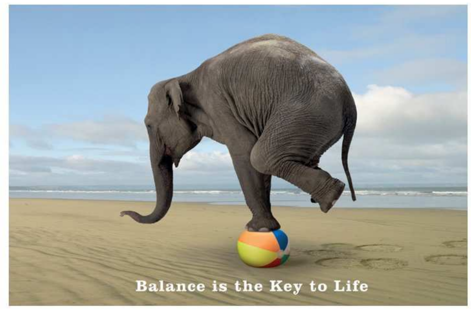
2.7 Solving Inequalities



Recall:
Relational operators are used to express inequalities:

- > greater than
- ≥ greater than or equal to
- < less than
- ≤ less than or equal to

Interval notation:

- Use square brackets for values that are included
- Use round brackets for values that are not included

Ex. $-3 < x \leq 8$ in interval notation is $(-3, 8]$

What is the difference between an equation and an inequality?

An equation leads to
one or many solutions which represent **points** on a graph.

An inequality leads to
a solution set - one or more **intervals** of x-values that satisfy the criteria.

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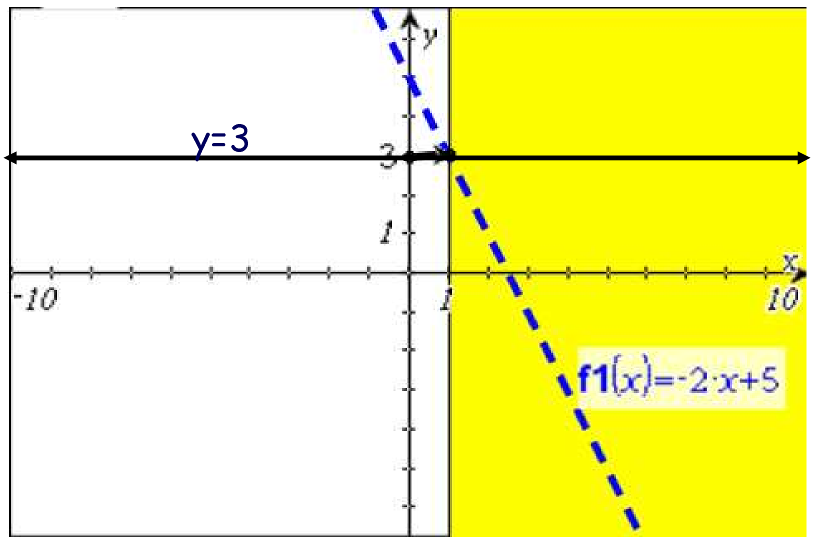
Ex. 1 Solve $-2x + 5 < 3$

We want to know the x-values where the graph of $y = -2x + 5$ has a y-value that is less than 3.



$(1, \infty)$

Solution is
$\{x \in R \mid x > 1\}$
or
$(1,\infty)$

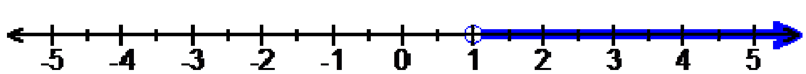
Algebraically:

$$-2x + 5 < 3$$
$$-2x < -2$$
$$\frac{-2x}{-2} > \frac{-2}{-2}$$
$$x > 1$$

Pull

Note: When you multiply or divide by a negative, you must change the direction of the inequality.

The solution can be expressed on a number line:



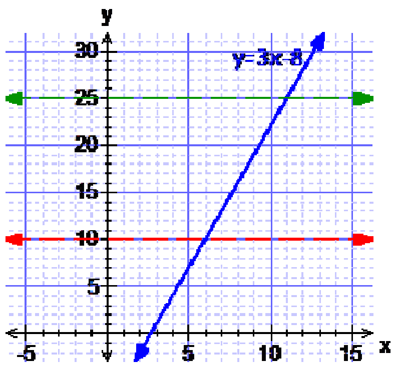
Ex. 2 Solve $10 \le 3(2x-5)-(3x-7) \le 25$

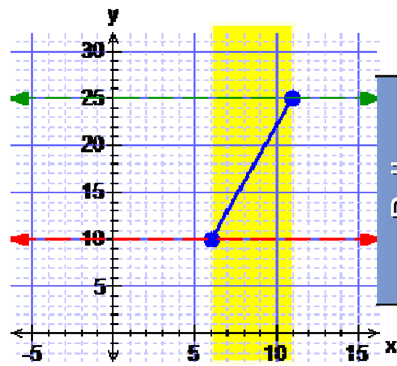
This is a **double inequality**. The solution must satisfy

$10 \le 3(2x-5)-(3x-7)$ AND $3(2x-5)-(3x-7) \le 25$

$$\begin{aligned} y &= 3(2x-5)-(3x-7) \\ &= 6x-15-3x+7 \\ &= 3x-8 \end{aligned}$$

The function defined by $y = 3(2x-5)-(3x-7)$ must be greater than or equal to 10 and less than or equal to 25:

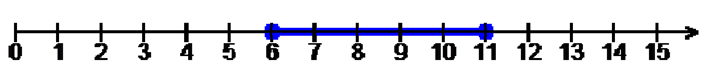




You can solve these two inequalities algebraically at the same time:

$10 \le 3(2x-5)-(3x-7) \le 25$	
$10 \le 6x-15-3x+7 \le 25$	← Expand and simplify
$10 \le 3x-8 \le 25$	
$10+8 \le 3x-8+8 \le 25+8$	← Add 8 to all three parts
$18 \le 3x \le 33$	← Divide all parts by 3
$6 \le x \le 11$	

Expressed on a number line:



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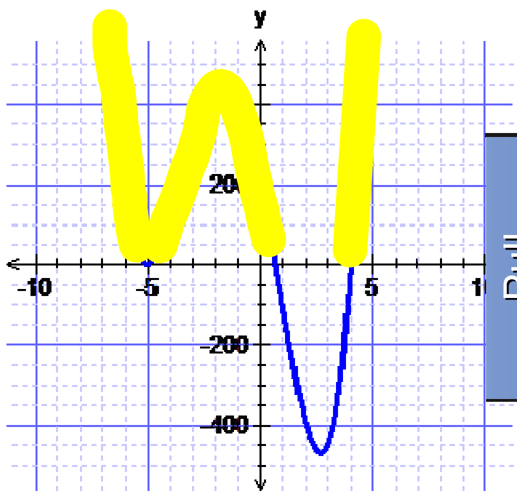
Ex. 3 a) Solve $f(x) > 0$, where $f(x) = 3x^4 + 16x^3 - 57x^2 - 270x + 200$, using graphing technology.

Zeroes: $-5, \frac{2}{3}, 4$



Pull

Solution:

$(-\infty, -5)$
$(-5, \frac{2}{3})$
$(4, \infty)$

Pull

b) if $f(x) \geq 0$

$\therefore (-\infty, \frac{2}{3}]$ & $[4, \infty)$

c) if $f(x) < 0$

$(\frac{2}{3}, 4)$

d) if $f(x) \leq 0$

$[\frac{2}{3}, 4]$

e) How would you solve $f(x) > 0$ algebraically?

Start by factoring....

more later.....

Homework
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