Student Learning Centre

Inequalities

Flinders University inspiring achievement

Symbol	Words	Example
$>$	greater than	$3 > 2$
$<$	less than	$7 < 28$
$\geq$	greater than or equal to	$5 \geq x - 1$
$\leq$	less than or equal to	$2y + 1 \leq 7$

Things that **DON'T** change the sign of an inequality:

- Adding or subtracting from both sides of an equation
- Multiplying or dividing from both sides of an equation with a **POSITIVE** number
- Simplifying either sides of an equation

Things that **DO** change the sign of an inequality:

- Exchanging left and right hand sides
  $2y < 12$ (see example below)
  $12 > 2y$
- Multiplying or dividing by a **NEGATIVE** number $-2y < -4$ dividing both sides by -2 will change the sign to $y > 2$

Adding or subtracting a Value

Solve: $x + 3 < 7$

By subtracting 3 from both sides, we get:

$$x + 3 - \mathbf{3} < 7 - \mathbf{3}$$

Solution: $\boldsymbol{x < 4}$

In other words, x can be any value less than 4.

x on left or x on the right?

Example: $12 < x + 5$

By subtracting 5 from both sides, we get:

$$12 - \mathbf{5} < x + 5 - \mathbf{5}$$

$$\Rightarrow \mathbf{7} < x$$

But it is normal to put "x" on the left hand side. So let's change sides and therefore, the inequality sign. *(See above on what changes the sign)*.

So our solution is: $\boldsymbol{x > 7}$

Similar to solving an equation, we want to have x by itself on the left of the inequality sign. However, if you multiply both sides by a negative number it will change the direction of the inequality.

Multiplying or dividing by a value

Solve: $3y < 15$

If we divide both sides by 3 we get:

$$3y/\mathbf{3} < 15/\mathbf{3}$$

Solution: $\boldsymbol{y < 5}$

Solve: $-2y < -8$

Let us divide both sides by -2 and **reverse the Inequality**:

$$-2y < -8$$
$$\Rightarrow \quad -2y/\mathbf{-2} > -8/\mathbf{-2}$$

Solution: $\boldsymbol{y > 4}$

Inequalities

Solve $5\,(3z\,-\,2)\,\leq\,50$ and graph the solution set on a number line

Step 1:

Divide both sides by 5. Because we are dividing by a positive number we do not reverse the inequality sign.

$$\frac{5(3z\,-\,2)}{5} \leq \frac{50}{5}$$

$$\Rightarrow\ 3z\,-\,2\,\leq\,10$$

Step 2:

Add 2 to both sides.

$$3z\,-\,2\,+\,2\,\leq\,10\,+\,2$$

$$\Rightarrow 3z\,\leq\,12$$

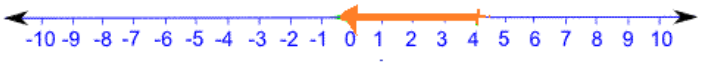
Step 3:

Divide both sides by 3. Because we are dividing by a positive number we do not reverse the inequality sign.

$$3z/3\,\leq\,12/3$$

$$\Rightarrow\ \ z\,\leq\,4$$

The solution set on the number line includes all numbers to the left of 4, and includes 4 itself, which is shown by a closed circle at 4:



Solve $½(3\,-\,5x)\,<\,-6$ and graph the solution set on a number line.

Step 1:

Multiply both sides by 2.

$$½(3\,-\,5x)\,\times\,2\,<\,-6\,\times\,2$$

$$\Rightarrow\ 3\,-\,5x\,<\,-12$$

Because we are multiplying both sides of the equation by a positive number we **do not reverse** the inequality sign.

Step 2:

Subtract 3 from both sides.

$$3\,-\,5x\,-\,3\,<\,-12\,-\,3$$

$$=\ -5x\,<\,-15$$

Because we are subtracting from both sides of the equation with a positive number we **do not reverse** the inequality sign.

Step 3:

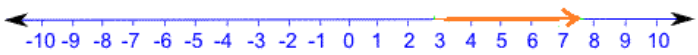
Divide both sides by -5.

$$-5x/-5\,>\,-15/-5$$

$$\Rightarrow x\,<\,3$$

Because we are dividing by a negative number we **must reverse** the inequality sign.

The solution set on the number line includes all numbers to the right of 3, but does not includes 3 itself, which is shown by an open circle at 3:



For more information: http://www.mathsisfun.com/algebra/inequality-solving.html

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