PC U1 L3 Linear Equations in Two Variables

Name: _____ HR: _____

Skills: Graph lines using slope, find slope from two points, write equations of lines, and identify parallel/perpendicular lines.

Warm-Up: Review

You'll use these three skills constantly in this lesson — make sure they're solid before we start.

1. Simplifying Fractions

Ex: simplify $\frac{18}{24}$ completely. $\frac{6}{8} = \frac{3}{4}$

Your turn — simplify $\frac{48}{36}$:

2. Evaluating Functions

PEMDAS

$g(x) = 2x^2 + 3x + 1$

$f(x) = -4(2x + 3)^2$

Find $g(-4)$ $= 2(-4)^2 + 3(-4) + 1$
$= 2(16) - 12 + 1$
$= 32 - 12 + 1$
$= 20 + 1$
$= 21$

Find $f(-1)$ $32 - 11$
$= 21$

$f(-1) = -4(2(-1) + 3)^2$
$= -4(-2 + 3)^2$
$= -4(1)^2 = -4(1) = -4$

3. Solving for equations.

Ex: solve $5x - 6 = 3x + 9$

$-3x \quad -3x$
$2x - 6 = 9$
$+6 \quad +6$
$\frac{2x}{2} = \frac{15}{2}$
$x = \frac{15}{2} = 7.5$

Ex: solve $2(x - 5) = 5x - 1$

$2x - 10 = 5x - 1$
$-2x \quad -2x$
$-10 = 3x - 1$
$3x - 1 = -10$
$+1 \quad +1$
$3x = -9$
$x = -3$

Vocabulary

- slope — a quantitative measurement of the steepness of a line **or** a ratio of change in output to change in input.
- parallel lines — two lines on the same plane that never intersect
- perpendicular lines — two lines that intersect at 90 degrees (a right angle)

perpendicular

Finding Slope from Two Points: (x_1, y_1) and (x_2, y_2)

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

Delta "Change in"

$$m = \frac{\Delta y}{\Delta x}$$

Slope Facts

m > 0: line rises left to right

m < 0: line falls left to right

m = 0: line is horizontal

m is undefined: line is vertical

Ex: slope through (–2, 0) and (3, 1)

$x_1, y_1 \quad x_2, y_2$

$m = \frac{1 - 0}{3 - -2} = \frac{1}{5}$

You try: slope through (–5, –6) and (2, 8)

$m = \frac{8 - -6}{2 - -5} = \frac{8 + 6}{2 + 5} = \frac{14}{7} = 2$

Graphing with Slope-Intercept Form $y = mx + b$

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

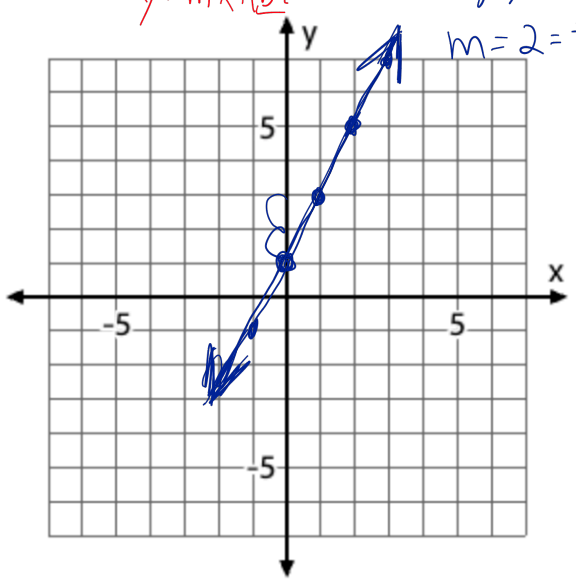
Ex: graph y = 2x + 1

$y = mx + b$

y-int is when $x = 0$

$(0, 1)$

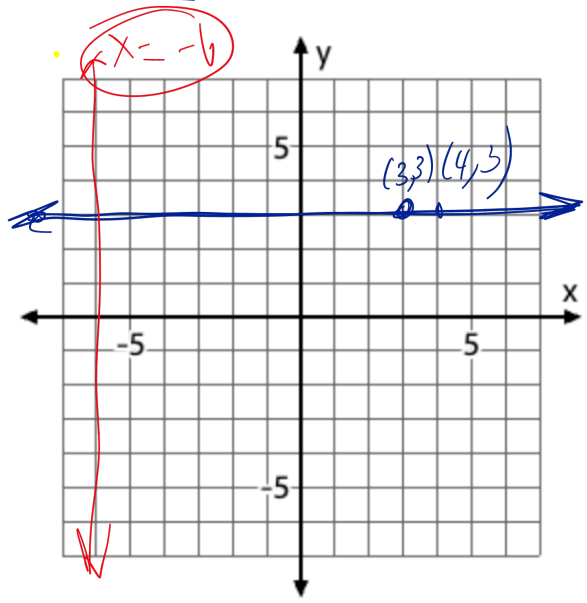
$m = 2 = \frac{2}{1}$



Ex: graph y = 3, graph x = -6

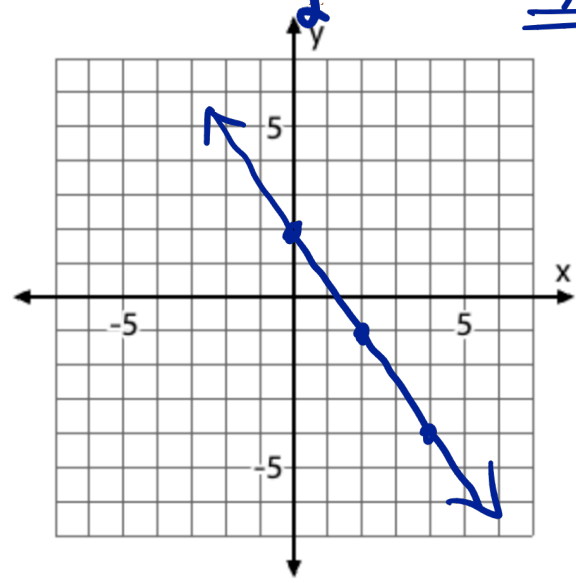
$x = -6$

$(3, 3) (4, 3)$



You try: graph $y = -\frac{3}{2}x + 2$

$(0, 2)$



U1 L3 Linear Equations in Two Variables

Name: _____ HR: _____

Skills: Graph lines using slope, find slope from two points, write equations of lines, and identify parallel/perpendicular lines.

Point-Slope Form

Use this form when you know a slope and one point on the line.

Given slope m and a point (x_1, y_1) → $y - y_1 = m(x - x_1)$ ← Point-slope form

(slope; Pt. The line goes through)

Directions: Write the equation of the line in slope-intercept form using the given information.

Ex: slope 3 through (1, −2)

$m = 3$, x_1, y_1

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

$y - -2 = 3(x - 1)$

$y + 2 = 3x - 3$

$-2 \quad -2$

$y = 3x - 5$

$y = mx + b$

$1 = x$

$y = 3x - 5$

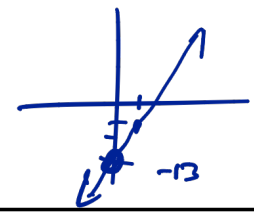
$y = 3(1) - 5$

$= 3 - 5$

$= -2$

You try: slope 2 through (3, −7)

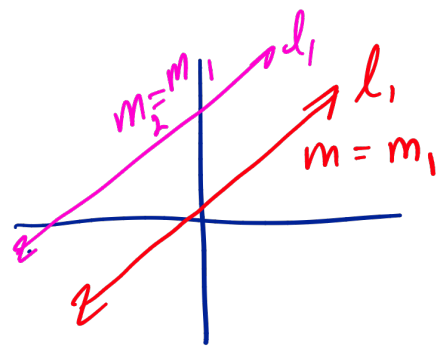
$y = 2x - 13$



Parallel and Perpendicular Lines

Parallel

Same slope: $m_1 = m_2$



Perpendicular

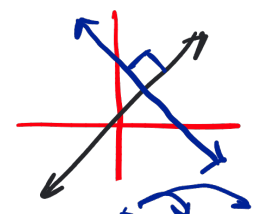
Negative reciprocal slopes: $m_1 = \frac{-1}{m_2}$ (opposite)

⊥ Perpendicular

$(2, -1)$ $m_\perp = \frac{-3}{2}$

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

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



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

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

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

Ex: line(s) through (2, −1), parallel/perp. to 2x − 3y = 5

$(2, -1)$

parallel to $2x - 3y = 5$

Same slope

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

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

$y + 1 = \frac{2}{3}x - \frac{4}{3}$

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

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

$\frac{2}{3} \cdot \frac{-2}{1}$

$2x - 3y = 5$

$-2x \quad -2x$

$-3y = -2x + 5$

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

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

You try: line(s) through (−4, 1), parallel/perp. to 5x − 3y = 8

$5x - 3y = 8$

$-5x \quad -5x$

$-3y = -5x + 8$

$y = \frac{5}{3}x - \frac{8}{3}$

$y = mx + b$ (x_1, y_1)

Find m

parallel: $(-4, 1)$ $m = \frac{5}{3}$

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

$y - 1 = \frac{5}{3}(x - -4)$

$y - 1 = \frac{5}{3}x + \frac{20}{3}$

$+1 \quad +1 = \frac{3}{3}$

$y = \frac{5}{3}x + \frac{23}{3}$

Perpendicular: $(-4, 1)$ $m = -\frac{3}{5}$

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

$y - 1 = \frac{-3}{5}(x + 4)$

$y - 1 = \frac{-3}{5}x - \frac{12}{5}$

$+1 \quad +1 = \frac{5}{5}$

$y = -\frac{3}{5}x - \frac{7}{5}$

Application: NIKE Sales Model

NIKE's annual sales y (in billions) can be modeled by y = 2.5t + 17.8, where t = 3 represents 2013.

$y = 2.5t + 17.8$

Use the model to estimate sales in year t = 5 (interpolation — between known data points).

You try: estimate sales at t = 9 (extrapolation — beyond the known data).

Section 1.3 Summary — Can you...

☐ Graph a line using slope and y-intercept?

☐ Find the slope through two points?

☐ Write an equation using point-slope form?

☐ Identify parallel and perpendicular lines?

☐ Use a linear model to interpolate/ extrapolate?

Formulas at a Glance — Section 1.3

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

$y = mx + b$ graph

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