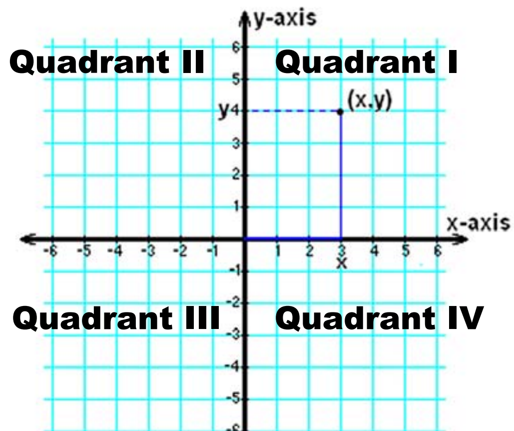
Algebra Connections

Mr. Breitsprecher's Edition November 10, 2005 Web: www.clubtnt.org/my_algebra

Graphing Equations

A **rectangular coordinate system** is a plane with vertical and horizontal number lines that intersect at their 0 coordinate. The vertical line is referred to as the **y-axis**; the horizontal line, **the x-axis**. We call the point of intersection the **origin** (0, 0).

We graph or plot an ordered pair by locating the corresponding x and y values on our rectangular coordinate system. To plot x=3 and y=4 (3, 4); start at the origin and move right 3 and then up 4.



Graph of (3, 4)

The rectangular coordinate system is divided into quadrants. The quadrants are:

Quadrant	x-axis	y-axis
I	Positive	Positive
II	Negative	Positive
III	Negative	Negative
IV	Positive	Negative

An ordered pair is a **solution** of an equation in 2 variables if replacing the variables with the coordinates of the ordered pair results in a true statement.

If we are given one coordinate of an ordered pair solution, the other value can be determined by substitution. **For example:** x-4y=16

Start by assuming x equals some convenient number to work with, say 0 (0, y). By substitution, we have:

0-4y = 16
-4y=16
(-4y)/-4 = 16/-4
y = (-4)

Our ordered pair is (0, -4)

A **linear equation in two variables** is an equation that can be written in the form **Ax+By=C**, where A and B are are not both 0. We call the form Ax+By=C **standard form**.

To graph a linear equation in two variables, find three ordered pairs that are solutions for the equation. Two points (each an ordered pair) determine the line. We use the third point as our "check." When we plot the three points, a straight line should connect all three points.

Graphing Linear Equations: Intercepts

An intercept point of a graph is the point where the line crosses an axis. The x-intercept is the point where a line crosses the x-axis. If that point is some number, let's call it "a," then the **x-intercept** is "a" and the corresponding intercept point is (a, 0). If a graph intersects the y-axis at a point we call "b," then b is the **y-intercept** and the corresponding intercept point is (0, b). To find intercept points:

- x-intercept point is determined by letting y=0 and solving for x
- y-intercept point is determined by letting x=0 and solving for x

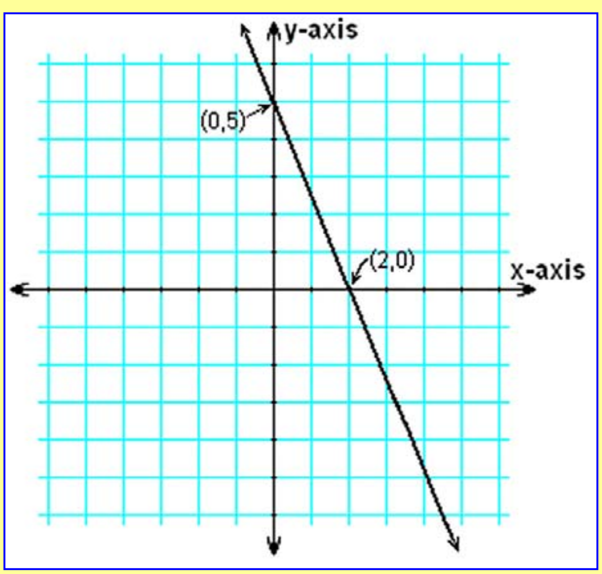
Example: 5x + 2y = 10

We find the x-intercept by setting y = 0 and solving for x.

5x + 2(0) = 10
5x=10
(5x)/5 = 10/5
x = 2
The x-intercept is (2, 0)

Next, we will find the y=intercept by setting x = 0 and solving for y.

5(0) + 2y = 10
2y = 10
(2y)/2 = 10/2
y = 5
The y-intercept is (0, 5)



Linear Equations: Intercepts

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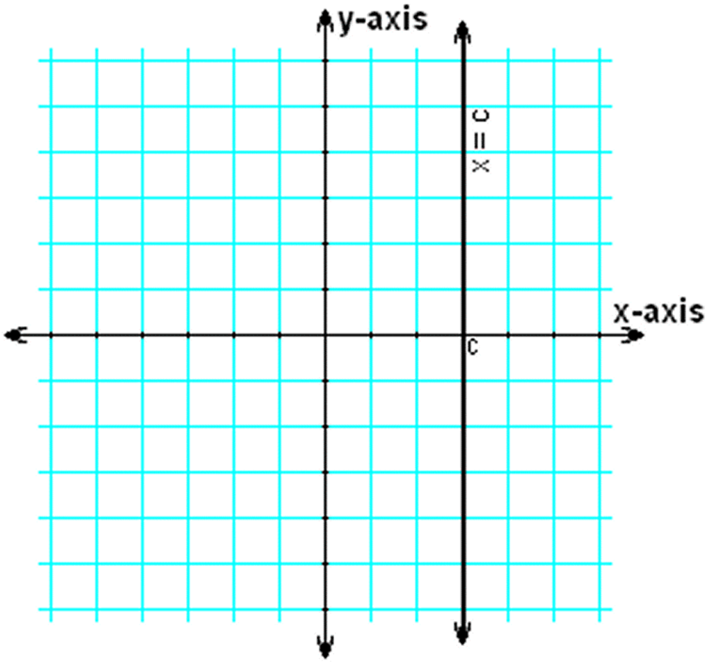
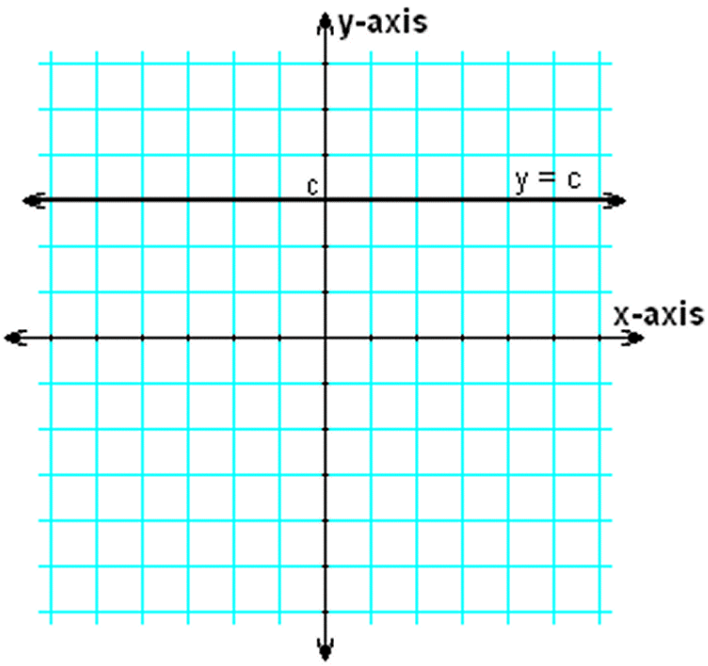
Special Case: Graph of x = c is a vertical line with x-intercept of "c." In this case, c = 3.



Special Case: Graph of y = c is a vertical line with x-intercept of "c." In this case, c = 3.



Linear Equations: Slope

The slant or steepness of a line is refered to as **slope**. The slope (m) of a line passing through points (x_1, y_1) and (x_2, y_2) can determined by:

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

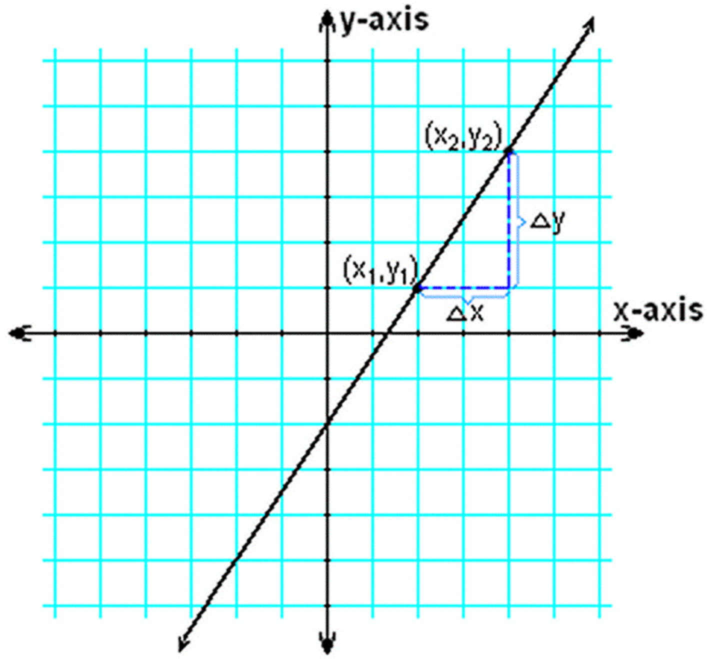
Example: Assume a line passes through (2, 1) and (4, 4).

Solving for m, we get:

$$m = \frac{4 - 1}{4 - 2}$$

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

Graphing this line, we can see how the slope indicates how many units the line's rise $(y_2 - y_1)$ and run $(x_2 - x_1)$



It makes no difference what 2 points of a line we choose to find its slope. The slope of a line is the same everywhere on the line. Note that when we calculate the slope, it makes no difference what points we assign as (x_1, y_1) and (x_2, y_2) as long as we make sure that when we call one point x_1, we use its corresponding y-coordinate as point y_1. **A positive slope goes up; a negative slope goes down** (from left to right).

A **horizontal line has a slope of 0**, because the "rise" is zero and its run is infinite – by definition, performing this division results in 0.

A **vertical line has a slope that is undefined**, because the "rise" is infinite and its run is 0 – by definition, division by 0 is undefined.

Nonvertical **parallel lines have the same slope**. Two nonvertical **lines are perpendicular if the slope of one is the negative reciprocal of the slope of the other**.