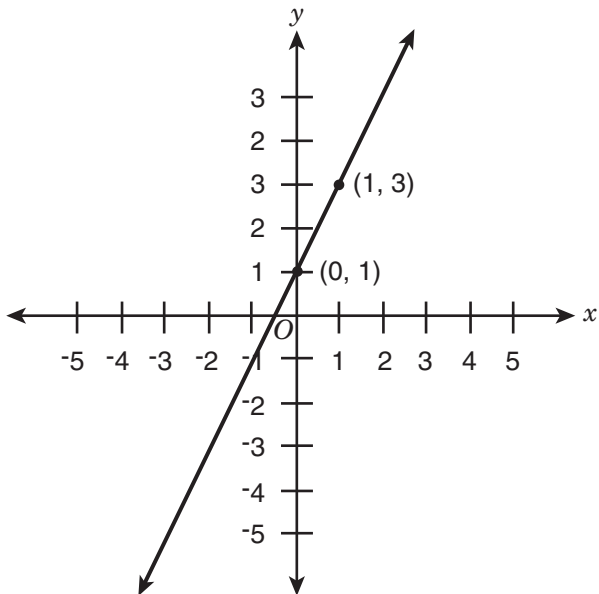


Grade 9

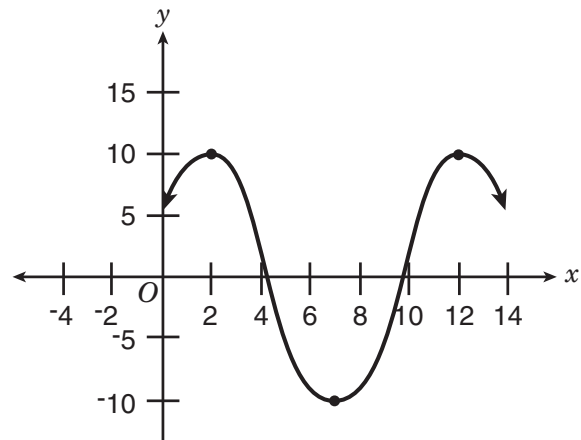
Mathematics Sample Questions

1. A function is given on the coordinate plane.



The function is linear. What is the y -value for $x = -4$?

2. What is the difference in x -values in the graph from where the function first begins decreasing to where it begins decreasing again?

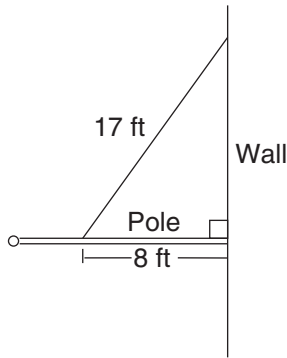


- 3.

$$\begin{cases} y = \frac{3}{2}x - 1 \\ x + 2y = 6 \end{cases}$$

What is the value of x in the solution to the system of equations shown above?

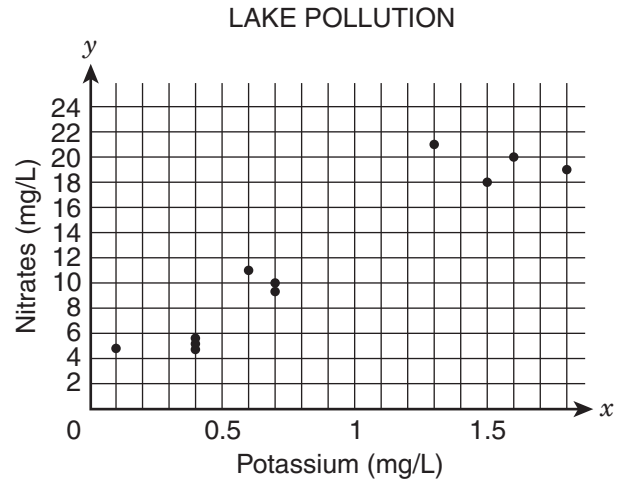
4.



The diagram above shows a pole connected to a wall at a 90° angle. A 17-foot wire is attached to the pole at a point 8 feet out from the wall. How many feet above the pole is the wire attached to the wall?

- E. 9
- F. 13
- G. 15
- H. 16

5. A researcher recorded pollution data that measured the presence of potassium and nitrates in some lakes. The scatter plot shows the data.



Which statement describes the data shown in the graph?

- A. The data show a nonlinear association.
 - B. The data show multiple outliers.
 - C. The data show a positive association.
 - D. The data show a negative association.
6. How much greater is (1.8×10^6) than (7.3×10^5) ?
- E. 1.07×10^5
 - F. 1.13×10^5
 - G. 1.07×10^6
 - H. 1.13×10^6

7. How is $0.\overline{6} \times 0.\overline{2}$ written as a fraction in simplest form?

A. $\frac{4}{27}$

B. $\frac{2}{15}$

C. $\frac{4}{33}$

D. $\frac{3}{25}$

8. If $2x - 6 = 8y - 10$ and $x > 5$, what is the **least** possible integer value of y ?

E. 1

F. 2

G. 3

H. 6

9. A data set relates a car's average gas mileage, y , in miles per gallon, to its engine size, x , in liters. The equation for the line of best fit is $y = -3.25x + 34.5$. What is the meaning of the slope of the line as it relates to gas mileage and engine size?

A. For each decrease of 1 L in engine size, the gas mileage decreases by 3.25 mpg.

B. For each increase of 1 L in engine size, the gas mileage decreases by 3.25 mpg.

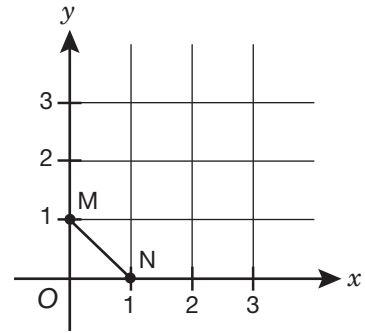
C. For each increase of 1 mpg in gas mileage, the engine size decreases by 3.25 L.

D. For each decrease of 3.25 mpg in gas mileage, the engine size decreases by 1 L.

10. On Saturday, the temperature changed at a constant rate from 2:00 a.m. until 2:00 p.m. At 4:00 a.m., the temperature was 47°F . At 10:00 a.m., the temperature was 32°F . What was the temperature at 2:00 a.m. on Saturday?

- E. 15°F
- F. 37°F
- G. 42°F
- H. 52°F

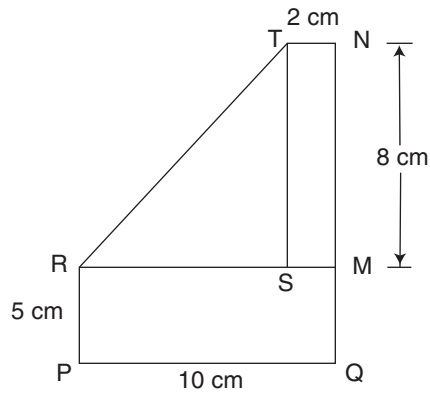
11.



If \overline{MN} is rotated 90° clockwise about the origin, what are the coordinates of N' ?

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

12.



In the diagram above, $STNM$ and $PRMQ$ are rectangles, and point S is on \overline{RM} . What is the length of \overline{RT} , in centimeters?

- E. 8
- F. $\sqrt{80}$
- G. 10
- H. $\sqrt{128}$

13.

$$N = \sqrt{y + (2x - 1)^2}$$

In the equation shown above, $y > 0$ and $N \geq 0$. What value of x will result in the **least** possible value of N ?

- A. $-\frac{1}{2}$
- B. 0
- C. $\frac{1}{4}$
- D. $\frac{1}{2}$

Grade 9

Mathematics Explanations of Correct Answers

1. (-7) The function goes through points (0, 1) and (1, 3). Use those points to determine the equation of the function:

$$\text{Slope: } \frac{3 - 1}{1 - 0} = \frac{2}{1} = 2$$

It can be determined from the graph that the y-intercept is 1.

$$\text{Equation: } y = 2x + 1$$

Now plug in $x = -4$ to find y :

$$y = 2(-4) + 1 = -8 + 1 = -7$$

-
2. (10) The function first begins decreasing at (2, 10) and begins decreasing again at (12, 10). The difference in x-values is $12 - 2 = 10$.

3. (2) First, solve the second equation for y :

$$x + 2y = 6$$

$$2y = 6 - x$$
 Apply the additive inverse property; subtract x from both sides of the equation.

$$y = \frac{6 - x}{2}$$
 Apply the multiplicative inverse property; divide both sides of the equation by 2.

Now set the two expressions for y equal to each other:

$$\frac{3}{2}x - 1 = \frac{6 - x}{2}$$
 Apply the multiplicative inverse property; multiply both sides by 2.

$$3x - 2 = 6 - x$$
 Apply the additive inverse property; add x to both sides of the equation.

$$4x - 2 = 6$$
 Apply the additive inverse property; add 2 to both sides of the equation.

$$4x = 8$$
 Apply the multiplicative inverse property; divide both sides of the equation by 4.

$$x = 2$$

4. **(G)** Let x represent the distance between the pole and the point where the wire attaches to the wall. Use the Pythagorean theorem to find x :

$$\begin{aligned}x^2 + 8^2 &= 17^2 \\x^2 + 64 &= 289 \\x^2 &= 225 \\x &= \sqrt{225} = 15\end{aligned}$$

5. **(C)** According to the scatter plot, as the potassium value increases, so does the nitrates value. Therefore, this is a positive association.

6. **(G)** In order to subtract the expressions, rewrite them so that they have the same exponent on the 10.

$$\begin{aligned}(1.8 \times 10^6) - (7.3 \times 10^5) &= \\(1.8 \times 10^6) - (0.73 \times 10^6) &= \\(1.8 - 0.73) \times 10^6 &= \\1.07 \times 10^6 &\end{aligned}$$

7. **(A)** Rewrite the repeating decimals as fractions:

$$x = 0.666666\dots \quad \text{Let } x \text{ equal the repeating decimal.}$$

$$10x = 6.66666\dots \quad \text{Multiply both sides of the equation by 10 to move the decimal one place to the right.}$$

$$10x = 6.6666\dots \quad \text{Subtract the two equations.}$$

$$\underline{-x = -0.6666\dots}$$

$$9x = 6.0000\dots \quad \text{Apply the multiplicative inverse property; divide both sides by 9.}$$

$$x = \frac{6}{9} = \frac{2}{3} \quad \text{Simplify the fraction to lowest terms (if needed).}$$

Perform the same process for $0.\overline{2}$:

$$\begin{aligned}10x &= 2.2222\dots \\ \underline{-x} &= \underline{-0.2222\dots} \\ 9x &= 2.0000\dots \\ x &= \frac{2}{9}\end{aligned}$$

Then multiply:

$$\frac{2}{3} \times \frac{2}{9} = \frac{4}{27}$$

8. (F) Solve for x :

$$x = 4y - 2$$

Since $x > 5$, then $4y - 2 > 5$. So,
 $y > \frac{7}{4}$ or 1.75. Since y is an integer, the
least possible integer value of y is 2.

9. (B) The slope of the line of best fit is
-3.25. Slope is $\frac{\text{change in } y}{\text{change in } x}$,

or in this case, $\frac{\text{change in gas mileage}}{\text{change in engine size}}$.

So, for every 1 L increase in engine size,
the gas mileage decreases by 3.25 mpg.

10. (H) The problem gives two points:
(4:00, 47) and (10:00, 32). Use that
information to find the rate of change:

$$\frac{32 - 47}{10 - 4} = \frac{-15}{6} = \frac{-5}{2}$$

So, the temperature change was $-\frac{5}{2}^{\circ}\text{F}$
each hour.

To find the temperature at 2:00 a.m.,
which is 2 hours before 4:00 a.m.,
subtract $-\frac{5}{2}$ from 47 twice:

$$47 - 2\left(-\frac{5}{2}\right) = 47 + 5 = 52$$

Therefore, the temperature at 2:00 a.m.
was 52°F .

11. (C) The new position of $A(k, h)$ after
rotating 90° clockwise will be $A'(k, -h)$.
Rotating 90° clockwise moves the line
segment to the fourth quadrant. So, M'
becomes $(1, 0)$ and N' becomes $(0, -1)$.

- 12. (H)** Triangle RTS is a right triangle. First, find the lengths of the two legs (TS and RS). Then the Pythagorean theorem can be used to find the length of \overline{RT} .

In rectangle STNM, TN is 2 cm, so SM is also 2 cm. Similarly, NM is 8 cm, so TS is also 8 cm.

In rectangle PRMQ, PQ is 10 cm, so RM is also 10 cm. Since $RM = RS + SM$, use the values of RM and SM to calculate the length of \overline{RS} , in centimeters:

$$\begin{aligned}RS + SM &= RM \\RS + 2 &= 10 \\RS &= 8\end{aligned}$$

Now use the Pythagorean theorem to find the length of \overline{RT} :

$$\begin{aligned}(RS)^2 + (TS)^2 &= (RT)^2 \\8^2 + 8^2 &= (RT)^2 \\64 + 64 &= (RT)^2 \\128 &= (RT)^2 \\\sqrt{128} &= RT\end{aligned}$$

- 13. (D)** In order to minimize the value of N , find the least possible value of $(2x - 1)^2$. Since this expression is squared, the least possible value is 0.

$$(2x - 1)^2 = 0 \quad \text{Take the square root of both sides of the equation.}$$

$$2x - 1 = 0 \quad \text{Apply the additive inverse property; add 1 to both sides of the equation.}$$

$$2x = 1 \quad \text{Apply the multiplicative inverse property; divide both sides of the equation by 2.}$$

$$x = \frac{1}{2}$$

Answer Key for Grade 9 Mathematics

1. -7	6. G	11. C
2. 10	7. A	12. H
3. 2	8. F	13. D
4. G	9. B	
5. C	10. H	