The Quadratic Formula

Content Objective: The student recognizes the advantages of being able to use the quadratic formula for any quadratic equation.

Language Objective: Students will communicate the quadratic formula by singing a song and practicing algorithmic procedures with a partner. Student should also be able to communicate using the following vocabulary:

- Quadratic Formula
- roots
- solution
- zeros

Solve each equation by "Completing the Square."

1. $x^2 - 2x - 24 = 0$

$x^2 - 2x + 1 - 24 - 1 = 0$

$(x-1)^2 - 25 = 0$

$+25 \quad +25$

$\sqrt{(x-1)^2} = \sqrt{25}$

$x - 1 = \pm 5$

$+1 \quad +1$

$x = 5 + 1 = 6$

$x = -5 + 1 = -4$

$\frac{-2}{2} = (-1)^2 = 1$

2. $x^2 - 8x + 15 = 0$

$\frac{-8}{2} = (-4)^2 = 16$

$x^2 - 8x + 16 = -15 + 16$

$\sqrt{(x-4)^2} = \sqrt{1}$

$x - 4 = \pm 1$

$+4 \quad +4$

$x = 1 + 4 = 5$

$x = -1 + 4 = 3$

3. $3a^2 - 6a - 34 = 0$

$\frac{-2}{2} = (-1)^2 = 1$

$3(a^2 - 2a + 1) = 34 + 3$

$\frac{3(a-1)^2}{3} = \frac{37}{3}$

$\sqrt{(a-1)^2} = \sqrt{\frac{37}{3}}$

$a - 1 = \pm\sqrt{\frac{37}{3}}$

$+1 \quad +1$

$a = 1 \pm \sqrt{\frac{37}{3}}$

4. $4n^2 + 11n = 15$

Solve Completing the Square Yikes!

$4n^2+11n = 15$

$4\left(n^2 + \frac{11}{4}n + \frac{121}{64}\right) = 15 + \frac{121}{16}$

$\left(\frac{11}{4} \div 2\right) = \left(\frac{11}{8}\right)^2 = \frac{121}{64}$

$\frac{4\left(n + \frac{11}{8}\right)^2}{4} = \frac{\frac{361}{16}}{4}$

$\left(n + \frac{11}{8}\right)^2 = \frac{361}{64}$

Quadratic Formula

$ax^2 + bx + c = 0$

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

Solve each equation using the Quadratic Formula

1. $x^2 - 2x - 24 = 0$

$a = 1 \quad b = -2 \quad c = -24$

$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-24)}}{2(1)} = \frac{2 \pm \sqrt{4 + 96}}{2} = \frac{2 \pm \sqrt{100}}{2} = \frac{2 \pm 10}{2} = 1 \pm 5 = 6, -4$

2. $x^2 - 8x + 15 = 0$

$a = 1 \quad b = -8 \quad c = 15$

$x = \frac{8 \pm \sqrt{64 - 4(1)(15)}}{2(1)} = \frac{8 \pm \sqrt{64 - 60}}{2} = \frac{8 \pm \sqrt{4}}{2} = \frac{8 \pm 2}{2} = 4 \pm 1 = 5, 3$

3. $3a^2 - 6a - 34 = 0$

$a = 3 \quad b = -6 \quad c = -34$

$x = \frac{6 \pm \sqrt{36 - 4(3)(-34)}}{2(3)} = \frac{6 \pm \sqrt{36 + 408}}{6} = \frac{6 \pm \sqrt{444}}{6}$

4. $4n^2 + 11n = 15$

$4n^2 + 11n - 15 = 0$

$a = 4 \quad b = 11 \quad c = -15$

$x = \frac{-11 \pm \sqrt{11^2 - 4(-15)(4)}}{2(4)} = \frac{-11 \pm \sqrt{121 + 240}}{8} = \frac{-11 \pm \sqrt{361}}{8} = \frac{-11 \pm 19}{8}$

$= \frac{-11 + 19}{8}, \frac{-11 - 19}{8}$

$\frac{8}{8} = 1, \quad \frac{-30}{8} = \frac{-15}{4}$

Practice (simplify completely):

Solve for x.

$x^2 - 2x - 10 = 0$

$a = 1 \quad b = -2 \quad c = -10$

$x = \frac{2 \pm \sqrt{4 - 4(1)(-10)}}{2(1)}$

$x = \frac{2 \pm \sqrt{4 + 40}}{2}$

$x = \frac{2 \pm \sqrt{44}}{2} = \frac{2 \pm 2\sqrt{11}}{2} = 1 \pm \sqrt{11}$

Solve for x.

$$3x^2 + 4x + 8 = 2x^2 + 7$$

$-2x^2 \qquad -2x^2$

$x^2 + 4x + 8 = 7$

$-7 \quad -7$

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

$a = 1 \quad b = 4 \quad c = 1$

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

$$x = \frac{-4 \pm \sqrt{12}}{2}$$

$$x = \frac{-4 \pm 2\sqrt{3}}{2}$$

$$x = -2 \pm \sqrt{3}$$