You may not use a calculator for questions 1–5.

1. Which expression has a value between -4 and -3?

A. $1 - 2\sqrt{10}$

B. $4 - \sqrt{15}$

C. $3\sqrt{5} - 7$

D. $\sqrt{20} - 8$

2. A company makes a puzzle that is made of 5^3 small plastic cubes. The puzzles are shipped in boxes that each contain 5^2 puzzles. The boxes are loaded into trucks that each contain 5^3 boxes. What is the total number of small plastic cubes in each truck?

A. 5^8

B. 5^{18}

C. 125^8

D. 125^{18}

3. Solve: $x^2 = 144$

A. $x = 12$

B. $x = \pm 12$

C. $x = 72$

D. $x = \pm 72$

4. The thickness of the skin on the human back is about 3×10^{-3} meter. The thickness of the skin on the human eyelid is about 3×10^{-4} meter. How many times as thick is the skin on the human back as on the human eyelid?

A. 0.1

B. 1

C. 10

D. 30

5. The human body contains about 1×10^{12} bacteria. The human body contains about 4×10^4 genes. The number of bacteria contained in the human body is how many times as great as the number of genes contained in the human body?

A. 250

B. 4,000

C. 25,000,000

D. 400,000,000

6. Amanda graphed a linear function with the equation $y = 1.\overline{4}x$. Which statement about the slope of Amanda's line is true?

A. The slope is a rational number that can be written as $\frac{13}{9}$.

B. The slope is a rational number that can be written as $\frac{14}{10}$.

C. The slope is an irrational number that can be written as $\frac{13}{9}$.

D. The slope is an irrational number that can be written as $\frac{14}{10}$.

7. Which statement correctly describes the number $\frac{62}{495}$ and its equivalent decimal notation?

A. The number $\frac{62}{495}$ is a rational number and its equivalent decimal notation is a repeating decimal number.

B. The number $\frac{62}{495}$ is a rational number and its equivalent decimal notation is a terminating decimal number.

C. The number $\frac{62}{495}$ is an irrational number and its equivalent decimal notation is a repeating decimal number.

D. The number $\frac{62}{495}$ is an irrational number and its equivalent decimal notation is a terminating decimal number.

8. Craig uses a ruler to determine the length of two pieces of metal. He records the length of each piece of metal as a rational number. Which statement **best** explains whether the sum of the two lengths Craig recorded must also be a rational number?

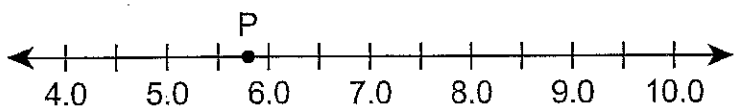
A. When adding two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, the numerators a and c do not have to be integers. Therefore, the sum does not have to be a rational number.

B. When adding two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, the common denominator bd does not have to be an integer. Therefore, the sum does not have to be a rational number.

C. When adding two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, the sum is $\frac{ac}{bd}$, and both the numerator and denominator are integers. Therefore, the sum must be a rational number.

D. When adding two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, the sum is $\frac{ad+bc}{bd}$, and both the numerator and denominator are integers. Therefore, the sum must be a rational number.

9. On the number line below, point P shows the location of an irrational number.



Which expression has a value that is **greater** than the irrational number represented by point P?

A. $\sqrt{7}-1$

B. $2\sqrt{7}$

C. $4+\sqrt{7}$

D. $7-\sqrt{7}$

10. The lengths of the legs of two right triangles are listed below.

- triangle A: 5 inches and 5 inches
- triangle B: 4 inches and 6 inches

Which statement correctly compares the lengths, in inches, of the hypotenuses for the two triangles?

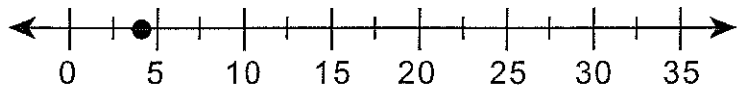
A. $2\sqrt{5} \approx 4.2$
$13\sqrt{2} \approx 14.4$
$2\sqrt{5} < 13\sqrt{2}$

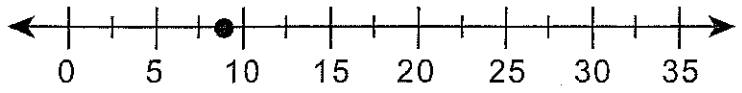
B. $2\sqrt{5} \approx 4.5$
$13\sqrt{2} \approx 18.4$
$2\sqrt{5} < 13\sqrt{2}$

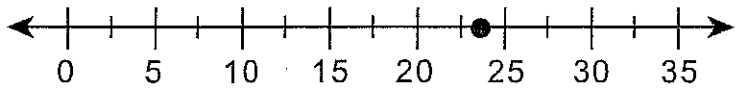
C. $5\sqrt{2} \approx 6.4$
$2\sqrt{13} \approx 5.6$
$5\sqrt{2} > 2\sqrt{13}$

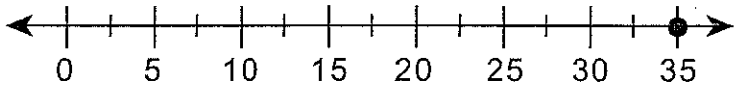
D. $5\sqrt{2} \approx 7.1$
$2\sqrt{13} \approx 7.2$
$5\sqrt{2} < 2\sqrt{13}$

11. A packing crate in the shape of a cube has a volume of 70 cubic feet. The length (x), in feet, of one side of the cube can be found by solving $x^3 = 70$. Which point on the number line represents the length, in feet, of one side of the cube?

A.


B.


C.


D.


12. The measure, in degrees, of angle X is represented by the expression shown below.

$$\frac{\left(3^2\right)^{-3} \cdot 2^6 \cdot 3}{6^2 \cdot 9^{-4}}$$

What is the measure of angle X?

A. 27°

B. 48°

C. 144°

D. 162°

13. Which expression is equivalent to $\frac{2^3 \cdot 5^2}{2^5 \cdot 3 \cdot 5^4}$?

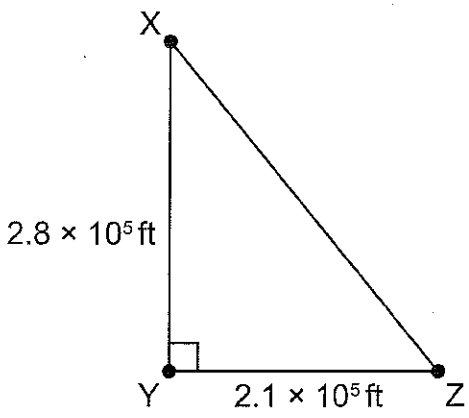
A. $\frac{1}{2^5}$

B. $\frac{2^3}{3 \cdot 5^4}$

C. $\frac{2^2 \cdot 5^2}{3}$

D. $\frac{1}{2^2 \cdot 3 \cdot 5^2}$

14. Towns X, Y, and Z can be represented as the vertices of a right triangle as shown below.



What is the shortest distance, in feet, from town X to town Z?

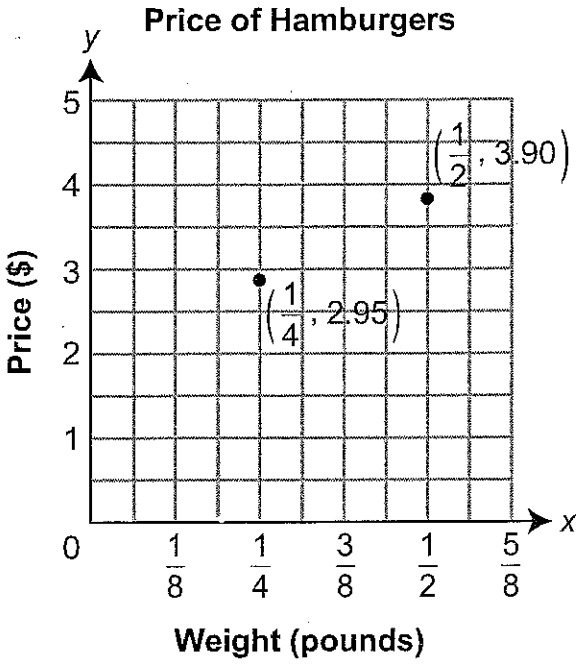
A. 3.5×10^5

B. 4.9×10^5

C. 3.5×10^{10}

D. 5.88×10^{10}

15. Connie sells hamburgers at a food stand. The graph below shows the relationship between the weight (x), in pounds, of meat used and the price (y), in dollars, of a hamburger.



The cost of meat per pound is the same for each hamburger Connie sells. What is the cost of meat per pound for each hamburger Connie sells?

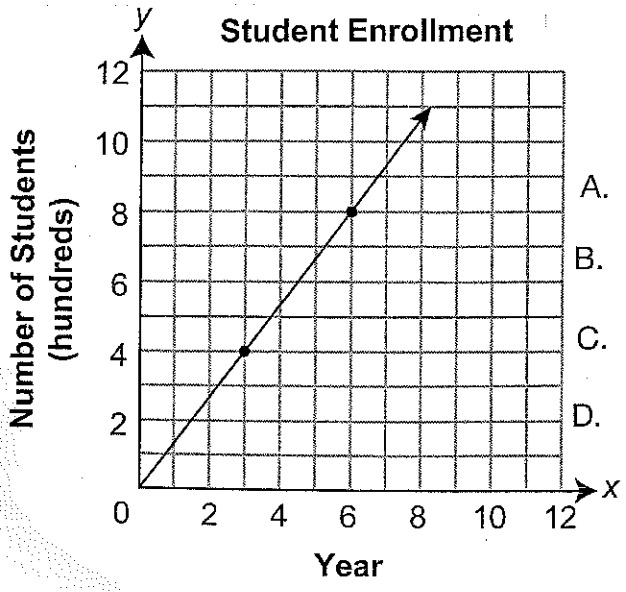
A. $0.95

B. $1.90

C. $2.00

D. $3.80

16. A school has collected student enrollment data since it opened. The graph below shows the number of students (y), in hundreds, enrolled at the school each year (x) the school has been open.



Which statement **best** describes the change in student enrollment shown in the graph?

A. Enrollment has increased by approximately 1.3 students per year.

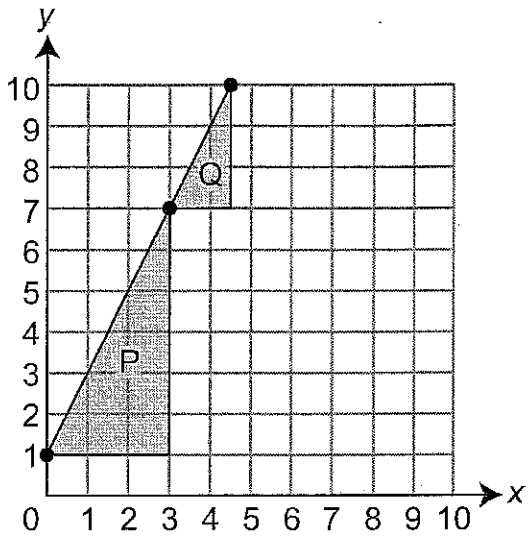
B. Enrollment has increased by approximately 133 students per year.

C. Enrollment has increased by approximately 400 students per year.

D. Enrollment has increased by approximately 1,100 students per year.

17. The graph of a line is shown below.

To find the slope, Jackie makes right triangle P by using the graph of the line as the hypotenuse of the triangle as shown in the figure. To check her work, she repeats the process and makes a right triangle Q as shown. Which statement explains why the slope of the line should be the same when calculated with either triangle?



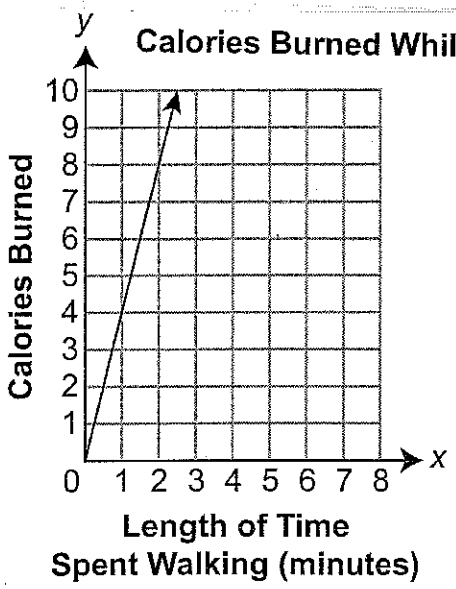
A. The two triangles are similar.

B. The two triangles are congruent.

C. One triangle is a translation of the other triangle.

D. The lengths of the hypotenuse of each triangle are equal.

18. The graph below shows the relationship between the number of minutes Ray walks and the number of calories he burns.



Which equation can be used to find the number of calories (y) Ray burns when he walks for x minutes?

A. $y = x + 4$

B. $y = x - 4$

C. $y = 4x$

D. $y = \frac{x}{4}$

19. A system of linear equations is shown below.

The system is graphed on a coordinate plane. An additional linear equation is graphed so that a triangle is created by the three lines. Which equation could be the additional linear equation?

$4y = 4x + 12$
$y = -x + 3$

A. $2y = -2x + 6$

B. $3y = 18$

C. $5(x + 1) = 5$

D. $5y = 3x + 15$

20. Quinn needs to buy fabric for a border to sew onto all four edges of a tablecloth. He also needs an extra 0.875 feet of fabric to make a matching potholder. The length of the table cloth is $\frac{4}{3}$ of its width (w), in feet. The total amount of fabric needed (f), in feet, is represented by the equation below.

Quinn needs $\frac{113}{8}$ feet of fabric for the border of the tablecloth and the potholder. What is the width of Quinn's tablecloth?

$$f = 2(w + \frac{4}{3}w) + 0.875$$

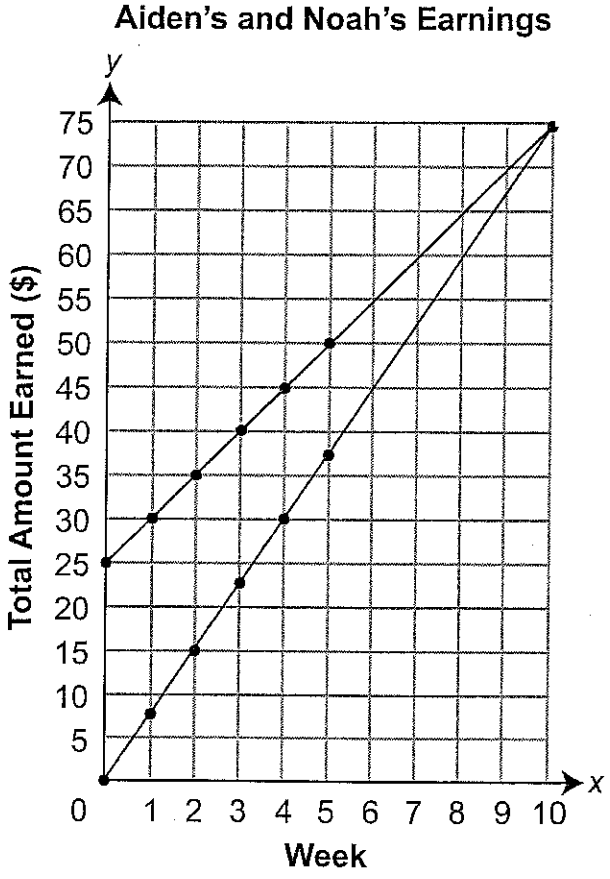
A. $\frac{39}{14}$ feet

B. $\frac{159}{40}$ feet

C. $\frac{159}{56}$ feet

D. $\frac{159}{32}$ feet

21. Aiden and Noah are going to work for their neighbor this summer. The neighbor gives Aiden $25 at the beginning of the summer and then pays him $5 each week to mow the lawn. The neighbor pays Noah $7.50 each week to walk the dog. The graph shown below models the total amount of money (y) each boy has earned after working for x weeks.



What does the point of intersection on the graph represent?

A. After 75 weeks, each boy has earned a total of $10.

B. After 10 weeks, each boy has earned a total of $75.

C. After 10 weeks, Noah has earned a total of $75 and Aiden has earned a total of $10.

D. After 75 weeks, Noah has earned a total of $10 and Aiden has earned a total of $75.

22. A store creates a mixture using only peanuts and almonds.

- There are 20 pounds of the mixture.
- Peanuts cost $2.95 per pound.
- Almonds cost $5.95 per pound.
- The mixture costs $4.00 per pound.

How many pounds of peanuts are in the mixture?

A. 2

B. 6

C. 7

D. 13

23. Karen and Maria each open a savings account at the same time. They only make deposits into their accounts and do not make withdrawals.

- When Karen opens her account she deposits $28 into it. She then deposits $5 into her account each week.
- The total amount of money (y), in dollars, in Maria's account x weeks after it is opened is described by the function $y = 8x + 7$.

What is the total amount of money that each girl has in her account 2 weeks after they have the same amount of money in their accounts?

A. Karen has $45.
Maria has $72.

B. Karen has $58.
Maria has $55.

C. Karen has $73.
Maria has $79.

D. Karen has $185.
Maria has $128.

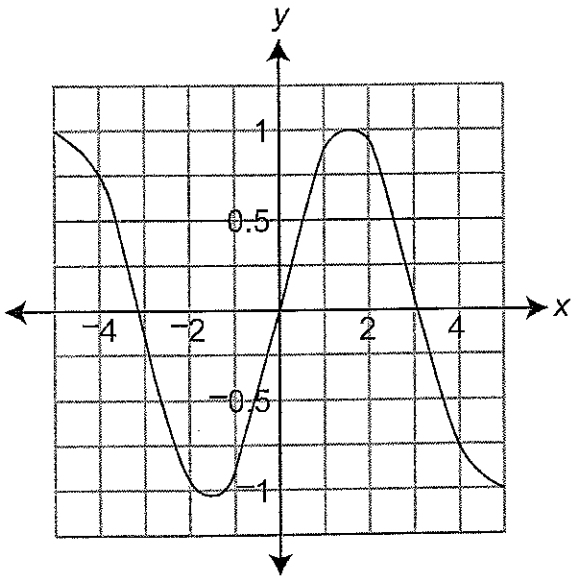
24. Which relation is **not** a function?

A. $y = 8x^2 + 11x + 14$

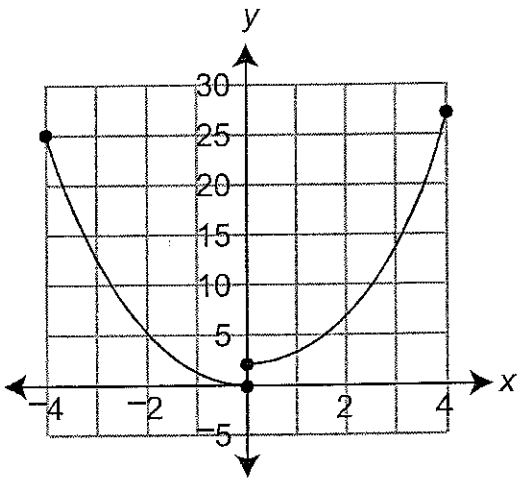
B.

x	*y*
1	6
3	18
5	30
7	42

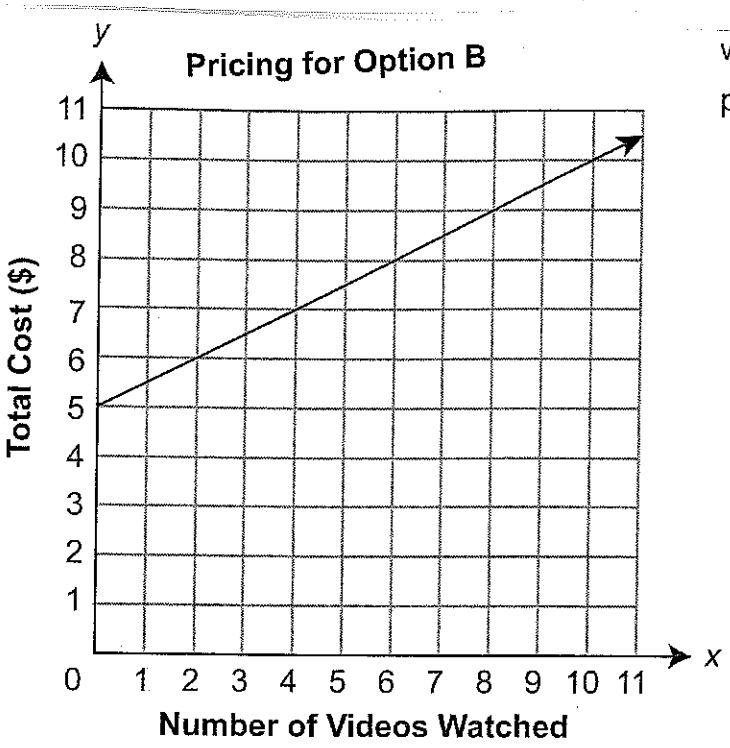
C.



D.



25. An online video service offers two price options. Pricing for option A is given by $y = 2x + 10$, where x is the number of videos watched and y is the total cost in dollars. Pricing for option B is shown in the graph below.



Both options include an initial charge and a charge per video watched. Which statement correctly compares the two price options?

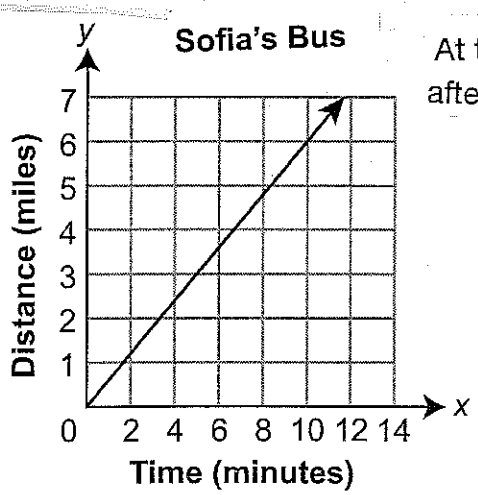
A. Option A has a higher initial charge and a higher charge per video watched.

B. Option B has a higher initial charge and a higher charge per video watched.

C. Option A has a higher initial charge, and option B has a higher charge per video watched.

D. Option B has a higher initial charge, and option A has a higher charge per video watched.

26. Sofia boarded a bus to school at the bus stop. The distance traveled by Sofia's bus is represented by the graph below.



At the same bus stop, Barry boarded a different bus to school 5 minutes after Sofia. The distance traveled by Barry's bus is described by the table below.

Barry's Bus

Time (minutes)	7	9	11
Distance (miles)	2.4	4.8	7.2

The school is located 12 miles from the bus stop. Which bus arrives at the school first, and what is the speed of that bus?

A. Sofia's bus arrives at the school first with a speed of 0.6 miles per minute.

B. Barry's bus arrives at the school first with a speed of 0.83 miles per minute.

C. Barry's bus arrives at the school first with a speed of 1.2 miles per minute.

D. Sofia's bus arrives at the school first with a speed of 1.67 miles per minute.

28. Sonia opened a savings account and then added the same amount to the savings account every week. After 5 weeks, her savings account had a total of $45. After 10 weeks, her savings account had a total of $70. Which equation represents the amount of money (y), in dollars, in Sonia's savings account after x weeks?

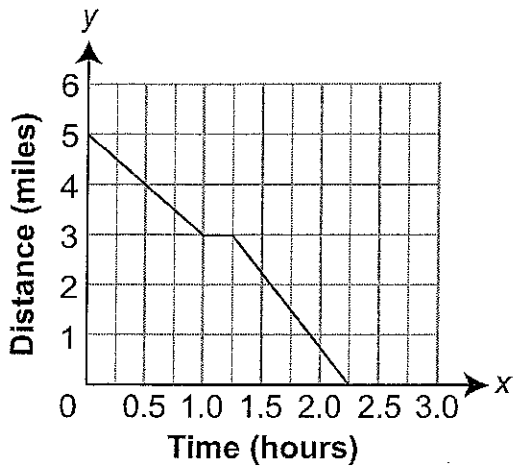
A. $y = 7x$ B. $y = 9x$ C. $y = 5x + 20$ D. $y = 20x + 5$

27. Which equation describes a function that is nonlinear?

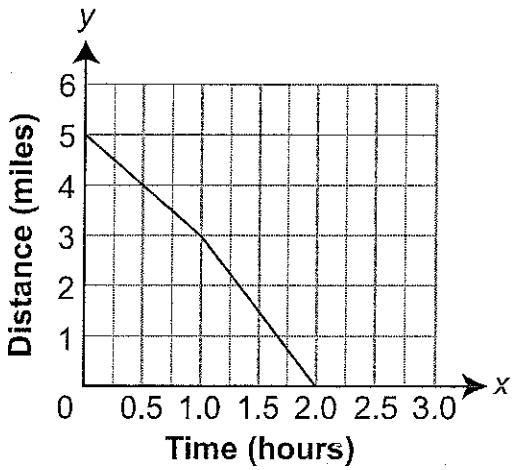
A. $y = x^2$ B. $y = 2x + 7$ C. $y = \frac{x+1}{2}$ D. $y = \frac{1}{2}x$

29. Andrea walks 5 miles from the library to her home. She starts walking at an average rate of 2 miles per hour. After 1 hour, she stops walking for 0.25 hour. When she begins walking again, Andrea walks at an average rate of 3 miles per hour until she arrives home. Which graph represents Andrea's distance (y), in miles, from her home as a function of the amount of time (x), in hours, since she left the library?

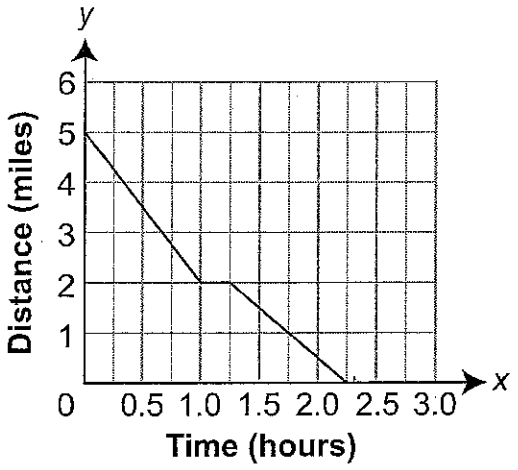
A.



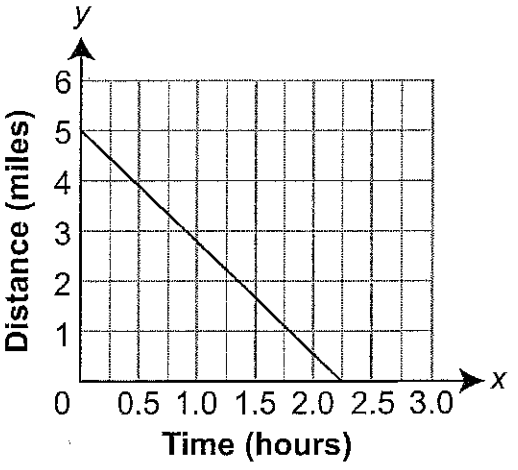
B.



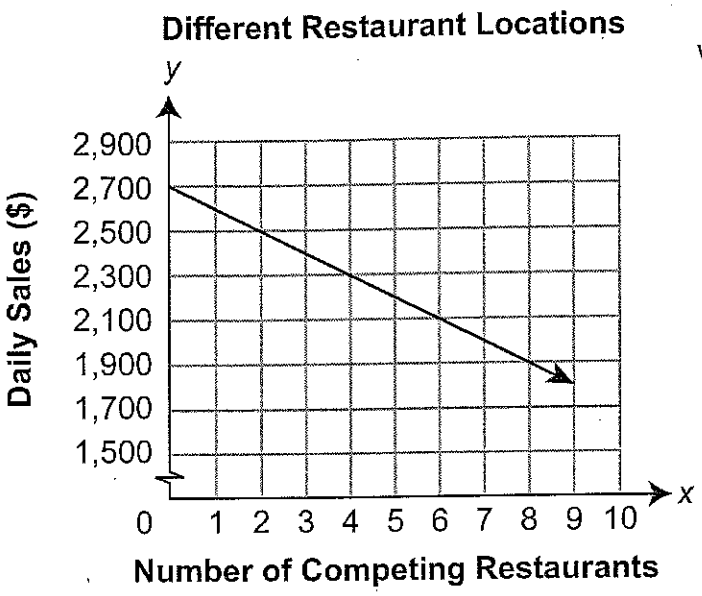
C.



D.



30. The manager of a small chain of restaurants compared the sales at different restaurant locations. She drew a graph comparing the daily sales, in dollars, to the number of competing restaurants in the neighborhood.



Based on the graph, how much do the daily sales change with each additional competitor

A. The daily sales increase by $100.

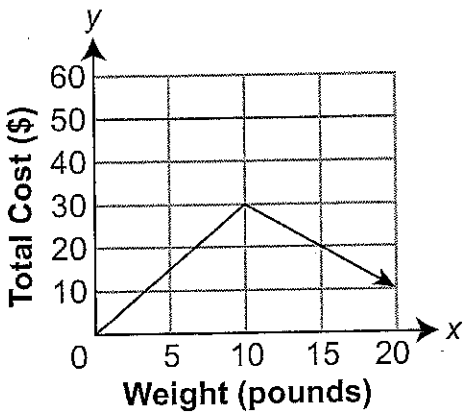
B. The daily sales decrease by $100.

C. The daily sales increase by $200.

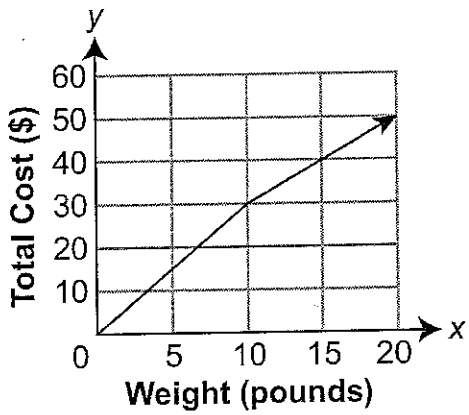
D. The daily sales decrease by $200.

31. At a market, assorted fruit costs $3 per pound for the first 10 pounds of fruit purchased. After the first 10 pounds, the fruit costs $2 per pound. Which graph represents the total cost (y), in dollars, of going to the market as a function of the weight of fruit (x), in pounds, purchased?

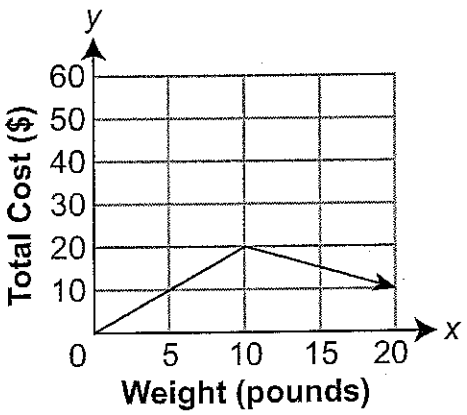
A.



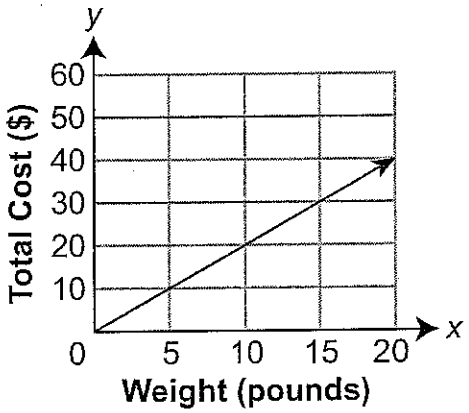
B.



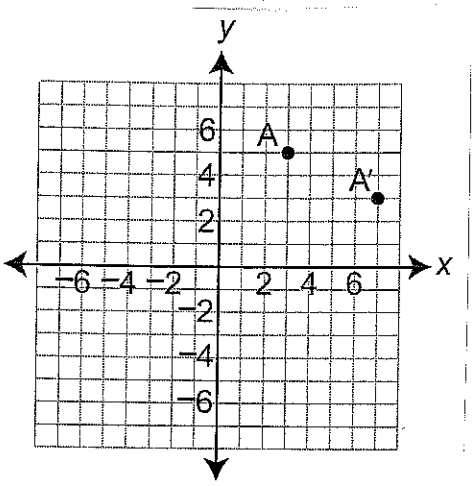
C.



D.



32. Point A' is the image of point A after a reflection across line w. Both points are graphed on the coordinate plane below.



What is the slope of line w?

A. -2

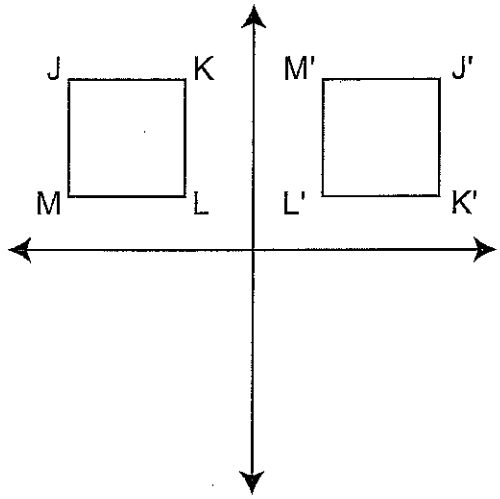
B. $-\frac{1}{2}$

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

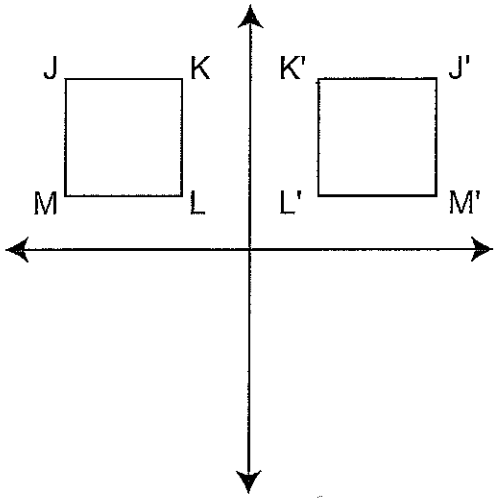
D. 2

33. Which graph shows only a rotation of 180° about the origin of square JKLM to square J'K'L'M'?

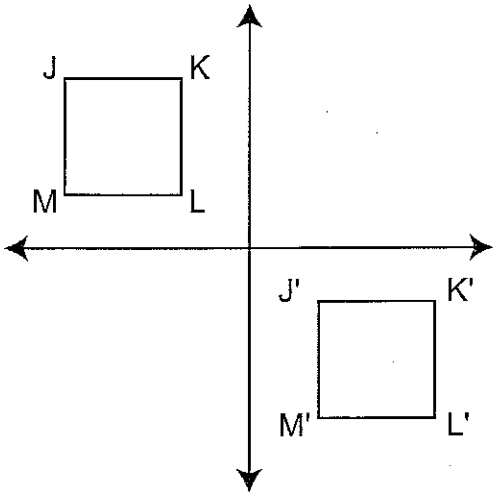
A.



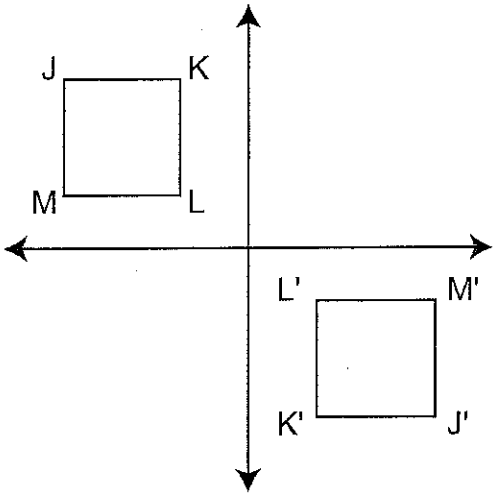
B.



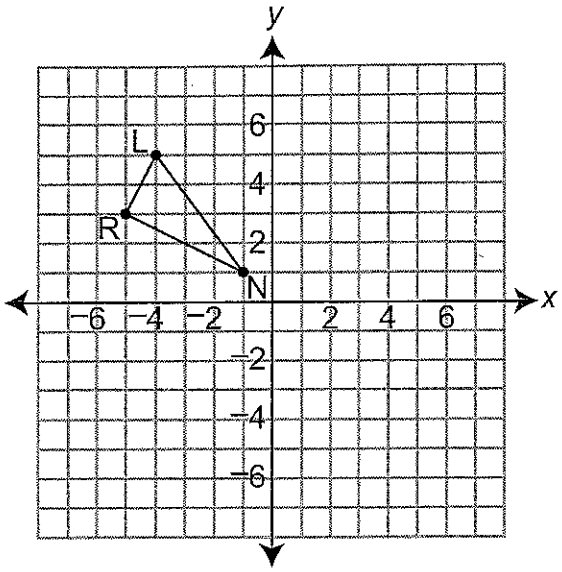
C.



D.



34. Triangle LNR is graphed on a coordinate grid shown below.



A translation 3 units right and 2 units down, followed by a dilation centered at the origin with a scale factor of 2, is performed on triangle LNR to create triangle L'N'R'. Which statement about side $\overline{L'N'}$ of triangle L'N'R' is true?

A. Because vertex L' is located at (−4, 4) and vertex N' is located at (2, −4), the length of side $\overline{L'N'}$ is 10 units.

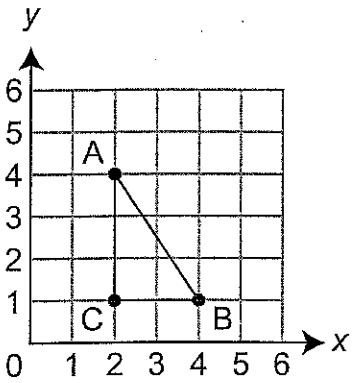
B. Because vertex L' is located at (−2, 6) and vertex N' is located at (4, −2), the length of side $\overline{L'N'}$ is 10 units.

C. Because vertex L' is located at (−4, 4) and vertex N' is located at (2, −4), the length of side $\overline{L'N'}$ is 12 units.

D. Because vertex L' is located at (−2, 6) and vertex N' is located at (4, −2), the length of side $\overline{L'N'}$ is 12 units.

35. Triangle ABC is graphed on the coordinate grid below.

Triangle DEF has a perimeter that is 4 times the perimeter of triangle ABC. Which ordered pairs could describe the locations of the vertices of triangle DEF?



A. D(14, −8)
E(14, −14)
F(18, −14)

B. D(−12, −8)
E(−12, −16)
F(0, −16)

C. D(−7, −6)
E(−7, −9)
F(−9, −6)

D. D(−12, 14)
E(−3, 14)
F(−12, 8)

36. Ken built the picture frame shown below.

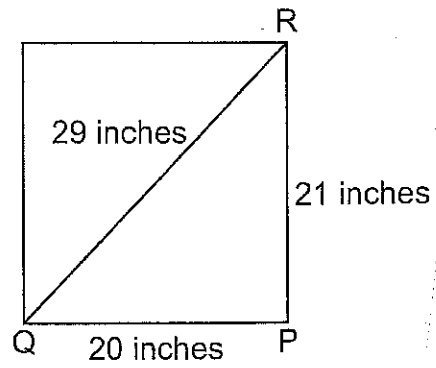
Which statement can be used to determine whether ∠P is a right angle?

A. $20 + 21 > 29$

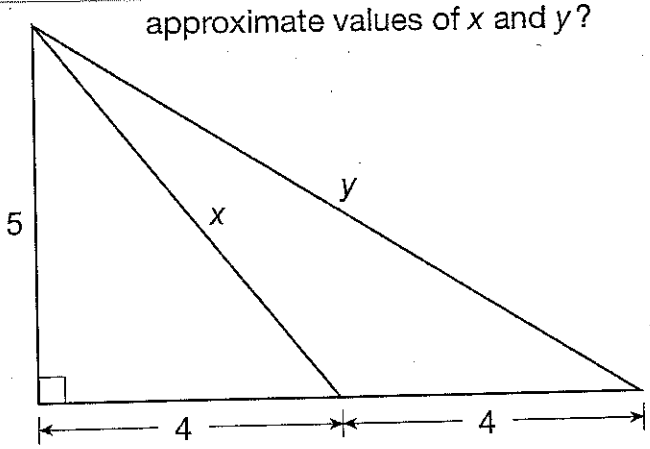
B. $20^2 + 21^2 > 29$

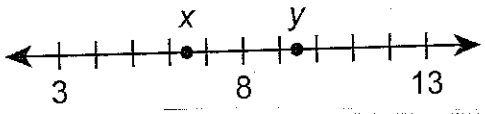
C. $(20 + 21)^2 > 29^2$

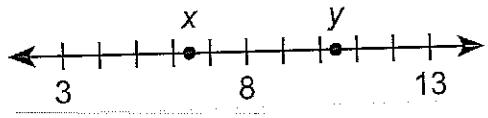
D. $20^2 + 21^2 = 29^2$

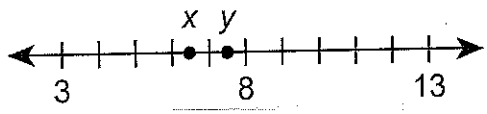


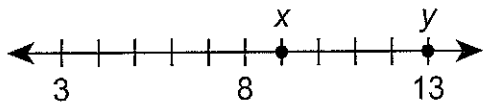
37. The lengths x and y are shown in the figure below. Which number line shows the **closest** approximate values of x and y?



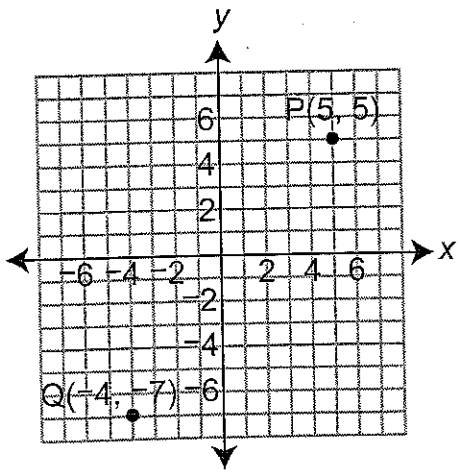
A.


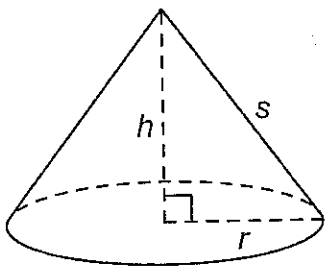
B.


C.


D.


38. Points P and Q are graphed on the coordinate plane shown below. A cone with radius r, slant height s, and height h is also shown below. For which radius (r) and slant height (s) is the height (h) of the cone the same as the distance between points P and Q?





A. $r = 5; s = 13$

B. $r = 6; s = 10$

C. $r = 8; s = 17$

D. $r = 9; s = 12$

39. The volume of a 12-inch-tall cone is 144π cubic inches. Which statement about the radius of the base of the cone is true?

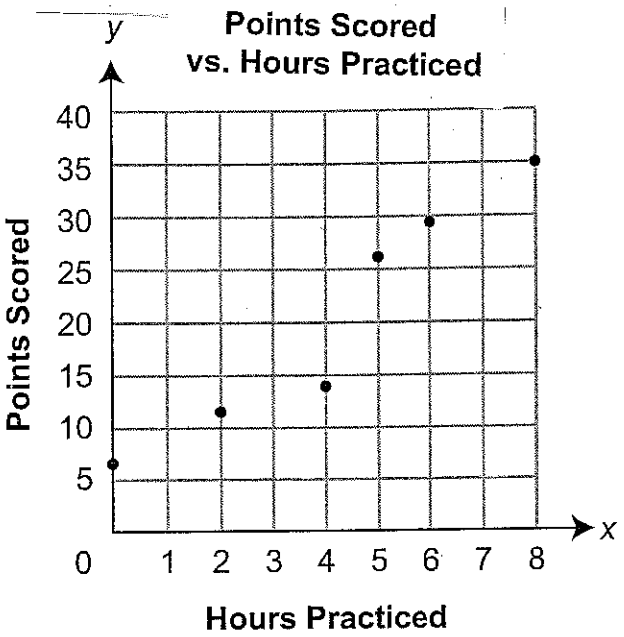
A. The radius is 6 inches, and it is a rational number.

B. The radius is 6 inches, and it is an irrational number.

C. The radius 12π inches, and it is a rational number.

D. The radius is 12π inches, and it is an irrational number.

40. The scatter plot below shows how many points Denise scored in a game based on the number of hours she practiced.



Using a line of best fit, how many points should Denise expect to score after she practices for 3 hours?

A. 7

B. 10

C. 12

D. 16

41. The table below shows the average number of fish Jamal caught in an hour based on the water temperature, in degrees Fahrenheit (°F).

Based on a linear model of the information in the table, how many fish should Jamal expect to catch in an hour when the water temperature is 55°F?

Jamal's Fishing

Water Temperature (°F)	Fish Caught
51	5
72	1
45	6
64	2
70	1

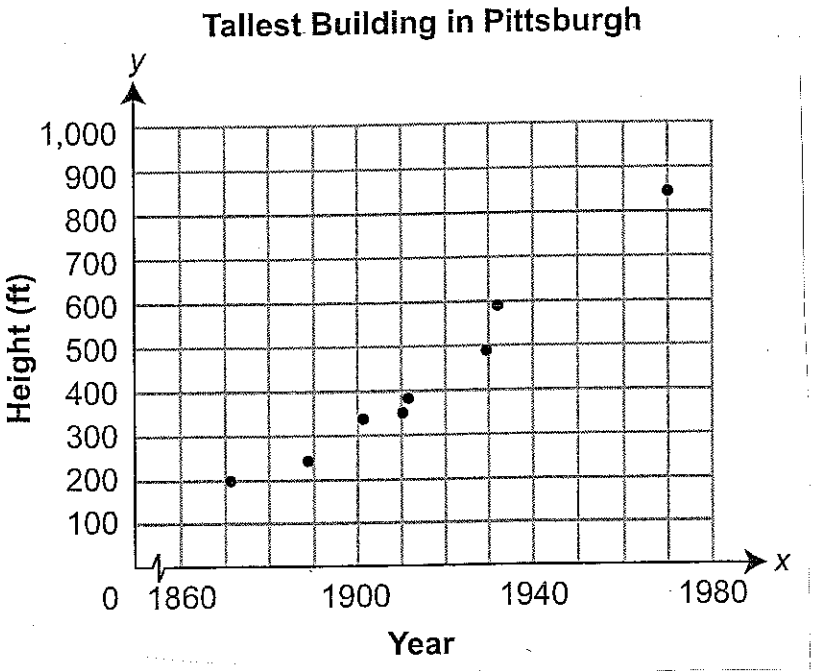
A. 3

B. 4

C. 5

D. 6

42. The height (y) of the tallest building in Pittsburgh in year x is shown in the scatter plot below.



Based on the scatter plot, which statement is true?

A. The data show no correlation.

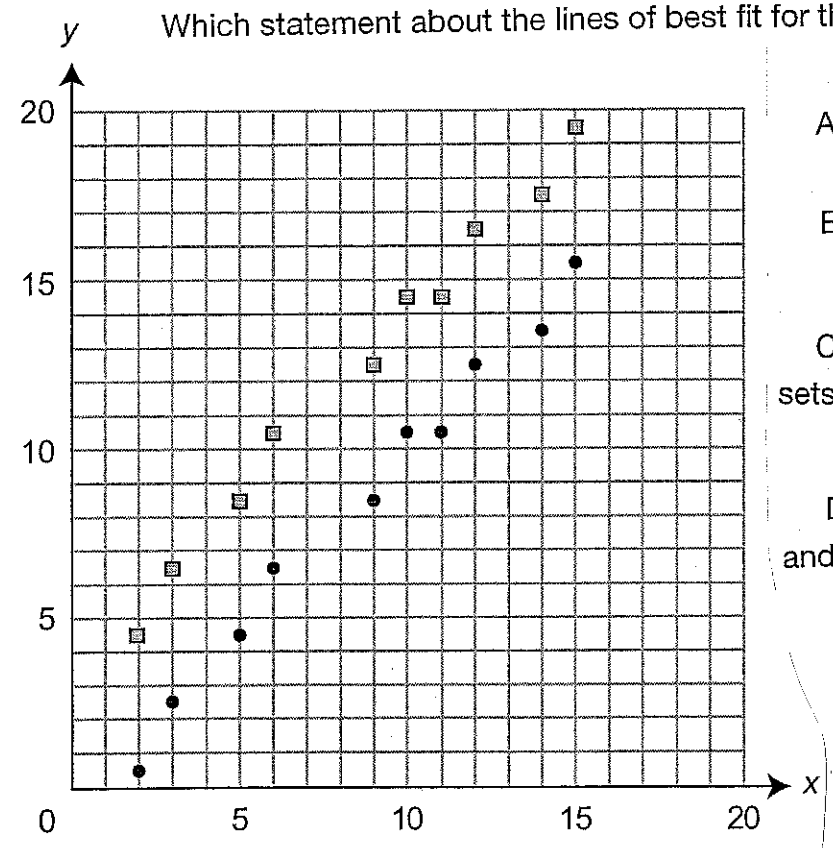
B. The data show a positive correlation.

C. The data show a negative correlation.

D. There are not enough data points to determine correlation.

43. Data sets A and B are graphed on the coordinate grid below.

Which statement about the lines of best fit for the two data sets is **most likely** true?



Key
▪ data set A
• data set B

A. The lines of best fit for data sets A and B are the same line.

B. The y-intercepts and the slopes of the lines of best fit for data sets A and B both differ by 4.

C. The y-intercepts of the lines of best fit for data sets A and B differ by 4, but the slopes are the same.

D. The slope of the line of best fit for data set A is 4, and the slope of the line of best fit for data set B is $\frac{1}{4}$.

44. The number of tickets sold for events at a theater last year varied with the cost per ticket, as shown in the scatter plot below.

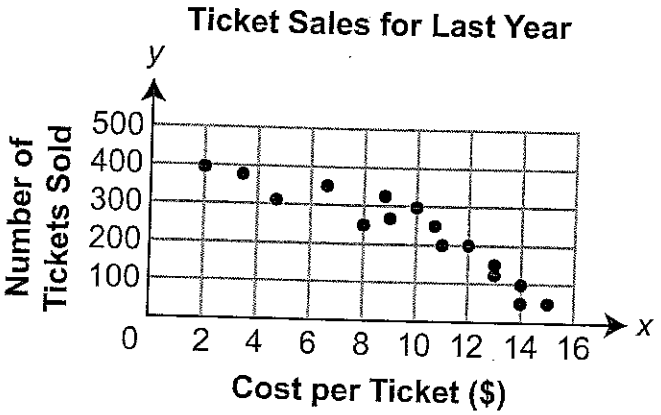
Based on the equation of the line of best fit for the scatter plot, which statement about the relationship between cost per ticket and number of tickets sold is true?

A. The slope of the line of best fit is approximately −26.5, which means that for every $2 increase in cost per ticket, the number of tickets sold decreased by 26.5.

B. The slope of the line of best fit is approximately −26.5, which means that for every $1 increase in cost per ticket, the number of tickets sold decreased by 26.5.

C. The slope of the line of best fit is approximately 26.5, which means that for every $2 increase in cost per ticket, the number of tickets sold increased by 26.5.

D. The slope of the line of best fit is approximately 26.5, which means that for every $1 increase in cost per ticket, the number of tickets sold increased by 26.5.



45. The table below shows the numbers of grade 7 and grade 8 students who chose cheese pizza or pepperoni pizza as their favorite pizza.

Which approximation is **closest** to the percent of the students who chose pepperoni pizza as their favorite?

Favorite Pizza

	Cheese Pizza	Pepperoni Pizza
Grade 7 Students	171	254
Grade 8 Students	285	143

A. 47%

B. 50%

C. 53%

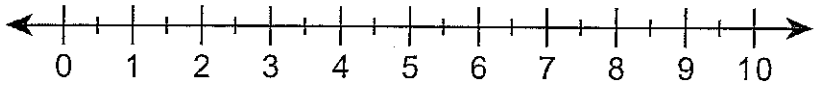
D. 87%

46. Kelsey draws a series of right triangles with sides that have the lengths shown in the table below.

Lengths of Sides of Kelsey's Right Triangles (inches)

Triangle	Length of First Leg	Length of Second Leg	Length of Hypotenuse
A	1	1	$\sqrt{2}$
B	1	2	$\sqrt{5}$
C	1	3	$\sqrt{10}$
D	1	4	$\sqrt{17}$
E	1	5	$\sqrt{26}$

A. Plot and label each of the five hypotenuse lengths on the number line shown below.



The next hypotenuse in the pattern is $\sqrt{37}$. Kelsey plots $\sqrt{37}$ on a number line without the use of a calculator.

B. Explain how Kelsey could find between which two consecutive whole numbers she should plot $\sqrt{37}$. Also explain how she can determine to which of these two whole numbers $\sqrt{37}$ is closest.

46. ***Continued.*** Please refer to the previous page for task explanation.

Kelsey continues making right triangles following the same pattern she used to make the first five right triangles.

C. Explain why none of the right triangles Kelsey makes will have a hypotenuse with a rational number length.