

PENANG SANGAM HIGH SCHOOL
DEPARTMENT OF MATHEMATICS/PHYSICS
YEAR 11 MATHEMATICS - WEEK 24

STRAND 5

COORDINATE GEOMETRY

Sub – Strand 5.2 PARALLEL AND PERPENDICULAR LINES

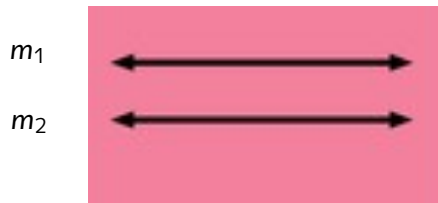
Learning Objective

At the end of this lesson, students should be able to:

- Describe the relationship of gradient of parallel and perpendicular lines.
- Determine equation of parallel and perpendicular lines.

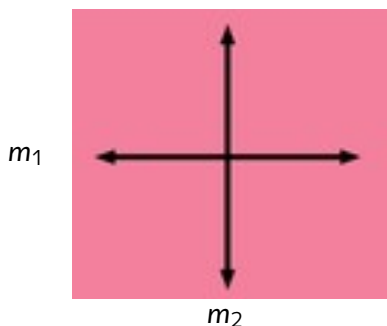
Parallel Lines

❖ The gradient is same.



$$m_1 = m_2$$

Perpendicular Lines



$$m_1 \times m_2 = -1$$

Examples

1. Given $3y - 4x = 5$ and $4y + 6 = 3x$. Are these lines parallel, perpendicular or neither? Why?

$$3y - 4x = 5$$

$$3y - 4x + 4x = 5 + 4x$$

$$3y = 5 + 4x$$

$$\frac{3y}{3} = \frac{4x + 5}{3}$$

$$y = \frac{4}{3}x + \frac{5}{3}$$

$$4y + 6 = 3x$$

$$4y + 6 - 6 = 3x - 6$$

$$4y = 3x - 6$$

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

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

$$y = \frac{3}{4}x - \frac{3}{2}$$

Parallel

$$m_1 = m_2$$

$$\frac{4}{3} \neq \frac{3}{4}$$

∴ it is not parallel

Perpendicular

$$m_1 \times m_2 = -1$$

$$\frac{4}{3} \times \frac{3}{4} = -1$$

$$1 \neq -1$$

Hence these lines are neither parallel nor perpendicular.

2. What is the equation of a line that passes through the point (4, -5) and is parallel to $3x + 2y = 12$.

$$3x + 2y = 12$$

$$3x - 3x + 2y = 12 - 3x$$

$$2y = 12 - 3x$$

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

$$y = 6 - \frac{3}{2}x$$

$$y = -\frac{3}{2}x + 6$$

Parallel

$$m_1 = m_2$$

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

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

(4, -5)

(x_1, y_1)

$$y - y_1 = m(x - x_1)$$

$$y - (-5) = \frac{-3}{2}(x - 4)$$

$$y + 5 = \frac{-3}{2}x + 6$$

$$y + 5 - 5 = \frac{-3}{2}x + 6 - 5$$

$$y = \frac{-3}{2}x + 1$$

3. A line passes through a point (2, 5) and has a slope of -3. What is the equation of a line perpendicular to this line through (2, 5)?

(2, 5)

(x_1, y_1)

$$m = -3$$

Perpendicular

$$m_1 \times m_2 = -1$$

$$-3 \times m_2 = -1$$

$$\frac{-3m_2}{-3} = \frac{-1}{-3}$$

$$m_2 = \frac{1}{3}$$

$$y - y_1 = m(x - x_1)$$

$$y - 5 = \frac{1}{3}(x - 2)$$

$$y - 5 = \frac{1}{3}x - \frac{2}{3}$$

$$y - 5 + 5 = \frac{1}{3}x - \frac{2}{3} + 5$$

4. Write the equation of a line that is parallel to $4x + 2y = -8$ and has the same y-intercept

as $-3y = -2x - 9$.

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

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

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

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

$$y = -2x - 4$$

$$\therefore m_1 = -2$$

Parallel to $4x + 2y = -8$

$$\therefore m_1 = m_2$$

$$\therefore -2 = m_2$$

$$\therefore m_2 = -2$$

$$-3y = -2x - 9$$

$$\frac{-3y}{-3} = \frac{-2x - 9}{-3}$$

$$y = \frac{-2x}{-3} - \frac{9}{-3}$$

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

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

$$y\text{-int} = (0, 3)$$

$$(x_1, y_1)$$

$$y - y_1 = m(x - x_1)$$

$$y - 3 = -2(x - 0)$$

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

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

$$y = 2x + 3$$

5. A line passes through the points shown in this table. What is the slope of a line perpendicular to this line?

x	1	3	5	7
y	2	5	8	11

$$(1, 2) \quad (3, 5)$$

$$(x_1, y_1) \quad (x_2, y_2)$$

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

$$m = \frac{5 - 2}{3 - 1}$$

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

Perpendicular

$$m_1 \times m_2 = -1$$

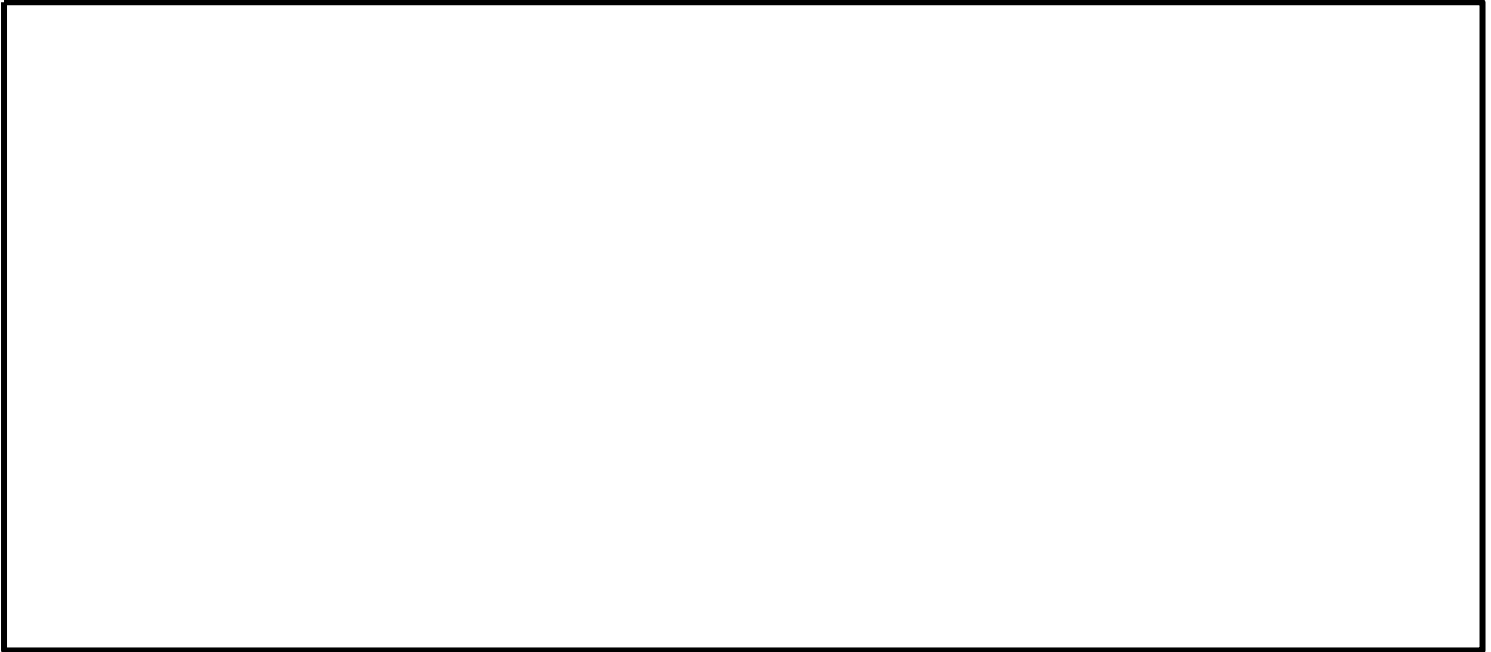
$$\frac{3}{2} \times m_2 = -1$$

$$\frac{3}{2} \times m_2 = \frac{-1}{\frac{3}{2}}$$


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

Exercise

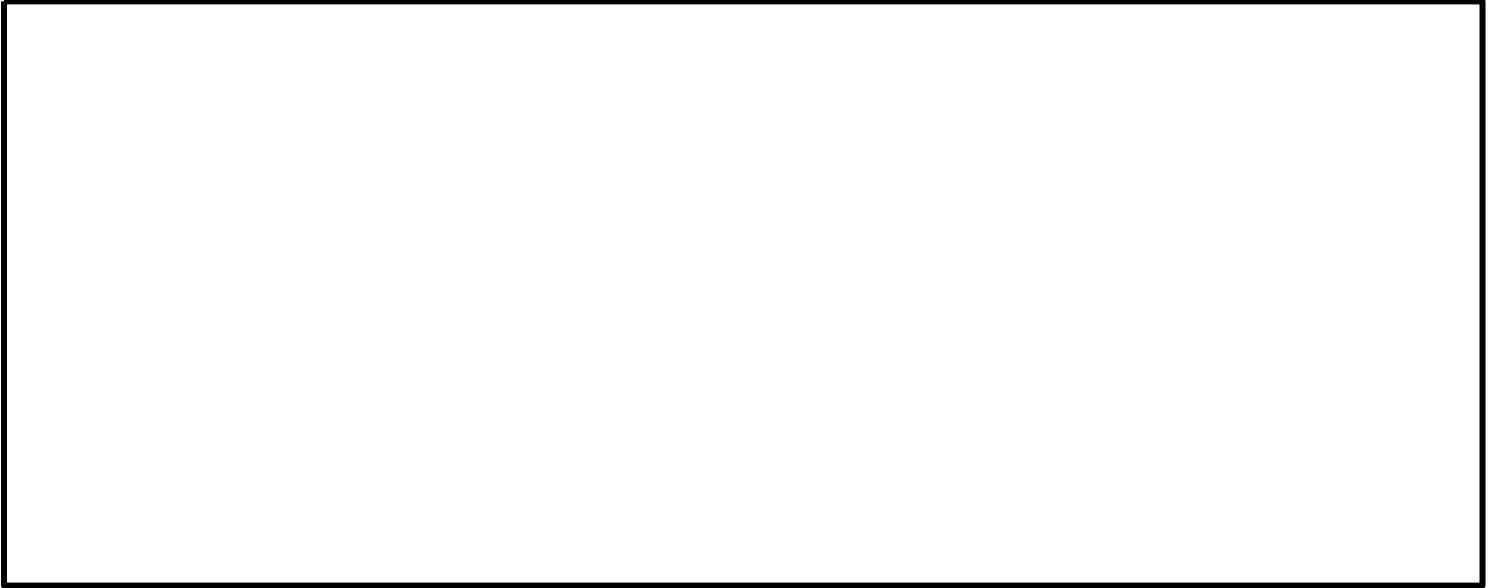
1. What is the slope of a line perpendicular to $2y = -6x - 10$?



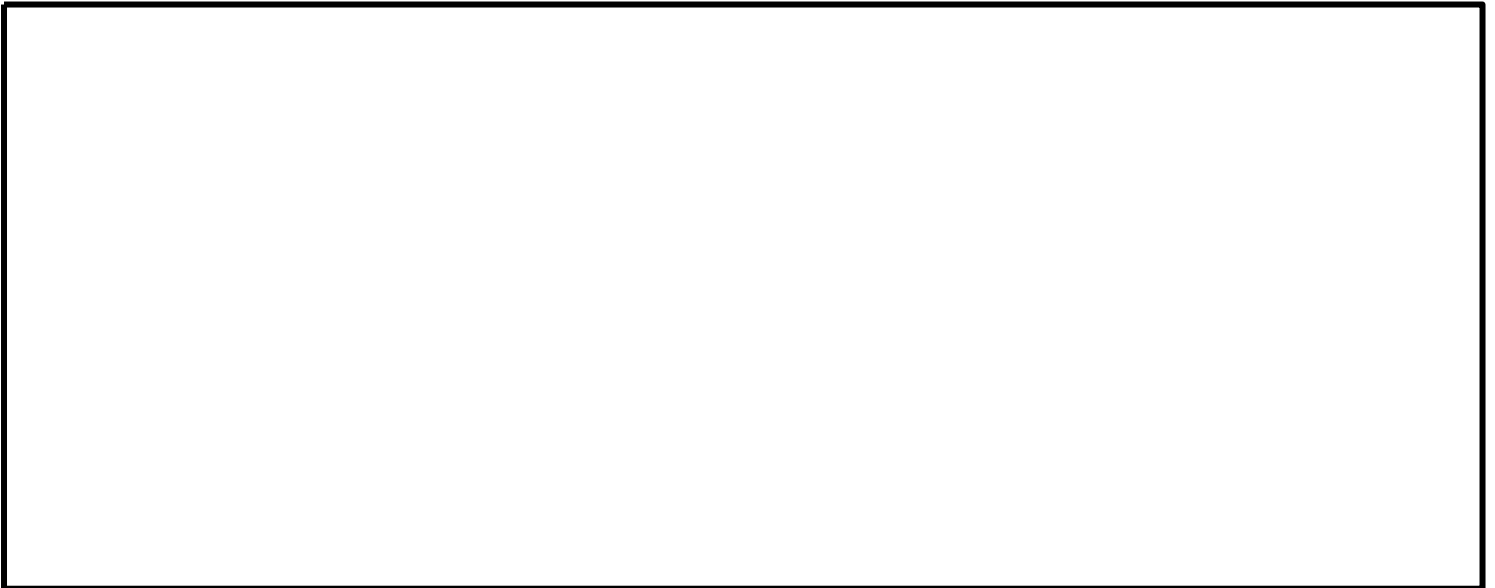
2. Given $4y - 2x = 10$ and $-6y - 6 = 3x$. are the lines parallel, perpendicular or neither?



3. What is the equation of a line that passes through the point $(-1,-2)$ and is perpendicular to $-5x = 6y + 18$?



4. What is the equation of a line that is parallel to $y = -4$ and passes through the point $(3,7)$?



THE END