

Polynomial Inequalities Worksheet

Complete answer key with factoring notes and interval-notation solutions

This key follows the same 18 problems as the student worksheet. Equivalent interval-notation answers are acceptable.

Level 1 Answers

#	Reasoning / factorization	Solution
1	Critical values: -5, 2. Signs are +, -, +.	$(-\infty, -5) \cup (2, \infty)$
2	Critical values: -1, 4. The product is nonpositive between the zeros.	$[-1, 4]$
3	Critical values: -6, -2, 3. Signs are -, +, -, +.	$[-6, -2] \cup [3, \infty)$
4	Critical values: -4, 1, 5. Signs are -, +, -, +.	$(-\infty, -4) \cup (1, 5)$
5	Zeros: -3 and 2. The zero at 2 has even multiplicity, so the sign does not change there.	$[-3, \infty)$
6	An upward-opening quadratic is at or below the x-axis between its intercepts.	$[-4, 2]$

Level 2 Answers

#	Reasoning / factorization	Solution
7	Factor: $(x - 2)(x - 5) > 0$.	$(-\infty, 2) \cup (5, \infty)$
8	Factor: $(x + 4)(x - 3) \leq 0$.	$[-4, 3]$
9	Factor by grouping: $(x - 4)(x - 1)(x + 1) \geq 0$.	$[-1, 1] \cup [4, \infty)$
10	Factor by grouping: $(x - 3)(x + 1)(x + 3) < 0$.	$(-\infty, -3) \cup (-1, 3)$
11	Factor: $(2x + 1)(x - 3) \geq 0$.	$(-\infty, -1/2] \cup [3, \infty)$
12	Read the intervals where the graph is below the x-axis; strict inequality excludes zeros.	$(-\infty, -3) \cup (1, 4)$

Level 3 Answers

#	Reasoning / factorization	Solution
13	The factor $(x - 3)^2$ has even multiplicity. Sign is controlled by $(x + 1)(x - 5)$, except $x = 3$ is a zero.	$(-\infty, -1) \cup (5, \infty)$
14	The product is negative on $(1, 4)$, zero at 1 and 4, and also zero at the isolated even-multiplicity root $x = -2$.	$\{-2\} \cup [1, 4]$
15	Factor: $(x + 3)(x - 3)(x - 2) \geq 0$.	$[-3, 2] \cup [3, \infty)$
16	Factor: $(x^2 - 1)(x^2 - 4) = (x - 1)(x + 1)(x - 2)(x + 2)$.	$(-\infty, -2] \cup [-1, 1] \cup [2, \infty)$
17	Factor: $(x - 2)(x - 1)(x + 1)(x + 3) < 0$.	$(-3, -1) \cup (1, 2)$
18	The graph is nonnegative for $x < 1$, equals 0 at $x = 1$, is negative on $(1, 5)$, and is nonnegative again from $x = 5$ onward.	$(-\infty, 1] \cup [5, \infty)$

Accuracy note

The polynomial factorizations and inequality solution sets in this answer key were checked before publication. Repeated-root problems were verified using multiplicity-based sign analysis.