Algebra Assessment: Equations and Proportional Relationships

Instructions

Complete all problems. Show clear work. Aim to finish in 30 minutes. Use exact values when radicals appear.

Context

Quadratic formula: For $ax^2 + bx + c = 0$ with $a \neq 0$, the solutions are

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

Proportional relationships: Two quantities x and y are proportional if $\frac{y}{x} = k$ (a constant), so $y = kx$. Example: If 3 books cost \$12, then $k = \frac{12}{3} = 4$ dollars per book, so 7 books cost $y = 4 \times 7 = \$28$.

Problems

1. Solve for x: $7x - 5 = 4x + 22$.
2. Solve for x: $3(2x - 1) = 5 - (x + 4)$.
3. Solve $x^2 - 9x + 18 = 0$.
4. Solve $4x^2 - 49 = 0$.
5. Solve $5x^2 + 30 = 0$.
6. Solve $2x^2 - 3x - 8 = 0$ using the quadratic formula.
7. A recipe uses 12 cups of water for 8 servings. How many cups of water are needed for 14 servings?
8. Two quantities are proportional. When $x = 18$, $y = 27$. Find y when $x = 30$.

9. A graph passes through $(2, 9)$ and represents a proportional relationship. Give the constant of proportionality and the equation relating y and x.

10. A store sells 5 notebooks for \$8.75. At the same rate, what is the price for 18 notebooks?

11. In a science lab, 45 grams of a substance produce 60 mL of solution. If the relationship is proportional, how many grams are needed for 160 mL?

12. A class plans a field trip. The cost is directly proportional to the number of students. If 24 students pay \$180 in total, what is the total cost for 31 students?