Point-Slope: $y - y_1 = m(x - x_1)$

Unit 3

Lesson 7

Parallel and Perpendicular Lines

Parallel Lines Two nonvertical lines are **parallel** if they have the same slope. All vertical lines are parallel.

Perpendicular Lines Two nonvertical lines are **perpendicular** if their slopes are opposite reciprocals (sign) (flipped over) of each other. Vertical and horizontal lines are perpendicular.

Ex 1: Write an equation in slope-intercept form for the line that passes through (–1, 6) and is parallel to the graph of $y = 2x + 12$.

same slope

$m = 2$

Point $(-1, 6)$ (x_1 y_1)

Point-Slope: $y - 6 = 2(x + 1)$

$y - 6 = 2x + 2$

$+6 \quad +6$

$y = 2x + 8$

Ex 2: Write an equation in slope-intercept form for the line that passes through (–4, 2) and is perpendicular to the graph of $2x - 3y = 9$.

Point $(-4, 2)$ (x_1 y_1)

none of these are slope

① Convert to $y = mx + b$

$2x - 3y = 9$

$-2x \quad -2x$

$-3y = -2x + 9$

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

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

(m)

② Perpendicular

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

③ Point-Slope

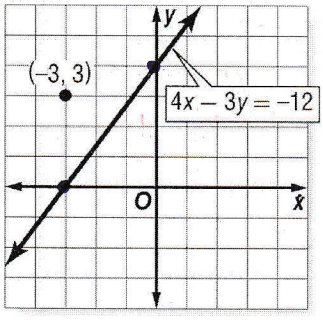
$y - 2 = -\frac{3}{2}(x + 4)$

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

$+2 \quad +2$

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

Ex 3: Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of the equation below.



$m = \frac{\text{rise}}{\text{run}} = \frac{4}{3}$

Parallel slope: $m = \frac{4}{3}$

Point: $(-3, 3)$ (x_1 y_1)

Point-Slope

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

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

$+3 \quad +3$

$y = \frac{4}{3}x + 7$

$y = mx + b$

Determine whether the graphs of the following equations are *parallel* or *perpendicular*.

A. $2x + y = -7$,

B. $x - 2y = -4$

C. $4x - y = 5$

(A) $2x + y = -7$ $-2x \quad -2x$

$y = -2x - 7$

$m = -2$

(B) $x - 2y = -4$ $-x \quad -x$

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

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

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

(C) $4x - y = 5$ $-4x \quad -4x$

$\frac{-y}{-1} = \frac{-4x}{-1} + \frac{5}{-1}$

$y = 4x - 5$

$m = 4$

None are parallel
A is perpendicular to B

ARCHITECTURE On the architect's plans for a new high school, a wall represented by $\overline{MN}$ has endpoints $M(-3, -1)$ and $N(2, 1)$. A wall represented by $\overline{PQ}$ has endpoints $P(4, -4)$ and $Q(-2, 11)$. Are the walls perpendicular? Explain.

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

① Find MN Slope

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

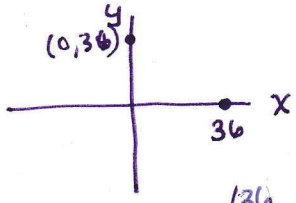
② Find PQ Slope

$m = \frac{11-(-4)}{-2-4} = \frac{15 \div 3}{-6 \div 3} = \frac{5}{-2}$

Yes, they are opposite reciprocals.

Practice STAAR Question

What is the equation in slope-intercept form of the line that crosses the x-axis at 36 and is perpendicular to the line represented by $y = -\frac{4}{9}x + 5$?



(36, 0)
x_1 y_1

m

Perpendicular
$m = \frac{9}{4}$

$y - 0 = \frac{9}{4}(x - 36)$

$y = \frac{9}{4}x - 81$

~~F $y = \frac{4}{9}x + 16$~~

~~G $y = \frac{4}{9}x - 16$~~

H $y = \frac{9}{4}x + 81$

J $y = \frac{9}{4}x - 81$