Quadratics [539186]

Student _____
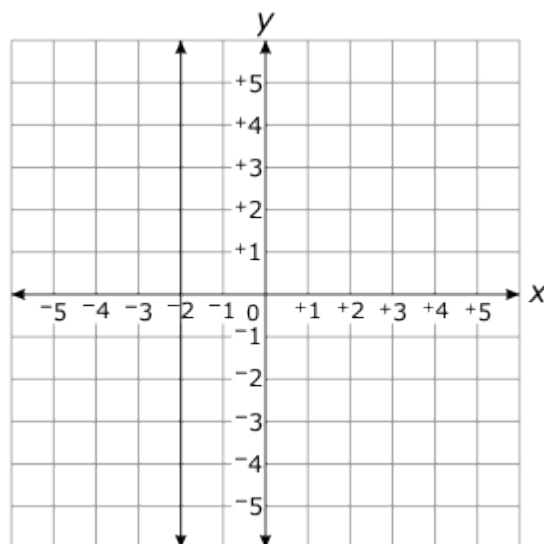
Class _____

Date _____

1. Investigate the graph of the quadratic function $y = x^2 + 4x - 12$ as follows:

Part A: Find any x-intercepts and the y-intercept. Show your work.

Part B: Find the vertex. Show your work.

Part C: Sketch the graph of the function on the standard x-y coordinate plane.

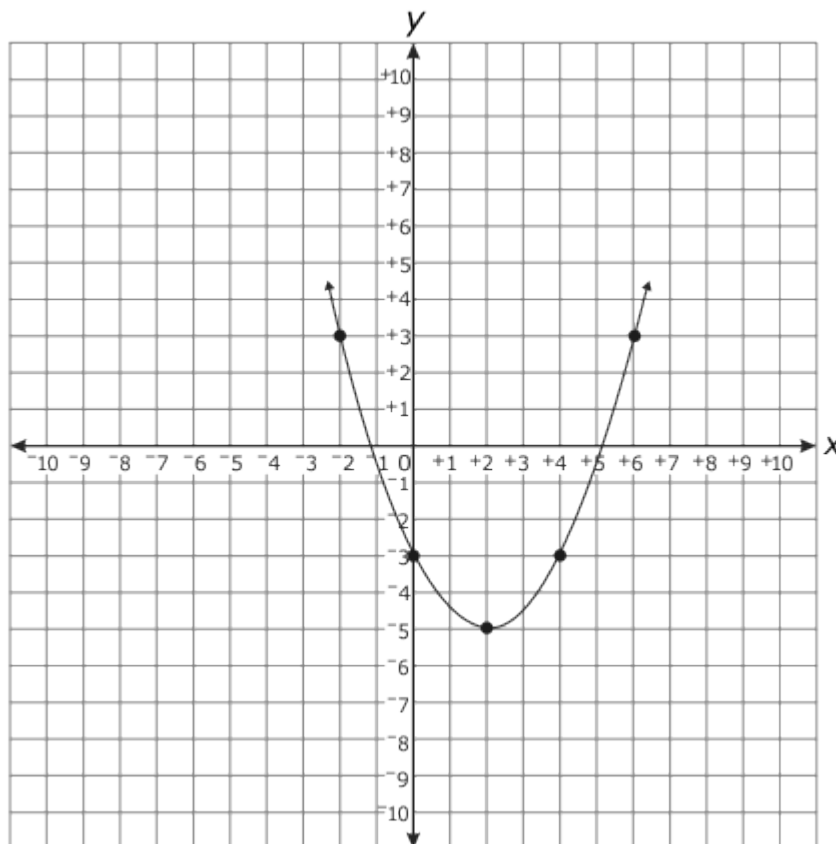**2.** Which is an equation of the line graphed below?

A. $y = {}^-2$

B. $y = {}^-2x$

C. $x = -2$

D. $x = -2y$

3. Which choice is an equation of the function graphed below?

A. $f(x) = \frac{1}{4}x^2 + x - 5$

B. $f(x) = \frac{1}{3}x^2 - 3x - 5$

C. $f(x) = \frac{1}{2}x^2 - 2x - 3$

D. $f(x) = x^2 + x - 3$

**4.** A punter kicks a football into the air during practice. The graph below shows the function that represents the height of the football with respect to time.

PATH OF FOOTBALL

What is the maximum height the football reaches after being kicked?

A. 1.5 meters

B. 3 meters

C. 3.5 meters

D. 7 meters

5. During a physics experiment, a ball is tossed and its height in feet, y, after x seconds is recorded. In the graph created from these data, the function is parabolic in shape and has a y-intercept at $x = 5$, an x-intercept at $y = 2.1$, and a vertex at $(1, 21)$. Which statement is true of the ball in this experiment?

   A. The ball is in the air for about 5 seconds.

   B. The ball is thrown from a height of about 2.1 feet.

   C. The ball reaches a minimum height of about 21 feet.

   D. The ball reaches a maximum height after about 1 second.

**6.** A flying disc is thrown up in the air. The graph below shows its height after *t* seconds.

HEIGHT OF FLYING DISC OVER TIME
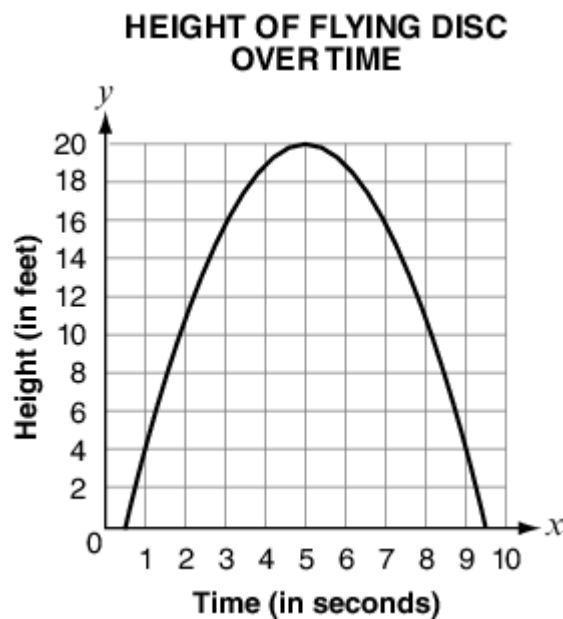
Which of these statements is true?

A. The disc reaches its minimum height of 5 feet at 20 seconds.

B. The disc reaches its maximum height of 5 feet at 20 seconds.

C. The disc reaches its minimum height of 20 feet at 5 seconds.

D. The disc reaches its maximum height of 20 feet at 5 seconds.

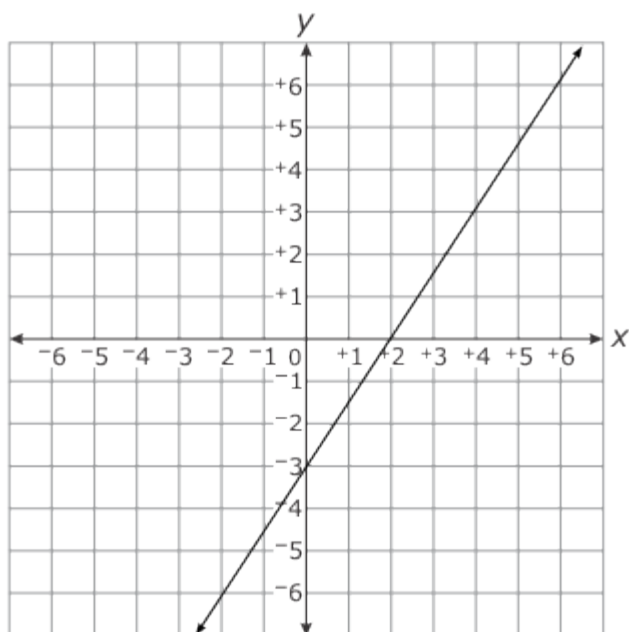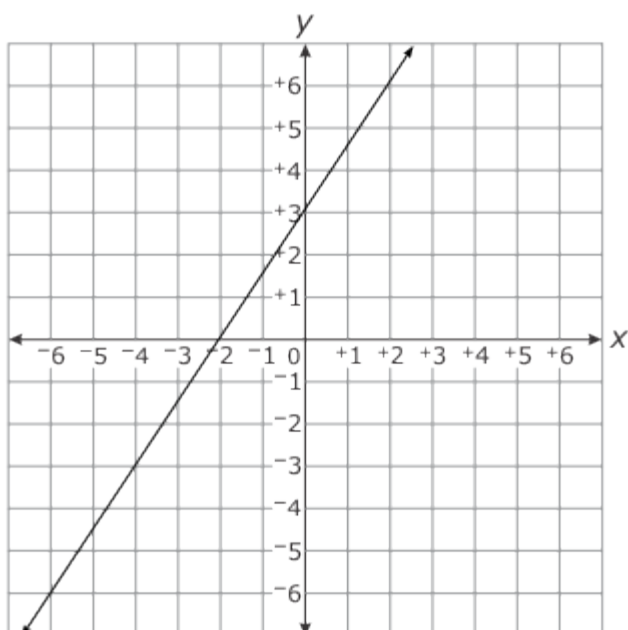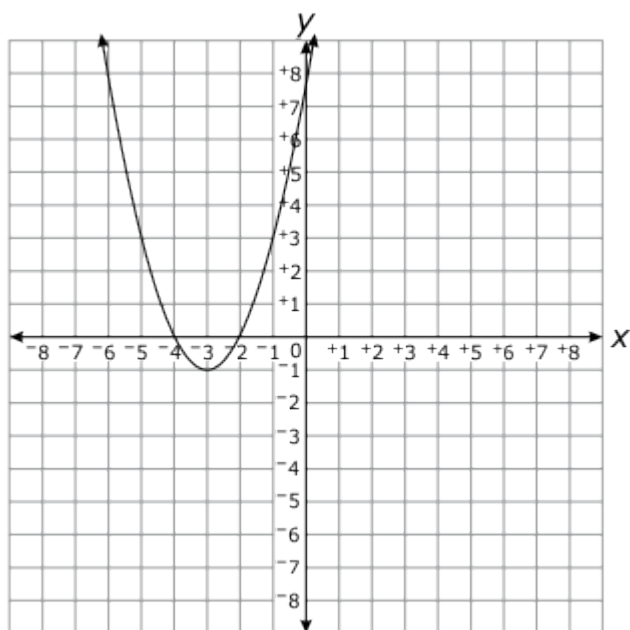**7.** Which is the graph of the equation $^-3x + 2y = 6$?

A.
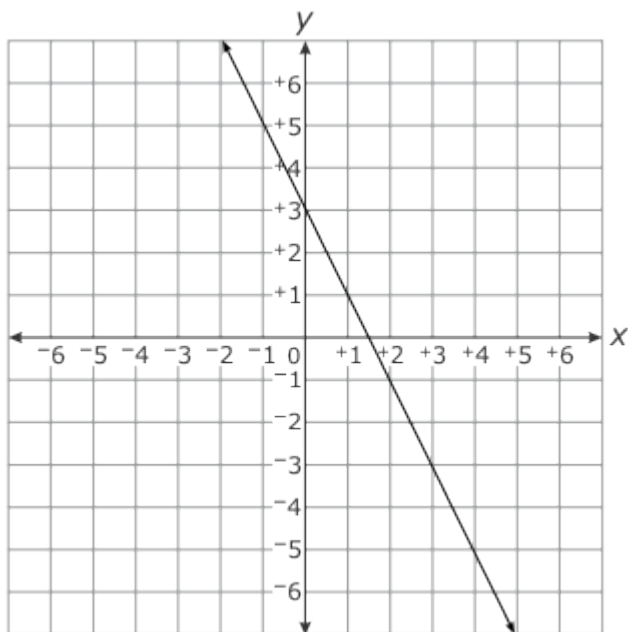
B.
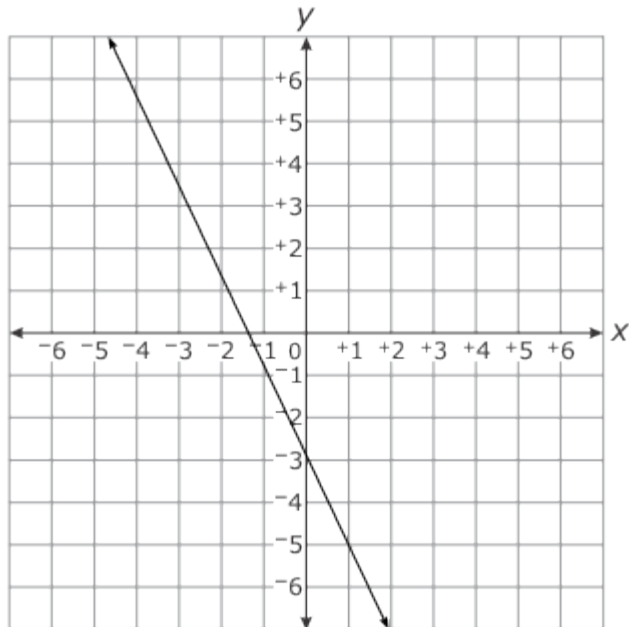
C.

D.

8. Which equation **best** models the function graphed below?
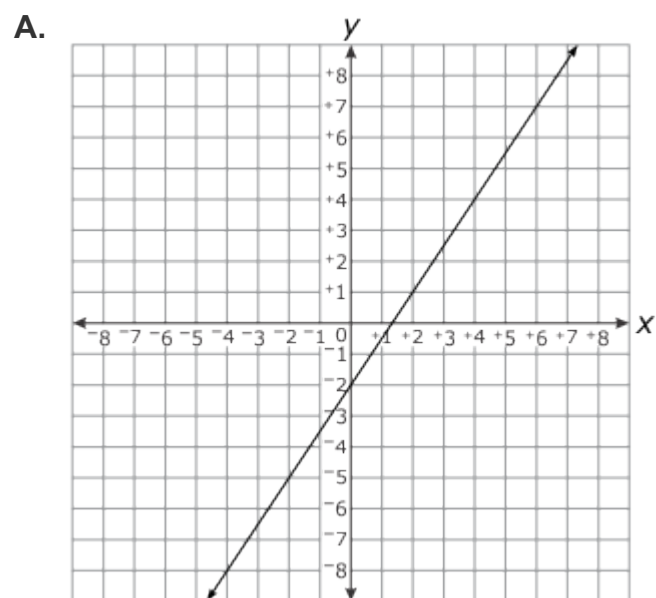

A. $y = x^2 - 6x - 8$
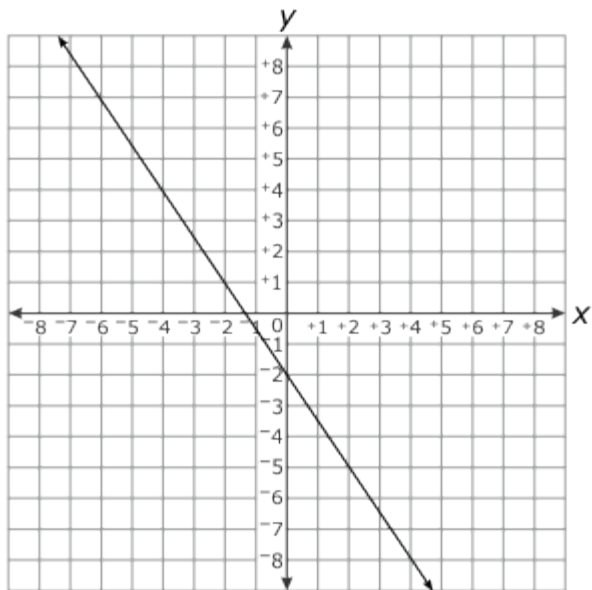
B. $y = {}^-x^2 + 6x - 8$

C. $y = {}^-x^2 + 6x + 8$

D. $y = x^2 + 6x + 8$

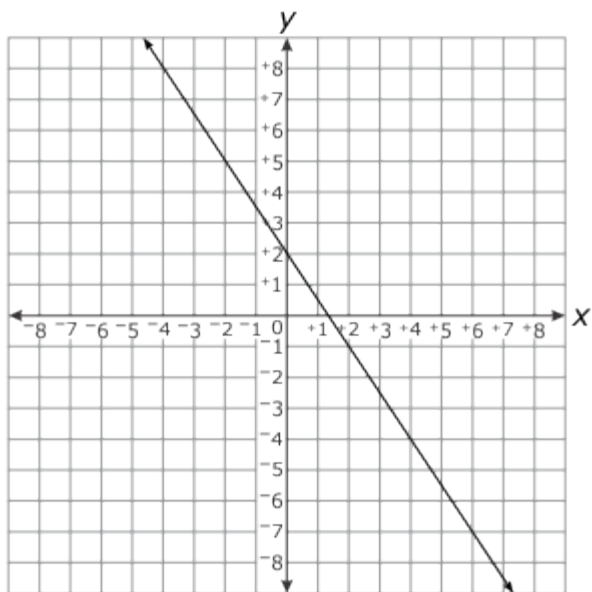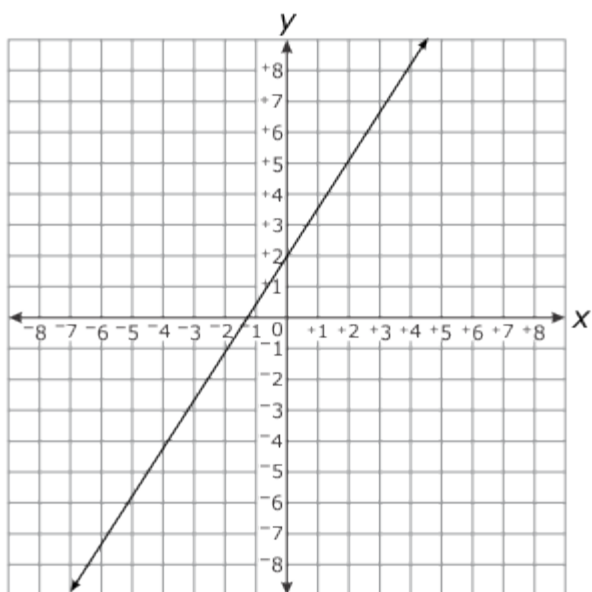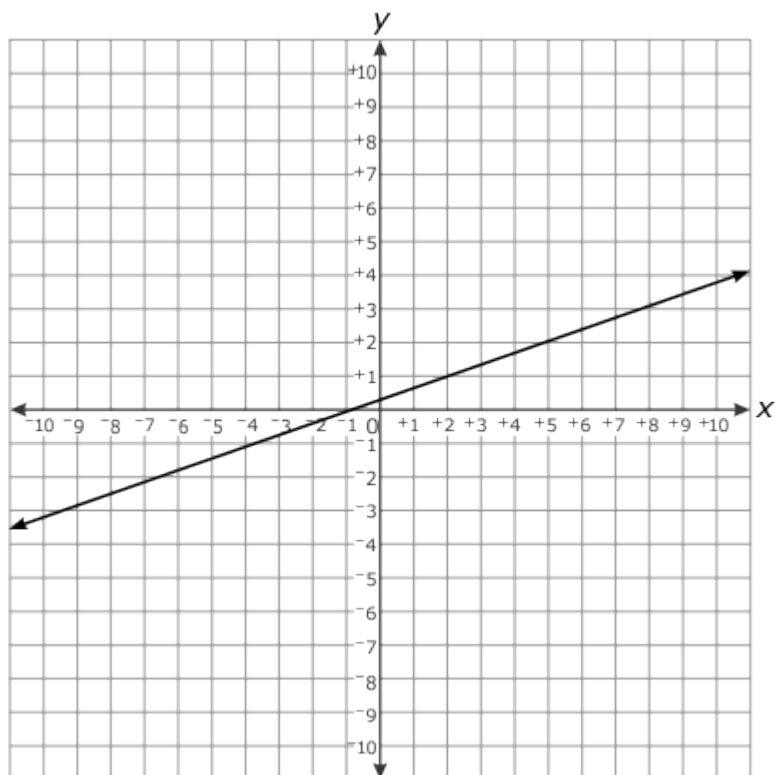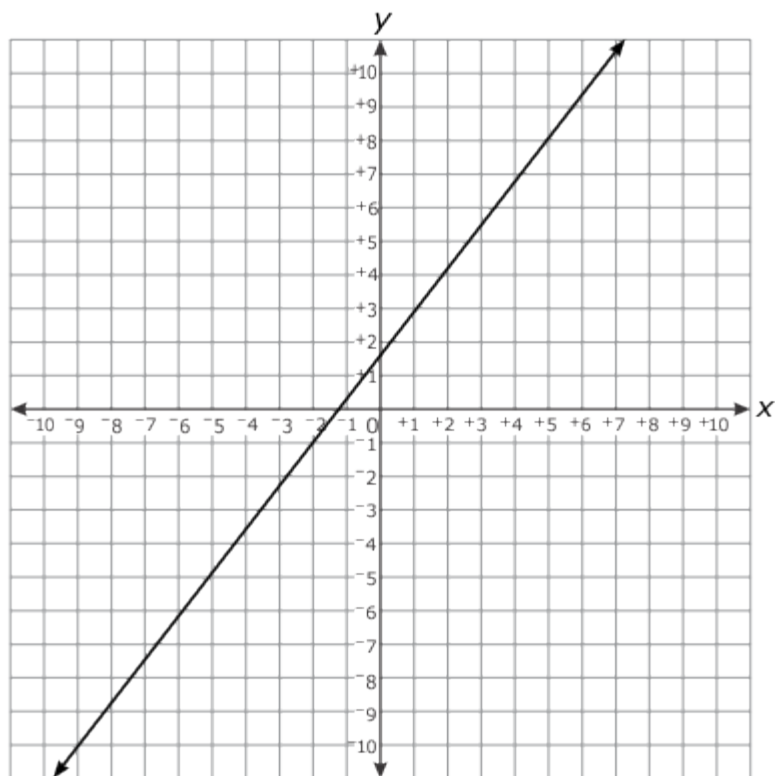9. Which is the graph of $3x - 2y = 4$?

A.

B.

C.

D.

10.

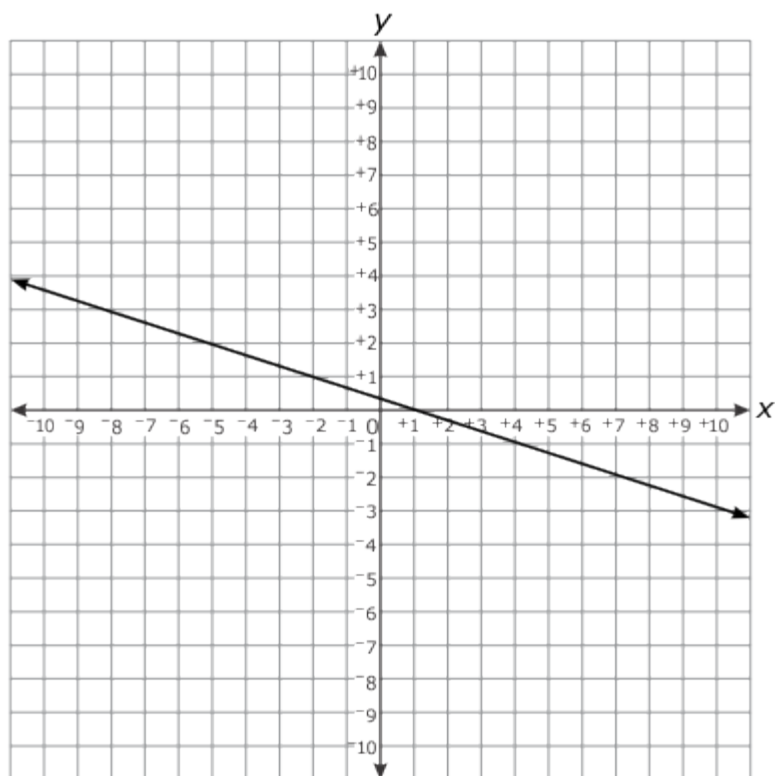Which choice is the graph of $\dfrac{2}{3}x + \dfrac{1}{2}y = \dfrac{3}{4}$?

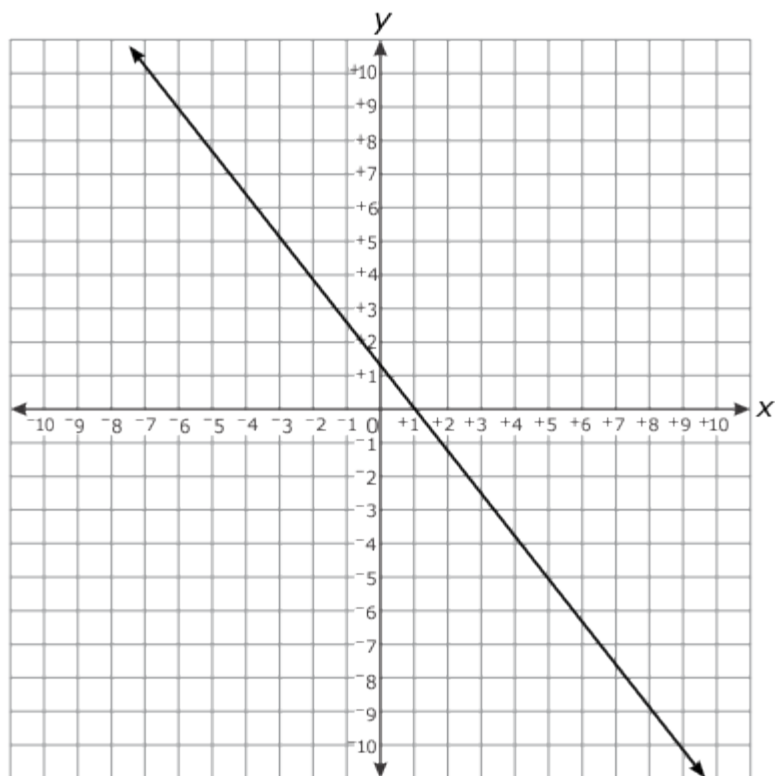**A.**

B.

C.

D.

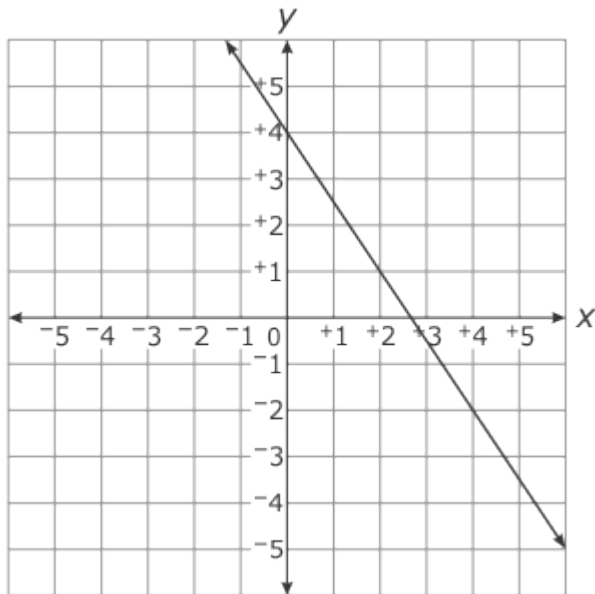**11.** Which function is graphed below?

A. $y = \dfrac{3}{2}x - 4$

B. $y = \dfrac{-3}{2}x - 4$

C. $y = \dfrac{3}{2}x + 4$

D. $y = \dfrac{-3}{2}x + 4$

12. Which graphs shows a quadratic function with a *y*-intercept of 3 and an axis of symmetry at $x = {}^-1$?

A.
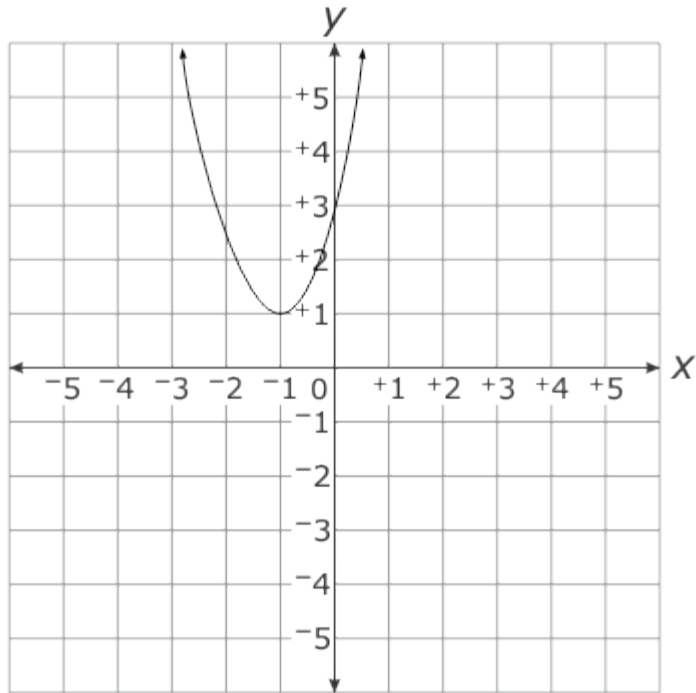
B.
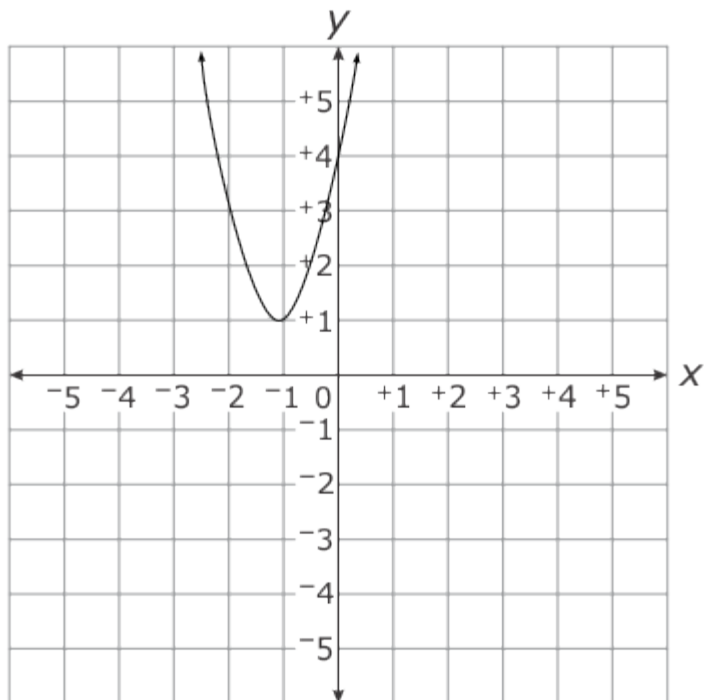
C.
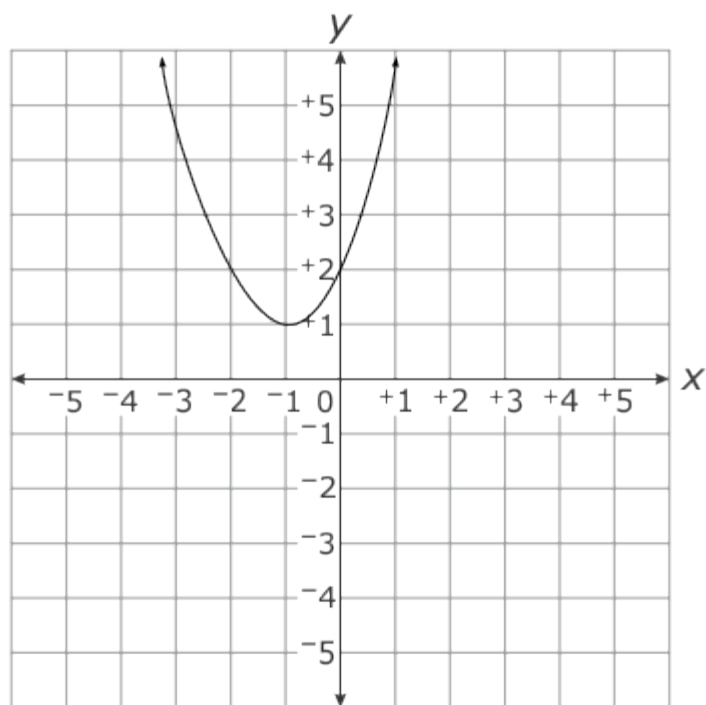
D.
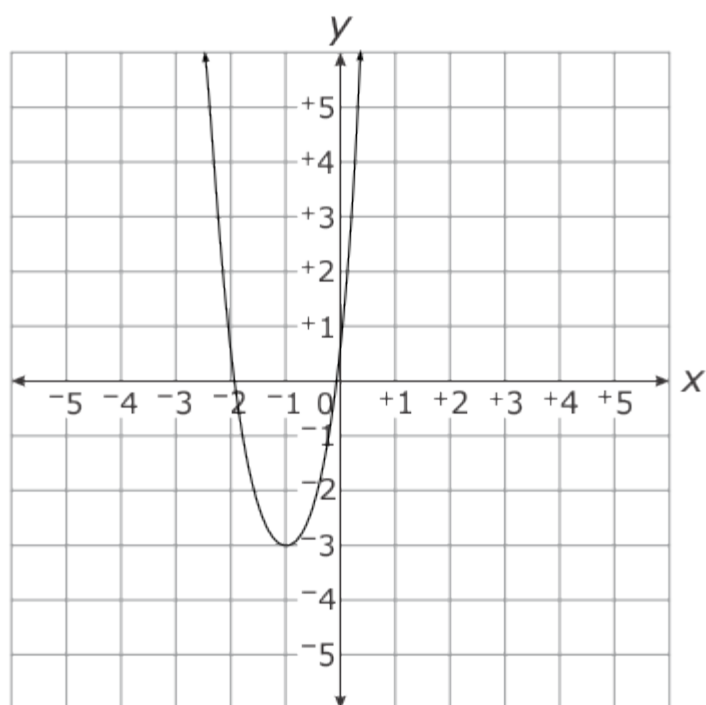
13. Which is an equation of the function graphed below?

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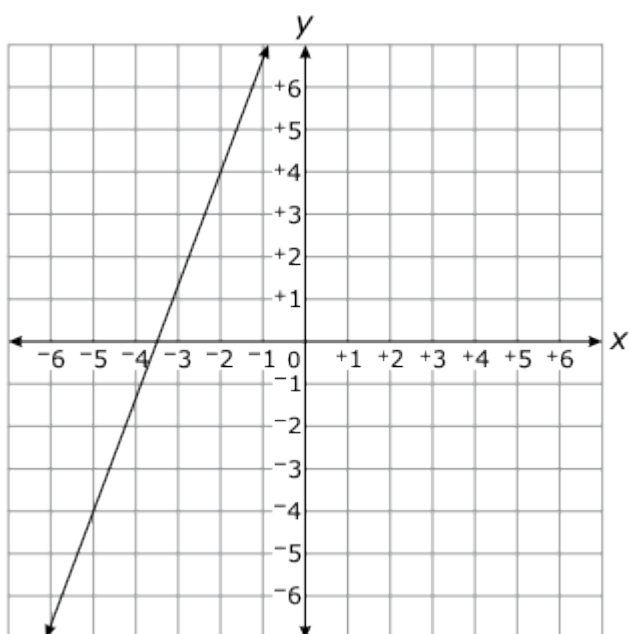
A. $8x + 3y = {}^-28$

B. $8x - 3y = {}^-28$

C. $3x + 8y = {}^-28$

D. $3x - 8y = {}^-28$

14. Which is the graph of $y = x^2 + 3$?

A.
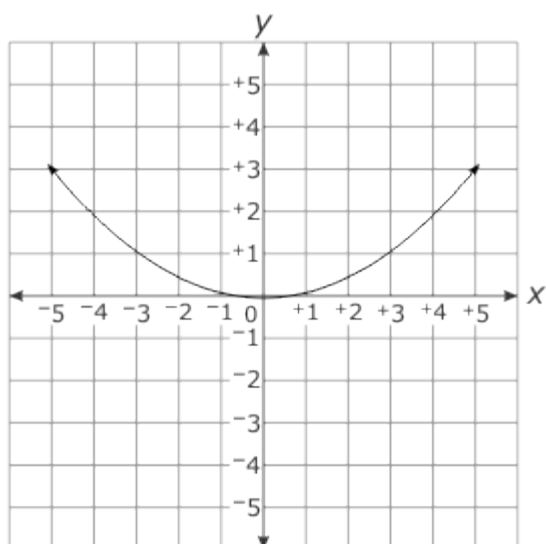
B.
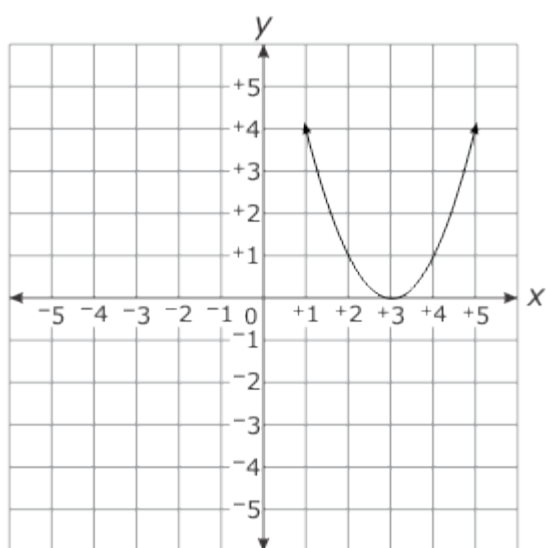
C.
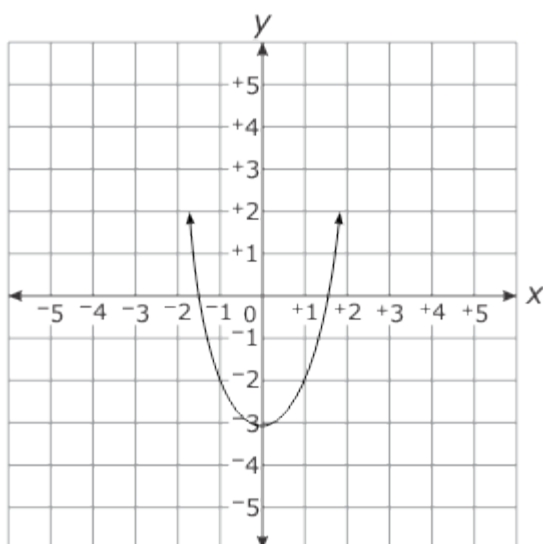
D.
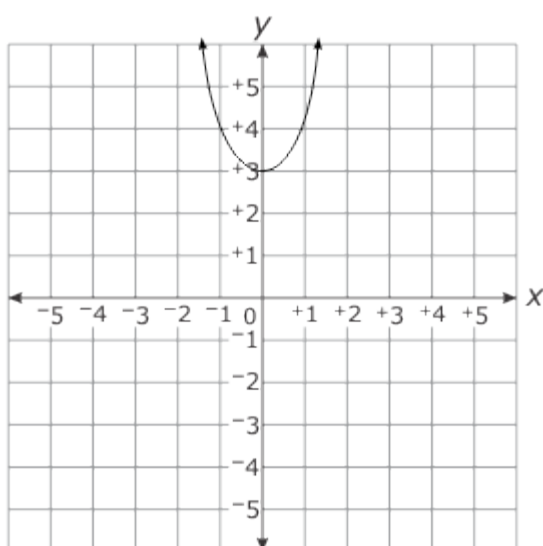
15. Which graph represents a linear function with a slope of -3 and a y-intercept of 2?

A.
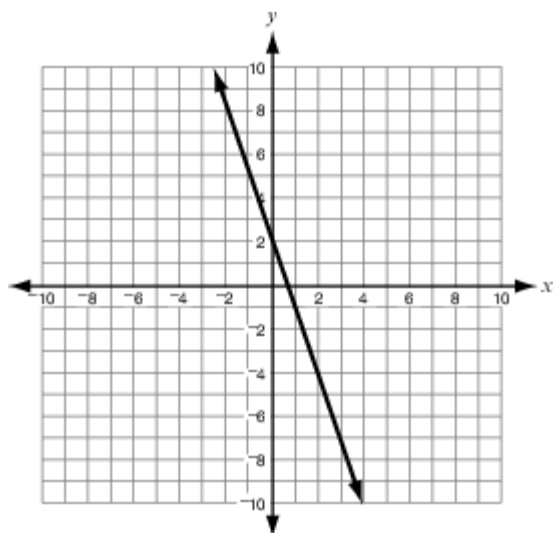
B.
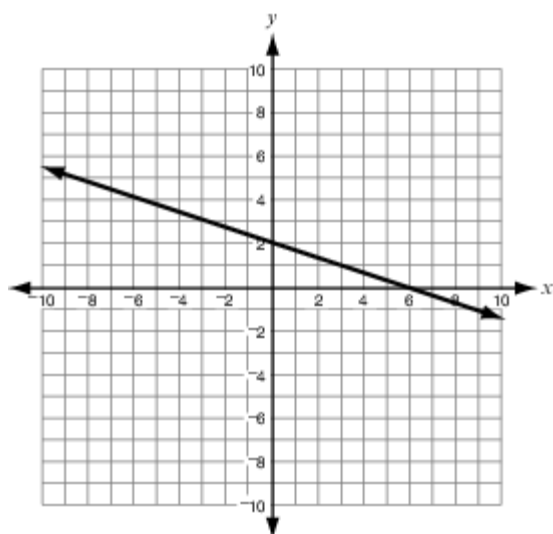
C.
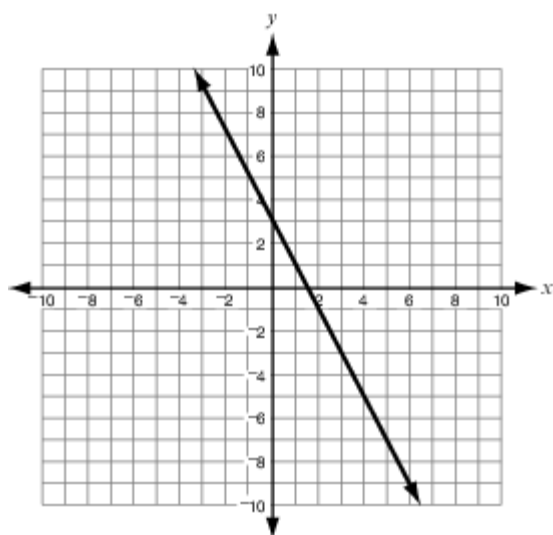
D.

16. On the coordinate plane shown, draw the graph of a linear function that has a *y*-intercept at $(0, 4)$ and *x*-intercept at $(3, 0)$.
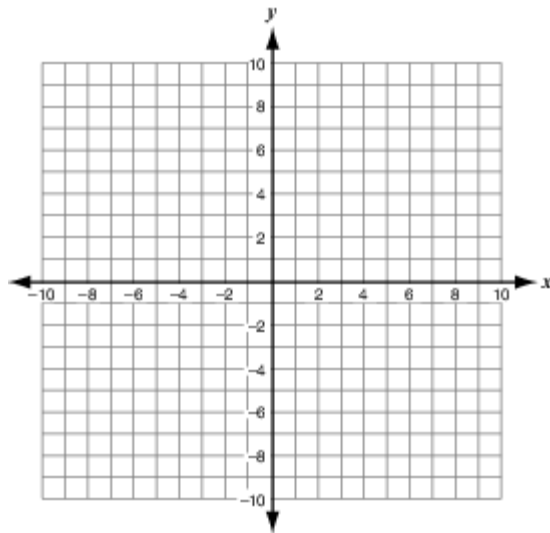
17. Which is an equation of the function graphed below?
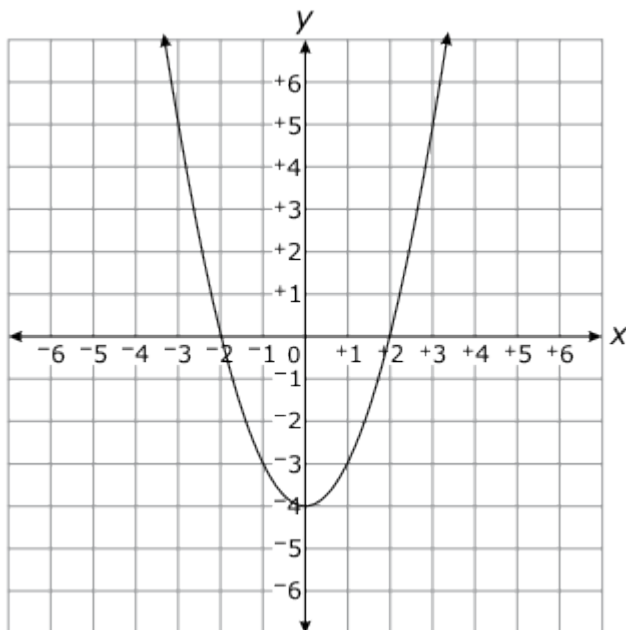
A. $y = x^2 - 4x$

B. $y = x^2 + 4x$

C. $y = x^2 - 4$

D. $y = x^2 + 4$

18. Which choice is the graph of $f(x) = -x^2 + 2x + 4$?

A.

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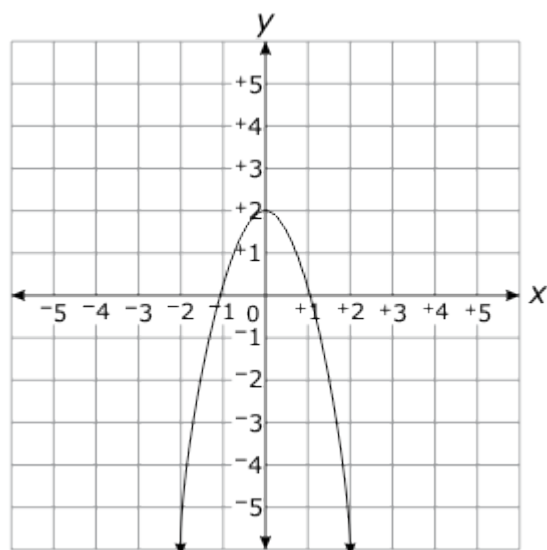
B.
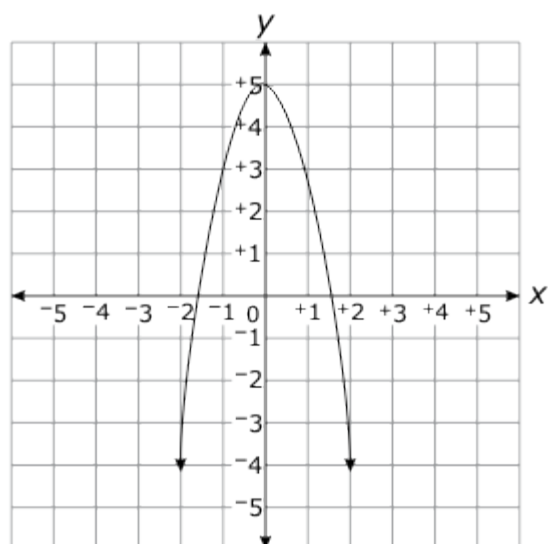
C.
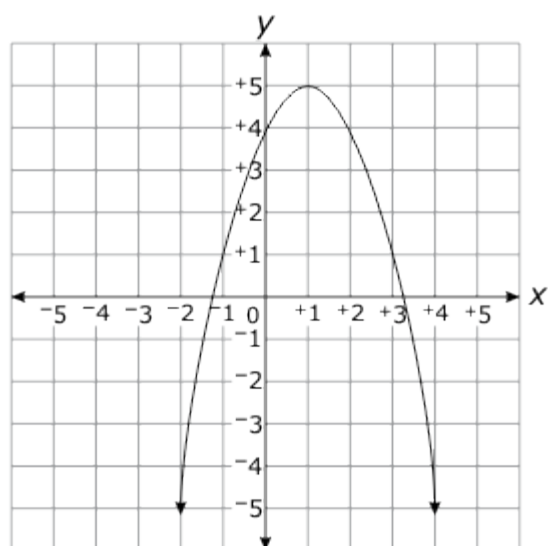
D.
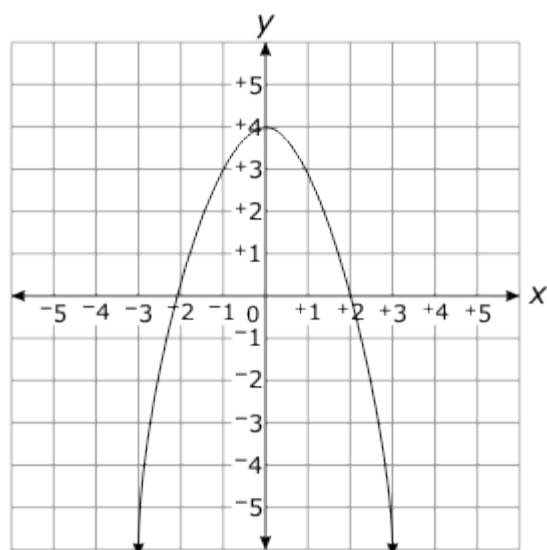
19. At approximately what point is the minimum of the graph shown below?
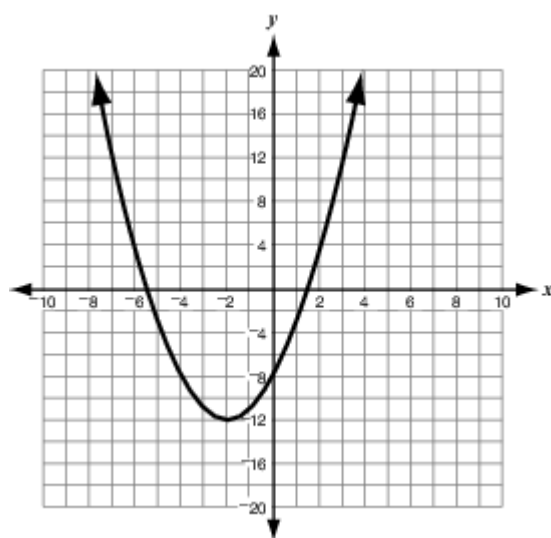
A. $(1.5, 0)$

B. $(0, -8)$

C. $(-2, -12)$

D. $(-5.5, -12)$

20. The graph of a function is shown.
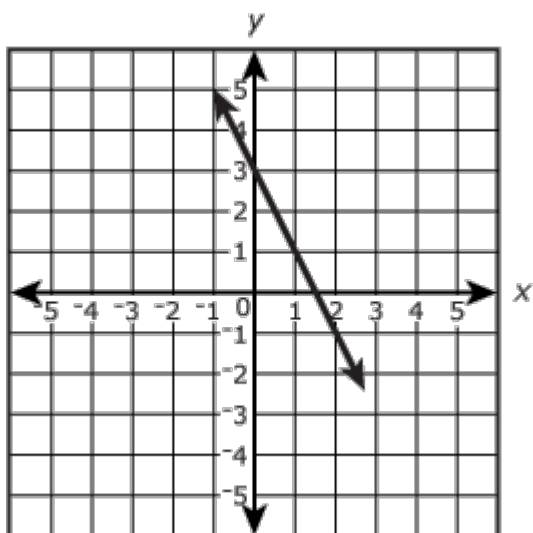
What is the *y*-intercept?

A. -3

B. -2

C. 2

D. 3

21. Which graph **best** represents the quadratic function $f(x) = 2x^2 + 5x - 6$?

A.
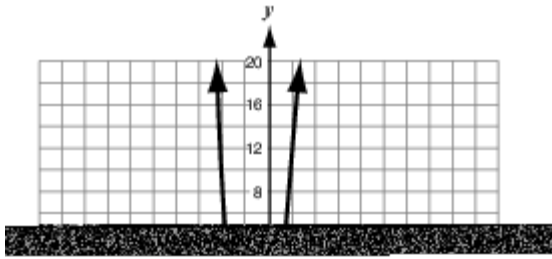
B.
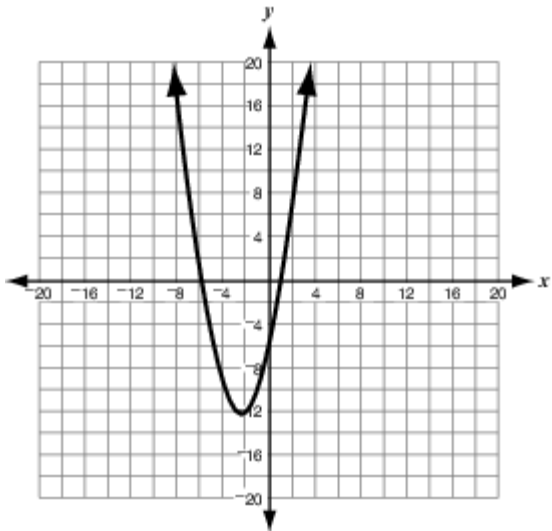
C.
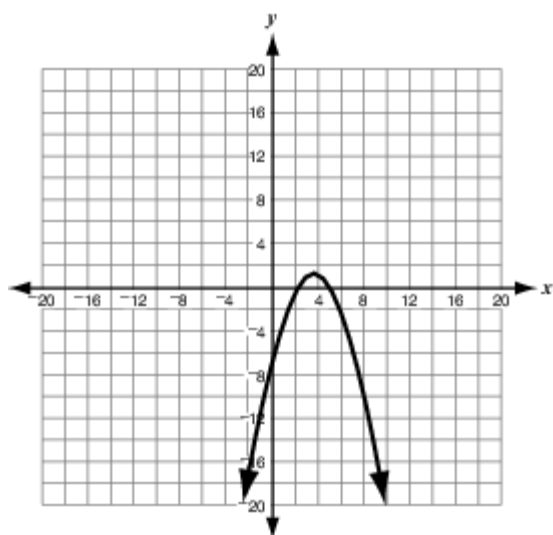
D.
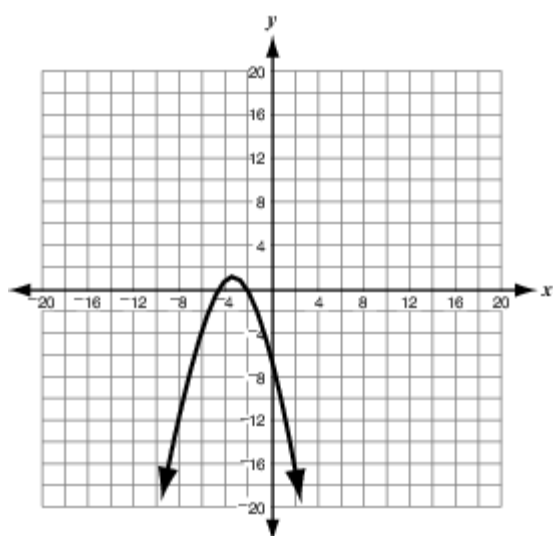
22.

Which is the graph of $y = \dfrac{^-1}{3}x + 2$?

A.
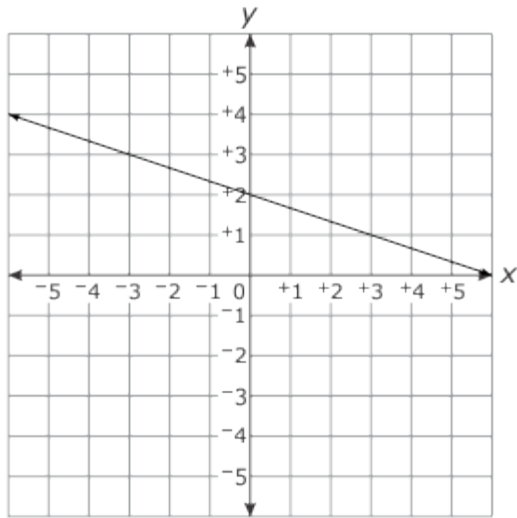
B.
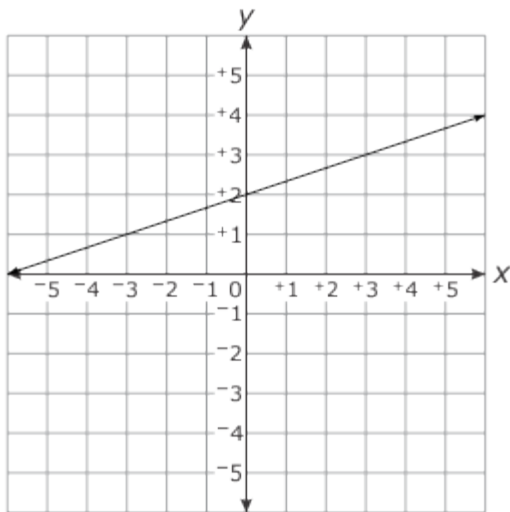
C.
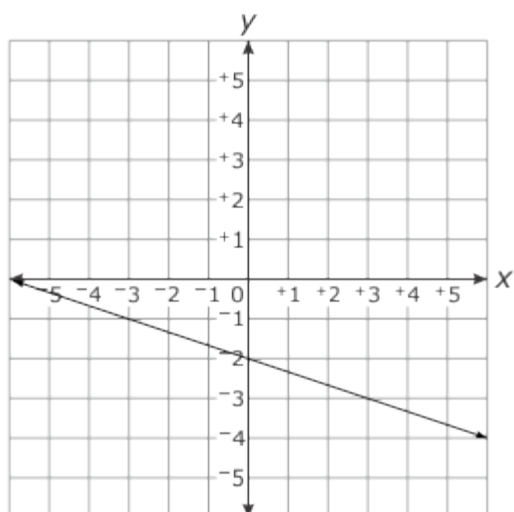
D.
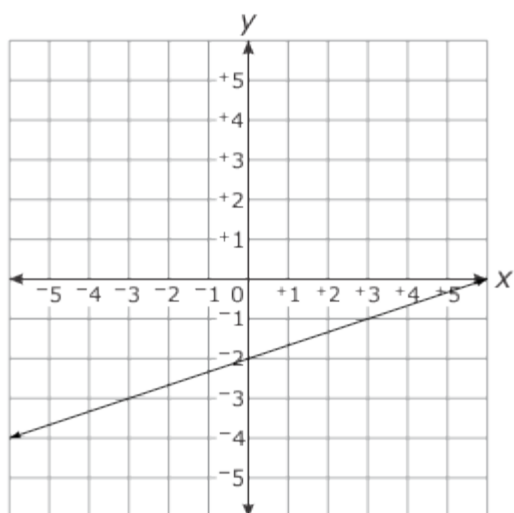
23. Which graph represents the function
$f(x) = -3x + 4$?

A.
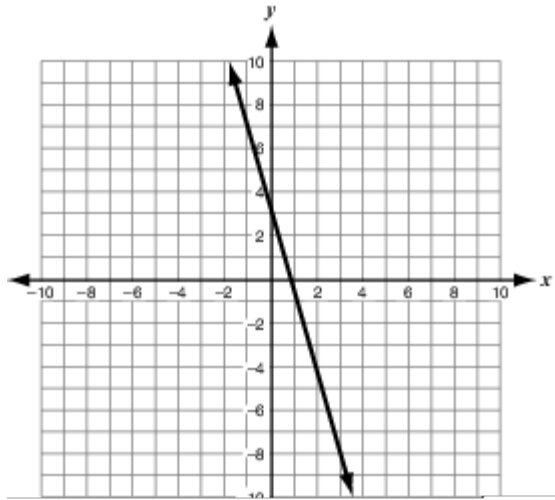
B.
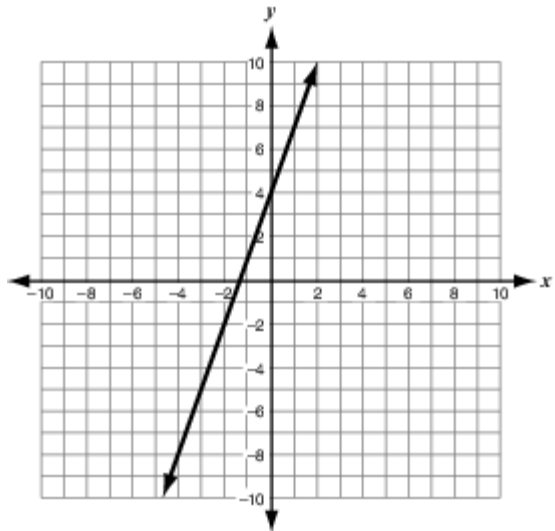
C.
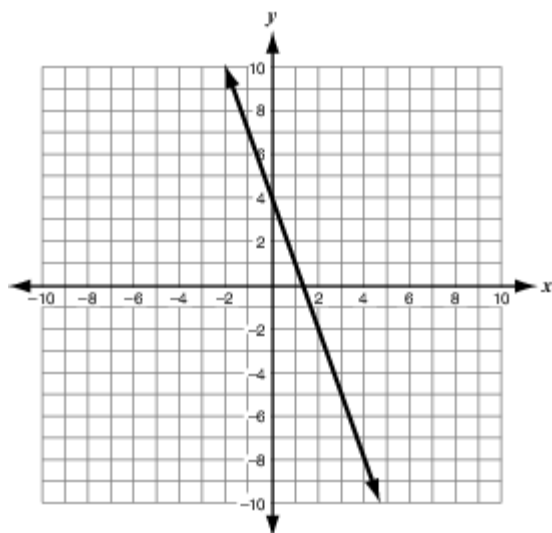
D.
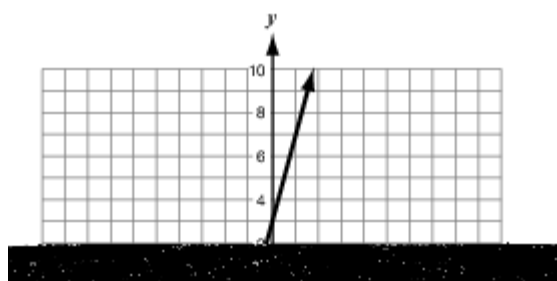
24. Use the function below to answer the questions.

$$f(x) = -2x^2 + 2x - 3$$

Part A. Graph the function $f(x)$. What are the the x- and y-intercepts of this function?

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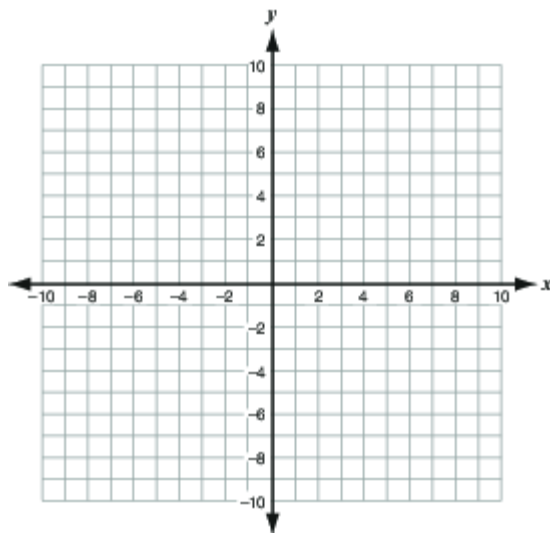
Part B. What is the equation for the axis of symmetry of $f(x)$?

Use words, numbers, and/or pictures to show your work.

25. Which choice is an equation of the line graphed below?
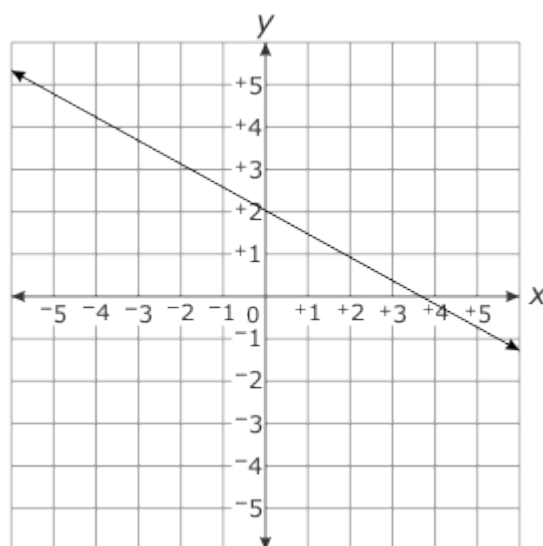
A. $y = {}^{-}2x + 2$

B. $y = \dfrac{^-1}{2}x + 2$

C. $y = \dfrac{1}{2}x + 2$

D. $y = 2x + 2$

26.

Which is the graph of $\dfrac{2}{3}x - \dfrac{1}{4}y = \dfrac{1}{2}$?

A.
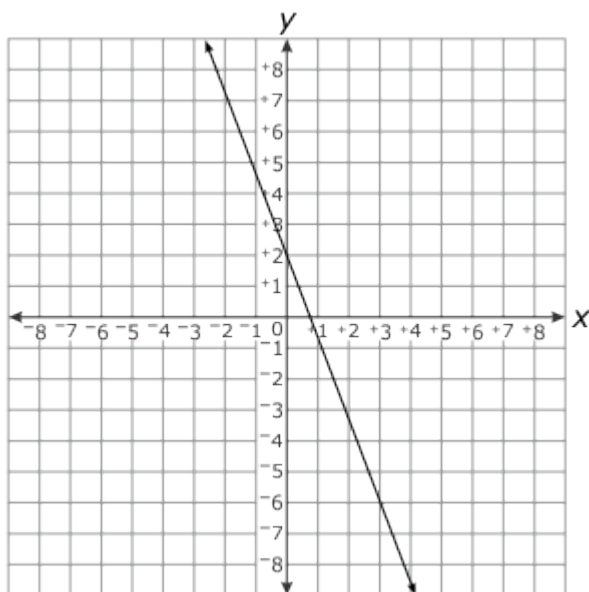
B.
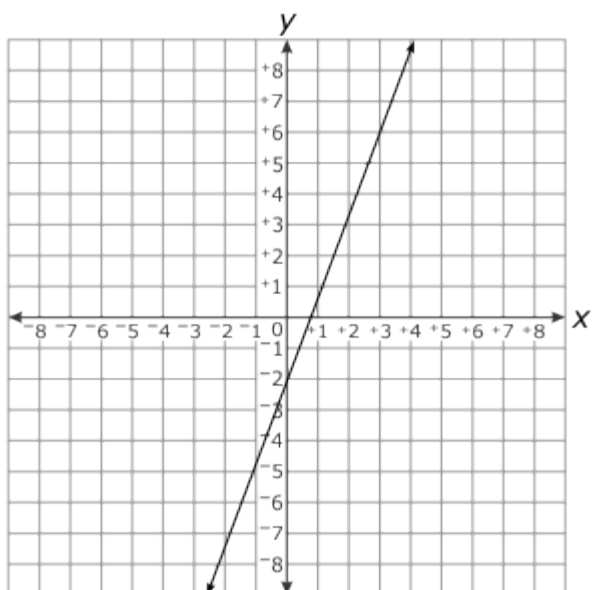
C.
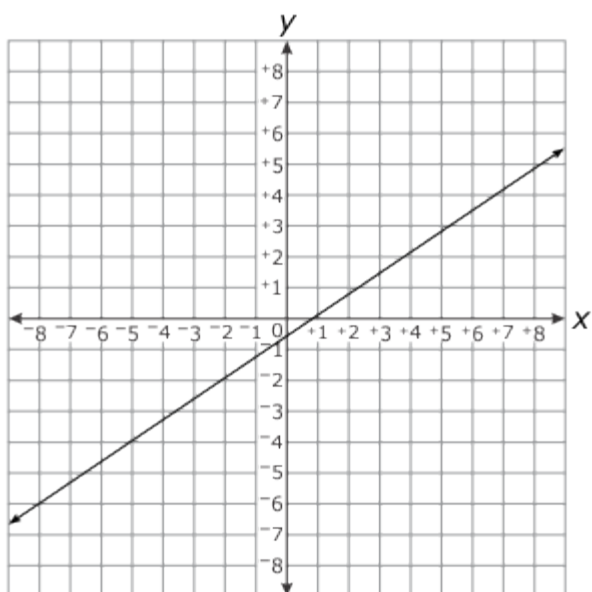
D.
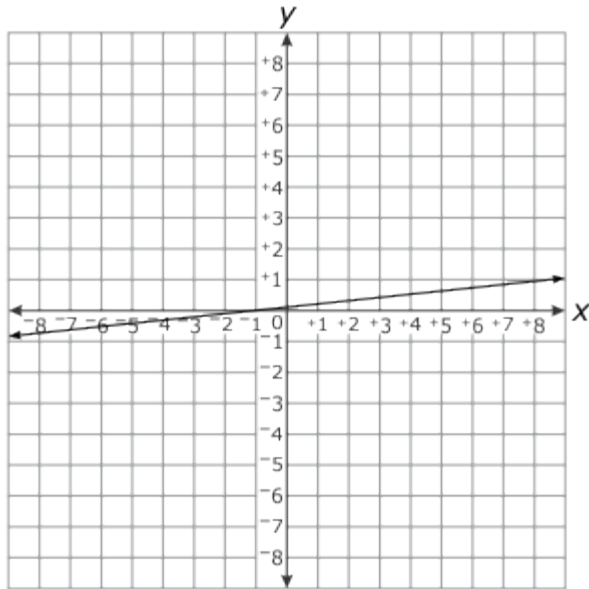
27. Harold owns a canoe rental business. He charges $10 per canoe rental and averages 20 rentals a day. He observes that for every $0.50 increase or decrease in the rental price, he loses or gains rentals each day.

The revenue earned by the business is represented by the function $R(x) = -x^2 - 10x + 200,$ where x represents the number of times the rental price is changed by $0.50.

- Represent the revenue function graphically.
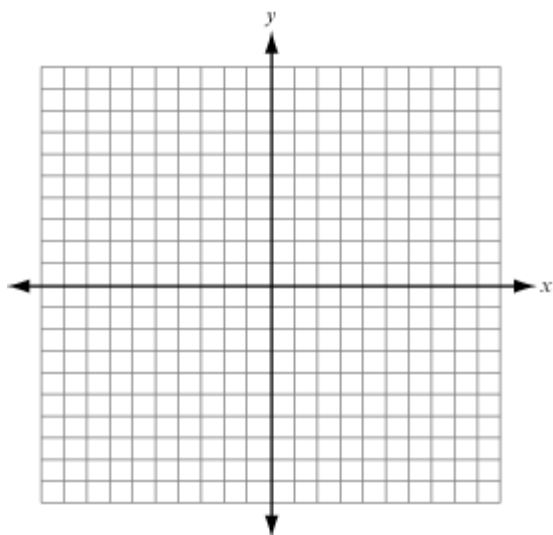
- Determine what price Harold should charge per canoe rental to earn the maximum revenue.

28.
Which is the graph of $f(x) = \frac{-1}{2}x - 5$?

A.

B.

C.

f(x)

D.

f(x)
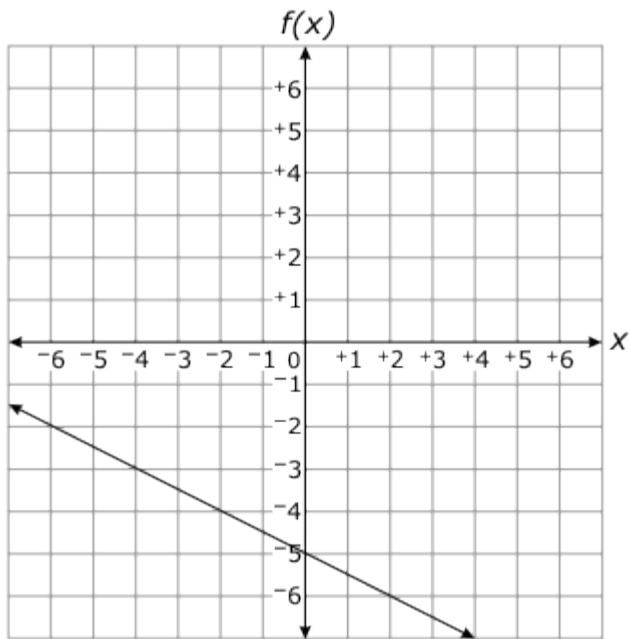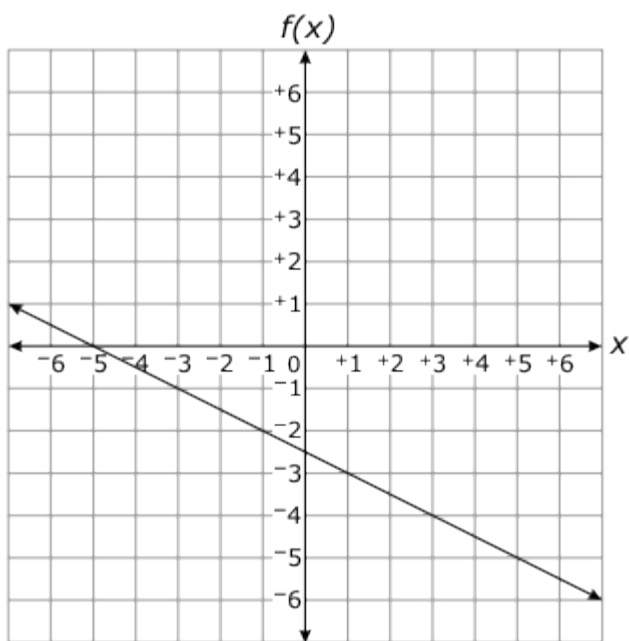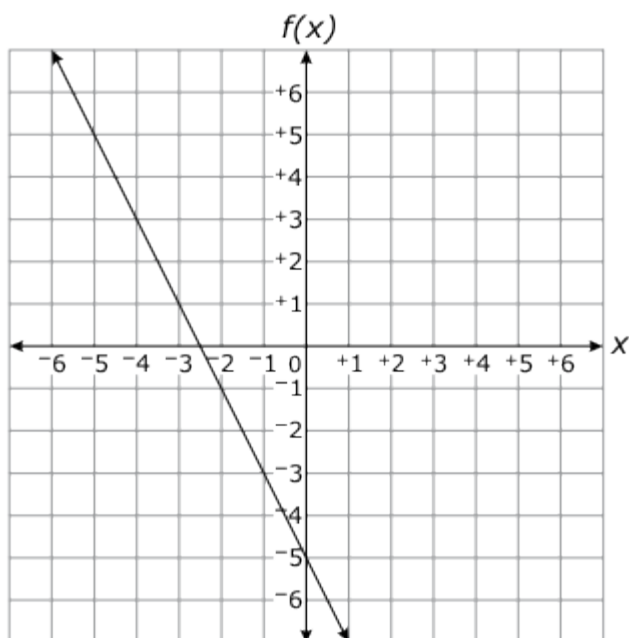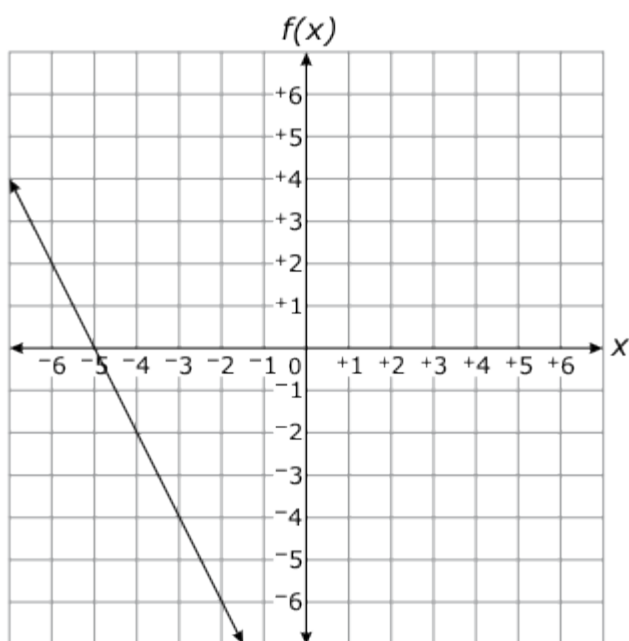
29.   **The Beauty of Gold**

The rectangle below, called a "golden rectangle," has a special property.

The ratio of the long side to the short side, $\dfrac{1}{x}$, is equal to the ratio of the

long side of the small rectangle to the short side of the small rectangle, $\frac{x}{1-x}$.
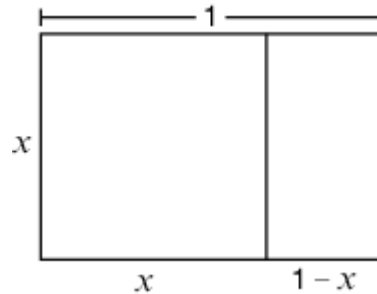
$$\frac{1}{x} = \frac{x}{1-x}$$

Part 1.

Cross-multiply the proportion above to produce a quadratic equation. Write the equation in this form:

$$ax^2 + bx + c = 0$$

Identify the values of a, b, and c.

$a =$ ____

$b =$ ____

$c =$ ____

Part 2.

Use the quadratic formula to solve for x when the expression is equal to 0.

Give the approximate decimal values of x, to the nearest thousandth.

Part 3.

Using the expression that was set equal to zero in Part 1 to find y, fill in

the table to identify values that fit the equation $ax^2+bx+c=y.$

x	y
	0
	0
0	
1	
2	
3	

Part 4.

Identify the axis of symmetry of the graph.

Identify the minimum of the graph.

Part 5.

Plot the points in the table on the grid and sketch the graph of the function.

Part 6.

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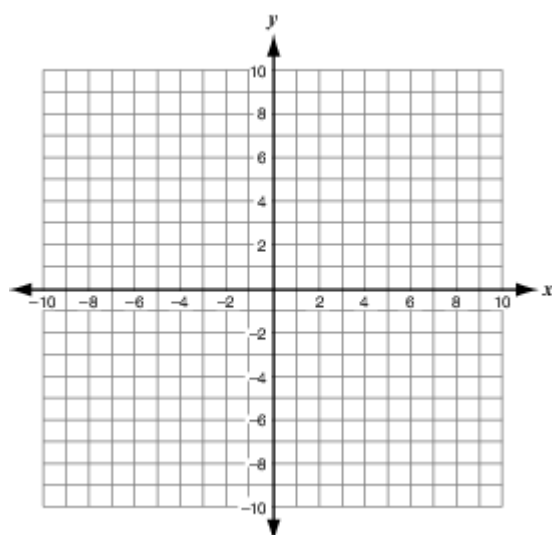
There are two other rectangles that have important ratios. If the width of the rectangles is assumed as x, the areas of the rectangles are given by the functions $p(x) = x^2 + 7x$ and $q(x) = x^2 + 6x$. Sketch the graphs of the two functions on the grid below. Label the functions $p(x)$ and $q(x)$.
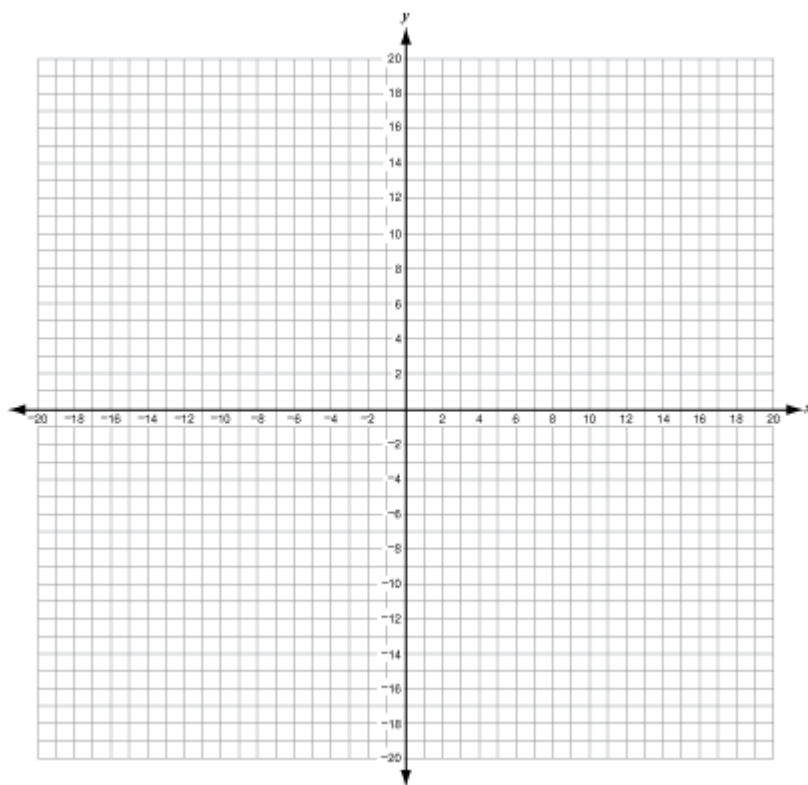
Part 7.

Examine $p(x)$ and $q(x)$ over a particular interval in the first quadrant. For positive values of x, determine which function represents the area of the rectangle that increases at a faster rate as the width increases.

Use words, numbers, and/or pictures to show your work.

30. Which statement is true for the graph
$y = x^2 + 2x - 3$?

 A. The x-intercepts are $^-3$ and 1, and the minima is

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(−1, −4).

B. The *x*-intercepts are −3and
1, and the minima is
(1, 0).

C. The *x*-intercepts are 3 and
−1 ,and the minima is
(−1, −4).

D. The *x*-intercepts are 3 and
−1 ,and the minima is
(1, 0).

31.

Graph the function $f(x) = 2x^2 + 4x + 8$ on the coordinate plane below.
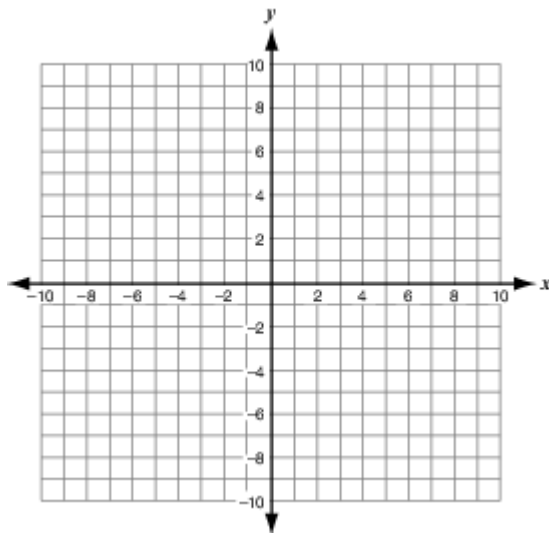
32. Function $f(x)$ has a minimum value of −4 and a maximum value of 8.

Which graph **most likely** represents function $f(x)$?

A.
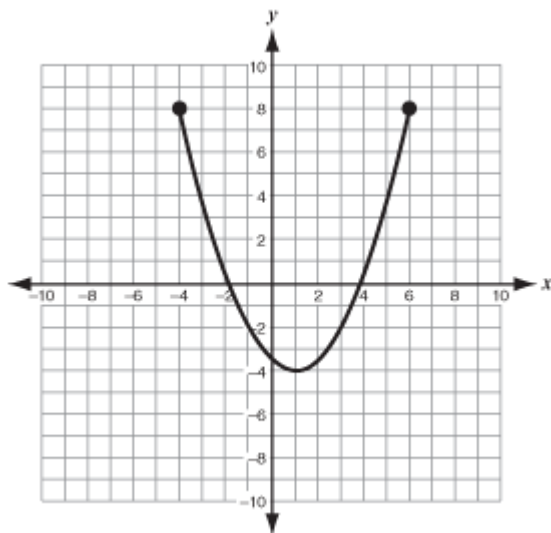
B.
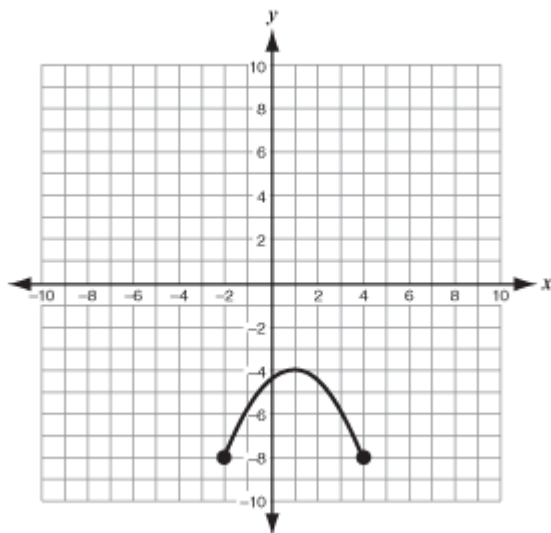
C.
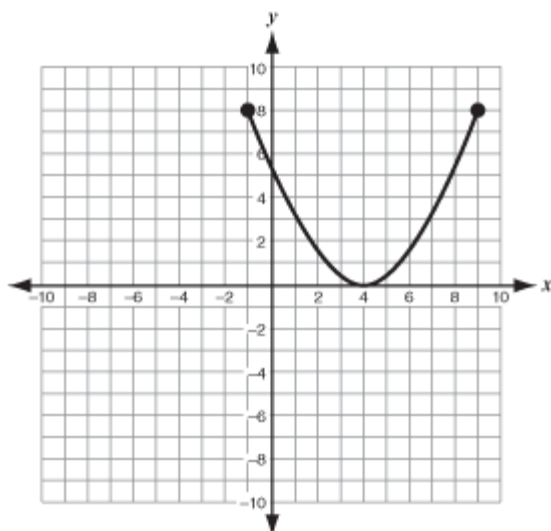
D.
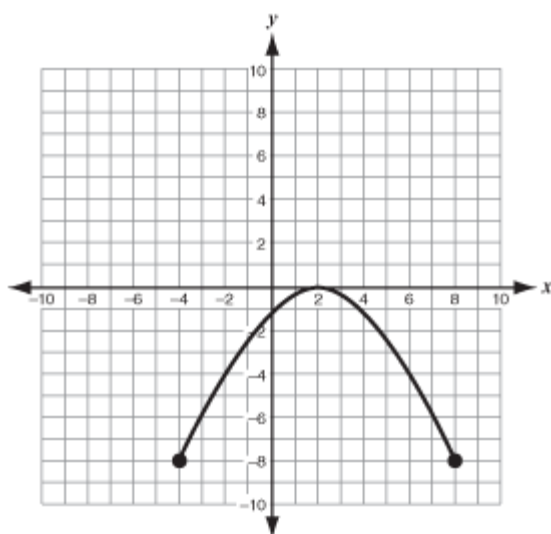
33. Which choice is an equation of the line graphed below?
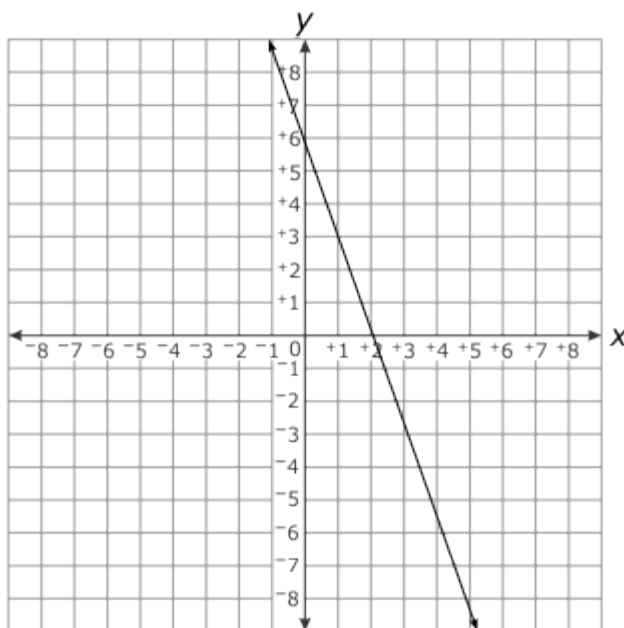
A. $y = \dfrac{^-1}{3}x + 6$

B. $y = {}^-2x + 6$

C. $y = {}^-3x + 6$

D. $y = {}^-6x + 2$

34. Which is an equation of the function graphed below?
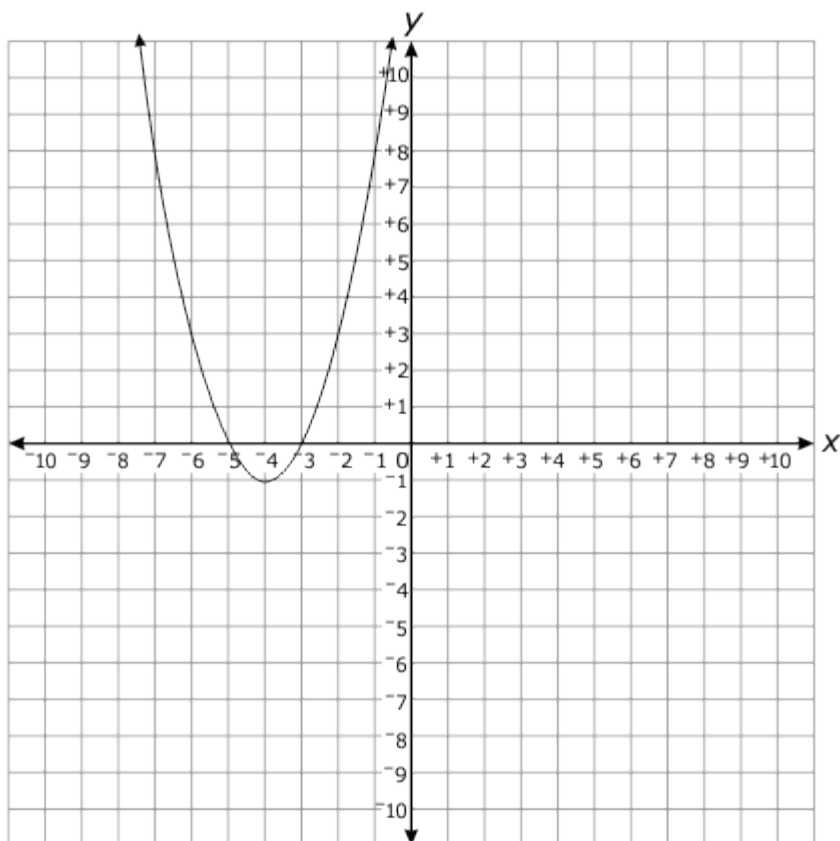
A. $y = ^{-}x^2 + 8x + 15$

B. $y = ^{-}x^2 + 8x - 15$

C. $y = x^2 + 8x - 15$

D. $y = x^2 + 8x + 15$

35.

A function has a slope of $\frac{2}{3}$ and a y-intercept of 1. Which is the graph of this function?

A.
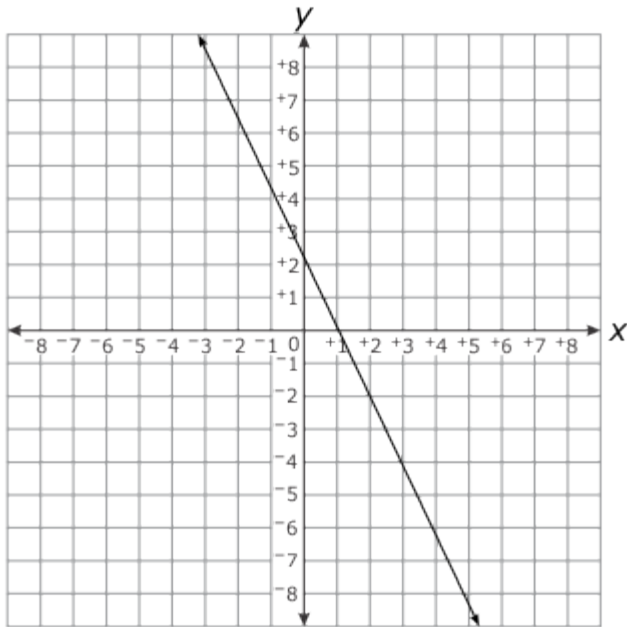
B.
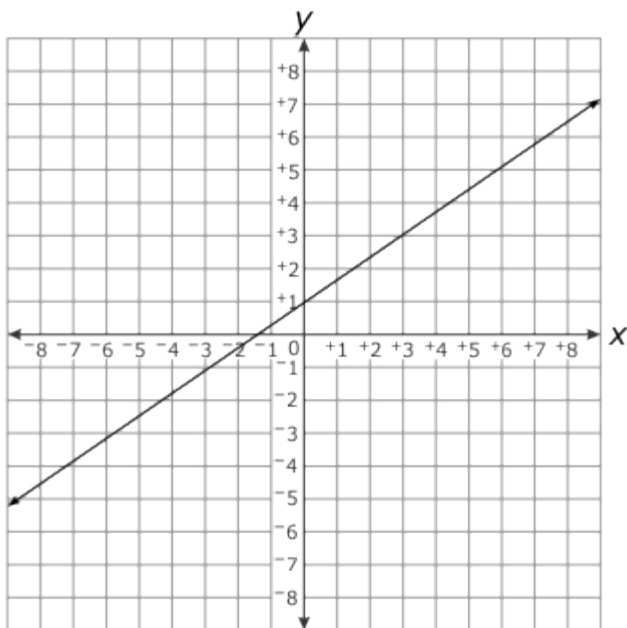
C.
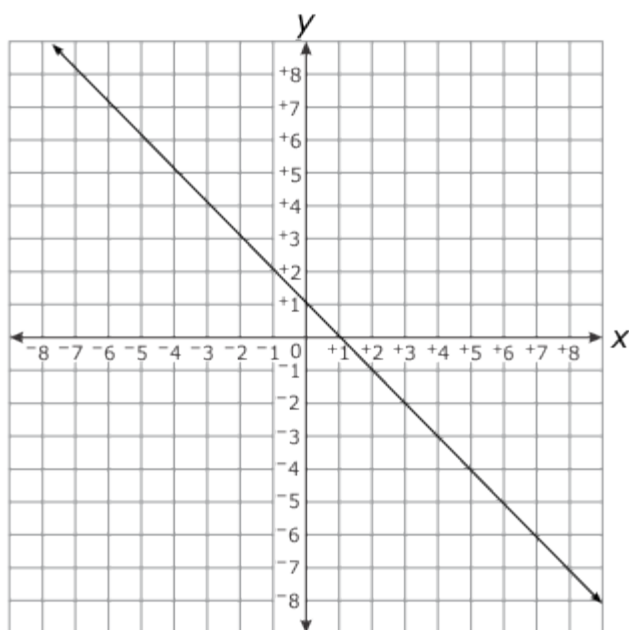
D.
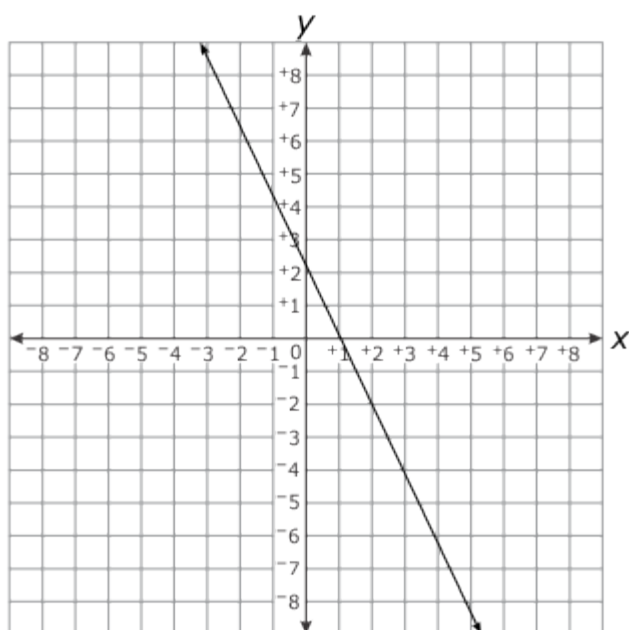
36. Which is the graph of $3x + 4y = 8$?

A.
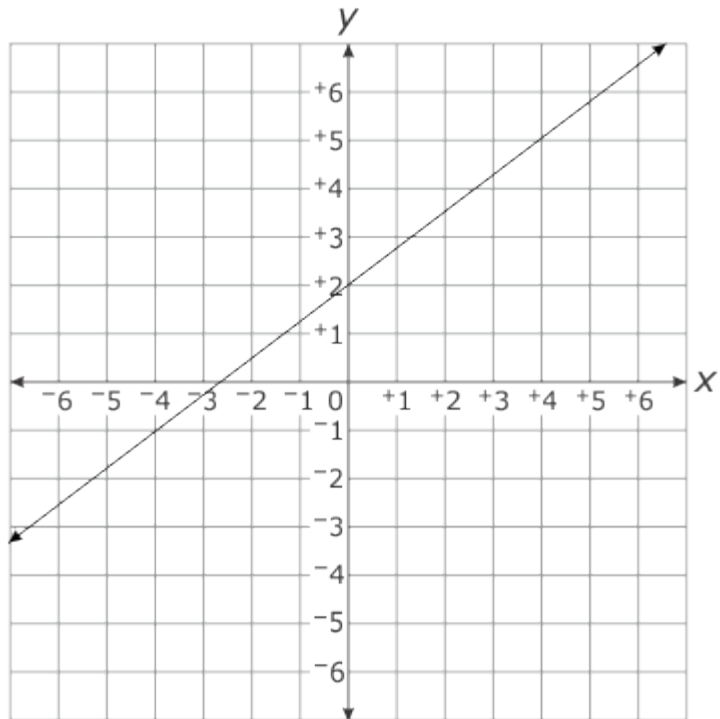
B.
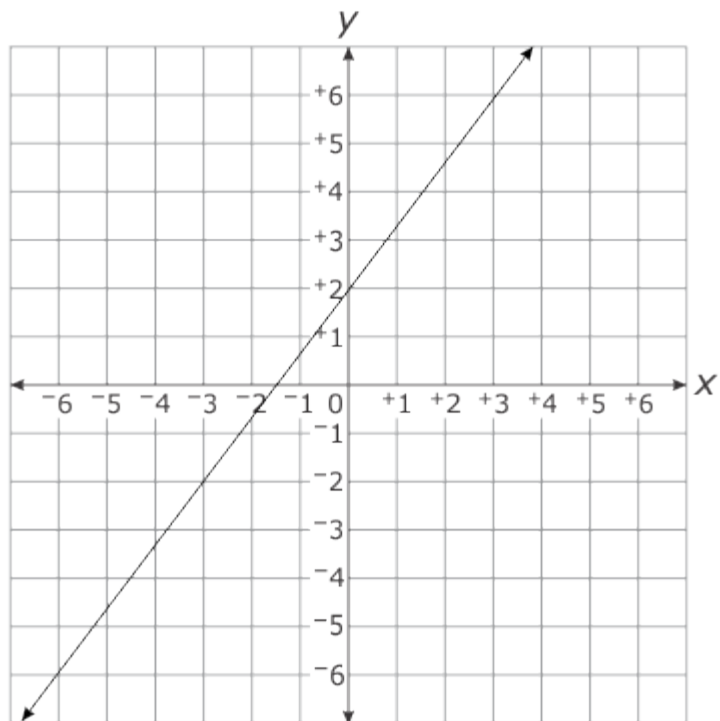
C.
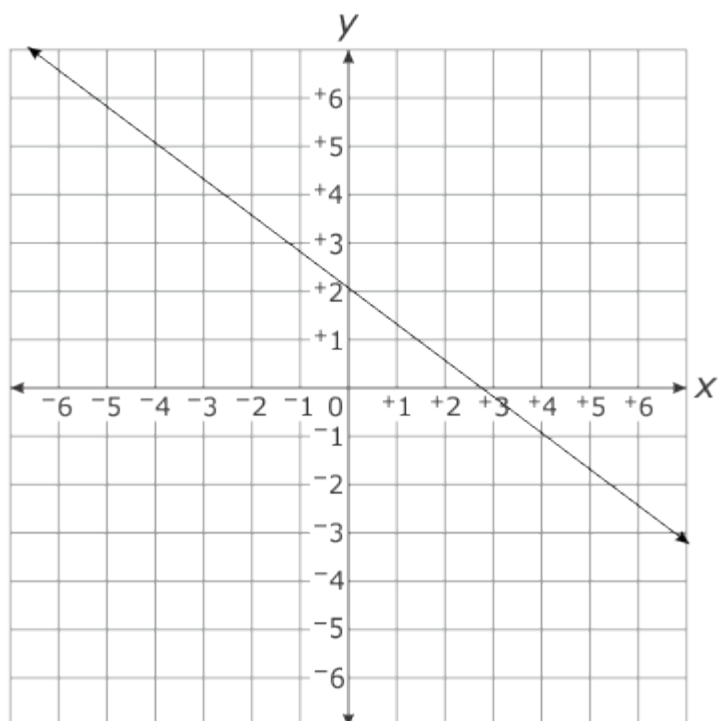
D.
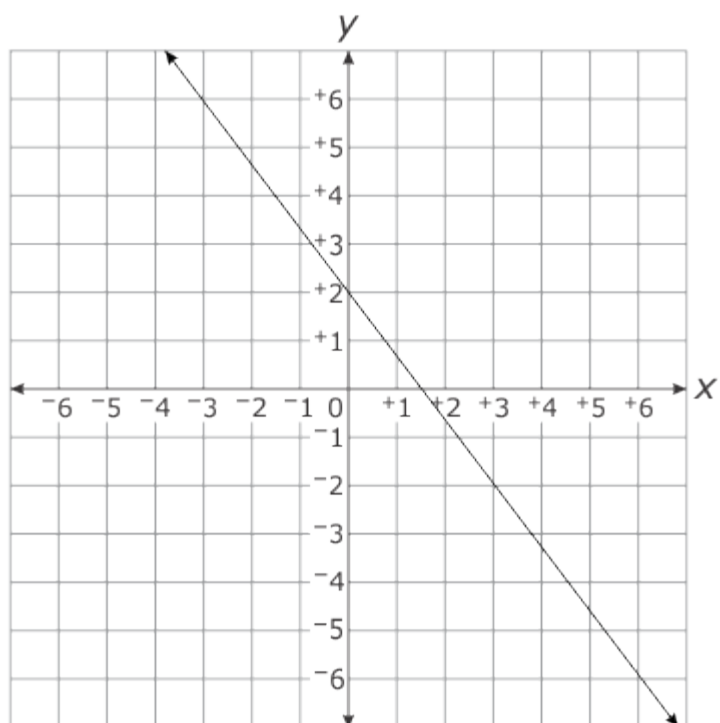
37. Which graph models the function $2(2x + y) = 6$?

A.
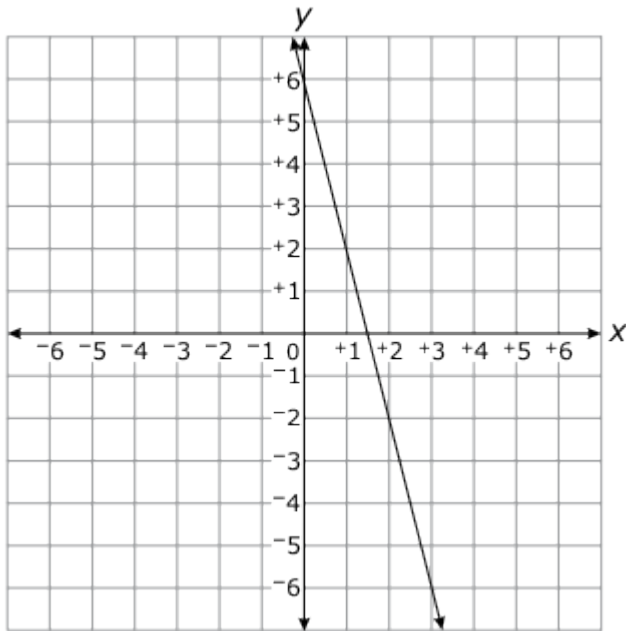
B.
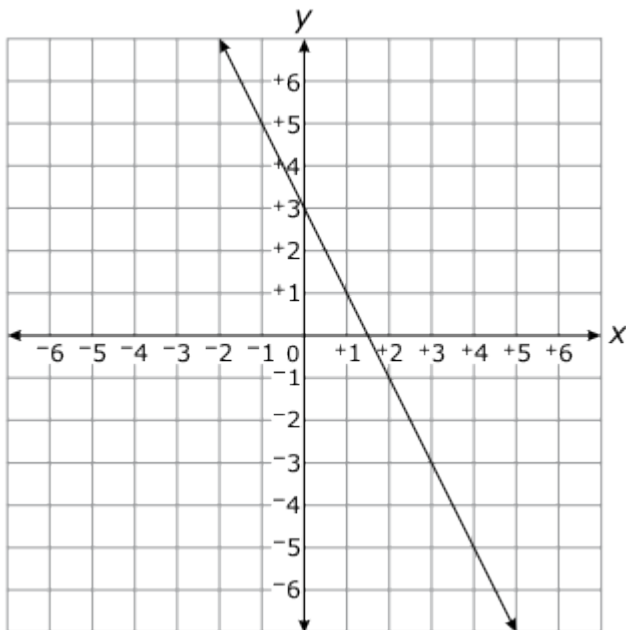
C.
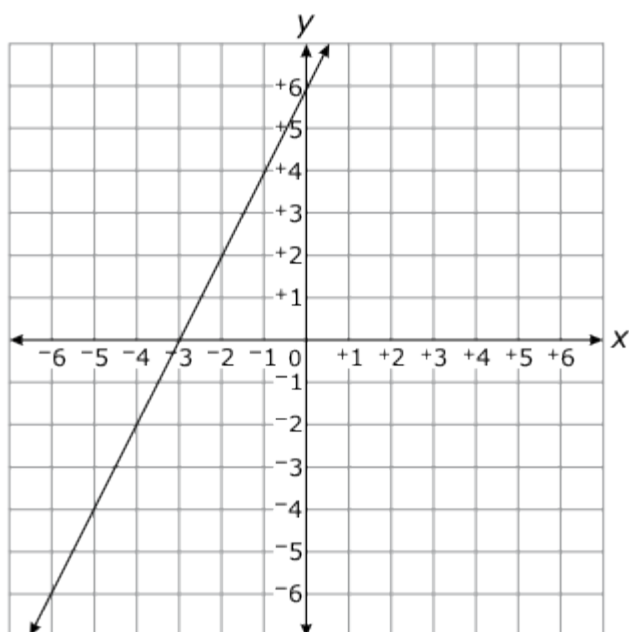
D.
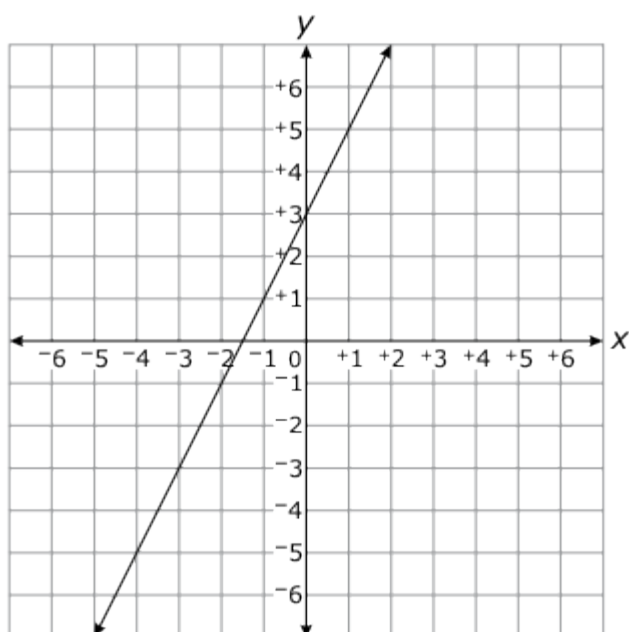
38. Which function has a minimum at the point (-2, -3)?

A. $y = (x - 2)^2 - 3$

B. $y = (x - 2)^2 + 3$

C. $y = (x + 2)^2 + 3$

D. $y = (x + 2)^2 - 3$

39. Which is the graph of $y - 1 = x^2$?

A.
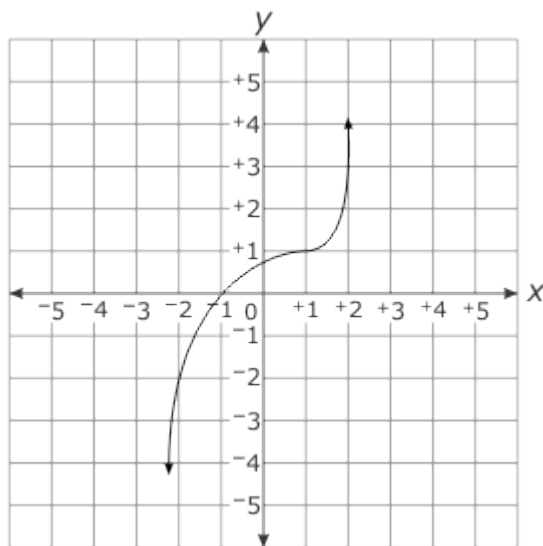
B.
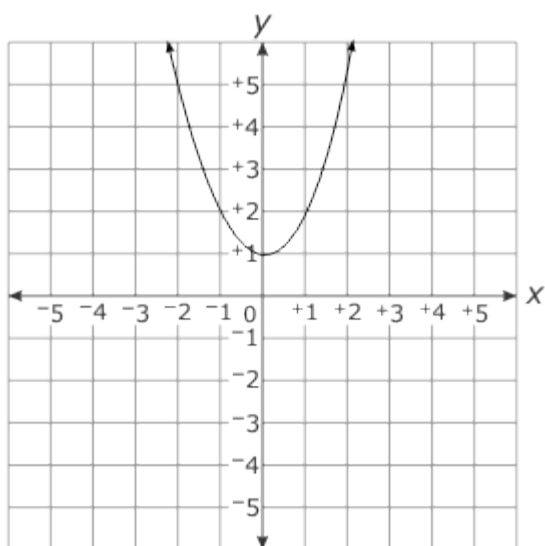
C.
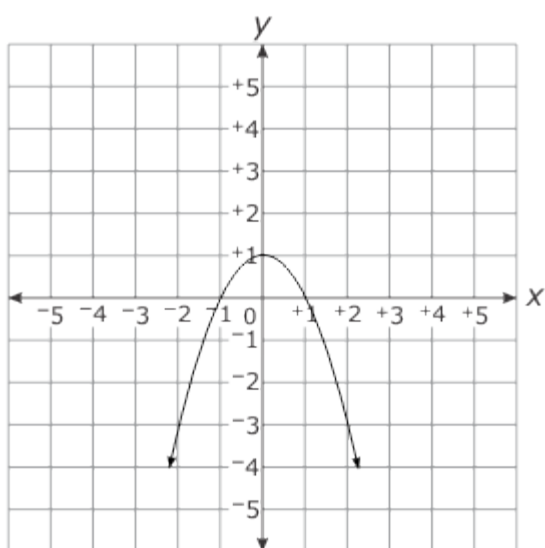
D.
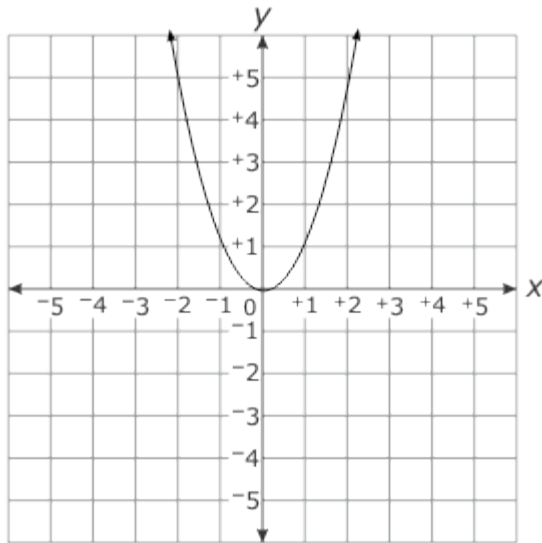
40. Two functions are shown in the table below.

x	f(x)	g(x)
0	9	1
1	15	2
2	25	4
3	39	8

Which statement is true about the functions when $x = 8$?

A. The value of $f(x)$ exceeds the value of $g(x)$ by 87.

B. The value of $g(x)$ exceeds the value of $f(x)$ by 87.

C. The value of $f(x)$ exceeds the value of $g(x)$ by 153.

D. The value of $g(x)$ exceeds the value of $f(x)$ by 153.

41. Two functions are listed below.

$$f(x) = 200 + 50x$$
$$g(x) = 50(1.5)^x$$

Which statement is true about the two functions when $x = 10$?

A. The value of $f(x)$ exceeds the value of $g(x)$ by about 50.

B. The value of $g(x)$ exceeds the value of $f(x)$ by about 50.

C. The value of $f(x)$ exceeds the value of $g(x)$ by about 2,200.

D. The value of $g(x)$ exceeds the value of $f(x)$ by about 2,200.

42. Two functions are shown in the table below.

x	$f(x)$	$g(x)$
$^-3$	1	8
$^-2$	4	4
$^-1$	7	2
0	10	1

Which statement is true about the two functions when $x = {}^-6$?

A. The value of $f(x)$ exceeds the value of $g(x)$ by 56.

B. The value of $g(x)$ exceeds the value of $f(x)$ by 56.

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C. The value of $f(x)$ exceeds the value of $g(x)$ by 72.

D. The value of $g(x)$ exceeds the value of $f(x)$ by 72.

43. What is the smallest positive integer such that the value of $f(x) = 2^x$ exceeds the value of $g(x) = 4x^2$?

A. 8

B. 9

C. 10

D. 11

44. Melissa and Steve bought new cars.

- The value of Melissa's car can be calculated using the function $f(x) = 16{,}000(0.9)^x$, where x is the number of years after the car was purchased.
- The value of Steve's car can be calculated using the function $f(x) = 18{,}000 - 1{,}500x$, where x is the number of years after the car was purchased.

After 7 years from the purchase of their cars, which statement below is true?

A. Melissa's car is worth about $150 more than Steve's car.

B. Steve's car is worth about $150 more than Melissa's car.

C. Melissa's car is worth about $1,500 more than Steve's car.

D. Steve's car is worth about $1,500 more than Melissa's car.

45. The number of female nurses in a country can be predicted using the function $f(t) = 7,300 + 25t$, where t is the number of years since 2000. The number of male nurses can be predicted using the function $m(t) = 2,500(1.02)^t$, where t is the number of years since 2000. **About** how many years will it take before the number of male nurses is expected to exceed the number of female nurses?

A. 60

B. 65

C. 70

D. 75

46. George is comparing the graphs of two functions $f(x) = 3^x$ and $g(x) = 3x^2 + x - 1$ for different values of x. Which statement **best** compares the values of the functions as the value of x increases?

A. $f(x)$ will eventually exceed $g(x)$ for all real numbers greater than a certain x-value.

B. $g(x)$ will eventually exceed $f(x)$ for all real numbers greater than a certain x-value.

C. $f(x)$ is greater than $g(x)$ for all values of x.

D. $g(x)$ is greater than $f(x)$ for all values of x.

47. Two functions are shown in the table below.

x	f(x)	g(x)
0	5	1
1	3	3
2	1	9
3	-1	27

Which statement is true about the functions when $x = 7$?

A. The value of $g(x)$ exceeds the value of $f(x)$ by 108.

B. The value of $g(x)$ exceeds the value of $f(x)$ by 126.

C. The value of $g(x)$ exceeds the value of $f(x)$ by 2,178.

D. The value of $g(x)$ exceeds the value of $f(x)$ by 2,196.

48. The functions $f(x) = 3x$ and $g(x) = 3^x$ intersect at the point $(1, 3)$.
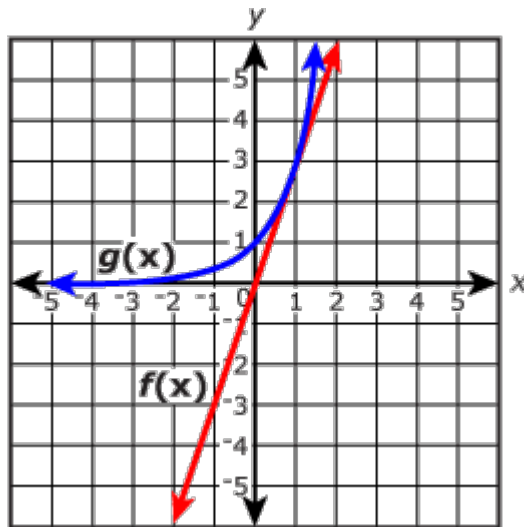
Which statement is true?

A. $f(x)$ and $g(x)$ increase at the same rate beginning at their intersection.

B. $f(x)$ increases at a slower rate beginning at their intersection.

C. $f(x)$ increases at a faster rate beginning at their intersection.

D. $f(x)$ increases at a slower rate until the functions intersect.

49. Thomas makes a table listing the values of the functions $f(x) = x^5$ and $g(x) = 5^x$ for different values of x.

x	$f(x)$	$g(x)$
1	1	5
2	32	25
3	243	125
4	1,024	625

Which of these statements is **true**?

A. $f(x)$ exceeds $g(x)$ for all values of x.

B. $g(x)$ exceeds $f(x)$ for all values of x.

C. $f(x)$ exceeds $g(x)$ for all values of x greater than 5.

D. $g(x)$ exceeds $f(x)$ for all values of x greater than 5.

50. Ronald invests $1000 at a simple interest rate of 10% for 4 years. His best friend Rudy invests the same amount of money, but earns 10% interest compounded annually for 4 years.

Part A

Create a table to show the amount of Rudy's investment after each year. Calculate the amount of Ronald's investment after 4 years.

Part B

Based on the amounts they made, which friend made the better investment? Explain.

51. Which statement is true about the functions $f(x) = 2x^2 + x + 2$ and $g(x) = 2^x + 2$, when $x = 0$?

A. The value of $f(x)$ and the value of $g(x)$ are the same.

B. The value of $f(x)$ exceeds the value of $g(x)$ by 1.

C. The value of $g(x)$ exceeds the value of $f(x)$ by 1.

D. The value of $g(x)$ exceeds the value of $f(x)$ by 2.

52. Which of the following functions increases at the greatest rate on the interval $[a, 2a]$ for very large values of a?

A. $f(x) = 2^x$

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

C. $f(x) = 4x$

D. $f(x) = 4x^2$

53. Two functions are shown in the table below.

x	$f(x)$	$g(x)$

-1	$\frac{2}{3}$	10
0	2	6
1	6	14
2	18	34

What statement is true when *x*= 4?

A. $f(x) > g(x)$

B. $f(x) \geq g(x)$

C. $g(x) > f(x)$

D. $g(x) \geq f(x)$

54. Two functions are shown below.

$$f(x) = 1.02x + 100$$
$$g(x) = 50(1.02)^x$$

What is the smallest positive integer in which the value of $g(x)$ exceeds the value of $f(x)$?

A. 60

B. 59

C. 55

D. 50

55. At what values of x will $f(x) = 3^x - 1$ exceed $g(x) = x^2 - 2x + 8$?

   A. $x > 8$

   B. $x \geq 8$

   C. $x > 2$

   D. $x \geq 2$

56. Two functions are shown below.

$$f(x) = 15 + (1.1)^x$$
$$g(x) = 115 + 1.1x$$

For what integer value of x does the value of $f(x)$ first exceed the value of $g(x)$?

   A. 54

   B. 60

   C. 181

   D. 187

57. Which of the following functions has the greatest value as the values of t become larger?

A.

$p(t) = 3^{-t}$

B. $s(t) = (-t)^7$

C.

$m(t) = \left(\dfrac{1}{2}\right)^{-t}$

D. $r(t) = (2t+3)^5$

58. Working together, Irene, Jeremy, and Katherine choose a rational number and designate it A. Each of them writes and graphs a function that uses A and then correctly describes the function.

Irene's function is $y = Ax.$ She announces, "For all positive values of x, the y-value of my function is positive."

Katherine's function is $y = A^{-2x}.$ She announces, "For all positive values of x, the y-value of my function is greater than the y-value of Irene's function."

Jeremy's function is $y = Ax^2 + 9x + 6.$ He announces, "For all values of x between 0 and 3, the y-value of my function is greater than the y-value of both Irene's function and Katherine's function."

- Based on Irene, Katherine, and Jeremy's statements, explain what must be true about the value of A?
- The three graphs will cross a finite number of times. To the right of these intersections, which student's graph will be higher than the

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other two? Justify your answer.

59. What is the smallest positive integer value of x such that the value of $f(x) = 2^x + 2$ exceeds the value of $g(x) = 12x + 8$?

    A. 4

    B. 5

    C. 6

    D. 7

60. Clarence is the finance manager for a local company. He projected that the number of online sales can be modeled by the function $y = 1.5^x$ for x months, and the number of sales through the outlet store can be modeled by the function $y = 35x$ for x months.

Part A. Which sales method, online or outlet store, initially has the higher number of sales as the number of months increases? Explain your answer.

Part B. Clarence wants to make a long-term comparison of the sales numbers. Complete the table below and explain how the sales compare as the number of months increases.

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x	$y = 1.5^x$	$y = 35x$
4		
8		
12		
16		

Part C. Clarence's company deposits its earnings in bank A, which yields an interest rate of 5%, compounded annually. Clarence investigated bank B, which yields an interest rate of 12%, paid directly to the company annually. Clarence claims that investing the earnings in bank B would serve the company better. Is Clarence correct? Explain your answer.

Use words, numbers, and/or pictures to show your work.

61. Which of these functions increases at the fastest rate?

A.
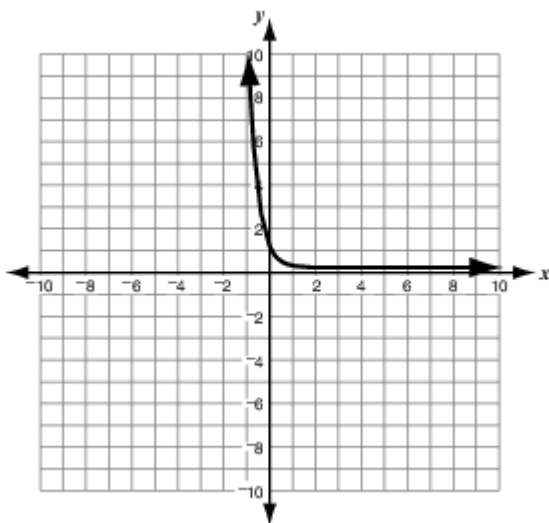
B.
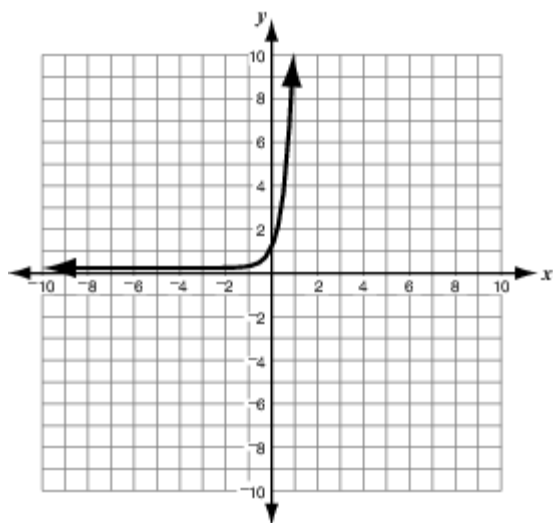
C.
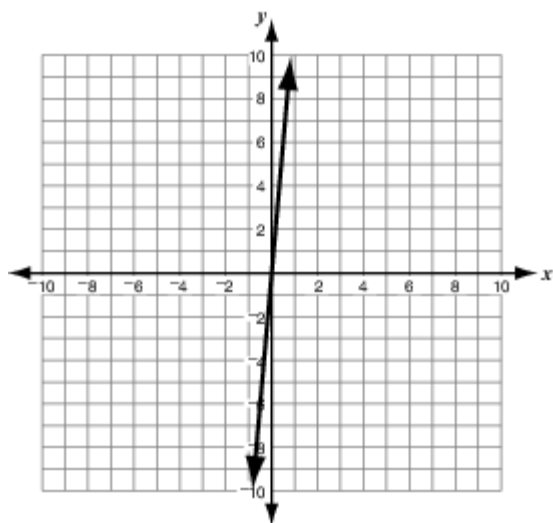
D.
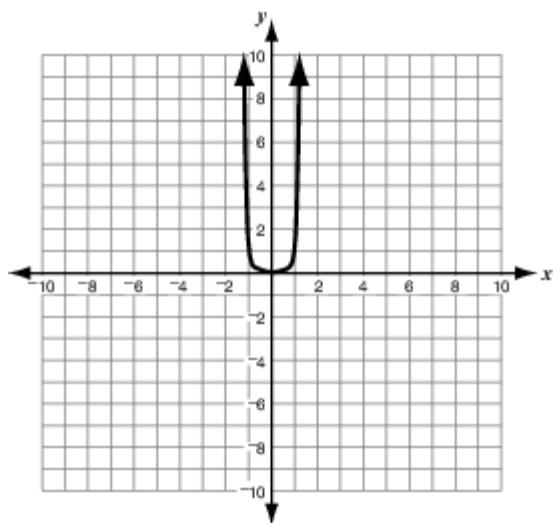
62. Which function displays the fastest growth as the *x*-values continue to increase?

x	−2	−1	0	1	2
f(x)	−4	−2	0	2	4
g(x)	9	6	5	6	9
h(x)	−18	−11	−10	−9	−2
d(x)	0.25	0.5	1	2	4

A. f(x)

B. g(x)

C. h(x)

D. $d(x)$

63. Which table shows the function that increases at the fastest rate?

A.

x	f(x)
−2	−6
−1	−2
0	2
1	6
2	10

B.

x	g(x)
−2	−1
−1	5.5
0	9
1	14.5
2	19

C.

x	h(x)
−2	0.0625
−1	0.25
0	1
1	4
2	16

D.

x	$w(x)$
−2	64
−1	1
0	0
1	1
2	64

64. Clara's and Michelle's parents started saving for college in 1998.

- Clara's college fund can be modeled by the function $f(x) = 500x + 2{,}500$, where x is the number of years since 1998.
- Michelle's college fund can be modeled by the function $g(x) = 2{,}500(1.1)^x$, where x is the number of years since 1998.

About what year will Michelle's college fund first exceed Clara's college fund?

A. 2013

B. 2015

C. 2017

D. 2019

1. What is the smallest positive integer such that the value of $f(x) = -x^2 + 5x$ exceeds the value of $g(x) = -10x + 10$?

A. 0

B. 1

C. 4

D. 10

2. What is the largest integer value of x such that the value of $f(x) = x^2 - 6x + 40$ exceeds the value of $g(x) = 2(1.5)^x$?

A. 6

B. 8

C. 10

D. 12

67. For what positive integer value of x will the value of $g(x) = 3^x$ first exceed the value of $f(x) = 2x + 25$?

A. 3

B. 4

C. 25

D. 26

68. Terry is given two salary options by his employer.

- The first option is a starting salary of $20,000 that increases by $500 each year he is with the company.
- The second option is a starting salary of $20,000 that

increases by 2.2% each year he is with the company.

How many years will Terry have to be with the company for the salary with the second option to be greater than the salary with the first option?

A. 11

B. 12

C. 13

D. 14

69. Two functions are shown in the table below.

x	f(x)	g(x)
0	100	5
1	102	10
2	104	20
3	106	40

Which statement is true about the two functions when x = 5?

A. The value of f(x) exceeds the value of g(x) by 20.

B. The value of g(x) exceeds the value of f(x) by 20.

C. The value of f(x) exceeds the value of g(x) by 50.

D. The value of $g(x)$ exceeds the value of $f(x)$ by 50.