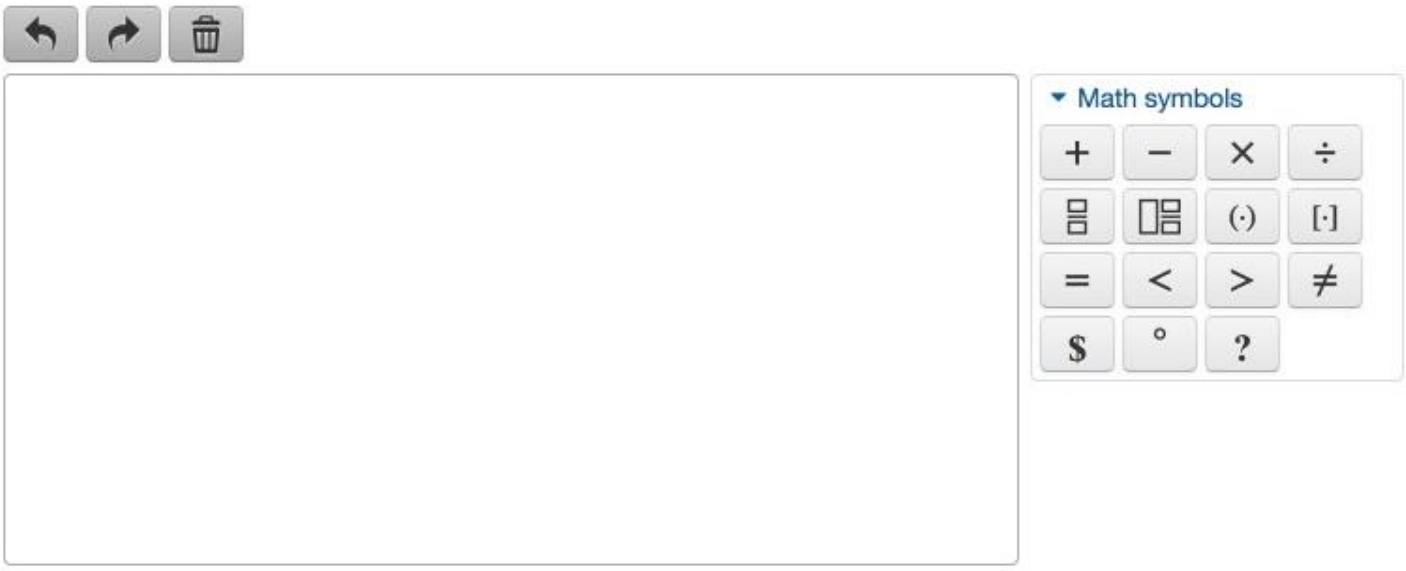
Part B

The tomatoes were harvested during July, August, and September of each year. The data are shown in the table.

	First Year	Second Year	Third Year
Number of seeds planted	75	20	120
Total number of tomatoes harvested in July	243	97	
Total number of tomatoes harvested in August	685	191	
Total number of tomatoes harvested in September	1,097	252	
Total number of tomatoes harvested	2,025	540	

If Bella harvests 3,240 tomatoes during the third year, how many tomatoes do you think she will harvest in each of the months: July, August, and September? Provide justification for your numbers.

Enter your answers and your justifications in the space provided.



9. **VH120064**

Students at a high school were asked if they had attended at least one of the high school's football games this season. The responses are shown in the table.

Student Survey: Attendance at at least one football game

	Freshman	Sophomore	Junior	Senior	Total
Yes, attended at least one game	350	400	400	425	
No, did not attend a game	150	75	100	75	
Total					1,975

Of the students who responded that they attended at least one game, what percent were seniors?

Give your answer to the nearest whole percent. Enter your answer in the box.

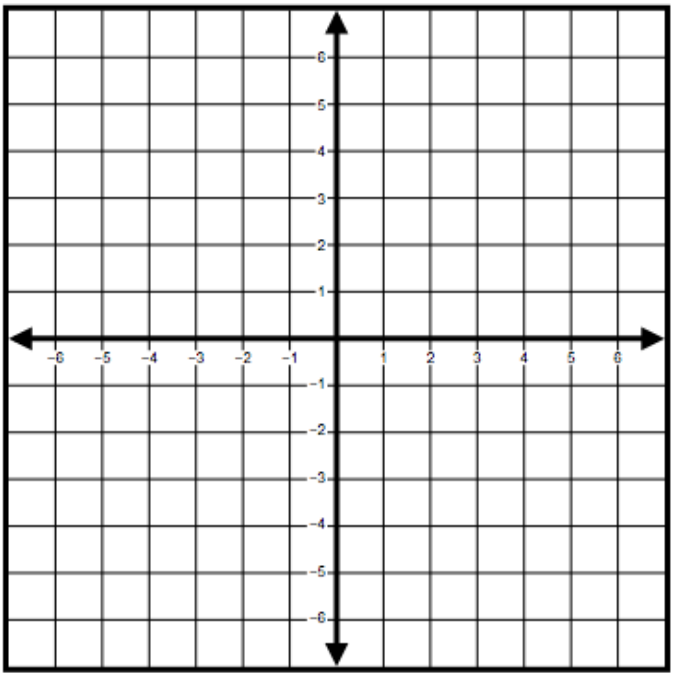
[ ] %

10. **VH231454**

Consider the given system of equations.

$$\begin{cases} 2x + y = 1 \\ y = x^2 - 2x - 3 \end{cases}$$

Select the places in the coordinate plane to plot the points that represent the solutions to the given system of equations.



11. **VH223149**

The table shows the number of loads of laundry per week generated by a family as a function of the number of people in the family.

Weekly Laundry Loads

Number of People in the Family	1	2	3	4	5	6
Number of Loads per Week	1.5	3	4.5	6	7.5	9

Part A

What type of function is represented by the data in the table? Justify your answer.

Enter the function type and your justification in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

(continues on next page)

11. (continued from previous page) **VH223149**

Part B

Consider a family that generates 18 loads of laundry in a week. Based on the data in the table, what is the total number of people in the family?

Enter your answer in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

12. **M44483**

Determine whether the equations shown have real solutions or no real solutions.

Drag and drop each equation into the correct box.

Real Solutions	No Real Solutions

$4x^2 - 2x = -1$

$3x^2 + 6x = -3$

$2x^2 - 5x + 7 = 0$

13. **M45580**

A group of students bakes 100 cookies to sell at the school bake sale. The students want to ensure that the price of each cookie offsets the cost of the ingredients. If all the cookies are sold for \$0.10 each, the net result will be a loss of \$4. If all the cookies are sold for \$0.50 each, the students will make a \$36 profit. First, write the linear function $p(x)$ that represents the net profit from selling all the cookies, where *x* is the price of each cookie. Then, determine how much profit the students will make if they sell the cookies for \$0.60 each.

Enter your answers in the spaces provided. Enter **only** your function and solution.

function: $p(x) =$ ☐

profit: \$☐

14. **VH018342**

The length of a rectangle is 7 inches less than twice the width, *w*, of the rectangle.

Part A

The quadratic function $A(w)$ represents the area *A*, in square inches, of the rectangle for a given value of *w*. Which function gives the area as a function of the width?

- A. $A(w) = 7w - w^2$
- B. $A(w) = 2w^2 - 7$
- C. $A(w) = 7w - 2w^2$
- D. $A(w) = 2w^2 - 7w$

Part B

If the area of the rectangle is 60 square inches, what is the width of the rectangle?

Enter your answer in the box.

☐

15. **M43410**

What is an equivalent form of the function $f(x) = -x^2 - 8x - 12$ that reveals the zeros of the function?

A. $f(x) = -(x+4)^2 + 4$

B. $f(x) = -(x-4)^2 + 4$

C. $f(x) = -(x+2)(x+6)$

D. $f(x) = -(x-2)(x-6)$

16. **VH104212**

The formula $A = \frac{1}{2}s^2$ expresses the area, *A*, of an isosceles right triangle in terms of the length, *s*, of a leg of the triangle.

Which equation expresses the length of a leg of an isosceles right triangle in terms of the area?

A. $s = \frac{\sqrt{A}}{2}$

B. $s = \sqrt{\frac{A}{2}}$

C. $s = 2\sqrt{A}$

D. $s = \sqrt{2A}$

17. **M40431**

A T-shirt company bought a new packaging and tracking system for $100,000. The formula $V = 100,000(1 - 0.125)^y$ models the value of the system *V*, in dollars, after depreciating for *y* years. In this formula, what is the meaning of the term $(1 - 0.125)$?

A. The value of the system will be $0 in 12.5 years.

B. The value of the system will decrease by $12.50 each year.

C. The value of the system will decrease by 12.5% each year.

D. The value of the system will continue to decrease for 125 years.

18. **3224-M44854**

A certain amount of concentrate is mixed with water to create a juice. The table shows the amount of concentrate, in ounces remaining, in the original container after x ounces of juice are made.

Juice Mixture

Juice Made (ounces)	Concentrate Remaining (ounces)
200	280
600	200
1,000	120
1,400	40

Part A

How many ounces of concentrate were in the original container before any juice was made?

Enter your answer in the box.

Part B

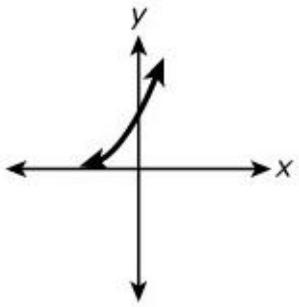
How many ounces of juice can be made using the whole container of concentrate?

Enter your answer in the box.

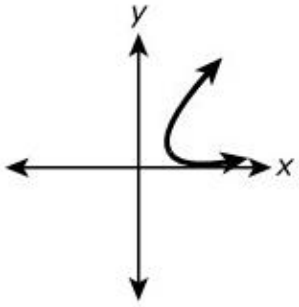
19. **VF905112**

Which graph showing the relation between x and y represents y as a function of x? Select **all** that apply.

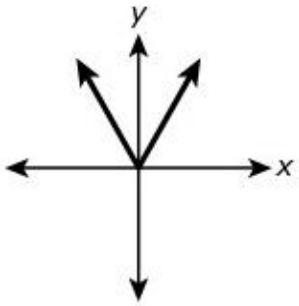
☐ A.



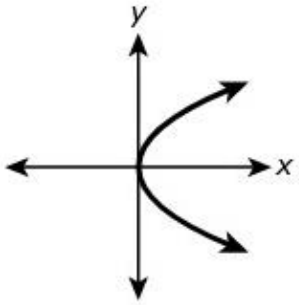
☐ B.



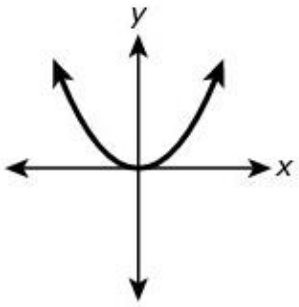
☐ C.



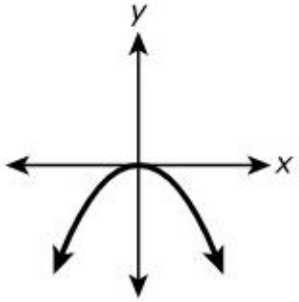
☐ D.



☐ E.



☐ F.



20. **VF890849**

Which statement(s) can be interpreted from the equation for an automobile cost, $C(t) = 28{,}000(0.73)^t$, where $C(t)$ represents the cost and t represents the time in years?

Select **all** correct statements.

- [ ] A. The equation is an exponential growth equation.
- [ ] B. The equation is an exponential decay equation.
- [ ] C. The equation is neither exponential decay nor exponential growth.
- [ ] D. $28,000 represents the initial cost of an automobile that appreciates 27% per year over the course of t years.
- [ ] E. $28,000 represents the initial cost of an automobile that appreciates 73% per year over the course of t years.
- [ ] F. $28,000 represents the initial cost of an automobile that depreciates 27% per year over the course of t years.
- [ ] G. $28,000 represents the initial cost of an automobile that depreciates 73% per year over the course of t years.

21. **2783-M44205**

Part A

Which expression is equivalent to $\left((1-r)^2+r\right)\left((1-r)^2-r\right)$?

A. $(1-r)^4-r^2$

B. $2(1-r)^2+2r$

C. $(1-r)^2(1-r)(1+r)$

D. $(1-r)^4+2r(1-r)^2+r^2$

Part B

Which expression is equivalent to $\left((1-x)^2-2x^2\right)\left((1-x)^2+2x^2\right)+4x^4$?

A. $(1-x)^4$

B. $2(1-x)^2+4x^4$

C. $\left(1-3x^2\right)\left(1+x^2\right)+4x^4$

D. $(1-x)^4+4x^2(1-x)^2+8x^4$

22. **2362-M41568**

Part A

A system of linear equations for the variables *x* and *y* is shown.

$$\begin{cases} y = -x - 4 \\ 3y = cx - 18 \end{cases}$$

For what value of *c*, if any, will this system have no solution? Justify your answer.

Enter your answer and your justification in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

Part B

Find any value of *c* for which the system has exactly one solution. Then solve the system using the value of *c* that you chose. Explain each step of your solution.

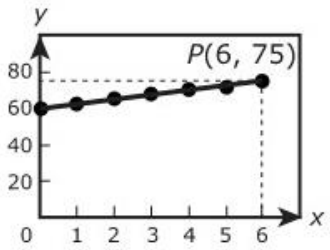
$$\begin{cases} y = -x - 4 \\ 3y = cx - 18 \end{cases}$$

Enter your answer and your explanation in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

23. **M41438**

Darrell tracked the number of employees in his company over a six-year period. In the graph, *x* represents years since 2006 and *y* represents the number of employees. The coordinates for one data point, *P*, are shown.



Find the average rate of change in the number of employees per year by using the data for year 0 and year 6. Round your answer to the nearest tenth.

Enter your answer in the box.

24. **M46425**

The function $C(x) = 6\sqrt{x} + 200$ represents the cost, in dollars, of producing *x* key chains. Calculate the average rate of change of the function between 0 and 25 key chains and between 25 and 50 key chains. Use the calculations to complete each sentence.

Select from the drop-down menus to correctly complete each sentence.

The average rate of change between 0 and 25 is Choose... the average rate of change

Choose...
less than
greater than
equal to

between 25 and 50. The average rate of change is

Choose... . The function is

Choose...
0 on both intervals
positive on both intervals
negative on both intervals
positive on one interval and negative on the other

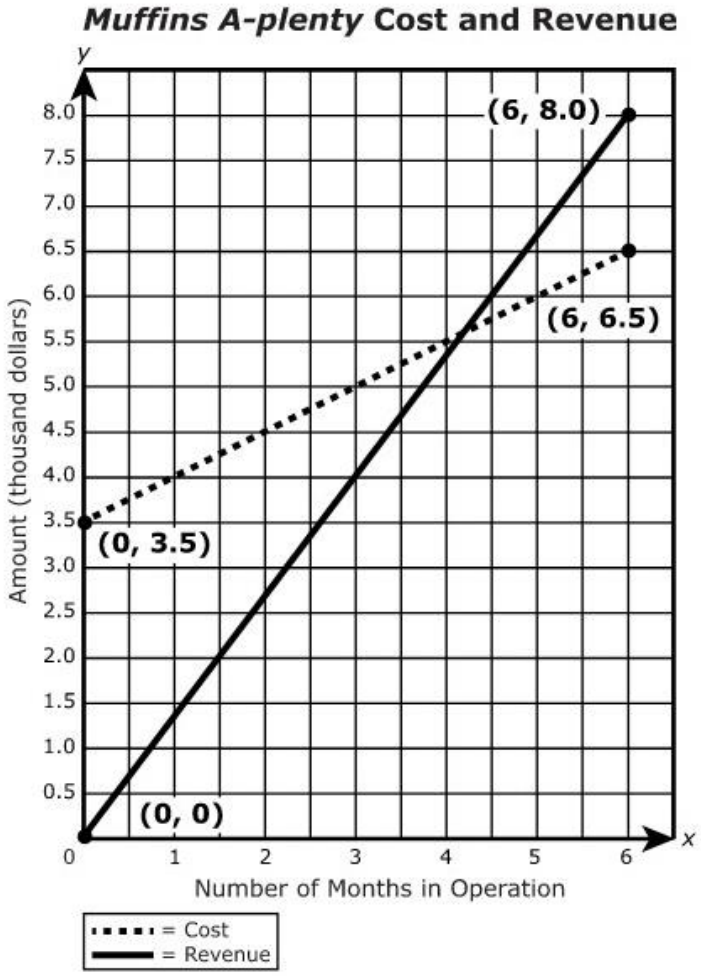
Choose... .

Choose...
increasing at a constant rate
decreasing at a constant rate
increasing faster between 0 and 25 than between 25 and 50
increasing faster between 25 and 50 than between 0 and 25
decreasing faster between 0 and 25 than between 25 and 50
decreasing faster between 25 and 50 than between 0 and 25

25. **2280-M41337**

The cost of a business is the amount of money spent to start the business and keep it in operation. The revenue is the amount of money the business earns from the sale of goods or services

An online business called Muffins A-plenty started on January 1 of a recent year. The lines in the graph represent the cost function and the revenue function of the first six months that Muffins A-plenty has been in operation.



Part A

Write equations to represent the cost function and the revenue function for this business.

Enter your equations in the spaces provided. Enter **only** your equations.

Cost function: $y =$ ☐

Revenue function: $y =$ ☐

(continues on next page)

Part B

The profit of a business equals revenue minus cost. First, write an equation that represents the profit function for Muffins A-plenty using your cost and revenue functions from Part A. Then, determine after how many months of operation Muffins A-plenty will make its first profit. Explain how you determined your answer.

Enter your equation, your answer, and your explanation in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

Part C

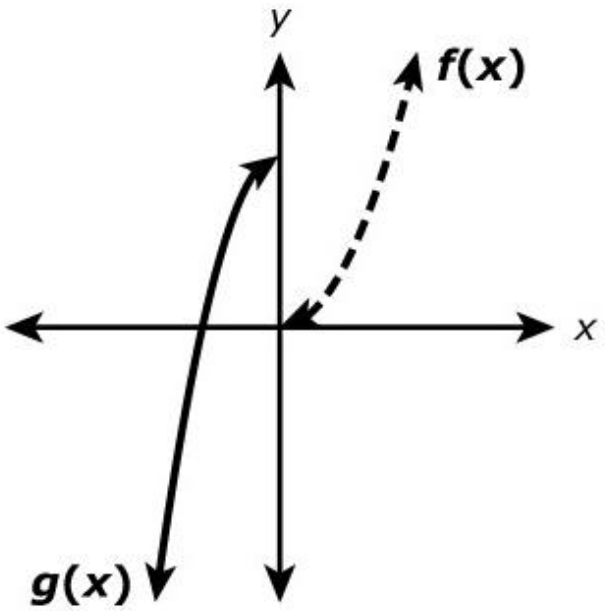
Predict the profit after 10 months of operation. Round your answer to the nearest dollar. Provide valid mathematical reasoning and calculations to support your answer.

Enter your answer and your support in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

26. **VH174749**

Quadratic functions $f(x)$ and $g(x)$ are defined for all real numbers.
Portions of the graphs of the functions are shown in the coordinate plane.



Part A

How many solutions does $f(x) = g(x)$ have? Provide your answer supported by valid mathematical reasoning.

Enter your answer and your justification in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

(continues on next page)

26. (continued from previous page) **VH174749**

Part B

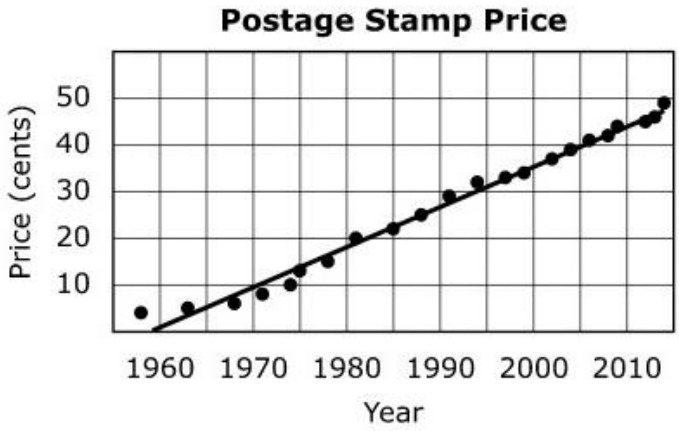
The function $h(x)$ is defined as $h(x) = ag(x)$, where a is a positive value. Explain why the number of solutions of $f(x) = g(x)$ is or is not the same as the number of solutions of $f(x) = h(x)$.

Enter your explanation in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

27. **VH118080**

The scatter plot shows the price, in cents, of a postage stamp used to mail a letter in the United States for the years from 1958 to 2014. Also shown is a line of fit to model the data.



The equation of the line of fit is $y = -0.71 + 0.86x$, where y represents the predicted price, in cents, of a stamp and x represents the number of years since 1958.

Part A

Which statement **best** describes the model?

A. The model estimates an increase, on average, of 0.71 cent per year in the price of a stamp.

B. The model estimates a decrease, on average, of 0.71 cent per year in the price of a stamp.

C. The model estimates an increase, on average, of 0.86 cent per year in the price of a stamp.

D. The model estimates a decrease, on average, of 0.86 cent per year in the price of a stamp.

Part B

In 1958, the price of a postage stamp was 4 cents. The price remained the same until 1963, when the price increased. Based on the information shown in the scatter plot, what is true about the model for the years from 1958 to 1963?

A. The model overpredicts the actual price of a stamp for the time period from 1958 to 1963.

B. The model underpredicts the actual price of a stamp for the time period from 1958 to 1963.

C. The model overpredicts the actual price of a stamp for 1958 and underpredicts the actual price of a stamp for 1963.

D. The model underpredicts the actual price of a stamp for 1958 and overpredicts the actual price of a stamp for 1963.

(continues on next page)

27. (continued from previous page) **VH118080**

Part C

The correlation coefficient for the variables for year and price of a postage stamp is 0.994. What is the **best** interpretation of the coefficient?

A. The relationship between the variables is weak, and as one variable increases in value, the other variable decreases in value.

B. The relationship between the variables is weak, and as one variable increases in value, the other variable increases in value.

C. The relationship between the variables is strong, and as one variable increases in value, the other variable decreases in value.

D. The relationship between the variables is strong, and as one variable increases in value, the other variable increases in value.

Part D

According to the model, what is the **best** estimate of the year when the price of a stamp will first reach 75 cents?

A. 2021

B. 2030

C. 2046

D. 2058

28. **M43294**

Kelly's monthly profit for selling candles is represented by the function $P(x) = 7.5x - 200$, where x represents the number of candles sold. Complete the table so that each value in the domain is assigned the correct value in the range.

Drag and drop the numbers into each box.

67	120	250	450	512.50	712.50	5,050

x	$P(x)$
60	
95	
	700