Slope Formula

The symbol for **slope** is **m**. **Slope** is the rate of change of the dependent variable "y" with respect to the independent variable "x". To find the **slope** of a line pick two points from the line:

point 1 (x_1,y_1) and point 2 (x_2,y_2).

Put these points into the formula for **slope**. **It does not matter which points you pick for point 1 and point 2** nor does it matter which formula you use. **What does matter is that you subtract the point 1 values from the point 2 values or that you subtract the point 2 values from the point 1 values** as shown below in the formula.

$$m = \frac{\text{change in y}}{\text{change in x}} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2}$$

Example, find the slope of the line with points (2,3) and (-7,8). Use both formulas to verify you get the same slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 3}{-7 - 2} = \frac{5}{-9} = -\frac{5}{9}$$

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{3 - 8}{2 - -7} = \frac{-5}{9} = -\frac{5}{9}$$

Slope-Intercept Form of an Equation

$$y = mx + b$$

Y-intercept, the point where the line crosses, intersects, intercepts, comes in contact with, meets, shares a common point, engages with the y-axis. The number by itself including the sign in front of it is **b**.

It is an actual point with an x-coordinate and a y-coordinate. This formula only uses the value of the y-coordinate which is what "**b**" stands for.

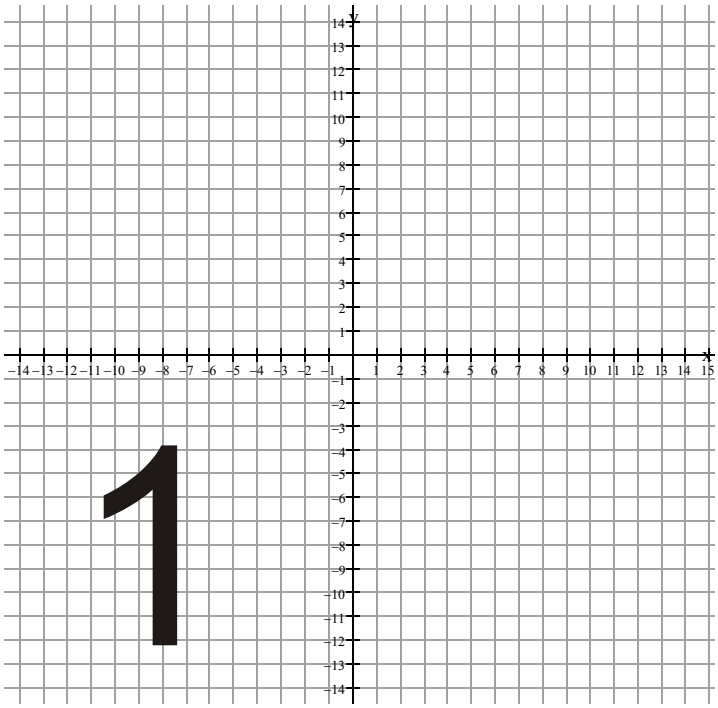
The y-intercept is the first point you plot when you start the graph of the equation.

The **slope** is **m**. This is the number that x is multiplied by. If it is not a fraction put a 1 under it to make it a fraction. **The slope tells you how to get to the next point.** The number on top tells you how many spaces to move vertically and the sign tells which direction, up if positive down if negative. The bottom number tells you how many spaces to move horizontally and the sign tells the direction, left if negative right if positive.

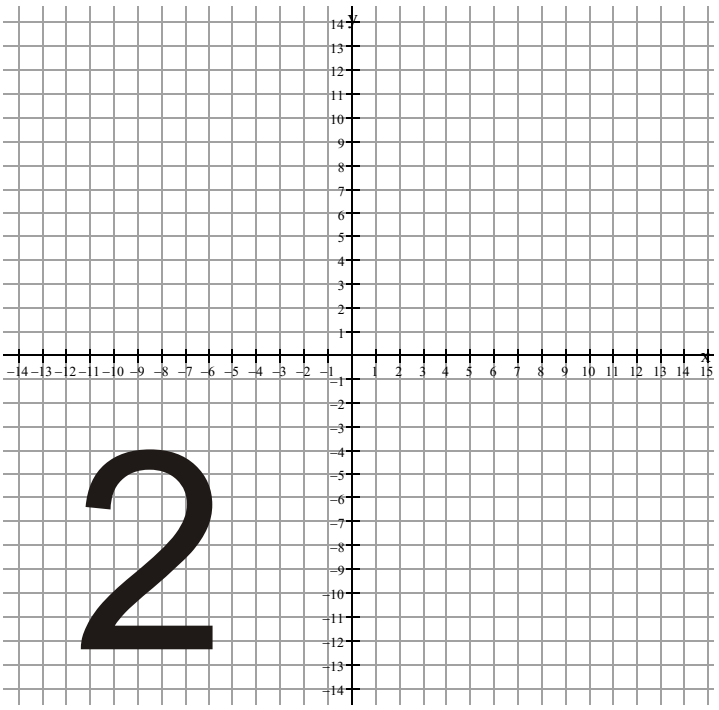
Graphing Equations

Put equations in slope-intercept form by solving for y before graphing them. Make sure that y is on the left side of the equation (for equations it is not actually required to have y on the left side but it is standard practice. When graphing inequalities it is required). Once that is done the equation tells you everything you need to make the graph.

All the graphs **start at the y- intercept b**. **The slope tells you how to get to the next point.** The number on top tells you how many spaces to move vertically and the sign tells which direction, up if positive down if negative. The bottom number tells you how many spaces to move horizontally and the sign tells the direction, left if negative right if positive.



m = -2
b = 4
Write the equation in slope-intercept form and graph it.



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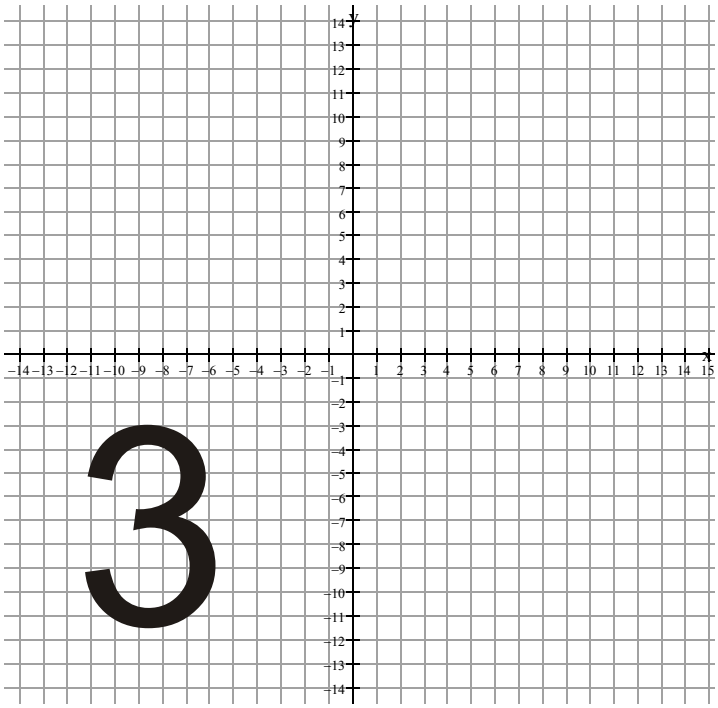

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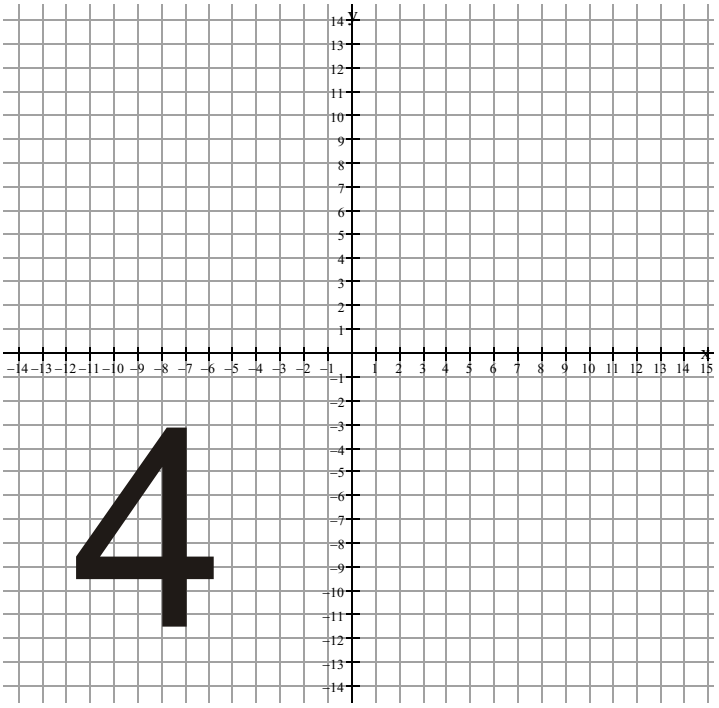


m = 2
b = 4
Write the equation in slope-intercept form and graph it.

Using the Slope-Intercept Form of an Equation to Find the Slope and Y-Intercept

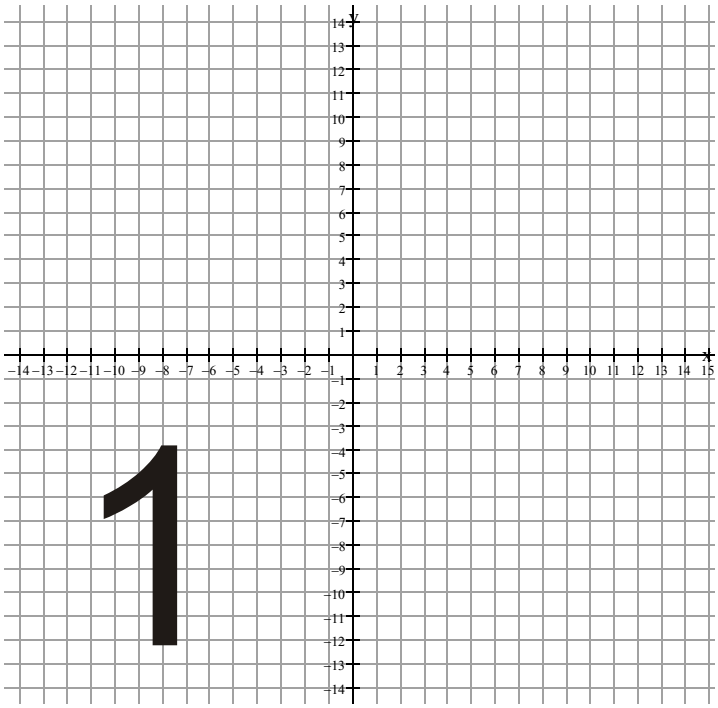
$$y = mx + b$$

Only when an equation is in slope-intercept form will you be able to just look at it and know what the **slope m** is and the **y-intercept b** is. The slope **m** is the number x is multiplied by and the y-intercept **b** is the number by itself (including the sign in front of it).

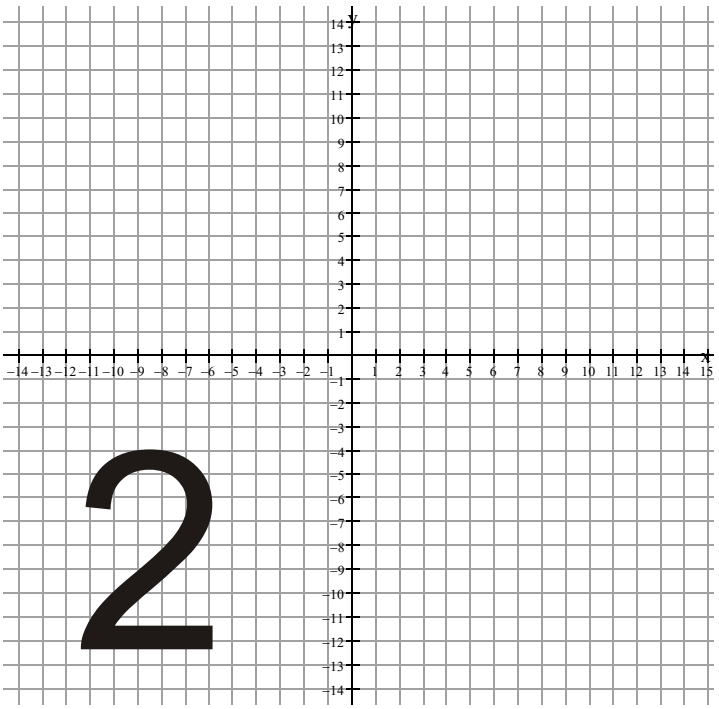
For example in the equation y = 3x -9 the slope **m** is 3 and the y-intercept **b** is -9.

When an equation is not solved for y it is not in slope-intercept form so this does not work. You need to put it in slope-intercept form by solving for y first before you can apply this trick.

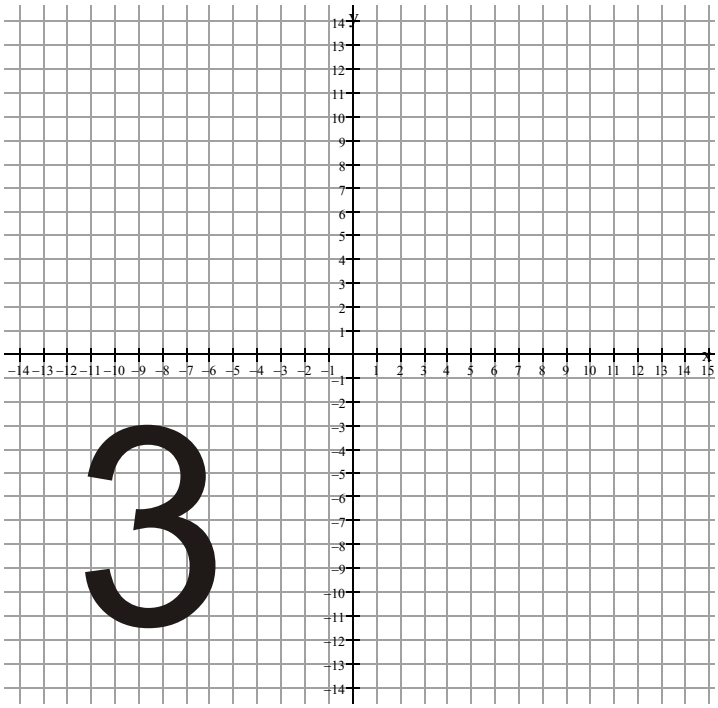
For example y + 6x = 12 is not in slope-intercept form. The slope is not 6. Solving for y you get y = -6x +12. Now it is in slope-intercept form so the slope m is -6 and the y-intercept b is 12.



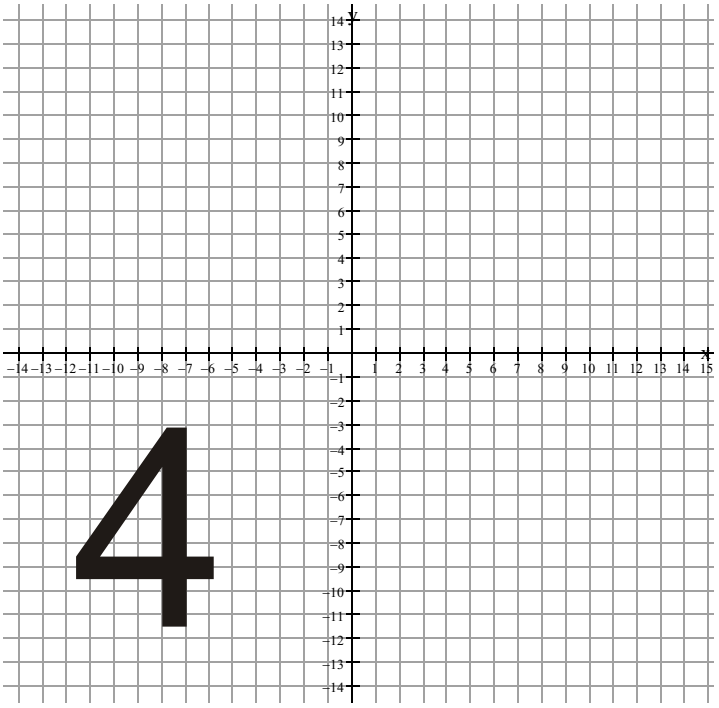
Graph the equation:
$y = 2x + 1$



Graph the equation:
$y - 2x = 1$



Graph the equation:
$y - 2x - 1 = 0$



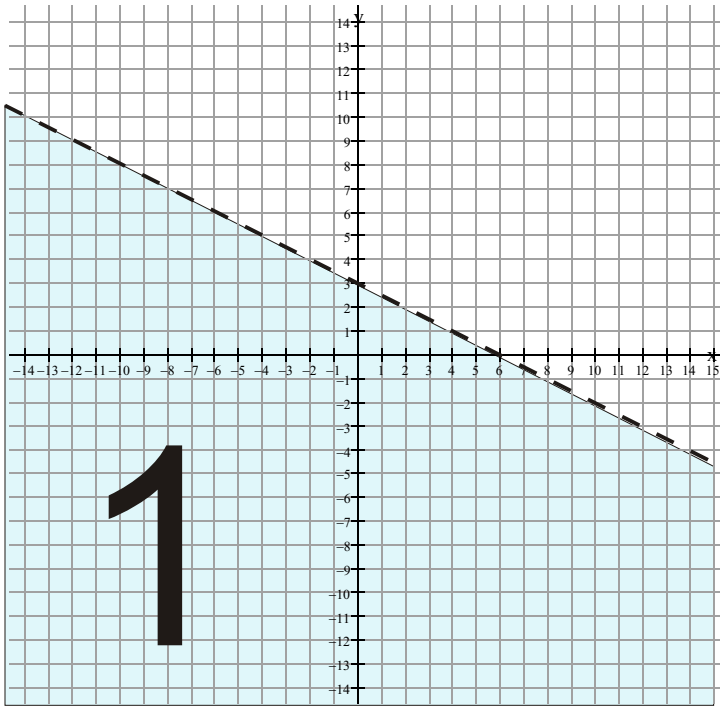
Graph the equation:
$-4x - 2 = -2y$

Graphing Inequalities

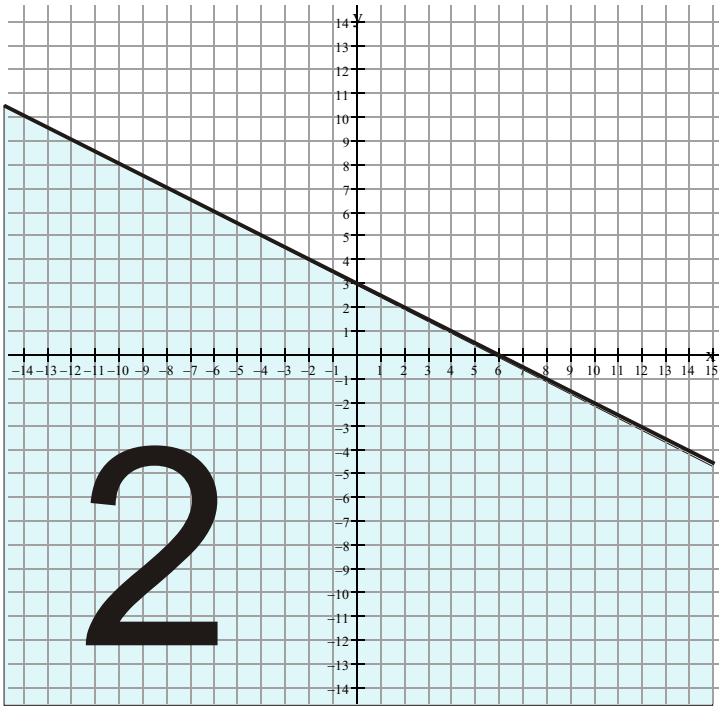
Put inequalities in slope-intercept form by solving for y before graphing them. Make sure that y is on the left side of the equation. Once that is done the inequality tells you everything you need to make the graph.

All the graphs **start at the y- intercept b**. **The slope m tells you how to get to the next point**. The inequality operator tells you if you need a solid line or a dashed line, **solid line if the inequality operator has a solid line under it, dashed line if no line under the inequality operator.** The inequality operator also tells you which side to shade. **Shade below if $<$ or $\leq$, shade above if $>$ or $\geq$.**

$y \leq mx + b$ solid line, shade below
$y \geq mx + b$ solid line, shade above
$y < mx + b$ dashed line, shade below
$y > mx + b$ dashed line, shade above



m =
b =
Shade up or down?
Solid or dashed line?
Write the inequality in slope-intercept form.



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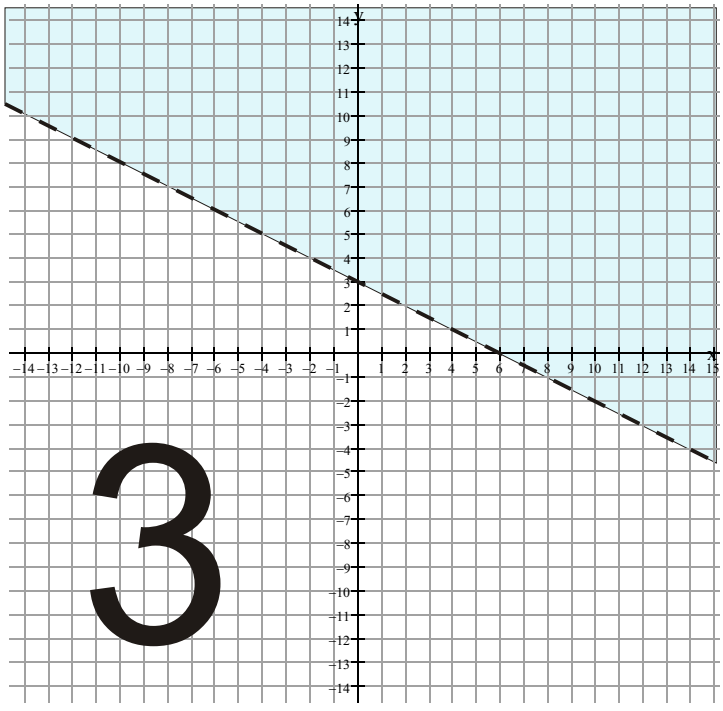
Write the inequality in slope-intercept form.



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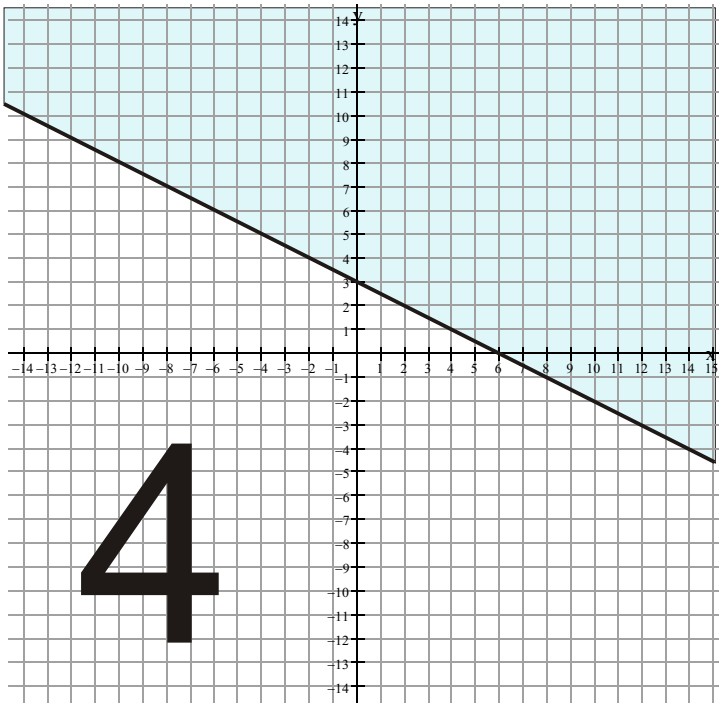
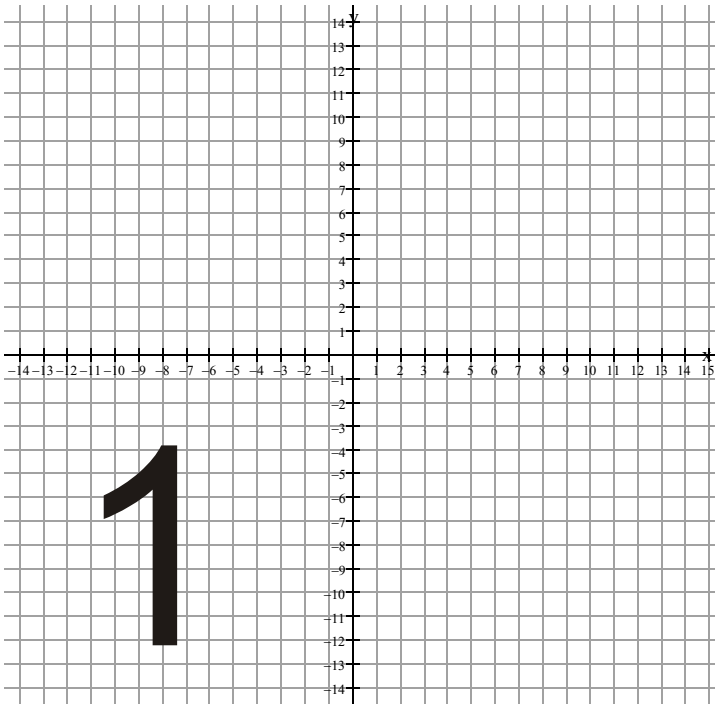
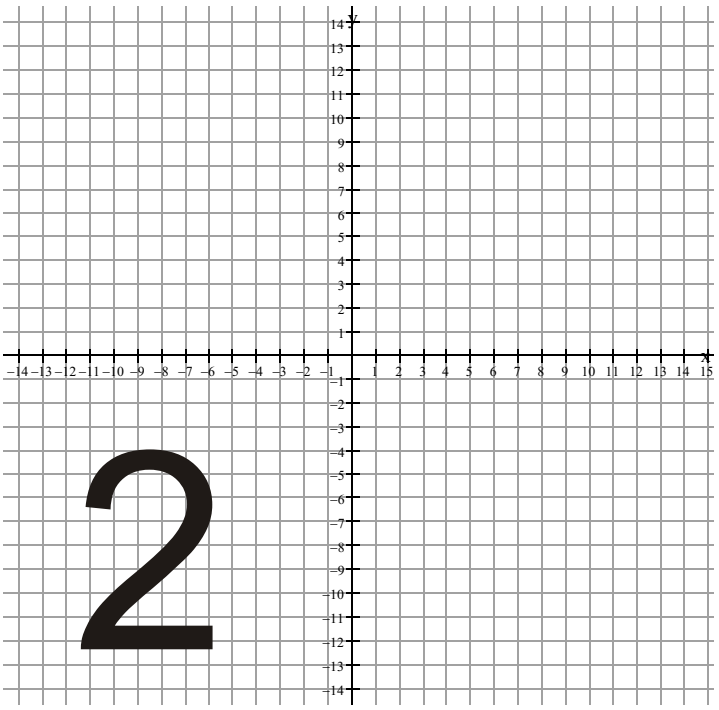


m =
b =
Shade up or down?
Solid or dashed line?
Write the inequality in slope-intercept form.



m = 2/3
b = 3
Shade up
Solid line
Write the inequality in slope-intercept form and graph it.



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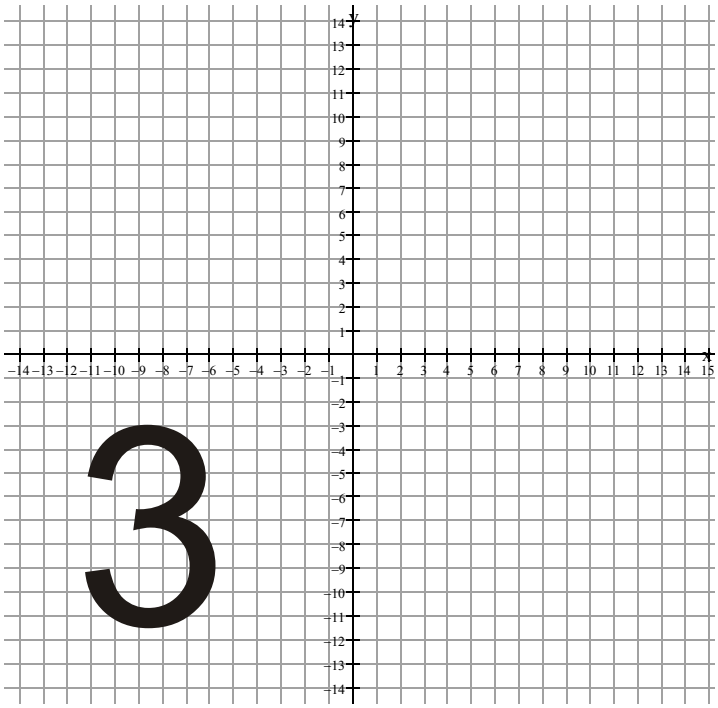
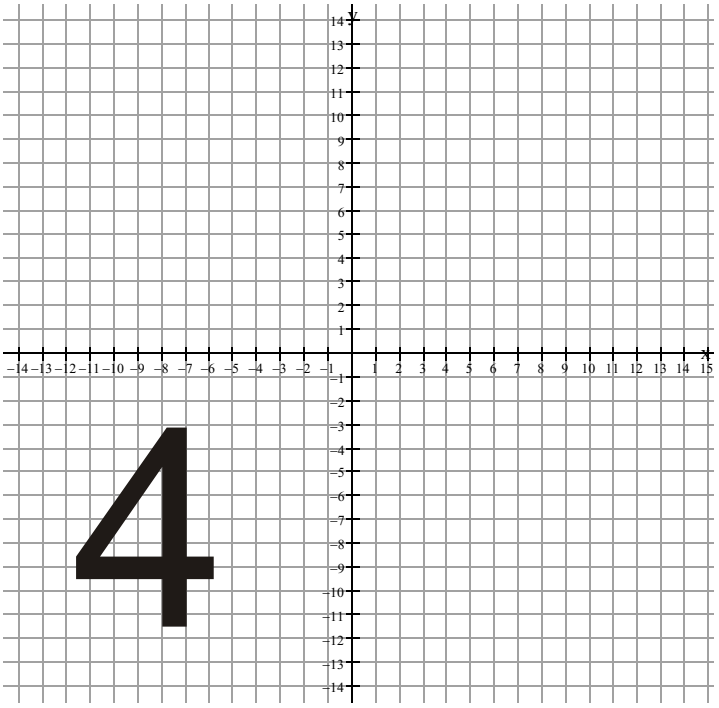
b = 3
Shade up
Dashed line
Write the inequality in slope-intercept form and graph it.



m = 2/3
b = 3
Shade down
Solid line
Write the inequality in slope-intercept form and graph it.



m = 2/3
b = 3
Shade down
Dashed line
Write the inequality in slope-intercept form and graph it.

Point-Slope Form of an Equation

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

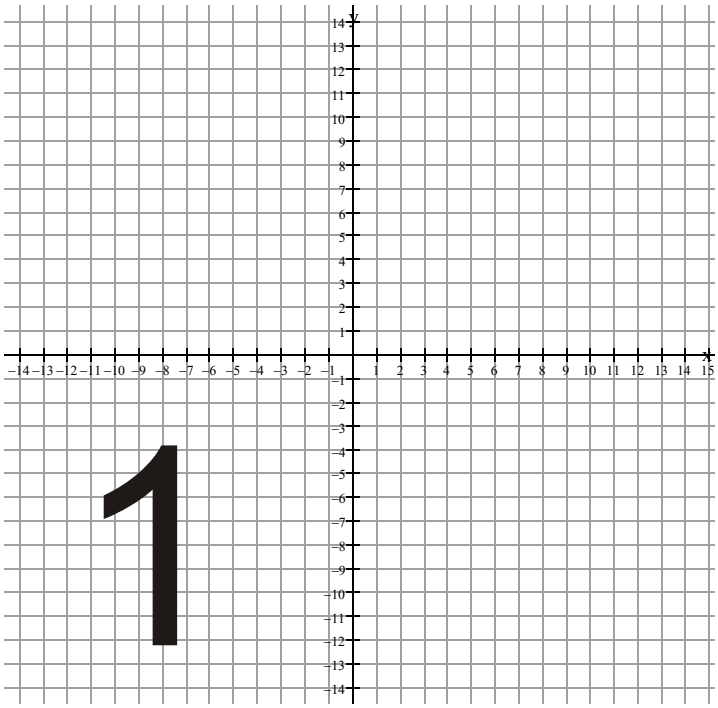
The point (x_1, y_1) is any point on the line. The value of **m** is the **slope** of the line. "y" and "x" are the variables y and x. The minus sign in front of y_1 is not part of y_1 and the minus sign in front of x_1 is not part of x_1. The minus signs are part of the formula and must be there for it to work correctly. For example if you are given the equation $y + 7 = 3(x + 9)$ you need to replace the + with a - - so that the equation is in the correct form. The correct form is $y - -7 = 3(x - -9)$. Now you can correctly pick out the value for y_1 which is -7 and x_1 which is -9.

There are two situations when this form is useful:

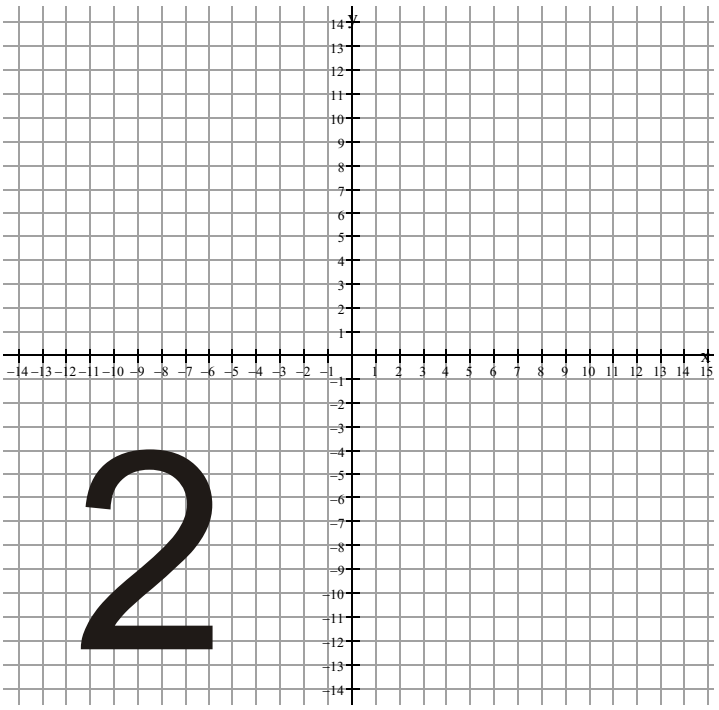
- You are given one point and the slope.
- You are given two points.

If you know one point and the slope just put them in and you have the equation. Since you know a point and the slope you can graph the equation. Start at the point and use the slope to get to the next point.

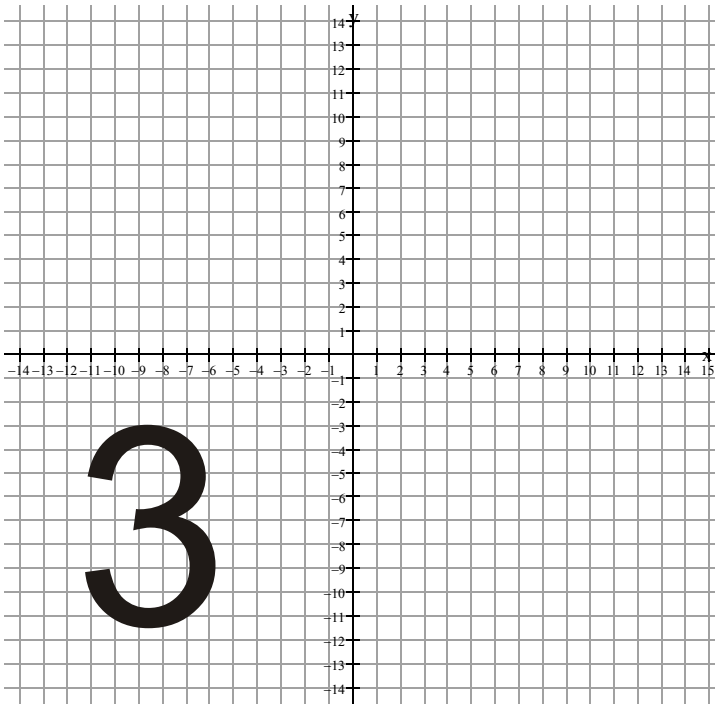
If you know two points you will have to calculate the slope using the slope formula. Once you know the slope you can plug it in along with either point and you have the equation. Although the equations will look different for each point they will look the same when you solve them for y. Graphing the equation when you know two points is easiest of all. Just plot both points and draw the line through them.



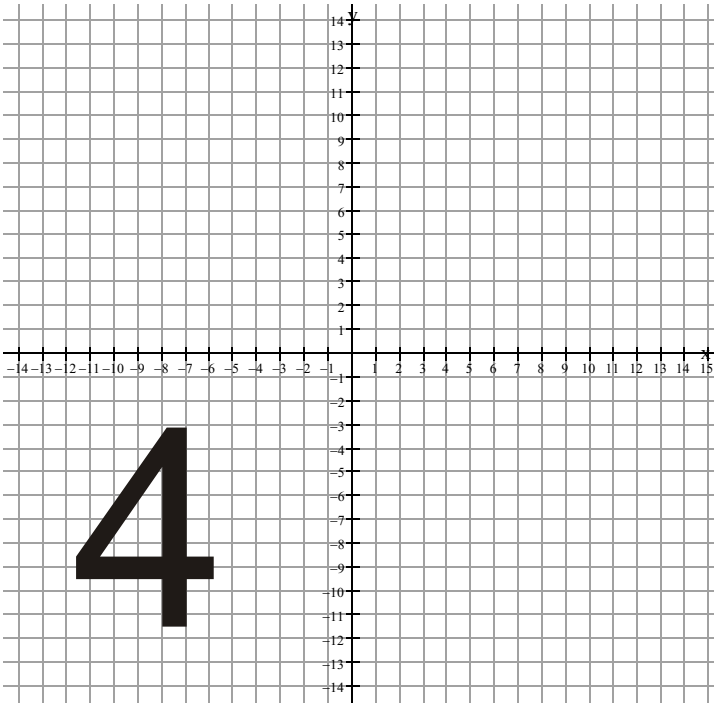
m = -2, the point is (3,4).
Write the equation in point-slope form and graph it. Now solve it for y so you can figure out the y-intercept.



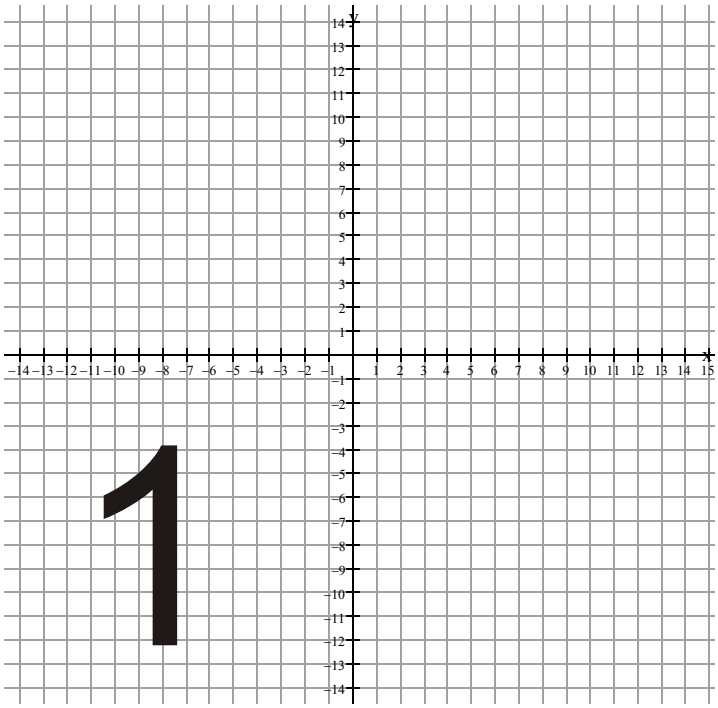
m = 2, the point is (-3,-4).
Write the equation in point-slope form and graph it. Now solve it for y so you can figure out the y-intercept.



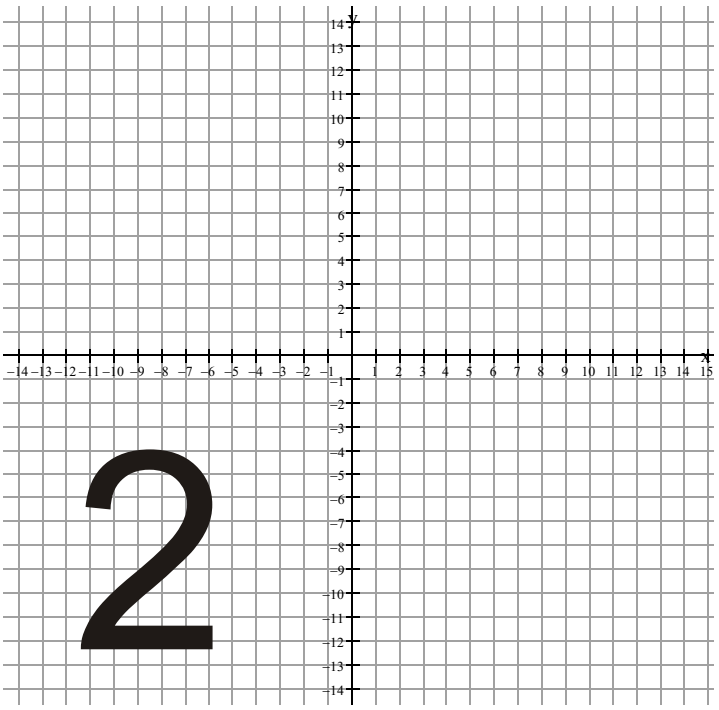
The two points are (5,6) and (-1,-2)
Write the equation in point-slope form and graph it. Now solve it for y so you can figure out the y-intercept.



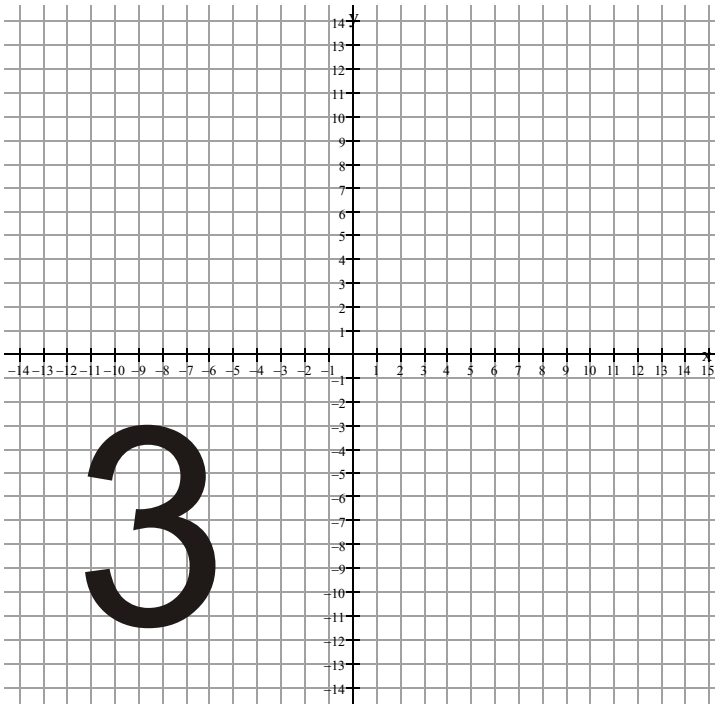
The two points are (2,3) and (4,7)
Write the equation in point-slope form and graph it. Now solve it for y so you can figure out the y-intercept.



Graph the equation:
$y - 5 = 3(x - 2)$
Now solve it for y so you can figure out the y-intercept.



Graph the equation:
$y + 5 = 3(x + 2)$
Now solve it for y so you can figure out the y-intercept.



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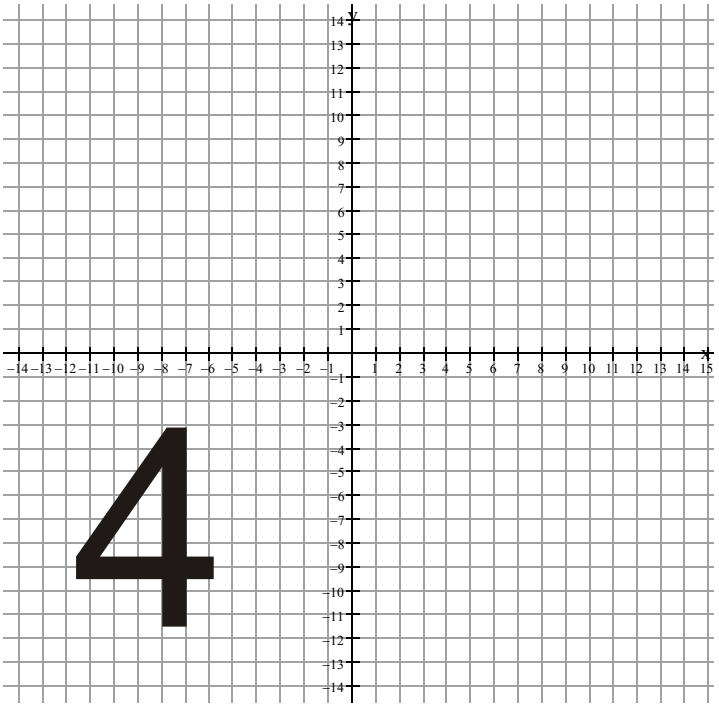


Graph the equation:
$y + 5 = 3(x - 2)$
Now solve it for y so you can figure out the y-intercept.

Standard Form of an Equation

$Ax + By = C$

A, B and C are integers not decimals or fractions and A and B can not be zero at the same time. This is best used to find the x-intercept and the y-intercept of the equation.

Y-intercept, the point where the line crosses, intersects, intercepts, comes in contact with, meets, shares a common point, engages with the y-axis. This is a point with an x-coordinate that is always zero but a y-coordinate that is the value on the y-axis where the line crosses the y-axis. If you solved the equation for y the value of the y-intercept would be “b”.

X-intercept, the point where the line crosses, intersects, intercepts, comes in contact with, meets, shares a common point, engages with the **x**-axis. This is a point with a y-coordinate that is always zero but an x-coordinate that is the value on the x-axis where the line touches the x-axis.

Standard Form of an Equation, Finding the x and the y-intercepts

$Ax + By = C$

Since the **y-intercept** is the point where the line crosses the y-axis. The x-coordinate of that point is always zero Put a zero in for x and you get a simpler equation By = C. Just solve for y and you have the y-intercept.

Find the y-intercept of:

$5x + 10y = 20$

$5(0) + 10y = 20$

$10y = 20$

$y=2$

Since the **x-intercept** is the point where the line crosses the x-axis. The y-coordinate of that point is always zero Put a zero in for y and you get a simpler equation Ax = C. Just solve for x and you have the x-intercept.

Find the x-intercept of:

$5x + 10y = 20$

$5x + 10(0) = 20$

$5x = 20$

$x=4$

Graphing Equations in Standard Form

$Ax + By = C$

To graph equations in standard form find the x-intercpet and the y-intercept. Plot these two points and draw the line through them.

To graph $5x + 10y = 20$

Find the x-intercept:

$5x + 10(0) = 20$

$5x = 20$

$x = 4$

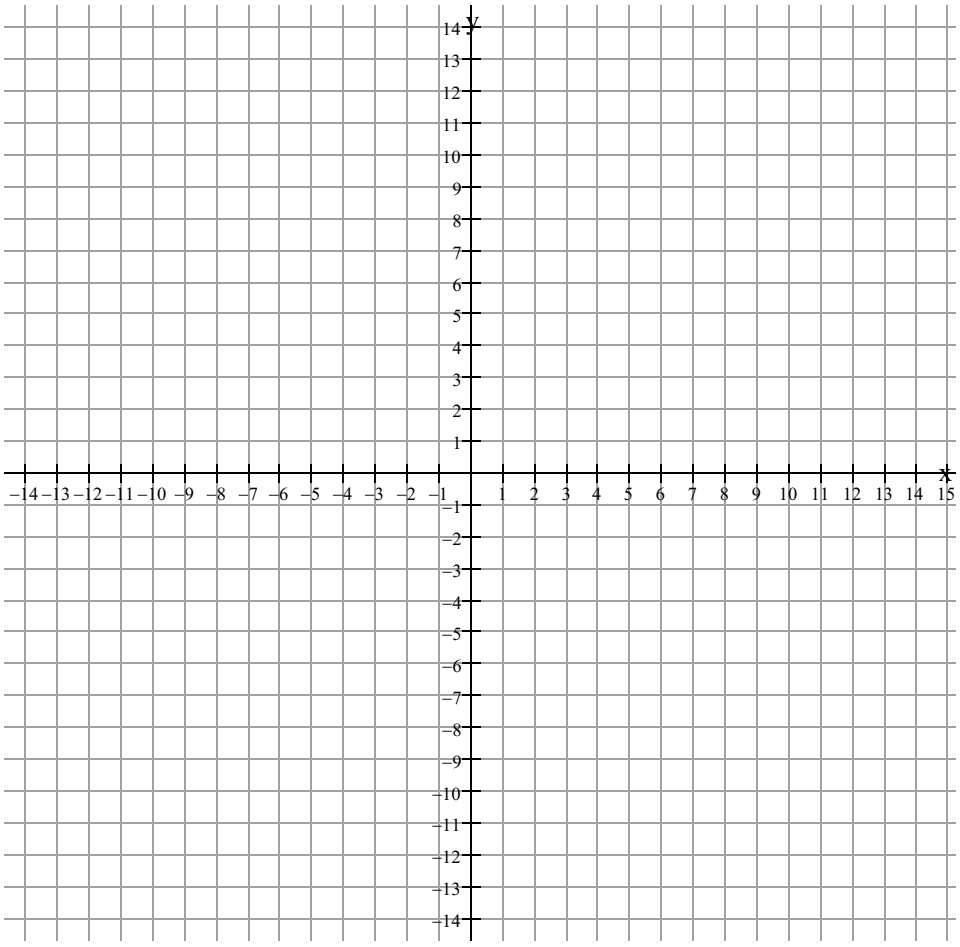
Find the y-intercept:

$5(0) + 10y = 20$

$10y = 20$

$y = 2$

Plot the points and draw the line through them.



Graphing Horizontal and Vertical Lines
x = a (vertical line), y = c (horizontal line)

Equations of the form x = a have no y in them so they never cross the y-axis, they might be on the y-axis but they do not cross it. Every point that has a value of
x = a is on the line so you get a line that goes straight up and down. Equations of the form y = c have no x in them so they never cross the x-axis, they might be on the x-axis but they do not cross it. Every point that has a value of y = c is on the line so you get a line that goes horizontally left to right.

To graph the equation x = 5, pick two points that have x = 5 and two different y values. Try (5,2) and (5, -4), plot these points below and draw a line through them. Try the same thing for y = 2. Pick two points with y = 2 and two different x values. Try (1,2) and (7, 2). Plot these and draw a line through them.