Unit 1 · Equations and Inequalities Cheat Sheet

Unit 1 focus: linear, absolute value and quadratic equations

1 LINEAR EQUATIONS

Distribute, collect variable terms, then isolate.

Example: 4(x − 3) = 2x + 10
Distribute: 4x − 12 = 2x + 10
Collect: 2x = 22
Answer: x = 11

2 ABSOLUTE VALUE EQUATIONS

Isolate the absolute value, then split into two cases.

Example: |2x − 5| = 9
Cases: 2x − 5 = 9 or 2x − 5 = −9
Answer: x = 7 or x = −2

3 ABSOLUTE VALUE INEQUALITIES

|u| < a → −a < u < a. |u| > a → u < −a or u > a.

Example: |x + 1| ≤ 4
Compound: −4 ≤ x + 1 ≤ 4
Answer: −5 ≤ x ≤ 3

4 QUADRATIC FORMULA

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

Example: $2x^2 - 3x - 5 = 0$
Discriminant: 9 + 40 = 49
Roots: $\frac{3 \pm 7}{4}$
Answer: $x = \frac{5}{2}$ **or x = −1**

5 THE DISCRIMINANT

$b^2 - 4ac$	Roots
> 0	two real
= 0	one real (double)
< 0	two complex conjugates

6 QUICK REMINDERS & COMMON MISTAKES

✔ Do remember

- Isolate |…| before splitting into cases.
- Set quadratics equal to 0 before factoring.
- Check solutions in the original equation.

✘ Common mistakes

- |x − 3| = −2 has solutions: no solution
- |u| > a written as −a < u < a: two separate rays
- Dividing both sides by x: factor instead: you lose x = 0

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More practice: polynomial, rational and radical equations and inequalities

1 POLYNOMIAL EQUATIONS

Factor completely and use the zero-product property.

Example: $x^3 - 4x^2 - 5x = 0$
Factor: x(x − 5)(x + 1) = 0
Answer: x = 0, 5, −1

2 POLYNOMIAL INEQUALITIES

Find zeros, test each interval with a sign chart.

Example: $x^2 - x - 6 > 0$
Zeros: (x − 3)(x + 2): −2 and 3
Signs: + | − | +
Answer: x < −2 or x > 3

3 RATIONAL EQUATIONS

Multiply by the LCD; reject values that make a denominator 0.

Example: $\frac{3}{x-2} = \frac{x}{x-2} - 1$
Multiply by x − 2: 3 = x − (x − 2) = 2 ✗
Answer: No solution

4 RATIONAL INEQUALITIES

Critical points: zeros of the top AND bottom. The bottom's zeros are never included.

Example: $\frac{x-1}{x+3} \leq 0$
Critical: 1 and −3
Signs: + | − | +
Answer: −3 < x ≤ 1

5 RADICAL EQUATIONS

Isolate the radical, square both sides, CHECK for extraneous roots.

Example: $\sqrt{x+7} = x + 1$
Square: $x + 7 = x^2 + 2x + 1$
Factor: (x + 3)(x − 2) = 0
Answer: x = 2 (x = −3 is extraneous)

6 CHECK YOURSELF

- Did I check every root in the original equation?
- Did I exclude zeros of the denominator?
- Did I test every interval on my sign chart?
- Did I flip the inequality when multiplying by a negative?