NOTES: Section 2.4 – Write Equations of Lines

Goals: #1 – I can write the equation of a line in slope-intercept form when given the slope and y-intercept.

#2 – I can write the equation of a line in point-slope form when given the slope and a point on the line, or when given 2 points on a line, then convert the equation to slope-intercept form.

#3 – I can convert a linear equation to standard form.
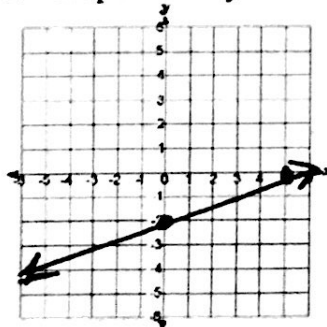
Homework: Lesson 2.4 Worksheet

Warm Up:

1. Find the x-intercept and y-intercept of the following equation: $5x - 2y = 10$

x-int: $(y=0)$
$5x - 2(0) = 10$
$5x = 10$
$x = 2$

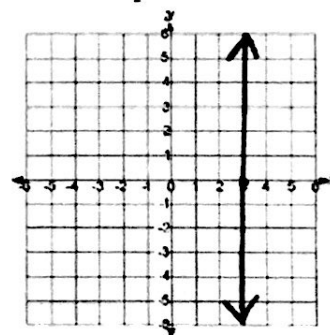y-int: $(x = 0)$
$5(0) - 2y = 10$
$-2y = 10$
$y = -5$

x-intercept: ___(2, 0)___
y-intercept: ___(0, -5)___

2. Graph $2x - 5y = 10$

x-int:
$2x - 5(0) = 10$
$2x = 10$
$x = 5$
$(5, 0)$

y-int:
$2(0) - 5y = 10$
$-5y = 10$
$y = -2$
$(0, -2)$

3. Graph $x = 3$ →vertical line

Exploration #1: Work with a partner and match the following:

___C___ 1. Slope-intercept form   A. $y - y_1 = m(x - x_1)$

___B___ 2. Standard form   B. $Ax + By = C$

___A___ 3. Point-slope form   C. $y = mx + b$

Notes:

Any linear equation in the form $y = mx + b$ is said to be in slope-intercept form.
$\hookrightarrow m$ $\hookrightarrow b$

Any linear equation in the form $Ax + By = C$ is said to be in standard form.

$\overset{\rightarrow m}{}$
Any linear equation in the form $y - y_1 = m(x - x_1)$ is said to be in point-slope form.
$\hookrightarrow (x_1, y_1)$

Example #1: Write an equation of the line shown.

1.
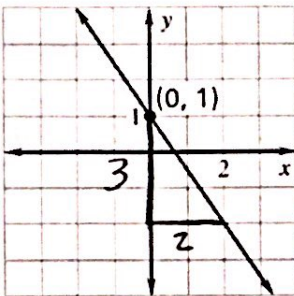
$b = 1$

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

Equation: $y = -\dfrac{3}{2}x + 1$

What form did you write your equation in? Slope-intercept

Example #2: Write an equation that passes through $(0, -1)$ and has a slope of 2.
$\hookrightarrow$ y-int

Equation: $y = 2x - 1$

What form did you write your equation in? slope-intercept

Notes:

When given the **slope** and the **y-intercept** of a line, use the
$y = mx + b$ to write the linear equation.
slope-intercept form

Example #3: Write an equation of the line that passes through (5, 4) and has a slope of -3.

$x,\ y,$ ↳ point ↳ slope

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

Equation: $y - 4 = -3(x - 4)$

What form did you write your equation in? **point-slope form**

Example #4: Write an equation of the line that passes through $(-1, 1)$ and ↗ point

a. is parallel to the line $y = -2x + 3$
↳ same slope

$m = -2$
$(-1, 1)$

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

b. is perpendicular to the line $y = -2x + 3$
↳ slope $\frac{1}{2}$

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

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

Equation: $y - 1 = -2(x + 1)$

Equation: $y - 1 = \frac{1}{2}(x + 1)$

What form did you write your equation in? **point-slope form**

CHALLEGE: Try to write your equations in the other two forms.

Notes:

When given the ___slope___ and the __a__ __point__ of a line, use the

$y - y_1 = m(x - x_1)$ to write the linear equation.

point-slope form

However, we can rewrite these equations in $y = mx + b$ by solving for m.

Example #5: Write your equations in Example #3 and #4a-b also in slope-intercept form.

#3:
$$y - 4 = -3(x - 5)$$
$$y - 4 = -3x + 15$$
$$\underline{+4} \qquad \underline{+4}$$
$$\boxed{y = -3x + 19}$$

#4a:
$$y - 1 = -2(x + 1)$$
$$y - 1 = -2x - 2$$
$$\underline{+1} \qquad \underline{+1}$$
$$\boxed{y = -2x - 1}$$

#4b:
$$y - 1 = \frac{1}{2}(x + 1)$$
$$y - 1 = \frac{1}{2}x + \frac{1}{2}$$
$$\underline{+1} \qquad +\frac{1}{1}$$
$$\boxed{y = \frac{1}{2}x + \frac{3}{2}}$$

Example #6: Write an equation of the line that passes through $(3, 1)$ and $(2, -3)$.

$$m = \frac{1-(-3)}{3-2} = \frac{4}{1} = 4$$

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

↳point ↳point

slope-intercept form:

$$y-1 = 4(x-3)$$
$$y-1 = 4x-12$$
$$\underset{+1}{} \quad \underset{+1}{}$$
$$y = 4x-11$$

standard form:

$$y = 4x-11$$
$$11+y = 4x$$
$$11 = 4x-y$$
$$4x-y = 11$$

Equation: $\underline{y-1 = 4(x-3)}$

What form did you write your equation in? $\underline{point\text{-}slope\ form}$

Write in *slope-intercept* form: $\underline{y = 4x-11}$

Write in *standard* form: $\underline{4x-y = 11}$

Notes:

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

When given $\underline{two\ points}$ of a line, first use the $\underline{slope\ formula}$ to find the slope. Then, use the $\underline{y-y_1 = m(x-x_1)}$ with either given point to write the linear equation. $\underline{point\text{-}slope\ form}$

Example #7: Females began participating in U.S. high school sports in 1990. In the school year ending in 1993, 2.00 million females participated in U.S. high school sports. By 2003, the number had increased to 2.86 million. Assume that the increase rate for female sport participants is linear.

a. What is the average growth rate of female participants in sports?

$$\frac{2.86 - 2.00}{2003 - 1993} = \frac{0.86}{10} = 0.086\ million/yr$$

↳yr 1990

b. How many females participated in sports the first year it was allowed?

$$0.086(3) = 0.258 \qquad 2.00 - 0.258 = \boxed{1.742\ million\ females}$$

c. Write an equation, in slope-intercept form, that models the number of female sport participants, f, as a function of the years, x, after female participation was allowed.

$$\boxed{f = 0.086x + 1.742}$$

d. Use the model from part c to predict the number of female participants in U.S. high school sports 50 years after it was allowed.

$$f = 0.086(50) + 1.742$$
$$= \boxed{6.042\ million\ females}$$