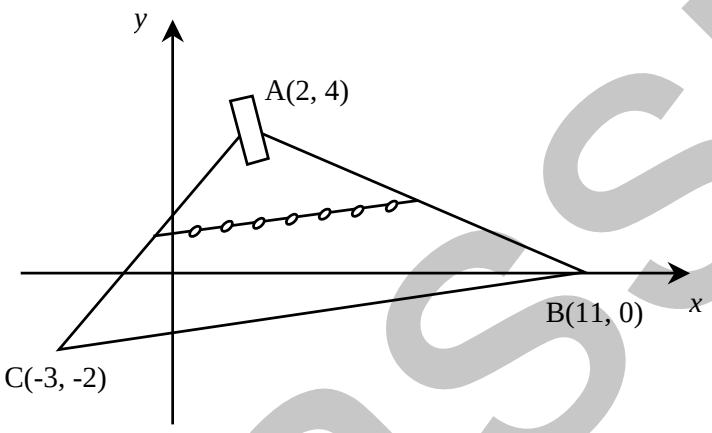
1 D

2 Example of an appropriate solution

Midpoint of side AC

$$M_x = \frac{-3 + 2}{2} = \frac{-1}{2}$$

$$M_y = \frac{-2 + 4}{2} = 1$$



Midpoint of side AB

$$M_x = \frac{2 + 11}{2} = 6.5$$

$$M_y = \frac{4 + 0}{2} = 2$$

Slope of the rope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{1 - 2}{\frac{-1}{2} - 6.5} = \frac{-1}{-7} = \frac{1}{7}$$

Slope of side BC

$$m = \frac{0 + 2}{11 + 3} = \frac{2}{14} = \frac{1}{7}$$

Answer: The rope is parallel to side BC of the pool because both lines have the same slope, $\frac{1}{7}$.

3 Example of an appropriate method

Slope of line ℓ_1

$$\frac{12-0}{0-18}=\frac{12}{-18}=\frac{-2}{3}$$

Slope of line ℓ_2

Since $\ell_1 \perp \ell_2$, the product of their slopes is equal to -1.

$\frac{-2}{3}$ × slope of ℓ_2 = -1

Slope of ℓ_2

$$\frac{3}{2}$$

Equation of ℓ_2

$y = ax + b$

$y = \frac{3}{2}x + 12$

x-intercept of ℓ_2

$0 = \frac{3}{2}x + 12$

$-12 = \frac{3}{2}x$

$-8 = x$

Answer: The x-intercept of line ℓ_2 is -8.

Note: Students who use an appropriate method in order to determine the slope of line ℓ_2 have shown that they have a partial understanding of the problem.

4 The equation of the line is $y = \frac{1}{3}x + 3$ or $x - 3y + 9 = 0$ or an equivalent expression.

5 Example of an appropriate method

Slope of Lake Road

$$a_{LR} = \frac{\Delta y}{\Delta x} = \frac{(1) - (-7)}{(8) - (4)} = \frac{8}{4} = 2$$

Equation of Lake Road

$y = 2x + b_{LR}$

Substituting (8, 1) $(1) = 2(8) + b_{LR}$

$b_{LR} = 1 - 16$

$b_{LR} = -15$

$y = 2x - 15$

Slope of Smith Drive Smith Drive $\perp$ Lake Road $\Rightarrow$ slope = $-\frac{1}{2}$

Equation of Smith Drive

$y = -\frac{1}{2}x + b_{SD}$

Substitution (13, -9) $(-9) = -\frac{1}{2}(13) + b_{SD}$

$-9 = -6.5 + b_{SD}$

$b_{SD} = -2.5$

$y = -0.5x - 2.5$

Point of intersection

Solve the system $\rightarrow$ $y = 2x - 15$

$y = -0.5x - 2.5$

By comparison method

$2x - 15 = -0.5x - 2.5$

$2.5x = 12.5$

$x = 5$

Solving for y

$y = 2(5) - 15$

$y = 10 - 15$

$y = -5$

Point of intersection is (5, -5)

Answer: The coordinates of the point at which Pietra reaches Lake Road are ***x* = 5** and ***y* = -5** or **(5, -5)**.

6 Work : (example)

Slope of the line representing the avenue

$$\frac{5-1}{9-1} = \frac{4}{8} = \frac{1}{2}$$

Slope of the line representing the street perpendicular to the avenue

$m \times \frac{1}{2} = -1$ $\quad$ $m = -2$

The co-ordinates of the midpoint of the avenue

$x_1 = \frac{9+1}{2} = \frac{10}{2}$ $\quad$ $y_1 = \frac{5+1}{2} = \frac{6}{2}$

$x_1 = 5$ $\quad$ $y_1 = 3$

$(x_1, y_1) \rightarrow (5, 3)$

Equation of the line representing the street

$y = -2x + b$ $\quad 3 = -2(5) + b$ $\quad b = 13$

Result The equation of the line representing the street is $y = -2x + 13$.

7 D

8 Work : (example)

Slope of segment AB(m_1)

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_1 = \frac{16 - 4}{8 - 2}$$

$$m_1 = 2$$

Slope of line *l*(m_2)

$$m_2 = \frac{-1}{m_1}$$ (Line *l* is perpendicular to $\overline{AB}$.)

$$m_2 = \frac{-1}{2}$$

Equation of line l

$$\frac{y - 8}{x - 4} = \frac{-1}{2}$$

$$2y - 16 = -x + 4$$

$$x + 2y - 20 = 0$$

Result The equation of line *l* is $x + 2y - 20 = 0$.

Note : Accept an equivalent equation.

9 Work : (example)

Slope of line $l_1(m_1)$

The equation of line l_1, of the form $y = mx + b$, is

$$y = \frac{2}{3}x + \frac{8}{3}$$

$$m_1 = \frac{2}{3}$$

Slope of line $l_2(m_2)$

$m_2 = m_1$ (Lines l_1 and l_2 are parallel.)

$$m_2 = \frac{2}{3}$$

Equation of line l_2

$$\frac{y+2}{x-5} = \frac{2}{3}$$

$$2x - 10 = 3y + 6$$

$$2x - 3y - 16 = 0$$

Result The equation of line l_2 is $2x - 3y - 16 = 0$.

Note : Accept an equivalent equation.

10 C

11 B

12 Work : (example)

Mid-point of the line segment joining the dock to the tip of the island.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{8-4}{2}, \frac{11+7}{2}\right) = (2,7)$$

Slope of this line segment.

$$\mathrm{m} = \frac{11-3}{8+4} = \frac{8}{12} = \frac{2}{3}$$

Slope of the line perpendicular to the line segment whose slope is $\frac{2}{3}$.

$m_1 m_2 = -1$ where $m_1 = \frac{2}{3}$

from which $m_2 = -\frac{3}{2}$

Equation of the line whose slope is $-\frac{3}{2}$ and which passes through point (2.7).

$$\frac{y-7}{x+2} = -\frac{3}{2}$$

$3x + 2y - 20 = 0$

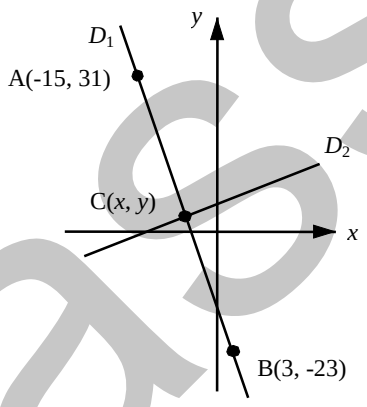
Result $3x + 2y - 20 = 0$ or an equivalent equation.

13 C

14 Work : (example)

Coordinates of point C, the midpoint of segment AB

$$C\left(\frac{x_A + x_B}{2}, \frac{y_A + y_B}{2}\right)$$



$$C\left(\frac{-15 + 3}{2}, \frac{31 - 23}{2}\right)$$

C(-6, 4)

Slope of segment AB

$$m_{\overline{AB}} = \frac{y_B - y_A}{x_B - x_A} = \frac{-23 - 31}{3 + 15} = -3$$

Slope of line L_2

$m_{L_2} \times m_{\overline{AB}} = -1$ (Because line L_2 is perpendicular to segment AB.)

$m_{L_2} \times 3 = -1$

$$m_{L_2} = \frac{1}{3}$$

Equation of line L_2

$$\frac{y-4}{x+6}=\frac{1}{3}$$

$x - 3y + 18 = 0$

Result The equation of line L_2 is $x - 3y + 18 = 0$.

Note : Accept an equivalent equation.

15 Statement: m $\angle$ABC = m $\angle$DEF

Reason: SAS similarity rule

Name : _____

Group : _____

Date : _____

568426 - Mathematics

Question Booklet

1 The two main streets of a city are perpendicular. These can be drawn in a Cartesian plane.

The line representing street A passes through the points (0, -60) and (70, 10).

The line representing street B passes through the point (90, -30).

Which of the following equations defines the line representing street B?

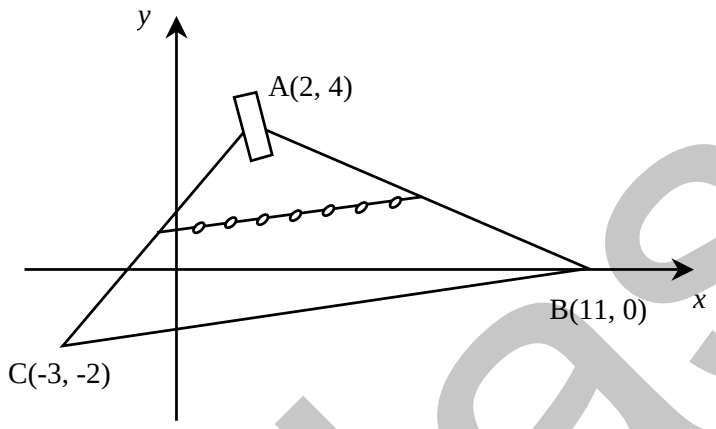
A) $y = -x - 60$

B) $y = x - 60$

C) $y = x + 60$

D) $y = -x + 60$

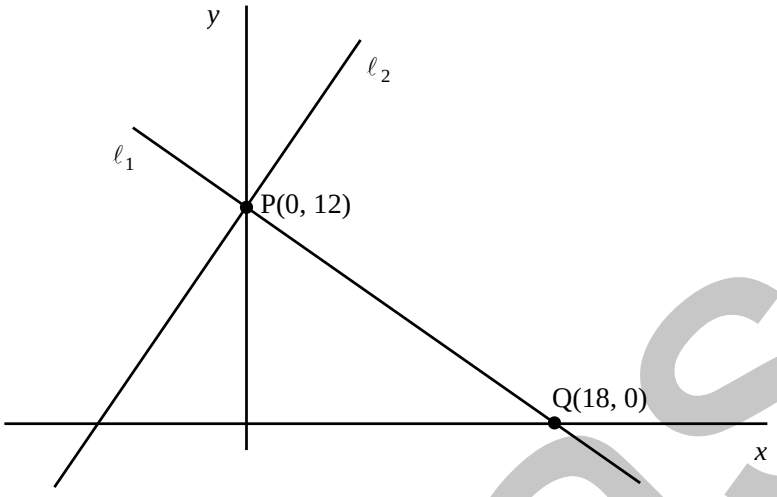
2 Mrs. Perez had a triangular-shaped pool installed in her back yard. A diving board was placed at corner A. The company installed a rope connecting the midpoints of sides AB and AC to designate the diving area. This situation is illustrated in the Cartesian plane below, which is scaled in metres.



Show that the rope is parallel to side BC of the pool.

Show all your work.

3 Perpendicular lines ℓ_1 and ℓ_2 are drawn in the Cartesian plane below.

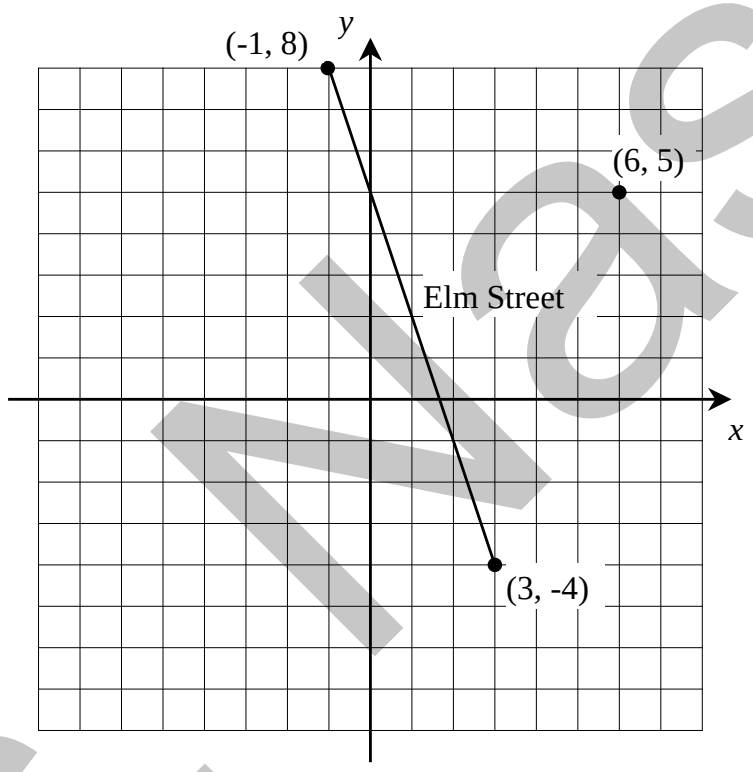


What is the *x*-intercept of lines ℓ_2?

Show all your work.

4 The city of Chateauguay uses a Cartesian grid for mapping out roads. Elm Street has endpoints (-1, 8) and (3, -4).

The town manager wishes to find the equation of a line representing Valour Lane which is perpendicular to Elm Street and passes through the point (6, 5).



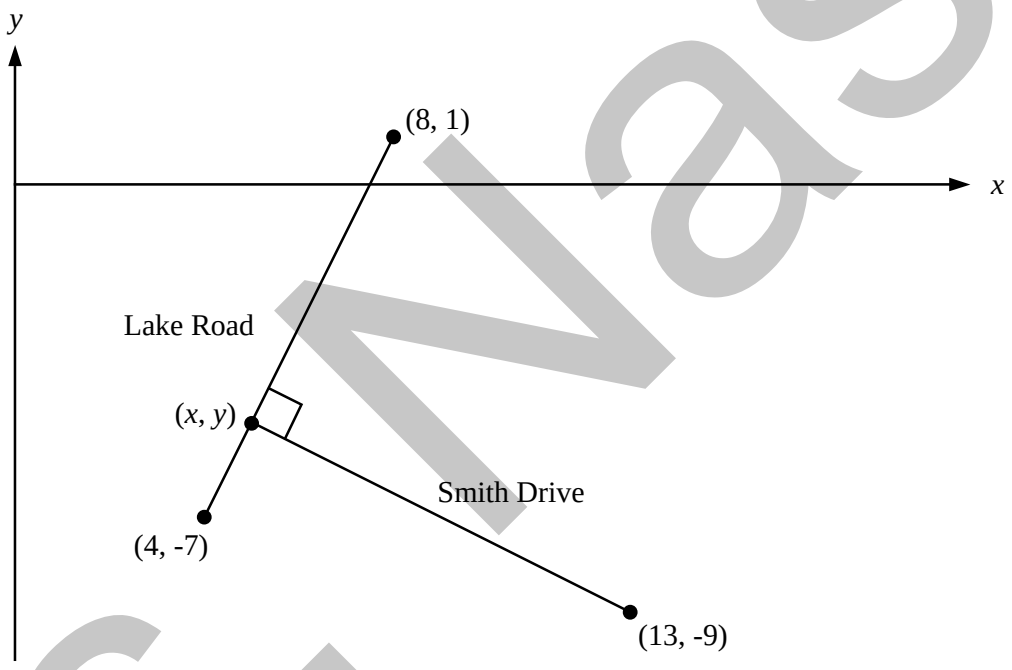
What is the equation of the line that represents Valour Lane?

5 Lake Road passes through points (4, -7) and (8, 1) on the Cartesian map below, scaled in kilometres.

Pietra lives on Smith Drive at the location given by the coordinates (13, -9).

She wants to jog to Lake Road, which is perpendicular to Smith Drive.

What are the coordinates (x, y) of the point at which Pietra reaches Lake Road?



NOTE: The diagram is not drawn to scale.

Show all your work.

6 When developing a particular town, the town planner established the following conditions : the streets and avenues would be straight lines perpendicular to one another. In the Cartesian plane, one of the avenues starts at point (1, 1) and stops at point (9, 5).

What is the equation of the line representing the street that divides this avenue into two equal parts?

Show your work.

7 Two lines are drawn in a Cartesian plane. The equations of these lines are as follows : $y = 2x + 5$ and $y = -2x - 3$

What is the relative position of these lines?

A) They are parallel and coincident.

B) They are parallel and distinct.

C) They are perpendicular to each other.

D) They intersect but are not perpendicular to each other.

8 In a Cartesian plane, line segment AB passes through points A(2, 4) and B(8, 16). Line *l* is perpendicular to this segment and passes through point C(4, 8).

What is the equation of line *l*?

Show your work.

9 The equation of line l_1 in a Cartesian plane is $2x - 3y + 8 = 0$. Line l_2 is parallel to the first line and passes through the point (5, -2).

What is the equation of line l_2?

Show your work.

10 Two lines are drawn in a Cartesian plane. The equations of these lines are $y = \frac{3}{2}x + 5$ and

$y = -\frac{2}{3}x + 5.$

What is the relative position of these lines?

A) They are parallel and distinct.

B) They are parallel and coincident.

C) They are perpendicular to each other.

D) They intersect but are not perpendicular to each other.

11 The map of a city is drawn in a Cartesian co-ordinate system.

On this map, the street on which the school and the arena are located is represented by the line whose equation is $y = 3x - 2$. The street where the church and the post office are located is represented by the equation $y = -3x - 2$.

What is characteristic of the lines representing these two streets?

A) They are perpendicular.

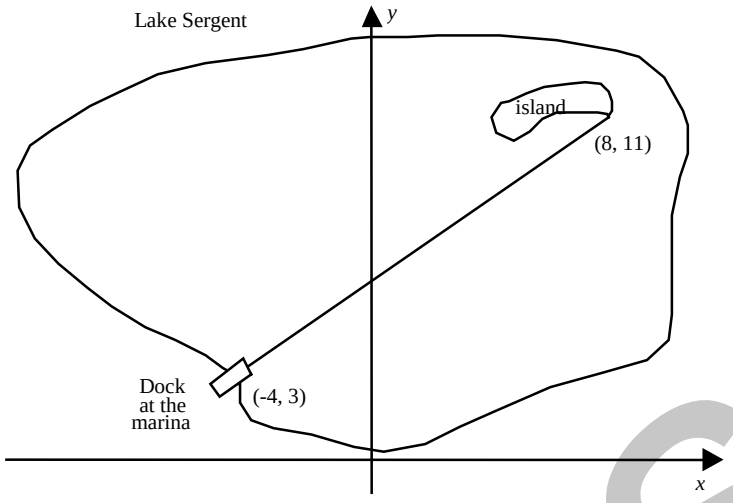
B) They intersect and are not perpendicular.

C) They are distinct and parallel.

D) They are coincident.

12 In a fishing tournament on Lake Sargent, a fisherman goes from the dock at the marina towards the tip of the island. He follows a line whose equation is $2x - 3y + 17 = 0$.

In the middle of his crossing, he catches a trout. At this point he changes to a direction perpendicular to the original one.



Give the equation of the line which represents the new direction.

13 Which one of the following statements is true in a Cartesian plane?

A) Every straight line has an *x*-intercept.

B) Every straight line has a *y*-intercept.

C) Two straight lines with the same slope are necessarily parallel.

D) Two straight lines with the same *y*-intercept are necessarily perpendicular.

14 In a Cartesian plane, line L_1 passes through the points A(-15, 31) and B(3, -23). Line L_2 is perpendicular to segment AB and passes through the midpoint of this segment.

What is the equation of line L_2?

Show your work.