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Parallel and Perpendicular Lines

Unit 5 Lesson 6

PARALLEL AND PERPENDICULAR LINES

Students will be able to:

Understand the relation between slopes of parallel and perpendicular lines and write their equations

Key Vocabulary:

- Slope-Intercept Form
- Point Slope Form
- Parallel Lines
- Perpendicular Lines



PARALLEL AND PERPENDICULAR LINES

Throwback!

- **Slope-Intercept Form:**

$$y = mx + b$$

m = Slope of the line

b = y-intercept (y-coordinate of the point where the line crosses the y-axis)

- **Point-Slope Form:**

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

m = Slope of the line

(x_1, y_1) = point on the line

PARALLEL AND PERPENDICULAR LINES

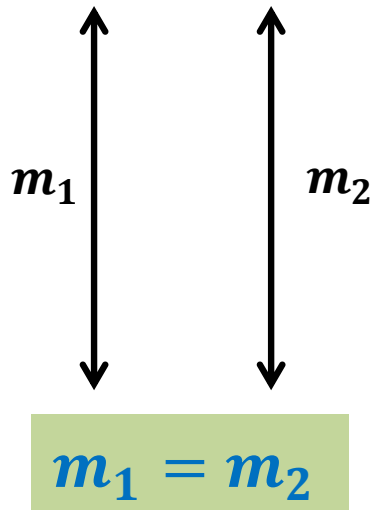
Parallel Lines

Two lines are parallel if they never intersect each other. Mathematically, two lines with slopes m_1 and m_2 are parallel if:

$$m_1 = m_2$$

To write the equation of a line parallel to a given line and passing through a point:

- Find the slope of the parallel line (two lines will have same slopes).
- Write the equation using the slope and the point.



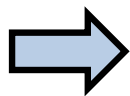
PARALLEL AND PERPENDICULAR LINES

Problem 1: Write an equation in slope-intercept form of the line passing through the point $(4,3)$ and parallel to the graph of $y = 2x + 4$.

PARALLEL AND PERPENDICULAR LINES

Problem 1: Write an equation in slope-intercept form of the line passing through the point $(4,3)$ and parallel to the graph of $y = 2x + 4$.

The slope of the line parallel to $y = 2x + 4$ is the slope of this line.

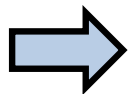


$$m = 2$$

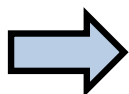
Now use the point-slope form to write its equation:

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

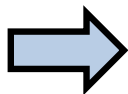
Here $m = 2$ and $(x_1, y_1) = (4, 3)$



$$y - (3) = 2(x - 4)$$



$$y = 2x - 8 + 3$$



$$y = 2x - 5$$



PARALLEL AND PERPENDICULAR LINES

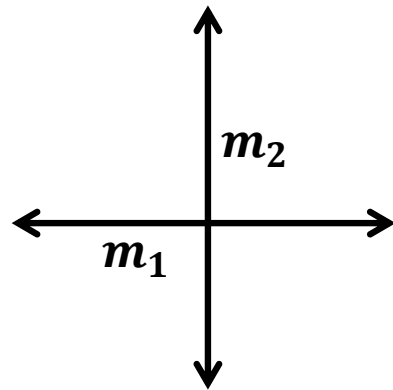
Perpendicular Lines

Two lines are perpendicular if they meet each other at right angles.
Mathematically, two lines with slopes m_1 and m_2 are perpendicular if:

$$m_1 \times m_2 = -1 \quad \Rightarrow \quad m_1 = -\frac{1}{m_2}$$

To write the equation of a line parallel to a given line and passing through a point:

- Find the slope of the perpendicular line (two lines will have slopes as negative reciprocals)
- Write the equation using the slope and the point.



$$m_1 \times m_2 = -1$$

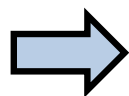
PARALLEL AND PERPENDICULAR LINES

Problem 2: Write an equation in slope-intercept form of the line passing through the point $(1,4)$ and perpendicular to the graph of $y = \frac{1}{3}x - 2$.

PARALLEL AND PERPENDICULAR LINES

Problem 2: Write an equation in slope-intercept form of the line passing through the point $(-1, 4)$ and perpendicular to the graph of $y = \frac{1}{3}x - 2$.

The slope of the line perpendicular to $y = \frac{1}{3}x - 2$ is the negative reciprocal of the slope of this line.

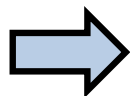


$$m = -3$$

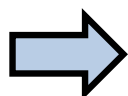
Now use the point-slope form to write its equation:

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

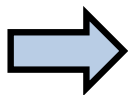
Here $m = -3$ and $(x_1, y_1) = (-1, 4)$



$$y - (4) = -3(x - (-1))$$



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



$$y = -3x + 1$$