TEST NAME: **Linear Functions & Systems**
TEST ID: **2644114**
GRADE: **09 - Ninth Grade**
SUBJECT: **Mathematics**
TEST CATEGORY: **My Classroom**

Student:

Class:

Date:

1. Three friends each have different monthly payment plans for sending text messages.

   - Naomi pays a flat fee of $30 for an unlimited number of text messages.
   - Tina pays a base fee of $6.00 plus $0.10 per text message.
   - Chris pays a base fee plus $0.05 per text message. Last month, he paid $18.00 for 100 text messages.

   Naomi researched how much she would have to pay if she switched to Tina or Chris's plan. She decided that her plan is the least expensive based on the number of text messages she uses each month. What is the minimum number of text messages Naomi must use each month for her plan to be the least expensive?

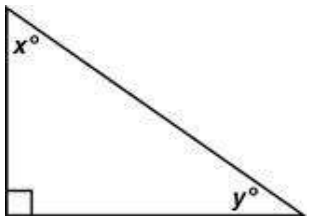
   A. 140 text messages

   B. 241 text messages

   C. 341 text messages

   D. 601 text messages

2. **The measures of the acute angles of the right triangle below are represented by x and y. In this triangle, y is 15 less than twice x.**



Which system of equations could be used to solve for x and y?

A. $x + y = 90$
$2x - y = 15$

B. $x + y = 90$
$x - 2y = 15$

C. $x + y = 180$
$2x - y = 15$

D. $x + y = 180$
$x - 2y = 15$

3. Dr. Smith's office is open 8 hours a day. The doctor allows 25 minutes for office visits and 50 minutes for procedures. The doctor can perform up to 5 procedures per day. Let x represent the number of office visits and y the number of procedures. Which system of inequalities models this scenario?

A. $0 \le x \le 5$
$0 \le y$
$25x + 50y \le 480$

B. $0 \le x \le 19$
$0 \le y \le 5$
$25x + 50y \le 480$

C. $0 \le x$
$0 \le y \le 5$
$25x + 50y \le 8$

D. $0 \le x \le 5$
$0 \le y \le 19$
$25x + 50y \le 8$

4. A baseball team hosts an exhibition game in order to raise at least $5,000 for new equipment. Regular stadium seats sell for $5 each, but each of the 400 premium seats sells for $10.

The coach draws up a feasible region in the coordinate plane, where x represents the number of premium seats the game sells, and y represents the number of regular seats the game sells. Which of the following inequalities is NOT a boundary condition for the feasible region?

A. $10x + 5y \ge 5000$

B. $x + y \ge 5000$

C. $x \le 400$

D. $x \ge 0$

5. The students of Lincoln High School are raising money to support the sports teams. A local organization donated boxes of popcorn and candy for the students to sell. The freshmen are selling boxes of popcorn for $2 each, and the sophomores are selling boxes of candy for $4 each. The students' target is to raise **more than** $800. The sophomores expect to sell **at most** 100 boxes of candy. Let x represent the number of boxes of popcorn sold and y represent the number of boxes of candy sold. Which system of inequalities models the given situation?

A. $\begin{cases} y < 100 \\ 2x + 4y > 800 \end{cases}$

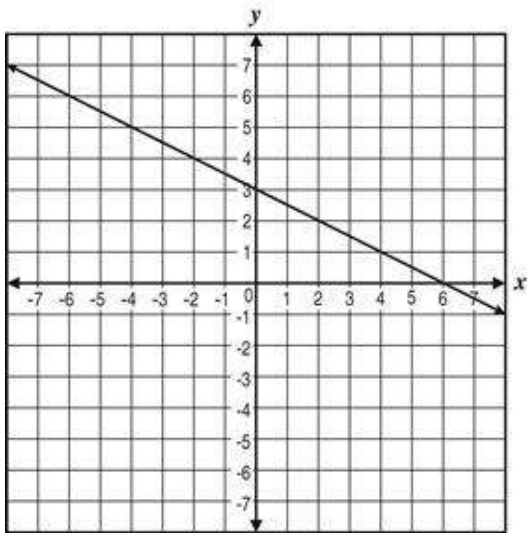
B. $\begin{cases} y \leq 100 \\ 2x + 4y > 800 \end{cases}$

C. $\begin{cases} y < 100 \\ 4x + 2y > 800 \end{cases}$

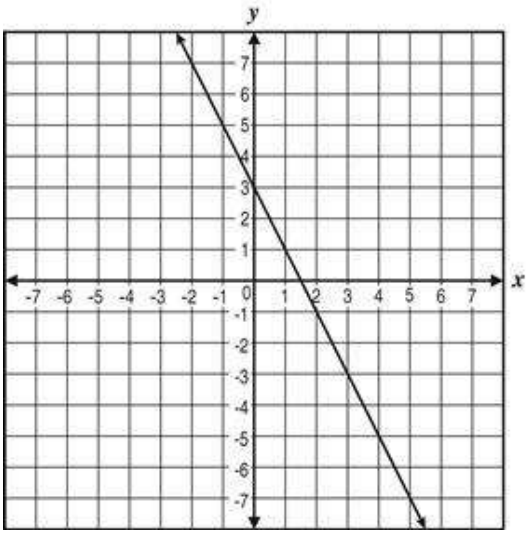
D. $\begin{cases} y \leq 100 \\ 4x + 2y > 800 \end{cases}$

6. **Which graph represents** $x + 2y = 6$**?**

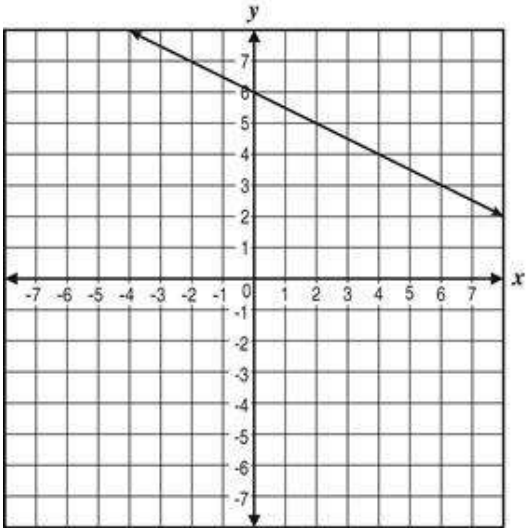
A.



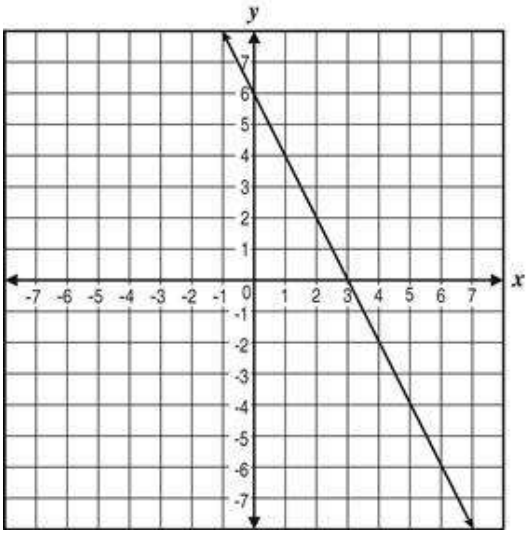
B.



C.



D.



7. If a point $\left(-\frac{3}{5}, b\right)$ is on the graph of the equation $2x + 3y = 6$ and also on the graph of $y = x + 3$, what is the value of b?

A. $\frac{12}{5}$

B. $\frac{39}{10}$

C. $-\frac{3}{5}$

D. $-\frac{18}{5}$

8. Which point is ***not*** a solution to the equation $^{-}2y + x = 8$?

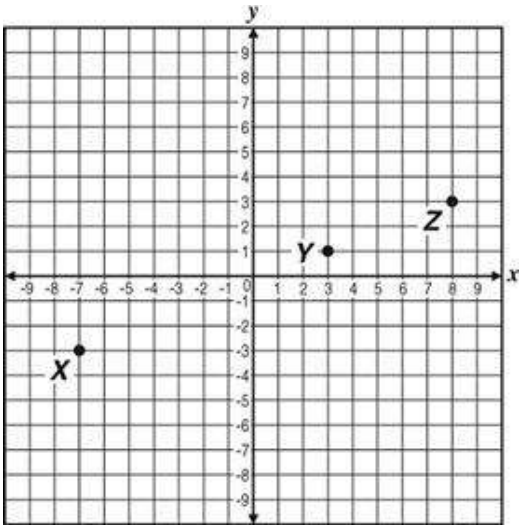
A. $(5, {}^{-}1.5)$

B. $(2, {}^{-}3)$

C. $({}^{-}1, {}^{-}4.5)$

D. $({}^{-}3, 2)$

9. **Points *X*, *Y*, and *Z* lie on the same line.**



What are the coordinates of another point that lies on the same line?

A. $(6, 2)$

B. $(-2, -1)$

C. $(-3, -2)$

D. $(0, 0)$

10. Which point is a solution to the equation $y = \frac{x}{3} + \frac{5}{7}$?

A. $\left(\frac{1}{3}, \frac{5}{7}\right)$

B. $\left(\frac{1}{3}, \frac{52}{63}\right)$

C. $\left(\frac{5}{7}, \frac{52}{63}\right)$

D. $\left(\frac{52}{63}, \frac{5}{7}\right)$

11. **The graph of which of the following equations contains the point (– 3, 0)?**

A. $2x + y = 6$

B. $x - 2y = 6$

C. $-x + 2y = 6$

D. $-2x + y = 6$

12. Which choice is an ordered pair that, for every real number k, represents a point that lies on the graph of $30x - 5y = 10$?

A. $(k + 2, 6k + 10)$

B. $(k + 4, 6k + 20)$

C. $(3k, 18k + 2)$

D. $(5k, 30k + 2)$

13. **Which point lies on the graph of the equation** $7x - 3y = 9$?

A. $(-3, -4)$

B. $(-3, 4)$

C. $(3, -4)$

D. $(3, 4)$

14. **Which of the following points lies on the line represented by** $y = 3x + 4$?

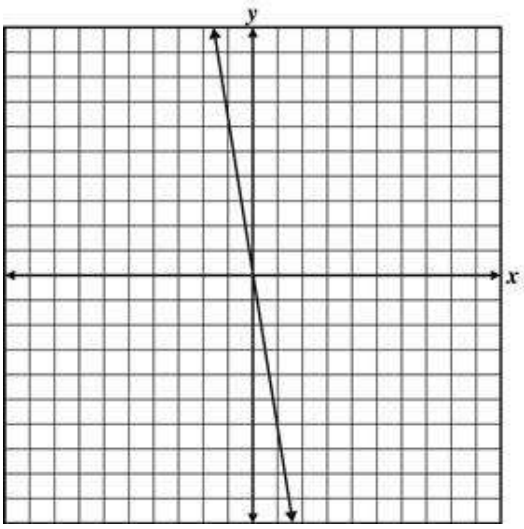
A. $(2, 10)$

B. $(3, 4)$

C. $(4, 3)$

D. $(10, 2)$

15. **Which point is NOT on the line on the graph?**



A. $(-1, 6)$
B. $(0, 0)$
C. $(1, -6)$
D. $(6, -1)$

16. Since January 2010, a grape farmer has been growing red and green grapes. The number of red grape vines can be modeled by the function $f(x) = 1{,}000(1.03)^x$, where x is the number of years since January 2010. The number of green grape vines can be modeled by the function $g(x) = 20x + 1{,}125$, where x is the number of years since January 2010. In what year will the number of each type of grape vine be ***approximately*** equal?

A. 2013
B. 2015
C. 2017
D. 2019

17. Two functions are shown below.

$$f(x) = 2^x$$
$$g(x) = x + 16$$

Between what two positive values of x does $f(x) = g(x)$?

A. 3 and 4

B. 4 and 5

C. 19 and 20

D. 20 and 21

18. What is the maximum number of intersections an exponential function can have with a linear function?

A. 0

B. 1

C. 2

D. 3

19. What is the point of intersection for the lines $y - x = 0$ and $3x + 5y = 15$?

A. (0, 0)

B. (1.875, 1.875)

C. (1.95, 1.95)

D. (2, 2)

20. Two functions are shown below.

$$f(x) = 4x - 4$$
$$g(x) = 2(3)^x - 6$$

For which value of x does $f(x) = g(x)$?

A. $^{-}4$

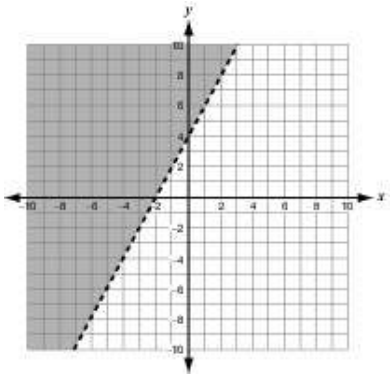
B. $^{-}2$

C. 0

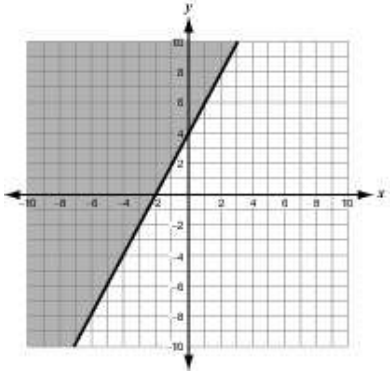
D. 2

21. Which graph represents the solution of $y < 2x + 4$?

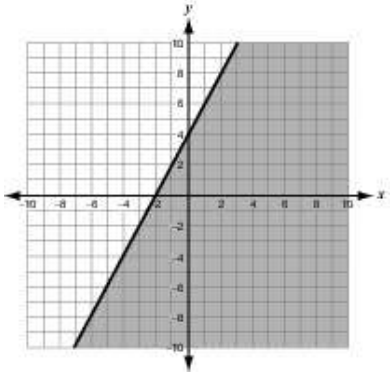
A.



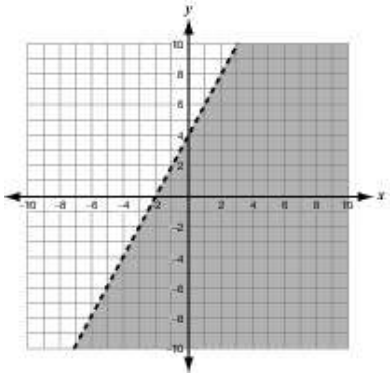
B.



C.

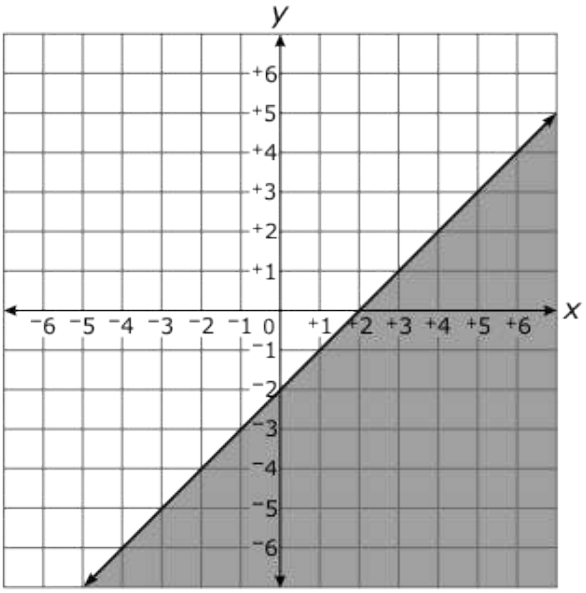


D.

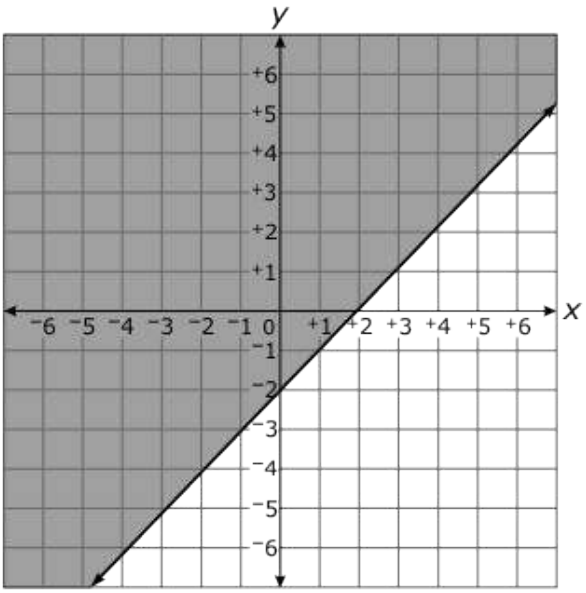


22. Which is the graph of $x - 2 < y$?

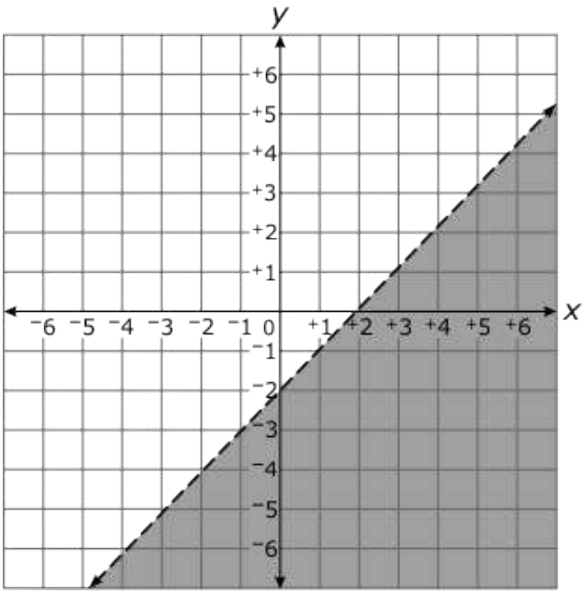
A.



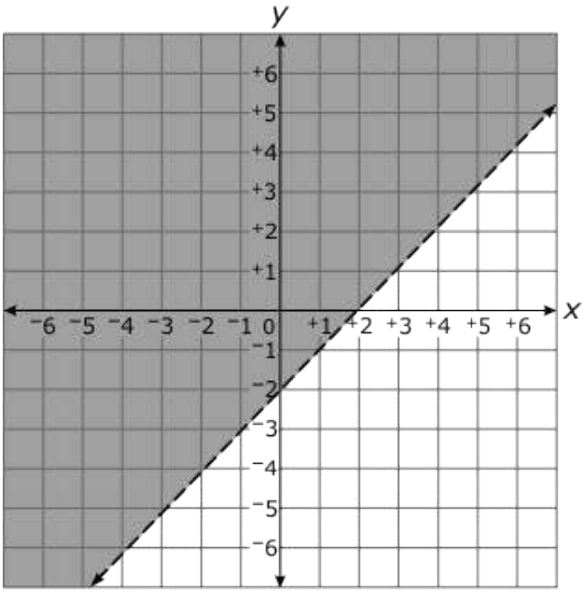
B.



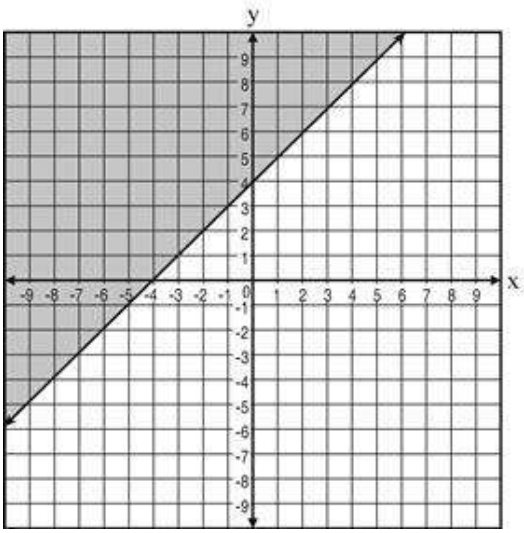
C.



D.



23. **The graph below represents which of the following linear inequalities?**



A. $y \leq x - 4$

B. $y \leq x + 4$

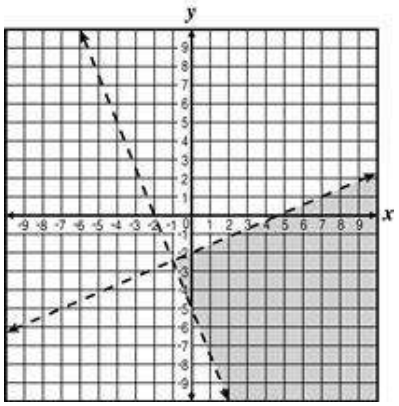
C. $y \geq x - 4$

D. $y \geq x + 4$

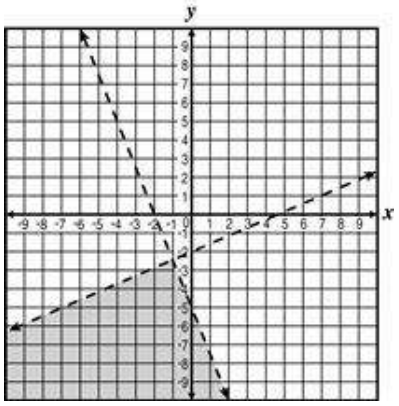
24. **Which graph BEST represents the solution to the system of linear inequalities below?**

$$3x - 7y > 14$$
$$5x + 2y < -10$$

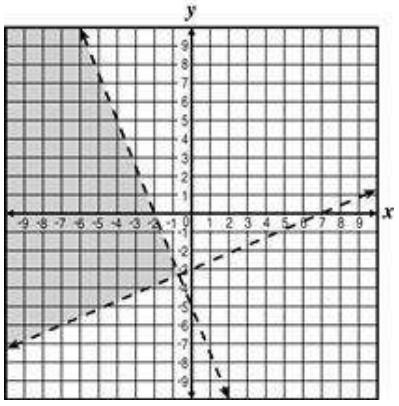
A.



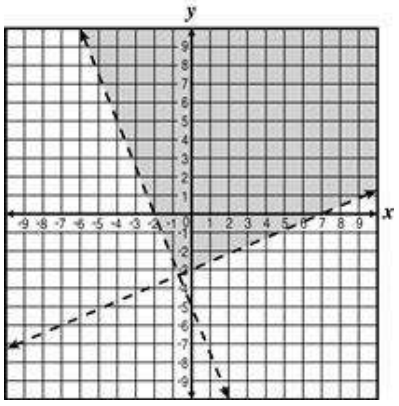
B.



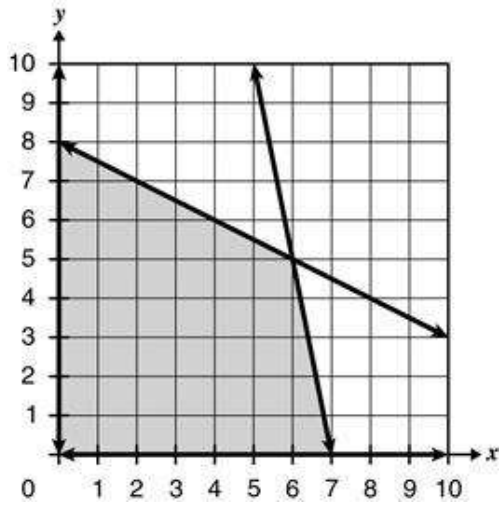
C.



D.



25. **The graph of a system of linear inequalities is shown.**



What are the constraints to the system of linear equations?

A. $\begin{cases} x \geq 0 \\ y \geq 0 \\ x + 2y \leq 16 \\ 5x + y \leq 35 \end{cases}$

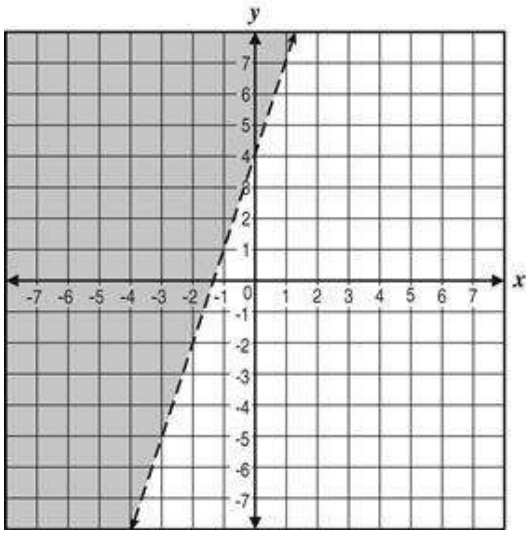
B. $\begin{cases} x \leq 0 \\ y \leq 0 \\ x + 2y \leq 16 \\ 5x + y \leq 35 \end{cases}$

C. $\begin{cases} x \geq 0 \\ y \geq 0 \\ x + 2y \geq 16 \\ 5x + y \geq 35 \end{cases}$

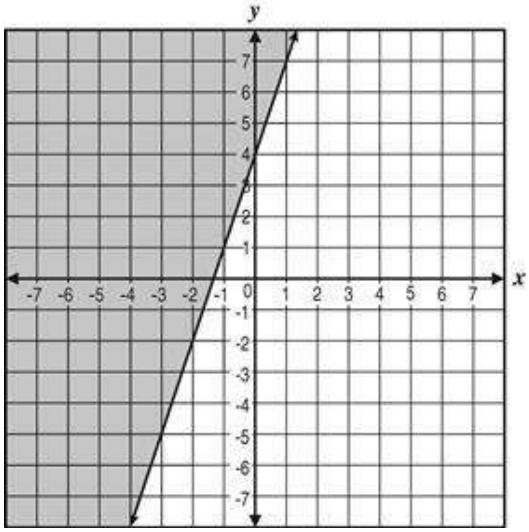
D. $\begin{cases} x \leq 0 \\ y \leq 0 \\ x + 2y \geq 16 \\ 5x + y \geq 35 \end{cases}$

26. **Which graph represents the inequality $3x + y > 4$?**

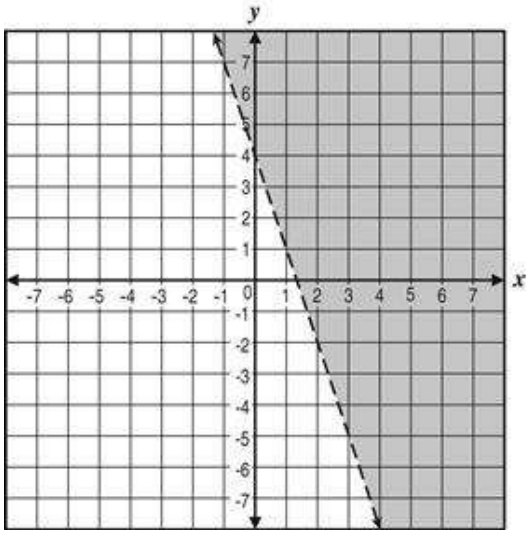
A.



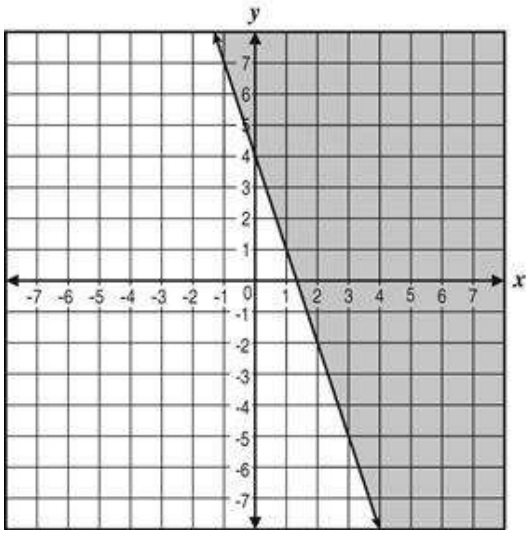
B.



C.

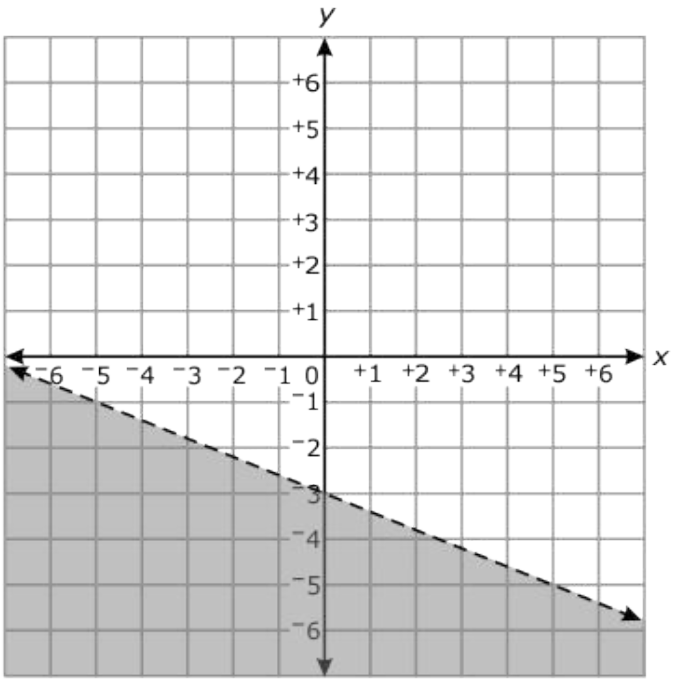


D.

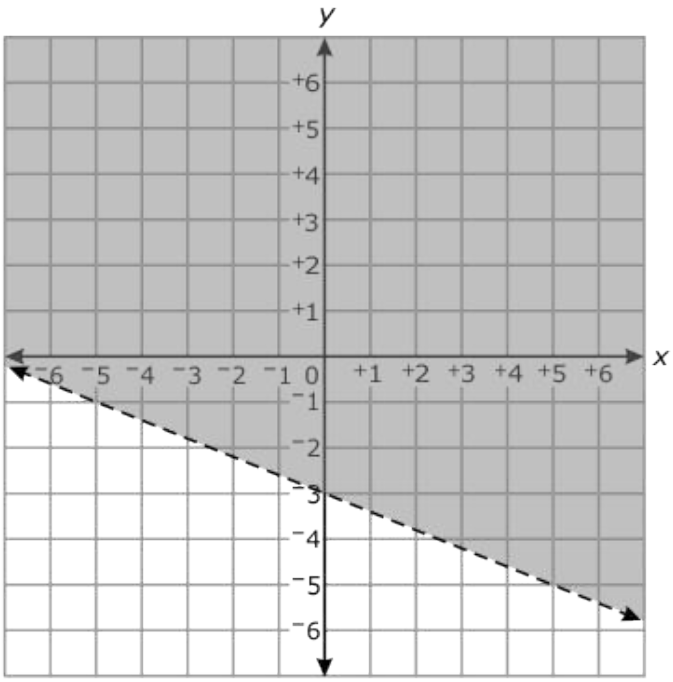


27. Which is the graph of $^{-}2x < 5y - 15$?

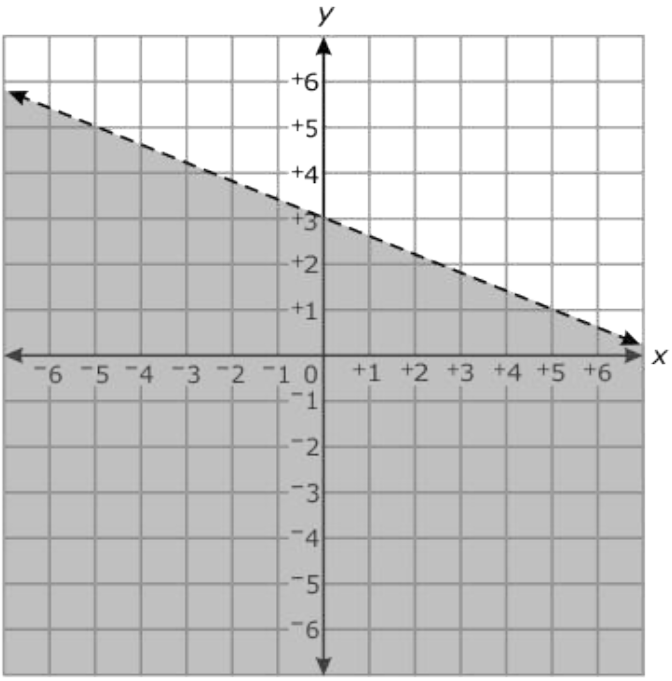
A.



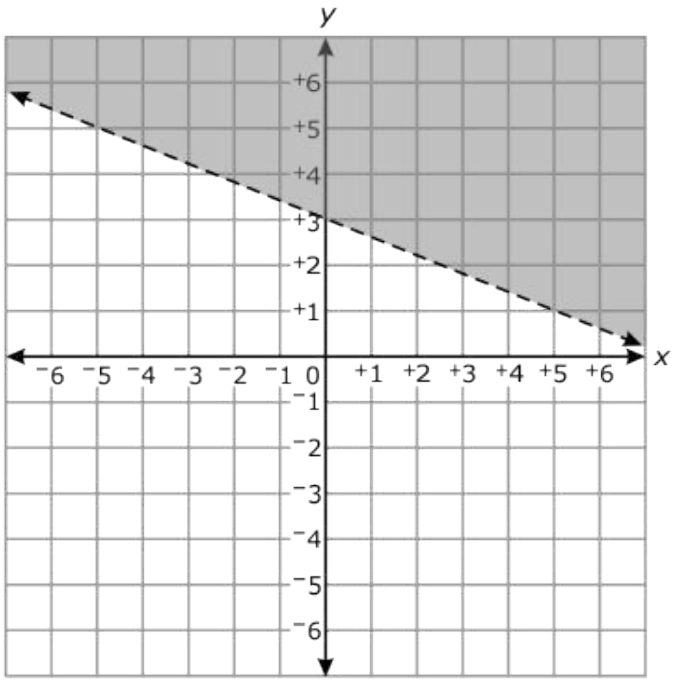
B.


y
x
+6
+5
+4
+3
+2
+1
−6 −5 −4 −3 −2 −1 0 +1 +2 +3 +4 +5 +6
−1
−2
−3
−4
−5
−6

C.


y
x
+6
+5
+4
+3
+2
+1
−6 −5 −4 −3 −2 −1 0 +1 +2 +3 +4 +5 +6
−1
−2
−3
−4
−5
−6

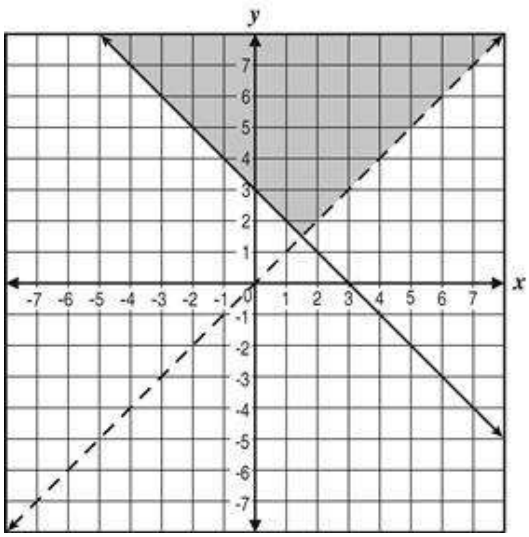
D.



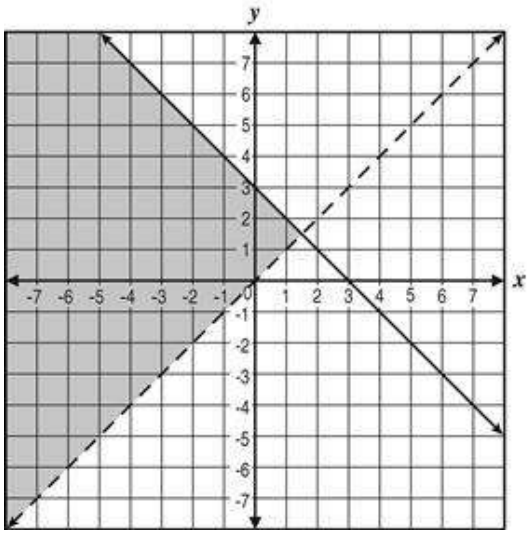
28. **Which graph represents the system of linear inequalities?**

$$\begin{cases} y < x \\ y \geq -x + 3 \end{cases}$$

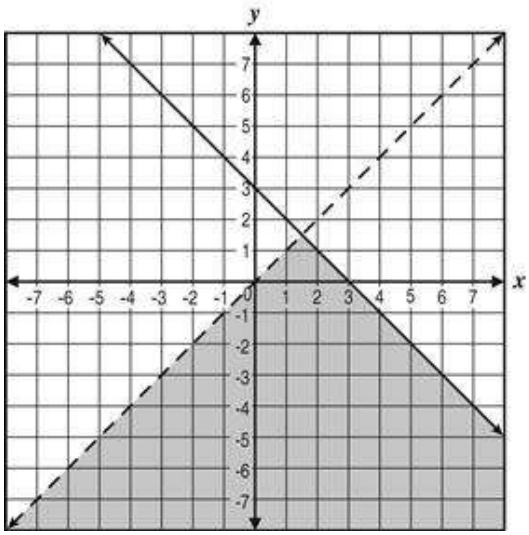
A.



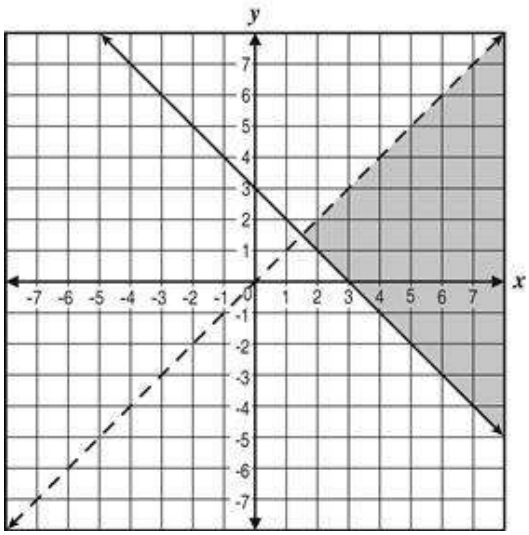
B.



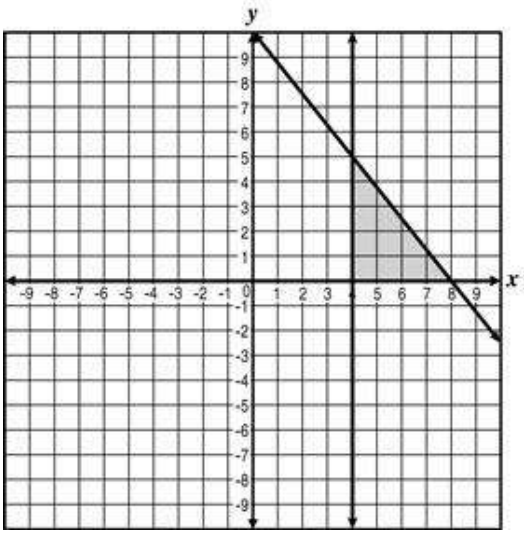
C.



D.



29. **The graph of a system of inequalities is shown.**



What are the constraints to the system?

A. $\begin{cases} x \geq 4 \\ y \geq 0 \\ 5x - 4y \leq 40 \end{cases}$

B. $\begin{cases} x \geq 0 \\ y \geq 4 \\ 5x + 4y \leq 40 \end{cases}$

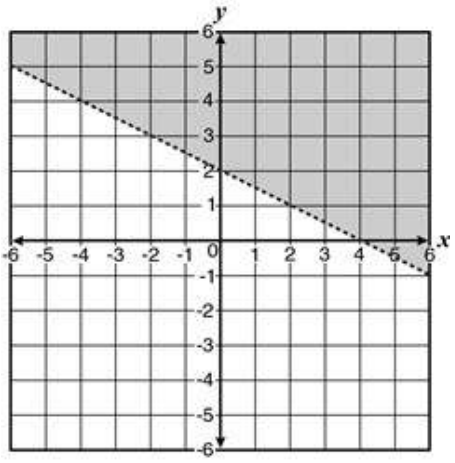
C. $\begin{cases} x \geq 4 \\ y \geq 0 \\ 5x + 4y \leq 40 \end{cases}$

D. $\begin{cases} x \geq 0 \\ y \geq 4 \\ 5x - 4y \leq 40 \end{cases}$

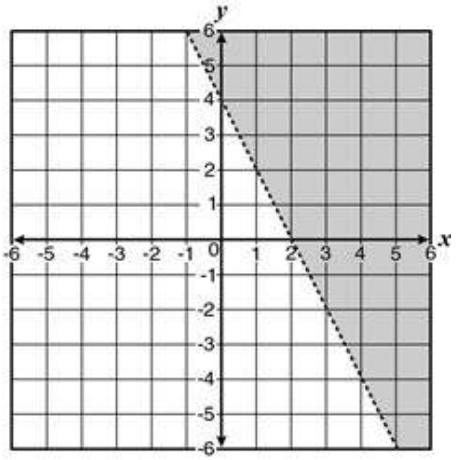
30. **Which graph shows the solution set for the inequality below?**

$3x + 6y > 12$

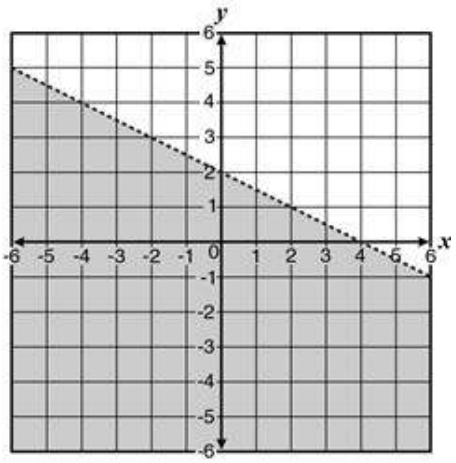
A.



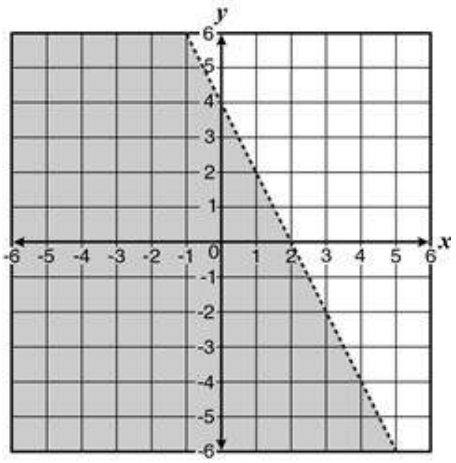
B.



C.



D.



31. **Gabriela wants to show that the following is true by example.**

Given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

She begins with the system of linear equations below.

$$6x - 2y = -4$$
$$2x + y = -8$$

She then multiplies the second equation by 3. What should she do next?

A. Add $6x - 2y = -4$ to $2x + y = -8$.

B. Add $6x + 3y = -24$ to $6x - 2y = -4$.

C. Multiply $2x + y = -8$ by 2 and add to $6x - 2y = -4$.

D. Multiply $6x - 2y = -4$ by 3 and add to $6x + 3y = -24$.

32. Jolene is solving the system of equations shown below.

$4x + 6y = -2$

$2x + 8y = -6$

Which of these systems of equations has the same solution?

A. $2x + 3y = -2$

$2x + 8y = -6$

B. $4x + 6y = -2$

$4x + 16y = -6$

C. $2x + 3y = -1$

$2x + 8y = -6$

D. $4x + 6y = -2$

$4x - 16y = -2$

33. In order to solve the system of equations $\begin{cases} x-3y=2 \\ 2x+y=11 \end{cases}$ using the elimination method, which of the following steps could be used?

A. Multiply the first equation by 2 and then add that result to the second equation.

B. Multiply the first equation by 3 and then add that result to the second equation.

C. Multiply the second equation by 2 and then add that result to the first equation.

D. Multiply the second equation by 3 and then add that result to the first equation.

34. **A system of equations is given below.**

$$\begin{cases} x-2y=6 \\ 3x+4y=5 \end{cases}$$

Which of the following systems of equations has the same solution as the system given above?

A. $\begin{cases} x-2y=6 \\ 4x=11 \end{cases}$

B. $\begin{cases} x-2y=6 \\ 4x=17 \end{cases}$

C. $\begin{cases} x-2y=6 \\ 5x=11 \end{cases}$

D. $\begin{cases} x-2y=6 \\ 5x=17 \end{cases}$

35. Which systems of equations have the same solutions?

$L\begin{cases} 3x+y=8 \\ x-4y=-6 \end{cases}$ $M\begin{cases} 4x-3y=2 \\ 5x-4y=-30 \end{cases}$ $N\begin{cases} 4x-3y=2 \\ 2x-8y=-12 \end{cases}$

A. *L* and *M*

B. *L* and *N*

C. *M* and *N*

D. *L, M,* and *N*

36. **If $2a+14=b$ and $5a-6=2b$, which equation can be used to find the value of a?**

A. $\frac{2a+14}{2}=5a-6$

B. $\frac{2a+14}{2}=\frac{5a-6}{2}$

C. $2(2a+14)=5a-6$

D. $2a+14=2(5a-6)$

37. Jan bought 6 cookies and 4 doughnuts for $3.50. Tom bought 12 cookies and 5 doughnuts for $5.23. What is the cost of 1 cookie?

A. $0.19

B. $0.29

C. $0.35

D. $0.59

38. **One side of the triangle lies on the line $5x-y=1$. A second side of the same triangle lies on the line $2x+3y=31$. What point represents the vertex between the two sides?**

A. $(2, 9)$

B. $(2, 11)$

C. $(-2, -11)$

D. $(-2, -9)$

39. Which ordered pair represents the solution to the system of equations shown below?

$2x-3y=3$
$4x-2y=10$

A. $(0, -1)$

B. $(0, -5)$

C. $(2, 1)$

D. $(3, 1)$

40. **Look at the system of equations below.**

$$-8a + 9b = 12$$
$$3a + 14 = b$$

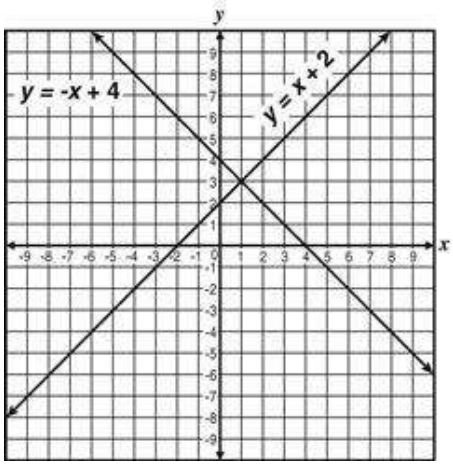
What is the value of *b* for the solution to this system of equations?

A. 6
B. 4
C. -4
D. -6

41. A metal alloy is 35% copper. Another metal alloy is 50% copper. How much of each alloy should be used to make 600 grams of a metal alloy that is 45% copper?

A. 180 grams of the 35% copper alloy and 420 grams of the 50% copper alloy
B. 190 grams of the 35% copper alloy and 410 grams of the 50% copper alloy
C. 200 grams of the 35% copper alloy and 400 grams of the 50% copper alloy
D. 210 grams of the 35% copper alloy and 390 grams of the 50% copper alloy

42. **Two lines are graphed. Which coordinate pair represents the intersection of the lines?**



A. $(-2, 0)$
B. $(-1, 1)$
C. $(2, 2)$
D. $(1, 3)$

43. **The equations for two distinct lines are given below.**

$y = -6x + 20$
$y = 5x - 13$

What is the *x*-coordinate of the point of intersection of the two lines?

A. 3
B. 2
C. −2
D. −3

44. A 140-meter rope is cut into two pieces. One piece is 20 meters longer than 3 times the other piece. How long is the smaller of the two pieces?

A. 20 meters
B. 30 meters
C. 40 meters
D. 50 meters

45. **Caroline is considering two video game rental plans. Plan A can be modeled with the equation $C = 2n$, and Plan B can be modeled with the equation $C = n + 6$, where C represents the cost in dollars and n represents the number of games rented each month. Which statement would justify selecting Plan A instead of selecting Plan B?**

A. Caroline rents exactly 7 games each month.
B. Caroline rents exactly 6 games each month.
C. Caroline rents 6 or more games each month.
D. Caroline rents from 1 to 5 games each month.

46. Michael has a jar of dimes and nickels. There are 152 dimes and nickels in the jar that total $11. If d represents the number of dimes and n represents the number of nickels, which system of equations below represents the situation?

A. $\begin{cases} d+n=11 \\ 0.05d+0.10n=152 \end{cases}$

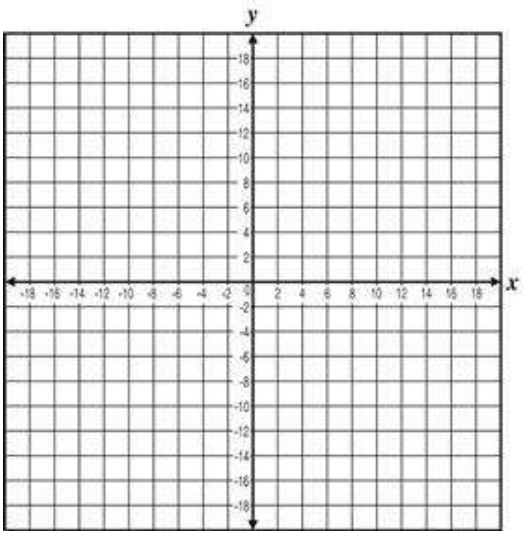
B. $\begin{cases} d+n=11 \\ 0.10d+0.5n=152 \end{cases}$

C. $\begin{cases} d+n=152 \\ 0.05d+0.10n=11 \end{cases}$

D. $\begin{cases} d+n=152 \\ 0.10d+0.05n=11 \end{cases}$

47. **What are the coordinates of the point of intersection of the graphs of the equations below?**

$$5x+y=19$$
$$5x+y=12$$



A. (2, 9)

B. (19, 12)

C. The lines are coincident.

D. The lines do not intersect; they are parallel.

48. A store sells a 4-pound mixture of plain and spinach noodles for $1.20 per pound. Plain noodles sell for $0.75 per pound. Spinach noodles sell for $1.75 per pound. How much of each type of noodle was used to make the mixture?

A. 1.8 pounds of plain noodles and 2.2 pounds of spinach noodles

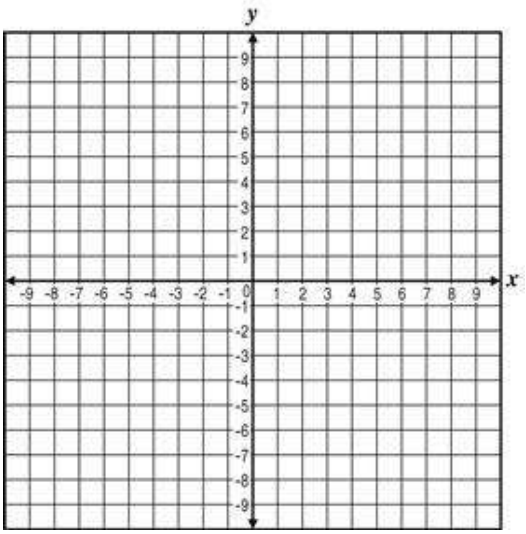
B. 2 pounds of plain noodles and 2 pounds of spinach noodles

C. 2.2 pounds of plain noodles and 1.8 pounds of spinach noodles

D. 3 pounds of plain noodles and 1 pound of spinach noodles

49. **The equations for two distinct lines are given below.**

$$\begin{cases} y = -7x + 9 \\ y = 4x - 2 \end{cases}$$



What is the *x*-coordinate of the point of intersection of the two lines?

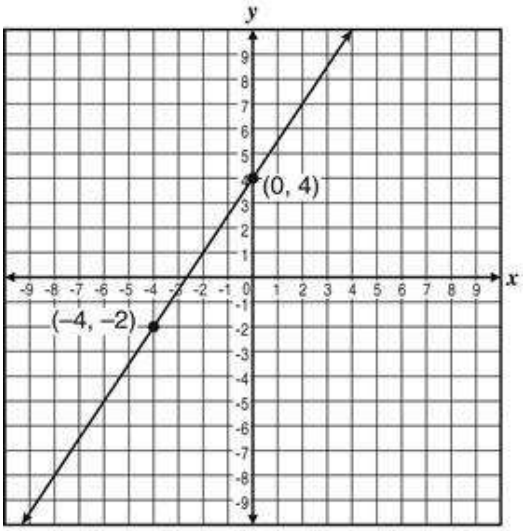
A. 2

B. 1

C. -1

D. -2

50. **A line perpendicular to the line graphed below has a *y*-intercept of** -2.5.



At which point do the two lines intersect?

A. $(-3, -0.5)$

B. $(-2, 1)$

C. $(-3, 4.5)$

D. $(-4, -2)$

51. **What is the solution to the system of equations below?**

$$\begin{cases} x + 2y = -3 \\ 3x + 6y = 6 \end{cases}$$

A. (0, 15)

B. (1, 2)

C. infinitely many solutions

D. no solution

52. Two trains are traveling towards each other at a constant speed.

- The trains are currently 714 miles from each other.
- The speeds of the trains differ by 8 miles per hour.
- The trains will meet in 7 hours.

What is the speed of the faster train?

A. 47 mph

B. 50 mph

C. 55 mph

D. 58 mph

53. What is the solution to the system of equations shown below?

$$y = 6x - 9$$

$$8x + 6y = 12$$

A. $(0, -9)$

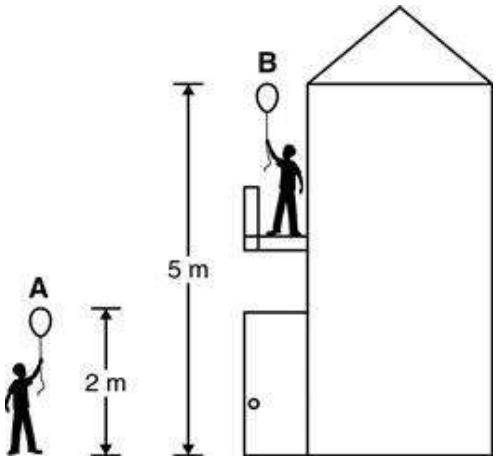
B. $(0.5, -6)$

C. $(1, -3)$

D. $(1.5, 0)$

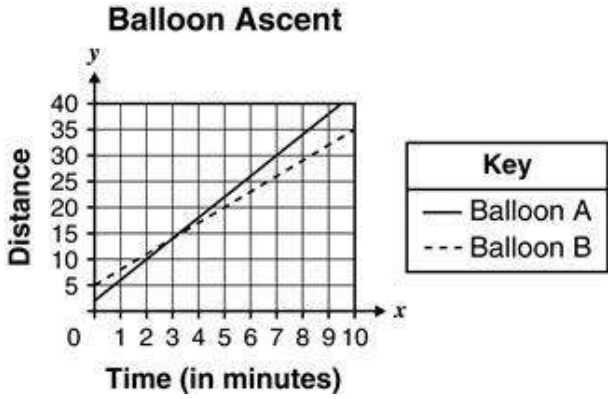
54. **Balloon A was released 2 meters from the ground, and it traveled straight up at a rate of 4 meters per minute. Balloon B was released at the same time 5 meters from the ground, and it traveled straight up at a rate of 3 meters per minute. Both balloons continued to travel straight up at constant speed with no interruptions. The following equations represent this information.**

Balloon A: $y = 4x + 2$
Balloon B: $y = 3x + 5$

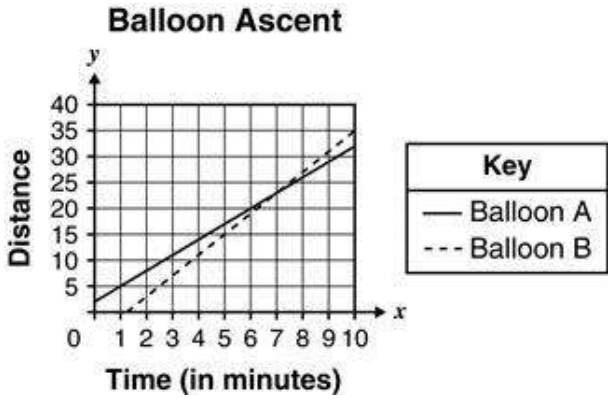


The balloons are at the same height after 3 minutes. Which graph correctly represents the heights of the balloons?

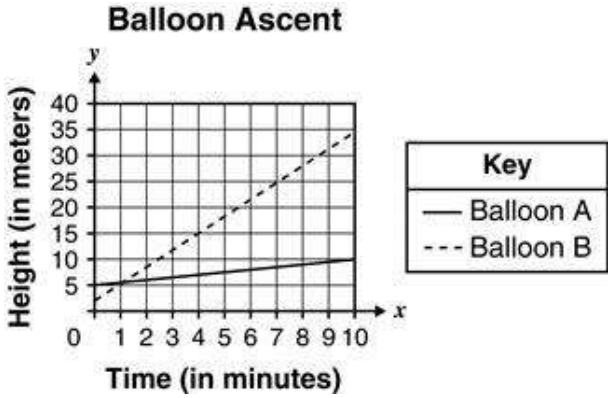
A.



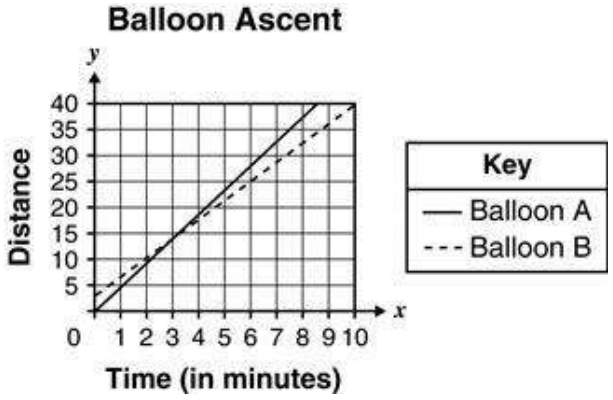
B.



C.



D.



55. Greg invested $11,000 in two accounts.

- The first account pays 5% interest per year.
- The second account pays 8% interest per year.
- Greg earned a total of $752.50 in interest at the end of the first year.

How much did Greg invest in the 5% account?

A. $3,415

B. $4,250

C. $5,500

D. $6,750

56. The table below shows the Internet sales of a small company over a 20-day period.

Day	Sales
1	$315
4	$358
8	$497
15	$652
20	$745

What was the ***approximate*** average rate of change in sales from day 4 to day 15?

A. $21.50 per day

B. $24.50 per day

C. $26.73 per day

D. $28.45 per day

57. What is the ***approximate*** average rate of change for $f(x) = 20(0.5)^x$ from $x = -2$ to $x = 2$?

A. -18.75

B. -17.5

C. 17.5

D. 18.75

58. The table below shows the distance Russell rolled a ball after different amounts of time.

Time (seconds)	**Distance** (feet)
1	4.5
2	6
3	8.5
4	12
5	16.5

What is the average rate of change in the distance Russell rolled the ball between 1 and 5 seconds?

A. 2.4 feet per second

B. 3.0 feet per second

C. 3.3 feet per second

D. 4.0 feet per second

59. What is the average rate of change of the function $f(x) = -3(2)^x$ over the interval $[-1, 2]$?

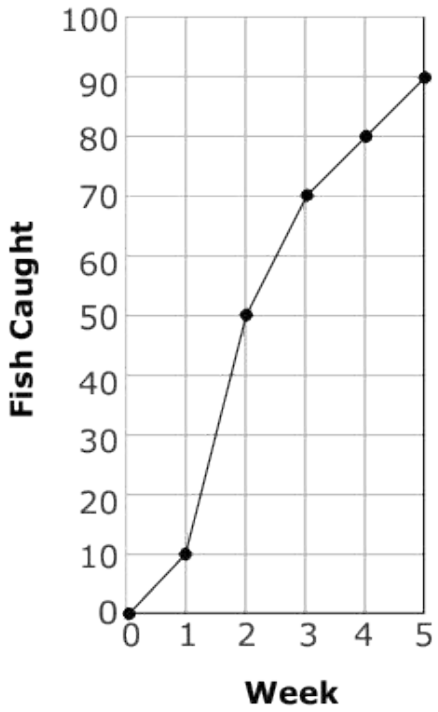
A. -1.5

B. -3.5

C. -4.5

D. -12

60. The graph below shows the total number of fish that a fisherman caught over a 5-week time period.



What was the average rate of change in the number of fish caught per week between weeks 2 and 5?

A. about 13 fish per week

B. about 18 fish per week

C. about 32 fish per week

D. about 40 fish per week

61. The population growth for a species of birds, in thousands, can be represented by the function $p(t) = 20(1.24)^t$, where t is the number of years since 2002. What is the approximate average rate of change of the population between the years of 2004 and 2007?

A. 9.3 thousand birds/year

B. 14.3 thousand birds/year

C. 27.9 thousand birds/year

D. 42.9 thousand birds/year

62. During a recent snowstorm, John measured the total snowfall accumulated at the end of each hour. He recorded his results in the table below.

Time	Snowfall Total (in inches)
1 p.m.	0.7
2 p.m.	1.9
3 p.m.	2.8
4 p.m.	3.6
5 p.m.	4.3
6 p.m.	5.1

What is the approximate average rate of change of the snowfall between 1 p.m. and 6 p.m.?

A. 0.7 inch/hour

B. 0.9 inch/hour

C. 1.1 inches/hour

D. 1.4 inches/hour

63. A volleyball camp charges $150 per camper for 10 campers. When a team brings 15 campers, the rate is reduced to $125 per camper. What is the rate of change in cost per camper?

A. $2.50

B. $5.00

C. $8.34

D. $10.00

64. A newspaper editor tracked the number of new subscribers to the newspaper each week in the table below.

Week	New Subscribers
1	202
2	225
3	276
4	379
5	408
6	557

What was the average rate of change in the number of new subscribers between weeks 4 and 6?

A. 59 new subscribers per week

B. 66 new subscribers per week

C. 77 new subscribers per week

D. 89 new subscribers per week

65. What is the average rate of change of the function $f(x) = \left(\frac{1}{2}\right)^x$ over the interval $[-2, 2]$?

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

B. $\frac{1}{8}$

C. $-\frac{15}{16}$

D. $-\frac{15}{4}$