Quadratic Equations: Solving and Interpreting

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■ Concept Explanation

Interpreting the solutions of a quadratic equation is also vital. In the context of a problem, the solutions might represent the number of items, the cost, the time, or any other relevant quantity. For instance, if we're modeling the height of a projectile as a function of time using a quadratic equation, the solutions might give us the times at which the projectile reaches a certain height or the maximum height it achieves.

✏■ Worked Examples

Example 1

Problem: Solve the quadratic equation x^2 + 5x + 6 = 0

Solution:
To solve this equation, we first try to factor it. The equation can be factored as (x + 3)(x + 2) = 0. Setting each factor equal to zero gives us x + 3 = 0 and x + 2 = 0. Solving these equations gives us x = -3 and x = -2. Therefore, the solutions to the equation are x = -3 and x = -2.

Example 2

Problem: Solve the quadratic equation x^2 - 7x + 12 = 0

Solution:
This equation can also be factored as (x - 3)(x - 4) = 0. Setting each factor equal to zero gives us x - 3 = 0 and x - 4 = 0. Solving these equations gives us x = 3 and x = 4. Therefore, the solutions to the equation are x = 3 and x = 4.

Example 3

Problem: Solve the quadratic equation x^2 + 2x + 2 = 0 using the quadratic formula

Solution:
The quadratic formula is x = (-b ± √(b^2 - 4ac)) / (2a). For this equation, a = 1, b = 2, and c = 2. Substituting these values into the formula gives us x = (-(2) ± √((2)^2 - 4(1)(2))) / (2(1)). Simplifying

under the square root gives x = (-2 ± √(4 - 8)) / 2, which further simplifies to x = (-2 ± √(-4)) / 2. Since √(-4) = 2i, the solutions are x = (-2 ± 2i) / 2, which simplifies to x = -1 ± i.

■ Practice Questions

1. Solve the quadratic equation x^2 - 4x - 3 = 0 [EASY]

2. Find the solutions to the equation x^2 + 2x + 1 = 0 [EASY]

3. Solve the quadratic equation x^2 - 3x - 4 = 0 [MEDIUM]

4. Use the quadratic formula to solve the equation x^2 + x + 1 = 0 [MEDIUM]

5. Solve the equation x^2 - 2x - 6 = 0 and interpret the solutions in the context of a projectile's height over time [HARD]

6. Find the solutions to the equation x^2 + 4x + 4 = 0 and explain their significance [EASY]

7. Solve the quadratic equation x^2 - x - 2 = 0 and provide the solutions in simplest form [EASY]

8. Use the quadratic formula to solve the equation x^2 - 5x + 6 = 0 and compare the solutions to those obtained by factoring [MEDIUM]

■ Answer Key

For teacher/tutor reference

1. x = -1 or x = 3

2. x = -1

3. x = -1 or x = 4

4. x = (-1 ± √(-3)) / 2

5. x = 1 ± √7

6. x = -2

7. x = -2 or x = 1

8. x = 2 or x = 3