Inequalities

Linear Inequalities

Ex

Inequality	Equation
$2x + 3 < 11$	$2x + 3 = 11$
$2x < 11 - 3$	$2x = 11 - 3$
$2x < 8$	$2x = 8$
$x < \frac{8}{2}$	$x = \frac{8}{2}$
$x < 4$	$x = 4$

We solve linear inequalities just as we solve linear equations - see example above

However, if we multiply or divide by a negative number the inequality sign is reversed.

Ex2

$$8x + 20 \leq 5x + 32$$

$$8x - 5x \leq +32 - 20$$

$$3x \leq 12$$

$$x \leq \frac{12}{3}$$

$$x \leq 4$$

OR

$$8x + 20 \leq 5x + 32$$
$$+20 - 32 \leq 5x - 8x$$
$$-12 \leq -3x$$
$$\frac{-12}{-3} \geq x$$
$$4 \geq x$$

Notice inequality sign was reversed when we divided by -3

Exercise

1) $3x - 1 > 14$

$3x > 14 + 1$

$3x > 15$

$x > \frac{15}{3}$

$\underline{x > 5}$

2) $10x + 7 \leq 20$

$10x \leq 20 - 7$

$10x \leq 13$

$x \leq \frac{13}{10}$

$x \leq 1.3$

3) $2x - 7 \geq 20$

$2x \geq 20 + 7$

$2x \geq 27$

$x \geq \frac{27}{2}$ $\quad x \geq 13.5$

4) $5x - 7 < 3x + 11$

$5x - 3x < 11 + 7$

$2x < 18$

$x < \frac{18}{2}$

$\underline{x < 9}$

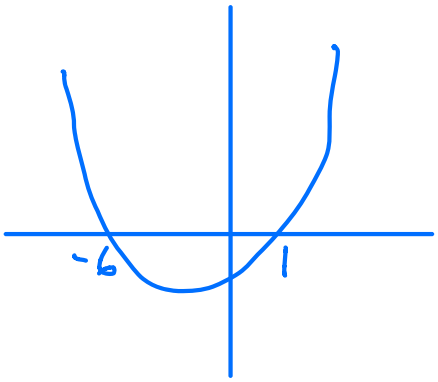
5) $4x + 11 \leq 41 - x$

$4x + x \leq 41 - 11$

$5x \leq 30$

$x \leq \frac{30}{5}$ $\quad x \leq 6$

Quadratic Inequalities



Quadratic Graph

$y = x^2 + 5x - 6$

$y = (x+6)(x-1)$

Solve $x^2 + 5x - 6 < 0$

$\underline{-6 < x < 1}$

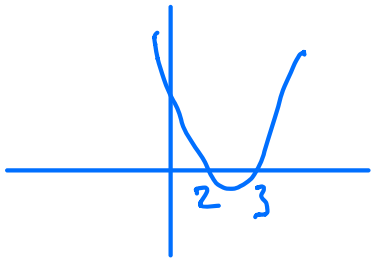
Solve $x^2 + 5x - 6 > 0$

$\underline{\text{Either } x > 1 \text{ or } x < -6}$

Ex 2 Solve $x^2 - 5x + 6 \leq 0$

$(x-2)(x-3) \leq 0$

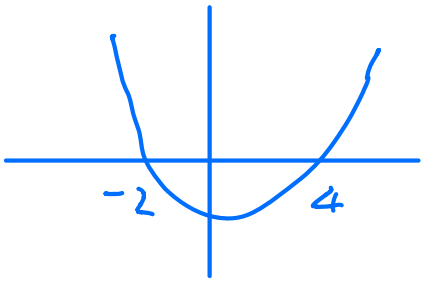
critical values $x = 2$, $x = 3$



$2 \leq x \leq 3$

Ex 3 Solve $x^2 - 2x - 8 > 0$

$(x+2)(x-4) > 0$



Either $x > 4$

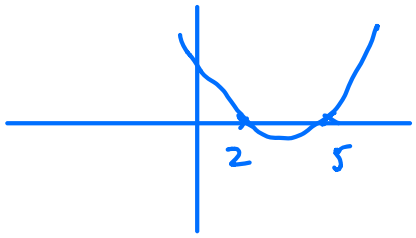
or $x < -2$

Exercise Solve

1) $x^2 - 7x + 10 < 0$

$(x-2)(x-5) < 0$

critical values $x = 2$
$x = 5$



$2 < x < 5$

2) $x^2 + 9x + 8 > 0$

$(x+1)(x+8) > 0$

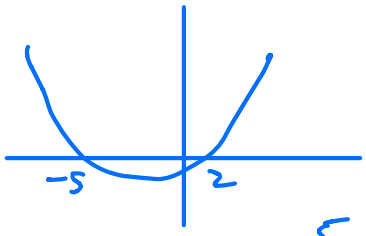
critical values $x = -1$
$x = -8$

Either $x > -1$
or $x < -8$

3) $x^2 + 3x - 10 \leq 0$

$(x+5)(x-2) \leq 0$

critical values $x = -5$
$x = 2$

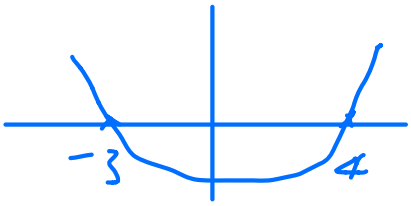


$-5 \leq x \leq 2$

4) $x^2 - x - 12 \geq 0$

$(x-4)(x+3) \geq 0$

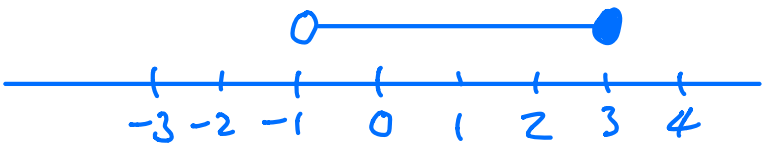
critical values $x = 4$
$x = -3$



Either $x \geq 4$
or $x \leq 3$

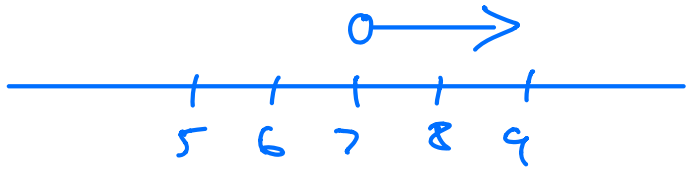
Linear Inequalities on the Number Line

Ex 1



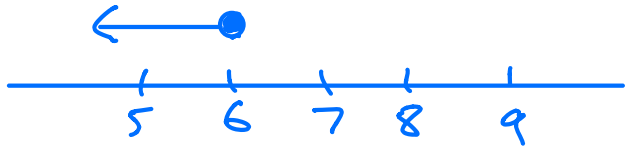
$-1 < x \leq 3$

Ex 2



$x > 7$

Ex 3



$x \leq 6$