

## Warm up

Find the zeros of  $x^2 - 4x - 5$ .

$$= (x-5)(x+1) \Rightarrow x=5, -1 \text{ are the zeros}$$

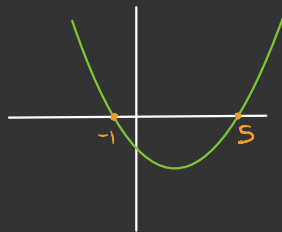
## Polynomial Inequalities

Solve  $x^2 - 4x - 5 > 0$

$$x^2 \Rightarrow \text{looks like } \cup$$

where is  $x^2 - 4x - 5 > 0$

$$(-\infty, -1) \cup (5, \infty)$$



## Ex

①  $x^2 + 3x - 5 \leq x + 3$

$$x^2 + 2x - 5 \leq 3$$

$$x^2 + 2x - 8 \leq 0$$

$$f(x) = (x+4)(x-2) \leq 0$$

Break up intervals by zeros

Intervals	$(-\infty, -4)$	$(-4, 2)$	$(2, \infty)$
Test Value	$f(-5) = 7$ +	$f(0) = -8$ -	$f(4) = 16$ +

The solution set is  $[-4, 2]$

$$(-5+4)(-5-2) = (-1)(-7) = 7$$

$$(0+4)(0-2) = (4)(-2) = -8$$

$$(4+4)(4-2) = (8)(2) = 16$$

② Solve  $x^3 > x$

$$x^3 - x > 0$$

$$x(x^2 - 1) > 0$$

$$f(x) = x(x-1)(x+1) > 0$$

$$(-2)(-2-1)(-2+1) = (-2)(-3)(-1) = -6$$

$$(-\frac{1}{2})(-\frac{1}{2}-1)(-\frac{1}{2}+1) = (-\frac{1}{2})(-\frac{3}{2})(\frac{1}{2}) = \frac{3}{8}$$

$$(\frac{1}{2})(\frac{1}{2}-1)(\frac{1}{2}+1) = (\frac{1}{2})(-\frac{1}{2})(\frac{3}{2}) = -\frac{3}{8}$$

$$(2)(2-1)(2+1) = (2)(1)(3) = 6$$

Intervals	$(-\infty, -1)$	$(-1, 0)$	$(0, 1)$	$(1, \infty)$
Test Value	$f(-2) = -6$ -	$f(-\frac{1}{2}) = \frac{3}{8}$ +	$f(\frac{1}{2}) = -\frac{3}{8}$ -	$f(2) = 6$ +

The solution set is  $(-1, 0) \cup (1, \infty)$

# Rational Inequalities

③ Solve  $\frac{3x}{x+6} < 0$

Find zeros and points where it's not defined

These are called critical values.

Undefined at  $x = -6$

Zero at  $x = 0$

$$\frac{3(0)}{0+6} = \frac{0}{6} = 0$$

Break up interval using  
the critical values

$$f(-8) = \frac{3(-8)}{-8+6} = \frac{-24}{-2} = 12$$

$$f(-2) = \frac{3(-2)}{-2+6} = \frac{-6}{4} = -\frac{3}{2}$$

$$f(3) = \frac{3(3)}{3+6} = \frac{9}{9} = 1$$

Interval	$(-\infty, -6)$	$(-6, 0)$	$(0, \infty)$
Test Value	$f(-8) = 12$ +	$f(-2) = -\frac{3}{2}$ -	$f(3) = 1$ +

Solution set is  $(-6, 0)$ .

④ Solve  $\frac{x+2}{2x} \geq 1$

DO NOT  
cross multiply!!!

$$\frac{x+2}{2x} - 1 \geq 0$$

$$\frac{x+2}{2x} - \frac{2x}{2x} \geq 0$$

$$\frac{x+2-2x}{2x} \geq 0$$

$$\frac{2-x}{2x} \geq 0$$

Undefined at  $x = 0$

Zero at  $x = 2$

$$f(-1) = \frac{2-(-1)}{2(-1)} = -\frac{3}{2}$$

$$f(1) = \frac{2-(1)}{2(1)} = \frac{1}{2}$$

$$f(3) = \frac{2-(3)}{2(3)} = -\frac{1}{6}$$

Interval	$(-\infty, 0)$	$(0, 2)$	$(2, \infty)$
Test Value	$f(-1) = -\frac{3}{2}$ -	$f(1) = \frac{1}{2}$ +	$f(3) = -\frac{1}{6}$ -

Solution Set:  $(0, 2]$