MTH1W Grade 9 Mathematics

4.8 Equations vs Inequalities

Goal(s) *- To understand the difference between an equation and an inequality*

- To solve inequalities by graphing and algebraically

- To determine the x- and y-intercepts of an equation or inequality and use them to sketch a graph

An **equation** is a mathematical statement comparing expressions that are *equal*.

An **inequality** is a mathematical statement comparing expressions that *may not be equal*.
Inequalities are similar to equations, except that instead of an **=** sign, these are the symbols used between unequal values:

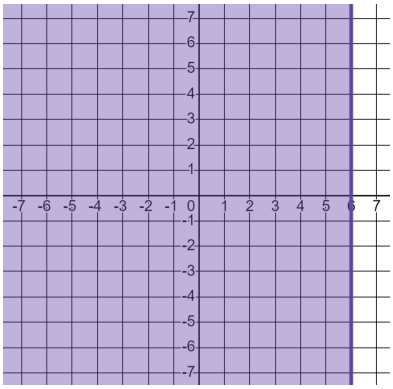
$<$ $>$ $\leq$ $\geq$ $\neq$

An inequality can be used to describe a region of 2-dimensional space.

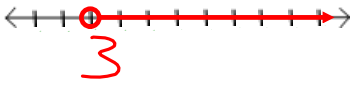
Inequalities can be expressed in different ways:
Verbally... *"All numbers less than or equal to 6."*

Algebraically using mathematical symbols... $x \leq 6$

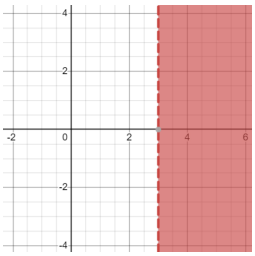
Graphically
On a number line... or On the Cartesian Plane...



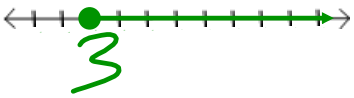
A **boundary point** separates the values less than from the values greater than a specified value.
An **open circle** or **dotted line** shows that the boundary point is **NOT** included in the solution.



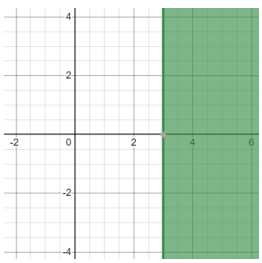
$x > 3$



A **closed circle** or **solid line** shows that the boundary point **IS** included in the solution.



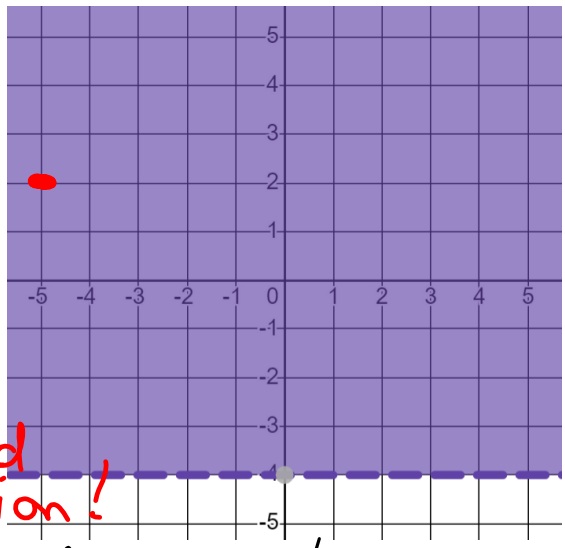
$x \geq 3$



Consider the graph of the inequality shown.
What points are described by the graph?

Write an algebraic representation of the inequality.

Does the point (-5, 2) satisfy the inequality? Yes. In the shaded region!



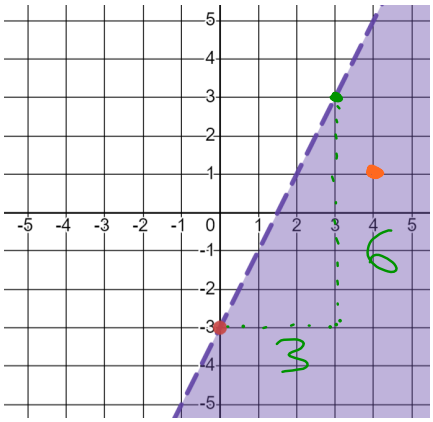
$y > -4$ ← boundary value

points in the shaded region have y-values > -4
-4 is NOT included → dotted line

Consider the graph shown.
Determine the equation of the dotted line.

Write an algebraic representation of the graph.

How would your above answer change if the line was solid instead of dashed?



$b = -3$

$m = \frac{6}{3} = 2$

$\Rightarrow y \boxed{?} 2x - 3$

choose a point in the shaded region, example (4, 1) sub into our expression

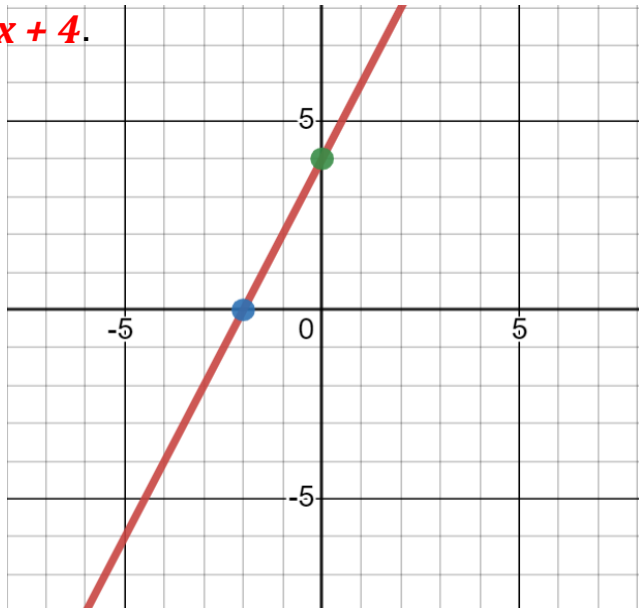
$\Rightarrow \quad 1 \quad 2(4) - 3$

$1 \quad 8 - 3 \Rightarrow y < 2x - 3$

$1 < 5$

This is the graph of the line $y = 2x + 4$.
State the coordinates of the:
x-intercept $(-2, 0)$
y-intercept $(0, 4)$

How could these values be determined using the equation?



x-intercept is when $y = 0$

y-intercept is when $x = 0$

Intercepts are the points on a graph where a line **crosses** either the x- or y-axis. If the intercepts are known or can be solved for, the line can be graphed.

The y-intercept of a line will always have coordinates $(0, y)$.

To solve for the y-intercept, let $x = 0$, and use opposite operations to solve for y.

The x-intercept of a line will always have coordinates $(x, 0)$.

To solve for the x-intercept, let $y = 0$, and use opposite operations to solve for x.

Solving Inequalities

Where an equation has one solution, there can be many solutions for an inequality.
Inequalities are solved the same way as equations are solved, with one exception - when multiplying or dividing by a negative value, the inequality symbol must be reversed.

$3 < 7$ T or F ?

$(x-2)$ $-6 < -14$ T or F ?

Flip the symbol to make it true

$\Rightarrow$ $-6 > -14$

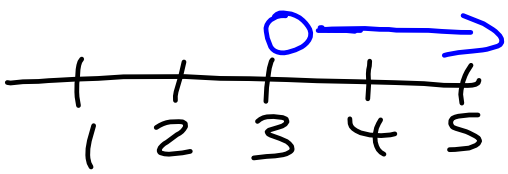
Solve and graph the solution.

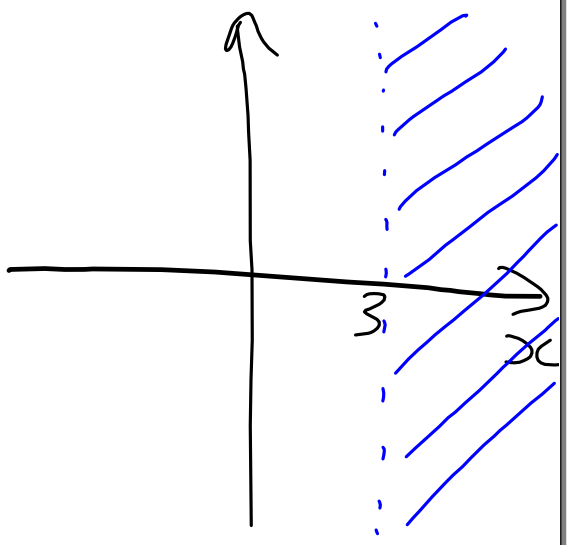
$3x + 7 > 16$

$3x + 7 - 7 > 16 - 7$

$\frac{3x}{3} > \frac{9}{3}$

$x > 3$





Solve and graph the solution.

$-23 \geq 5 - 4q$

$-23 \geq -4q + 5$

$-23 - 5 \geq -4q + 5 - 5$

$\frac{-28}{-4} \geq \frac{-4q}{-4}$

$7 \leq q$

flip the symbol because $\div$ by -4