Lesson 28: The Quadratic Formula

Objective: Solve quadratic equations using the quadratic formula.

Students will be able to:

- Use the quadratic formula to solve a quadratic equation.
- Fully simplify solutions to quadratic equations obtained using the quadratic formula.
- Approximate a decimal solution to a quadratic equation for graphing purposes.

Prerequisite Knowledge:

- Identifying coefficients of a quadratic in standard form.
- Order of operations.
- Simplifying radicals.
- Evaluating expressions.

Lesson:

The *Quadratic Formula* states that the solutions to the equation $ax^2 + bx + c = 0$ are given by the formula

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

I - Motivating Example(s):

Example: Solve the given equation for all values of x.

$$x^2 - 4x - 1 = 0$$

$a = 1,\ b = -4,\ c = -1$ Identify $a, b,$ and c

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2(1)}$$ Use quadratic formula

$$x = \frac{4 \pm \sqrt{16 + 4}}{2}$$ Simplify

$$x = \frac{4 \pm \sqrt{20}}{2}$$ Discriminant is 20 (positive)

$$x = \frac{4}{2} \pm \frac{2\sqrt{5}}{2}$$ Split up fraction

$$x = 2 \pm \sqrt{5}$$ Our solutions

$$x \approx 2 \pm 2.2$$ $\sqrt{5} \approx 2.2$

$x \approx 4.2$ or $x \approx -0.2$ Decimal approximations

II - Demo/Discussion Problems:

Use the quadratic formula to find the roots of each of the following equations. If your answer contains a square root, find a decimal approximation.

1. $y = x^2 + 7x - 8$
2. $y = x^2 - 13x - 30$
3. $y = 25x^2 - 30x - 11$
4. $y = 4x^2 - 12x + 9$
5. $y = x^2 - 6x + 25$

III - Practice Problems:

Use the quadratic formula to find the roots of each of the following equations. If your answer contains a square root, find a decimal approximation.

1. $y = x^2 + 6$
2. $y = x^2 + 2x - 1$
3. $y = -3x^2 - 12x - 5$
4. $y = 3x^2 + 12x - 1$
5. $y = -5x^2 - 40x$
6. $y = x^2 - 8x + 15$
7. $y = x^2 + 4x - 2$
8. $y = x^2 + 16x - 2$
9. $y = 4x^2 + 10x$
10. $y = 5x^2 - 4x + 1$
11. $y = -x^2 + 3x - 9$
12. $y = x^2 + 6x + 9$

Solve each of the following equations using any means.

13. $4a^2 + 6 = 0$
14. $3k^2 + 2 = 0$
15. $2x^2 - 8x - 2 = 0$
16. $6n^2 - 1 = 0$
17. $2m^2 - 3 = 0$
18. $5p^2 + 2p + 6 = 0$
19. $3r^2 - 2r - 1 = 0$
20. $2x^2 - 2x - 15 = 0$
21. $4n^2 - 36 = 0$
22. $3b^2 + 6 = 0$
23. $v^2 - 4v - 5 = -8$
24. $2x^2 + 4x + 12 = 8$
25. $2a^2 + 3a + 14 = 6$
26. $6n^2 - 3n + 3 = -4$
27. $3k^2 + 3k - 4 = 7$
28. $4x^2 - 14 = -2$
29. $7x^2 + 3x - 16 = -2$
30. $4n^2 + 5n = 7$
31. $2p^2 + 6p - 16 = 4$
32. $m^2 + 4m - 48 = -3$
33. $3n^2 + 3n = -3$
34. $3b^2 - 3 = 8b$
35. $2x^2 = -7x + 49$
36. $3r^2 + 4 = -6r$
37. $5x^2 = 7x + 7$
38. $6a^2 = -5a + 13$
39. $8n^2 = -3n - 8$
40. $6v^2 = 4 + 6v$
41. $2x^2 + 5x = -3$
42. $x^2 = 8$
43. $4a^2 - 64 = 0$
44. $2k^2 + 6k - 16 = 2k$
45. $4p^2 + 5p - 36 = 3p^2$
46. $12x^2 + x + 7 = 5x^2 + 5x$
47. $-5n^2 - 3n - 52 = 2 - 7n^2$
48. $7m^2 - 6m + 6 = -m$
49. $7r^2 - 12 = -3r$
50. $3x^2 - 3 = x^2$
51. $2n^2 - 9 = 4$
52. $6b^2 = b^2 + 7 - b$