LESSON MAKER PRO

Parabola Solution Paths

Solve quadratic inequalities with factors, signs, and graphs.

HIGH SCHOOL · MA.912.AR.3.3

MA.912.AR.3.3 "Given a mathematical or real-world context, write and solve one-variable quadratic inequalities over the real number system. Represent solutions algebraically or graphically."

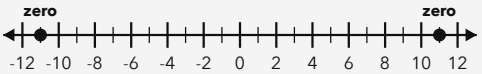
NAME _____ DATE _____

TRACK THE SIGNS

First move every term to one side so the inequality compares a quadratic expression to 0. Find the zeros, use them to split the number line into intervals, and determine where the expression has the needed sign. Include a zero for ≤ or ≥, and exclude it for < or >.

WORKED EXAMPLE

The number line marks the zeros of $q(x) = x^2 - 121$. Solve $q(x) > 0$.



1. Factor: $q(x) = (x - 11)(x + 11)$.
2. The zeros, -11 and 11, split the number line into three intervals.
3. Because the parabola opens up, $q(x)$ is positive outside the two zeros.

Answer: $x < -11$ or $x > 11$

PRACTICE 6 problems

1 Solve: $x^2 - 7x + 10 \geq 0$

ANSWER _____

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

ANSWER _____

3 Solve: $-x^2 + 9x - 14 \leq 0$

ANSWER _____

4 Solve: $(x + 1)(x - 6) > 0$

ANSWER _____

5 The number line marks the zeros of $f(x) = (x + 2)(x - 5)$. Use the marked zeros to solve $f(x) \leq 0$.



ANSWER _____

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

ANSWER _____

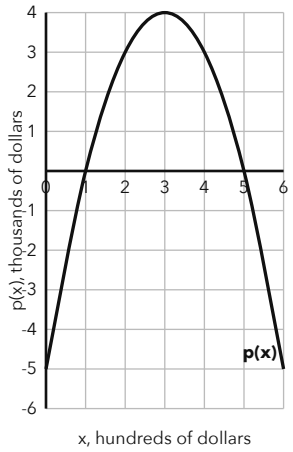
APPLY IT Show your work

1 A student video crew tracks a drone's height, in feet, with $h(t) = -t^2 + 10t + 6$, where t is time in seconds. Write and solve an inequality for the times when the drone is at least 22 feet high.

WORK SPACE

ANSWER _____

2 A student sells custom phone cases online. The graph shows p(x), the monthly profit in thousands of dollars, where x is the amount spent on online ads in hundreds of dollars. Use the graph to solve $p(x) \geq 0$.



ANSWER _____

CHALLENGE One step up

Solve the inequality, then explain why the endpoint values are included: $x^2 - 6x + 8 \leq 2x - 4$.

WORK SPACE AND ANSWER

ANSWER KEY

Parabola Solution Paths

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve: $x^2 - 7x + 10 \geq 0$	**$x \leq 2$ or $x \geq 5$**
2	Solve: $x^2 + x - 6 < 0$	**$-3 < x < 2$**
3	Solve: $-x^2 + 9x - 14 \leq 0$	**$x \leq 2$ or $x \geq 7$**
4	Solve: $(x + 1)(x - 6) > 0$	**$x < -1$ or $x > 6$**
5	The number line marks the zeros of $f(x) = (x + 2)(x - 5)$. Use the marked zeros to solve $f(x) \leq 0$.	**$-2 \leq x \leq 5$**
6	Solve: $x^2 - 2x + 5 > 0$	**all real numbers**

PART 2 · APPLY IT

1. **$-t^2 + 10t + 6 \geq 22$; $2 \leq t \leq 8$** Set the height expression greater than or equal to 22. Rearranging gives $t^2 - 10t + 16 \leq 0$, which factors as $(t - 2)(t - 8) \leq 0$.
2. **$1 \leq x \leq 5$** The profit is on or above the x-axis from $x = 1$ through $x = 5$. Both intercepts are included because the inequality allows profit equal to 0.

CHALLENGE

$2 \leq x \leq 6$. After rearranging, $x^2 - 8x + 12 \leq 0$, or $(x - 2)(x - 6) \leq 0$. The endpoints are included because the inequality is $\leq$.

Accept interval notation equivalent to each solution set. For graph-based items, accept correct closed endpoints when the quadratic equals 0 and the inequality is non-strict.