

## Math 9 Unit 8: Analytic Geometry

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### Lesson #3: Standard Form - Notes

**Learning Goal:** We are learning how to write the equation of a line in standard form by converting it from y-intercept form OR by using the slope-point form.

Today we will explore the second equation of a line form, called the Standard Form. Without further adieu, here it is:  $Ax + By + C = 0$ .

- x and y are a point on a line (x,y)

- A, B, and C are integers, meaning no decimals or fractions

A needs to be positive.

Examples:

$$2x + 3y - 8 = 0$$

$$14x - 5y + 100 = 0$$

Standard Form can also be written as  $Ax + By = C$ , but then this is called Pseudo-Standard Form. We will mostly stick to the true Standard Form.

① Move everything on the same side so that the x-term is positive.

**Example 1: Convert to Standard Form:**

② Convert everything to integers by multiplying by the common denominator

a)  $y = -5x + 4$

$$5x + y - 4 = 0$$

b)  $y = \frac{3}{4}x - 7$

$$\begin{aligned} 0 &= \frac{3}{4}x - y - 7 \\ 0 &= 3x - 4y - 28 \end{aligned}$$

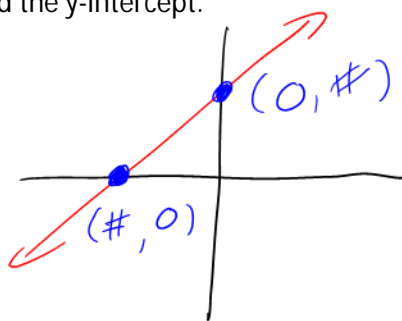
c)  $y = \frac{-2}{5}x + \frac{4}{3}$

$$\begin{aligned} \left( \frac{2}{5}x + y - \frac{4}{3} = 0 \right) \cdot 15 \\ 6x + 15y - 20 = 0 \end{aligned}$$

Standard Form really finds its usefulness when you need to find the x-intercept and the y-intercept.

**Recall:** x-intercept is when the line crosses the x-axis

y-intercept is when the line crosses the y-axis



At the x-intercept,  $y = 0$ .

At the y-intercept,  $x = 0$ .

This is true ALWAYS.

We will use these facts.

**Example 2: Calculate the x-intercept and the y-intercept. Then plot them and draw a line.**

a)  $2x - 3y + 12 = 0$

① x-int,  $y=0$

$$2x - 3(0) + 12 = 0$$

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

$$x = -6$$

$$\therefore (-6, 0)$$

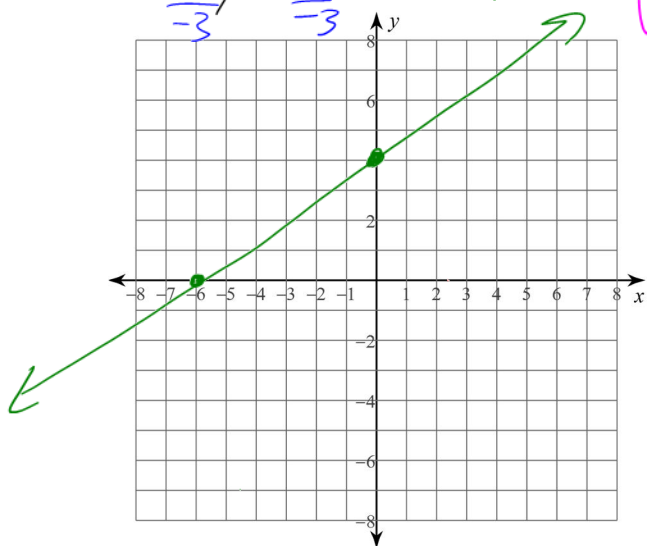
② y-int,  $x=0$

$$2(0) - 3y + 12 = 0$$

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

$$y = 4$$

$$\therefore (0, 4)$$



b)  $5x - 6y - 15 = 0$

① x-int,  $y=0$

$$5x - 6(0) - 15 = 0$$

$$\frac{5x}{5} = \frac{15}{5}$$

$$x = 3$$

$$\therefore (3, 0)$$

② y-int,  $x=0$

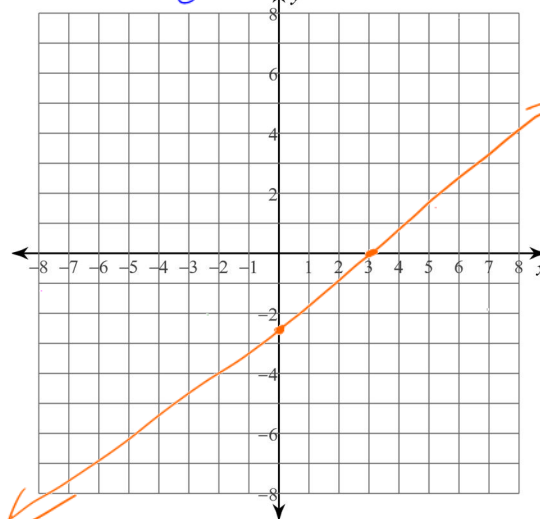
$$5(0) - 6y - 15 = 0$$

$$\frac{-6y}{-6} = \frac{15}{-6}$$

$$y = -\frac{15}{6}$$

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

$$y = -2.5$$



Just like we did with the Slope Intercept Form ( $y = mx + b$ ), we learned how to convert to it and how to access some properties to graph. The last thing we need to learn, then, is how to create the Standard Form equation from a graph or from information. This process is a little more tricky, and to help, we need to employ another equation called the **Point Slope Form** is  $y - y_1 = m(x - x_1)$  where **m** is slope and  $(x_1, y_1)$  is the given point. This form comes from the slope formula.

$(x, y)$  generic point, leave them alone...

**Example 3: Create the Standard form given the following information.**

a)  $m = 4$  and  $(3, 7)$

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

$$y - 7 = 4(x - 3)$$

$$y - 7 = 4x - 12$$

$$+7$$

$$\rightarrow 0 = 4x - y - 5$$

b)  $m = \frac{-3}{5}$  and  $(10, 4)$

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

$$y - 4 = \frac{-3}{5}(x - 10)$$

$$5y - 20 = -3x + 30$$

$+3x$        $+3x - 30$

$$3x + 5y - 50 = 0$$

c)  $m = \frac{3}{2}$  and  $(5, -8)$

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

$$y - (-8) = \frac{3}{2}(x - 5)$$

$$2y + 16 = 3x - 15$$

$-2y - 16$        $-2y - 16$

$$0 = 3x - 2y - 31$$

d)  $(4, 10)$  and  $(8, -12)$

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

$$m = \frac{-12 - 10}{8 - 4}$$

$$m = \frac{-22}{4}$$

$$m = -\frac{11}{2}$$

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

$$y - 10 = -\frac{11}{2}(x - 4)$$

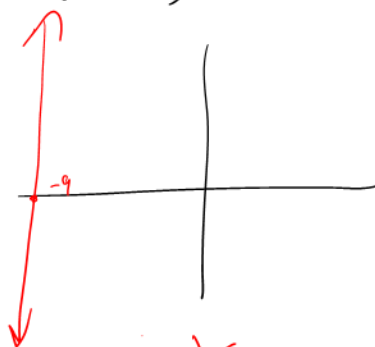
$$2y - 20 = -11x + 44$$

$+11x$        $-44$        $+11x$        $-44$

$$11x + 2y - 64 = 0$$

e)  $(-9, 8)$  and  $(-9, 23)$

$$m = \frac{23 - 8}{-9 - (-9)} = \frac{15}{0} = \text{undefined}$$



$$x = -9$$

$$x + 9 = 0 \text{ is the standard form way}$$

#### Success Criteria:

- I can convert the y-intercept form into standard form by expanding it and collecting like terms
- I can write the equation of a line in standard form by using the point-slope formula
- I can find the y-intercept of a line by setting  $x = 0$  in the standard form equation
- I can find the x-intercept of a line by setting  $y = 0$  in the standard form equation
- I can graph a line, if I am given its equation in standard form, by finding the x and y intercepts