5.3 - Graphing Linear Inequalities

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FOUNDATIONS OF MATH 11 Ch. 5 – Day 3: Graphing Linear Inequalities in Two Variables

In this section, we're going to discuss inequalities. Recall that we use inequality signs when we discuss inequalities (or "inequations"):

< : "Less than" > : "Greater than"

≤ : "Less than or equal to" ≥ : "Greater than or equal to"

Also recall that an inequation has a range of possible solutions, ie. the inequation $x < 5$ can be satisfied by $x = 4, 3, 1.4, -100$, etc.

In this section, we're going to learn how to graph linear inequalities. Essentially, we graph the lines just as we would if there was an equal sign, but there's two other rules we need to follow:

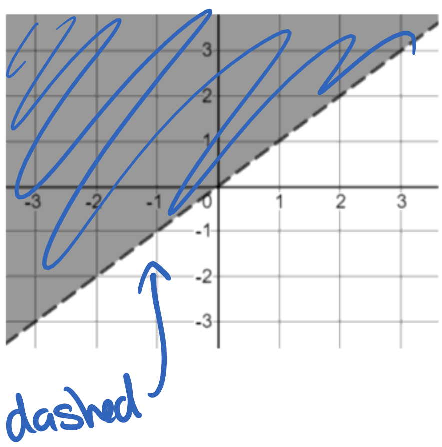
Firstly,

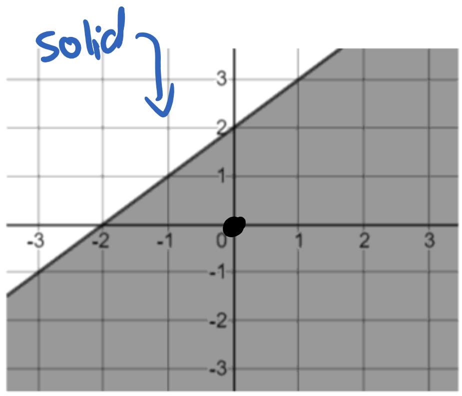
If the inequality sign is either " ≤ " or " ≥ ", we draw the line as ___Solid___.

If the inequality sign is either " < " or " > ", we draw the line as ___dashed.___.

Secondly, we need to shade either above or below the line. This is because we're dealing with inequalities that have a range of possible answers. Since these signs indicate **greater than** or **less than**, the answer will be either **above** or **below** the line we graph, but it isn't that simple.

Before we continue, let's just see exactly what we're talking about:





Now that we're clear on what we mean by "shading above or below the line," we must understand one important thing:

We can follow the rule of "if the inequality sign is < or ≤, we shade **below** the line, and if the inequality sign is > or ≥, we shade **above** the line" if, **and only if** y is isolated and on the left.

For this reason, I would recommend converting any linear inequality you're given to slope-intercept form ($y = mx + b$) for the simple reasons that you're familiar with it, and -it has *y* isolated.

In this inevitable event, you must remember that if you multiply or divide an inequality by a negative number, you must reverse the inequality sign.

Example

Convert $8x - 4y + 12 < 0$ from general form to slope-intercept form.

$8x - 4y + 12 < 0$

$-2 \quad -2$

$\cancel{8x} - 4y < -12$

$-8x \quad -8x$

$-4y < -8x - 12$

$-4 \quad -4$

$y > 2x + 3$

★ When multiply or dividing by a negative #, switch the inequality sign!

★ Alternatively, if you choose not to graph a linear equation by converting it to slope-intercept form (perhaps you prefer the x and y-intercept method) you must make use of a "test point".

A test point helps us determine if we should shade above or below the line. To select a test point, pick a point that is on either side of the line, and not on the line. Ideally you will pick one that has easy numbers to work with such as (0 , 0) or (1 , 1).

→ Substitute the x-value of the coordinate in for " x " in the equation, substitute the y-value of the coordinate in for " y " in the equation, and simplify. If the inequality you're left with is true (such as 4 < 6 or 11 > -2), the solution (the part you shade) is the side you've chosen the test point from.

If the inequality you're left with is false (such as 9 > 9 or -2 < -5) then the solution is the side from which you <u>didn't</u> select the test point from.

Example

Graph the linear inequation $y \geq 2x - 1$

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

Test Point:

(0,0)

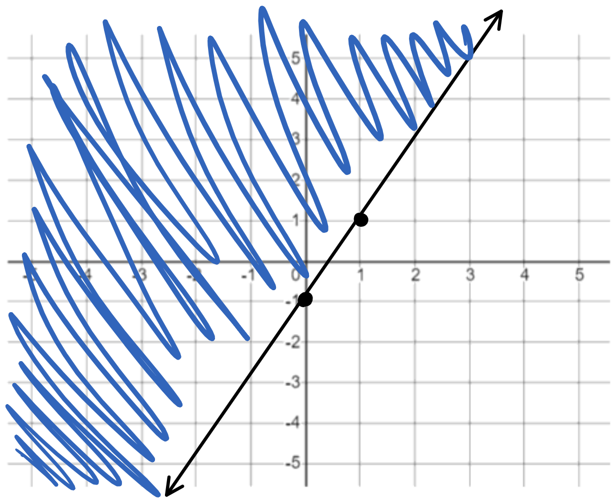
$y \geq 2x - 1$

$(0) \geq 2(0) - 1$

$0 \geq -1$

True! :)

∴ shade the side with the test point.



Example

Graph the linear inequation $2x + 3y - 6 < 0$ using the x and y-intercept method.

x-int (y=0)

$2x+3y-6=0$

$2x+3(0)-6=0$

$2x-6=0$

$2x=6$

$x=3$

(3,0)

y-int (x=0)

$2(0)+3y-6=0$

$3y-6=0$

$y=2$

(0,2)

Pick an easy test point:

(1,2)

$2x+3y-6<0$

$2(1)+3(2)-6<0$

$2+6-6<0$

$2<0$

False Statement

∴ Shade the side the test point is <u>not</u> on.