## Graphing a Line using Standard Form

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## WHAT'S COVERED

This tutorial covers graphing a line using standard form, through the exploration of:

1. Graphing an Equation: A Review
2. Standard Form of an Equation
3. Graphing Equations in Standard Form

## 1. Graphing an Equation: A Review

As you may recall, it's often useful to graph equations to visually represent the relationship between variables. To graph a line, you only need to find at least two points on the line. There are several ways to graph a line:

- One strategy is to pick two values for $x$ and find the corresponding $y$ values to plot on a graph.
- Another strategy is to write an equation in a certain form to easily identify important information about the line.


## 2. Standard Form of an Equation

Equations in standard form are expressed as A times $\times$ plus B times y equals C :

## $\boldsymbol{I}$ FORMULA TO KNOW

## Standard Form of a Line

$$
A x+B y=C
$$

The benefit of having an equation in standard form is that it makes finding the $x$ - and $y$-intercepts relatively easy. To find the $y$-intercept, you substitute 0 for x , making the whole A times x term 0 , and leaving $B$ times y equals C , which can be easily solved for $y$.

Similarly, to find the x -intercept, you substitute O for y , making the B times y term O and leaving A times x equals $C$, which is easily solved for $x$. The standard form of a line is important when studying systems of linear

## 3. Graphing Equations in Standard Form

There are several methods for graphing an equation in standard form. In the first method, you can use the variables in the standard form equation to easily identify the $x$ - and $y$-intercepts, which will give you the minimum two points needed to graph a line.
$\Leftrightarrow$ EXAMPLE Suppose you want to graph the equation:

$$
3 x-4 y=12
$$

Start by finding the $x$-intercept, which is at a point ( $x, 0$ ), where $y$ is 0 . You can substitute 0 for $y$ into your equation, which gives you the expression shown below. 4 times 0 is 0 , so you now have $3 x$ equals 12 . Divide both sides by 3 , which simplifies to $x$ equals 4 . Therefore, the $x$-intercept is at the point $(4,0)$.

$$
\begin{aligned}
& 3 x-4(0)=12 \\
& 3 x=12 \\
& \frac{3 x}{3}=\frac{12}{3} \\
& \quad x=4 \\
& x \text { intercept }=(4,0)
\end{aligned}
$$

Now, find the $y$-intercept. The $y$-intercept is at a point ( $0, y$ ), where x is 0 . You can substitute 0 for x into your equation. 3 times 0 is 0 , so you now have $-4 y$ equals 12 . Divide both sides by -4 , which simplifies to y equals -3 . Therefore, the $y$-intercept is at the point $(0,-3)$.

$$
\begin{aligned}
& 3(0)-4 y=12 \\
& -4 y=12 \\
& \frac{-4 y}{-4}=\frac{12}{-4} \\
& y=-3 \\
& y \text { intercept }=(0,-3)
\end{aligned}
$$

You can now plot both of your intercepts on the graph. The x-intercept is $(4,0)$, and the $y$-intercept is $(0,-3)$, so you have the two points needed to graph a line. Finally, you can connect your points to create a line.


In the second method, instead of graphing the $x$ - and $y$-intercepts, you can rewrite the standard form equation in slope intercept form and graph the equation using the $y$-intercept and slope of the line. Slope intercept form may be preferred for graphing since $y$ is on one side of the equation and the variables representing slope ( m ) and $y$-intercept (b) are easily identifiable on the other side.
$\Leftrightarrow$ EXAMPLE Suppose you want to graph the equation:

$$
-2 x+5 y=10
$$

To write your equation in slope intercept form, you need to isolate the $y$ variable. Start by adding 2 x on both sides. On the right side, 10 and $2 x$ are not like terms, so you cannot actually combine them.

## ■ HINT

You'll note that it is written as $2 x+10$ instead of $10+2 x$, because you should place the $x$ term in front of the constant term. This is because you want the format to reflect the slope-intercept form.

Divide both sides by 5 . On the right side, you divide both terms by 5 . Your final equation is:

$$
\begin{aligned}
& -2 x+2 x+5 y=10+2 x \\
& 5 y=2 x+10 \\
& \frac{5 y}{5}=\frac{2 x+10}{5} \\
& y=\frac{2}{5} x+2 \\
& y=m x+b
\end{aligned}
$$

To graph, start at the $y$-intercept, which is at 2 . You can then use your slope, 2 over 5 , to find a second point. Therefore, from the y-intercept, you move up 2 and over 5 to place your second point. Finally, you connect your points to create a line.


## SUMMARY

Today you learned that it is often useful to graph equations to visually represent the relationship between variables, and that to graph a line, you need to find at least two points on the line. You also learned how to identify equations in standard form. Lastly, you learned two methods of graphing equations in standard form: one, solving for the x - and y -intercepts; and two, rewriting a standard form equation in slope intercept form.

Source: This work is adapted from Sophia author Colleen Atakpu.
$\leftrightharpoons$ FORMULAS TO KNOW

Standard Form of a Line
$A x+B y=C$

