Polynomial Inequalities Worksheet

Sign charts, factoring, interval notation, graph interpretation, and three difficulty levels

Name: _____ Date: _____

1. Rewrite	2. Factor	3. Find zeros	4. Test signs	5. Write intervals
Put 0 on one side.	Factor completely.	Use zeros as boundaries.	Test each interval or use multiplicity.	Match >, <, ≥, or ≤.

Quick sign-chart reference

For (x + 3)(x - 1)(x - 4), the zeros -3, 1, and 4 divide the number line into four intervals. Since each zero has odd multiplicity, the sign changes at every zero.

Interval	(-∞, -3)	(-3, 1)	(1, 4)	(4, ∞)
Sign	Negative	Positive	Negative	Positive
Use for p(x) ≥ 0?	No	Yes	No	Yes

Reference solution: (x + 3)(x - 1)(x - 4) ≥ 0 gives [-3, 1] ∪ [4, ∞).

Level 1 - Build the Sign Chart

These expressions are already factored. Find the zeros, determine the sign on each interval, and write the solution in interval notation.

1. $(x - 2)(x + 5) > 0$

2. $(x + 1)(x - 4) \leq 0$

3. $(x - 3)(x + 2)(x + 6) \geq 0$

4. $(x + 4)(x - 1)(x - 5) < 0$

5. $(x - 2)^2(x + 3) \geq 0$

6. Graph interpretation: A quadratic has x-intercepts at -4 and 2 and opens upward. On what interval is $f(x) \leq 0$?

Show your sign chart or number-line work in the space below.

Level 2 - Factor First

Factor each polynomial completely before building a sign chart. Show the factorization and write the final solution in interval notation.

7. $x^2 - 7x + 10 > 0$

8. $x^2 + x - 12 \leq 0$

9. $x^3 - 4x^2 - x + 4 \geq 0$

10. $x^3 + x^2 - 9x - 9 < 0$

11. $2x^2 - 5x - 3 \geq 0$

12. Graph interpretation: A polynomial crosses the x-axis at $x = -3$, 1, and 4. The graph is below the x-axis on $(-\infty, -3)$ and $(1, 4)$. Solve $f(x) < 0$.

Factoring workspace

Level 3 - Multiplicity and Higher Degree

Track repeated zeros carefully. Odd multiplicity changes the sign; even multiplicity keeps the same sign on both sides of the zero.

13. $(x - 3)^2(x + 1)(x - 5) > 0$

14. $(x + 2)^2(x - 1)(x - 4) \leq 0$

15. $(x^2 - 9)(x - 2) \geq 0$

16. $x^4 - 5x^2 + 4 \geq 0$

17. $x^4 + x^3 - 7x^2 - x + 6 < 0$

18. Graph interpretation: A polynomial touches the x-axis at $x = -2$, crosses at $x = 1$ and $x = 5$, lies above the x-axis for $x < 1$, below it on $(1, 5)$, and above it again for $x > 5$. Solve $f(x) \geq 0$.

Optional extension

Choose any two problems and sketch a possible polynomial graph that matches your sign chart. Show the x-intercepts and indicate whether the graph crosses or touches the x-axis at each repeated zero.