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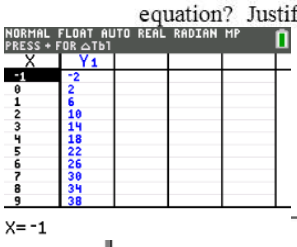
THE REAL TRUTH ABOUT GRAPHS...

At this point we've looked at graphs of **linear functions** and more general functions as simply being plots of input/output pairs. And, for functions, this makes a lot of sense. But, more generally, we want to be able to define points that lie on the graph of an equation or on an **inequality** with a simple test/definition.

***Do Now*:** Consider the linear equation $y = 4x + 2$.

(a) Does the point $(2, 10)$ lie on the graph of this equation? Justify your answer.

x y



$y = 4x + 2$

$10 = 4(2) + 2$

$10 = 8 + 2$

$10 = 10$ ✓

(b) Does the point $(-1, 4)$ lie on the graph of this equation? Justify your answer.

$y = 4x + 2$

$4 = 4(-1) + 2$

$4 = -4 + 2$

$4 = -2$ ✗

GRAPHING EQUATIONS AND INEQUALITIES

The connection between graphs and equations/inequalities is a simple one:

1. Any coordinate pair (x, y) that makes the equation or inequality **true** lies **on the graph**.
2. The **entire graph** is a collection of **all** of the (x, y) pairs that make the equation or inequality **true**.

***Exercise* #2:** The equation $y = 2x^2 - x + 5$ describes a **parabola**. Does the point $(3, 20)$ lie on its graph? Use your graphing calculator to answer this question.

$20 = 2(3)^2 - (3) + 5$

$20 = 2(9) - 3 + 5$

$20 = 18 - 3 + 5$ ✓

Inequalities can also be graphed and we will concentrate on that in the next lesson. But, in this lesson we can certainly determine if particular points will lie on the graph of an inequality.

***Exercise* #3:** Determine for each of the following inequalities whether the point given lies on its graph.

(a) $(4, 1)$ for $y > 2x - 5$

Is 1 greater than 3?

$1 > 2(4) - 5$

$1 > 8 - 5$

$1 > 3$

→ No, (4,1) does not lie on $y > 2x - 5$

(b) $(2, 8)$ for $x + y \leq 10$

x y

$(2) + (8) \leq 10$

$10 \leq 10$

10 is equal to 10

True :)

We can even determine, with some additional calculations, whether a point is a solution to a **system of equations** or a **system of inequalities**. You've studied systems before and we will devote the next unit to them. But, with a simple definition you can "easily" tell whether points are solutions.

★ Systems of Equations ★

A **system of equations** is a collection of **two or more equations** joined by the **AND** truth condition. Because the AND condition is only true when all of its components are true, the solution set of a system is:

That is an extremely important idea. Let's test it out in the next exercise:

***Exercise* #4:** Determine if the point $(3,1)$ is a solution to the system of equations shown below. Justify your work.

★ $y = 2x - 5$

and

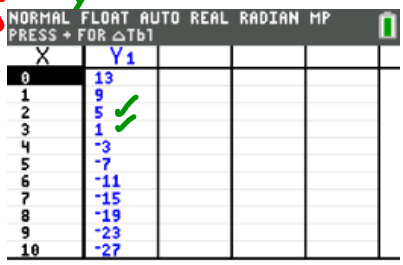
★ $y = -4x + 13$

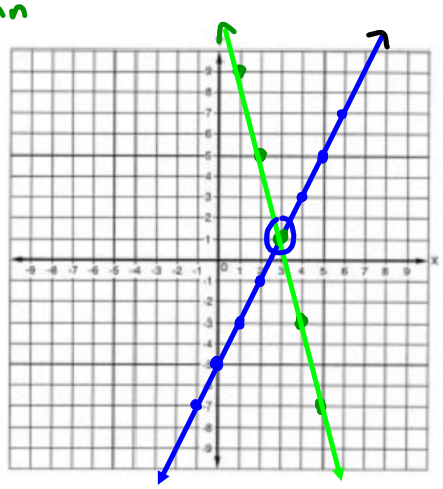
slope = 2
y-int = -5
2/1 rise/run

slope = -4
y-int = 13
rise/run = -4/1

These are the Points

(1,9)
(2,5)
(3,1)





Yes, (3,1) is a solution. It's where the lines meet (cross).

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THE TRUTH ABOUT GRAPHS
HOMEWORK!

1. Which of the following points lies on the graph of $y = 3x - 5$?

   (1) $(1, -5)$ (3) $(4, 7)$

   (2) $(2, 0)$ (4) $(5, 5)$

2. Which of the following points does not lie on the graph of $y = \frac{1}{2}x + 3$?

   (1) $(10, 8)$ (3) $(0, 3)$

   (2) $(-2, 2)$ (4) $(-6, -3)$

3. Which of the following points would not lie on the line $y = 7$?

   (1) $(-2, 7)$ (3) $(0, 7)$

   (2) $(7, -1)$ (4) $(5, 7)$

4. For the inequality $y > 4x + 1$ determine if each of the following points does or doesn't lie in its solution. Show the work that leads to your answer.

   (a) $(2, 15)$ (b) $(4, 10)$

   (c) $(0, 1)$ (d) $(-3, -8)$

5. Determine if the point $(4, 7)$ is a solution to the system of equations shown below. Justify your yes/no answer.

$y = 2x - 1$

and

$y = \frac{1}{2}x + 5$