

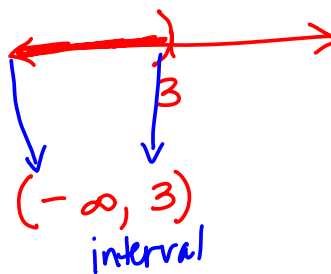
Solving Quadratic Inequalities

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Review – Linear Inequalities

Solve $3x - 2 < 7$

$$\begin{array}{r} +2 \quad +2 \\ \hline 3x < 9 \\ \frac{3x}{3} < \frac{9}{3} \\ x < 3 \end{array}$$



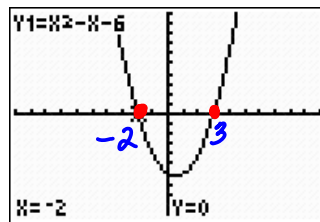
Review – Interval Notation and Graphs

$x \geq -2$		$[-2, \infty)$
$x \leq 7$		$(-\infty, 7]$
$x > 6$		$(6, \infty)$
$x < -4$		$(-\infty, -4)$

Review – Solutions of Quadratic Equations and Graph of Parabola

How do the solutions of a quadratic equation relate to the graph of the associated parabola?

$$x^2 - x - 6 = 0$$
$$(x - 3)(x + 2) = 0$$
$$x - 3 = 0 \text{ or } x + 2 = 0$$
$$x = 3 \text{ or } x = -2$$



x-intercepts of graph

Boundary Number Method

Steps to Solve Quadratic Inequalities

- 1) Solve associated equation.
- 2) Place these numbers on the number line.
- 3) Test a number from each region formed by the boundary numbers. *Shade true regions*
- 4) Determine sign to go on boundary numbers (parentheses or brackets). *<, > use ()*
≤, ≥ use []
- 5) Write solution in interval notation. *infinity gets ()*

Another example

Solve $2x^2 + 5x - 3 > 0$

① $2x^2 + 5x - 3 = 0$

$2 \cdot 3 = 6$
 $\frac{1}{6}$

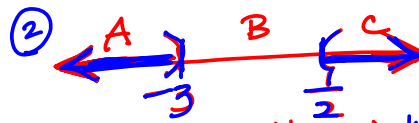
$2x^2 + 6x - x - 3 = 0$

$2x(x+3) - 1(x+3) = 0$

$(x+3)(2x-1) = 0$

$x+3=0$
 $x=3$

$2x-1=0$
 $x=1/2$



$(-\infty, 3) \cup (1/2, \infty)$

③ A: $x = -4$

$2(-4)^2 + 5(-4) - 3 > 0$
 $32 - 20 - 3 > 0$
 $9 > 0$ True

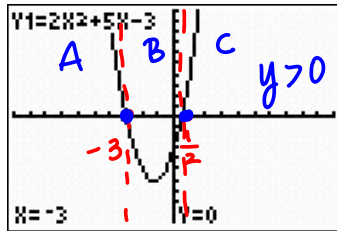
B: $x = 0$
 $2(0)^2 + 5(0) - 3 > 0$
 $-3 > 0$ F

C: $x = 1/2$
 $2(1/2)^2 + 5(1/2) - 3 > 0$
 $4 > 0$ True

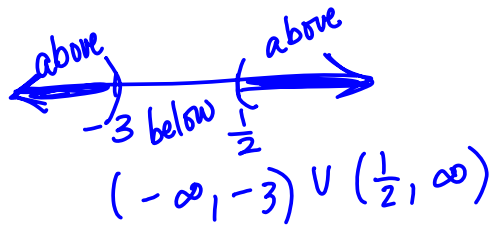
Using the calculator to check work

$$2x^2 + 5x - 3 > 0$$

2nd GRAPH



X	Y1	
-4	9	True
-2	0	
-1	-6	False
0	-3	False
1	4	True
2	15	True



Another Example

$$\left(\frac{1 - \sqrt{21}}{2}, \frac{1 + \sqrt{21}}{2} \right)$$

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

① $x^2 - x - 5 = 0$

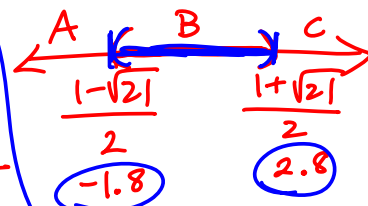
$a = 1, b = -1, c = -5$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-5)}}{2(1)}$$

$$x = \frac{1 \pm \sqrt{21}}{2}$$

$$x = \frac{1 + \sqrt{21}}{2}, \frac{1 - \sqrt{21}}{2}$$



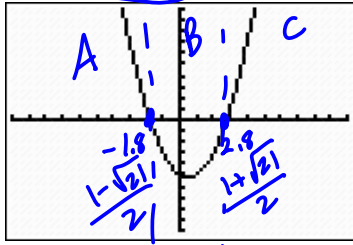
A: $x = 2$
 $(-2)^2 - (-2) - 5 < 0$
 $4 + 2 - 5 < 0$ $1 < 0$ F

B: $x = 0$ $0^2 - 0 - 5 < 0$ T
 C: $x = 3$ $(3)^2 - 3 - 5 < 0$ F

$$y_1 = x^2 - x - 5$$

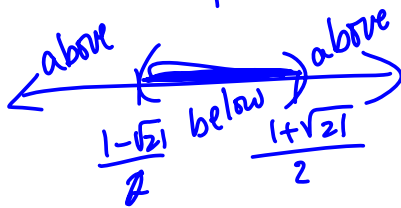
Use calculator to check

$$x^2 - x - 5 < 0 \quad \text{below } x\text{-axis}$$



X	Y1	
-3	7	F
-2	1	F
-1	-3	T
0	-5	T
1	-3	T
2	1	F
3	7	F

X=3



Examples

Solve $(x-3)^2 \geq -4$

①

$$(x-3)^2 = -4 \quad \text{sq. root}$$

$$x-3 = \pm \sqrt{-4}$$

$$x-3 = \pm 2i$$

$$x = 3 \pm 2i \quad \text{A: } x=0$$

not real $(0-3)^2 \geq -4$

$$9 \geq -4 \quad \text{True}$$

$$(x-3)^2 < -4$$

pos. < neg.

$$(x-3)^2 = -4$$

$$x = 3 \pm 2i$$

not real

never true

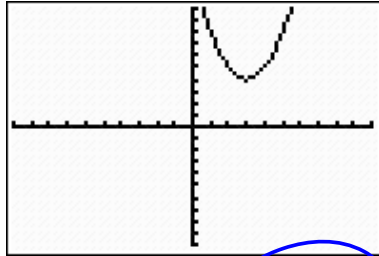
A



A: $x=0 \quad (0-3)^2 < -4$
 $9 < -4 \quad \text{False}$

Use calculator to check work

Graph $y = (x-3)^2 + 4$



$(x-3)^2 + 4 \geq 0$
above
x-axis
 $(-\infty, \infty)$
everywhere

$(x-3)^2 \geq -4$
 $(x-3)^2 < -4$ $(x-3)^2 + 4 < 0$ $(x-3)^2 + 4 = 0$

X	Y1	
3	4	
2	2	
1	2	
0	13	
-1	8	
-2	4	

X = -3

$(x-3)^2 + 4 < 0$
below
x-axis
 \emptyset
no where