Lesson 9-6 Solving Quadratic Equations by Using the Quadratic Formula

The Quadratic Formula can be used to solve equations in the form of $ax^2 + bx + c = 0$, where $a \neq 0$. The quadratic formula is

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

$Ax^2 + Bx + C = 0$

A. Solve $x^2 - 2x - 35 = 0$ by using the Quadratic Formula.

a = 1, b = -2, c = -35

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-35)}}{2(1)}$$ Substitute

$$x = \frac{2 \pm \sqrt{4 + +140}}{2}$$ Multiply

$$x = \frac{2 \pm \sqrt{144}}{2}$$ Add

$$x = \frac{2 \pm 12}{2}$$ Simplify

$$x = \frac{2+12}{2} \qquad x = \frac{2-12}{2}$$ Write 2 equations

$$x = \frac{14}{2} = 7 \qquad x = \frac{-10}{2} = -5$$

The solution set is $\{7, -5\}$

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Practice:

1. Solve $x^2 + x - 30 = 0$

a = 1. b = 1. c = -30

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

$$x = \frac{-1 \pm \sqrt{1^2-4(1)(-30)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{1+120}}{2}$$

$$x = \frac{-1 \pm \sqrt{121}}{2}$$

$$x = \frac{-1 \pm 11}{2}$$

$$x = \frac{-1+11}{2} \qquad x = \frac{-1-11}{2}$$

$$x = \frac{10}{2} = 5 \qquad x = \frac{-12}{2} = -6$$

The solution set is $\{5, -6\}$

2. Solve $x^2 + 7x + 6 = 0$

a = 1. b = 7. c = 6

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

$$x = \frac{-7 \pm \sqrt{7^2-4(1)(6)}}{2(1)}$$

$$x = \frac{-7 \pm \sqrt{49-24}}{2}$$

$$x = \frac{-7 \pm \sqrt{25}}{2}$$

$$x = \frac{-7 \pm 5}{2}$$

$$x = \frac{-7+5}{2} \qquad x = \frac{-7-5}{2}$$

$$x = \frac{-2}{2} = -1 \qquad x = \frac{-12}{2} = -6$$

The solution set is $\{-1, -6\}$

Solving Quadratic Equations by Using the Quadratic Formula

Irrational Roots

Solve $15x^2 - 8x = 4$ by using the Quadratic Formula. Round to the nearest tenth if necessary.

STEP 1 – Rewrite the equation in standard form.

$15x^2 - 8x = 4$ Original equation.

$15x^2 - 8x - 4 = 4 - 4$ Set equation equal to zero.

$15x^2 - 8x - 4 = 0$ Simplify

STEP 2 – Apply the Quadratic Formula $a = 15 \quad b = -8 \quad c = -4$

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

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(15)(-4)}}{2(15)}$$

$$x = \frac{8 \pm \sqrt{64 + 240}}{30}$$

$$x = \frac{8 \pm \sqrt{304}}{30}$$

$$x = \frac{(8 + \sqrt{304})}{30} \qquad x = \frac{8 - \sqrt{304}}{30}$$

$x = 0.85 \qquad x = -0.31$

The solution set is $\{0.85, -0.31\}$

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Practice:

3. Solve $20x^2 - 4x = 8$

$a = 20$, $b = -4$, $c = -8$

$20x^2 - 4x - 8 = 0$

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

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(20)(-8)}}{2(20)}$$

$$x = \frac{4 \pm \sqrt{16 + 640}}{40}$$

$$x = \frac{4 \pm \sqrt{656}}{40}$$

$$x = \frac{(4 + \sqrt{656})}{40} \qquad x = \frac{(4 - \sqrt{656})}{40}$$

$x = 0.74$ $\qquad$ $x = -0.54$

4. Solve $4x^2 + 2x = 17$

$-17 \quad -17$

$4x^2 + 2x - 17 = 0$

$a = 4$, $b = 2$, $c = -17$

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

$$x = \frac{-2 \pm \sqrt{2^2 - 4(4)(-17)}}{2(4)}$$

$$x = \frac{-2 \pm \sqrt{4 + 272}}{8}$$

$$x = \frac{-2 \pm \sqrt{276}}{8}$$

$$x = \frac{-2 + \sqrt{276}}{8} \text{ OR } x = \frac{-2 - \sqrt{276}}{8}$$

$x = 1.83$ OR $x = -2.33$

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1. Write equation in standard form
2. Identify a, b, + c.
3. APPS
4. - POLYSMLT
5. - POLYROOT Finder
   ORDER = 2; DECIMAL
   NEXT
6. enter A, B, + C
7. SOLVE

Lesson 9-6

Solving Quadratic Equations by Using the Quadratic Formula

In the Quadratic Formula, the expression under the radical sign, $b^2 - 4ac$, is called the discriminant. If the discriminant is positive, there are 2 real roots (answers) and the graph will cross the x-axis in two places, if the discriminant equals zero, there is 1 double root – (the graph touches the x-axis in 1 place), and if the discriminant is negative there are NO real roots (the graph does not cross the x-axis.)

Find the value of the discriminant. Then determine the number of real roots of the equation.

C. $4x^2 - 2x + 14 = 0$
(A = 4, B = −2, C = 14)

$b^2 - 4ac = (-2)^2 - 4(4)(14)$

$= 4 - 224 = -220$

There are NO real roots.

D. $x^2 + 24x = -144$

$x^2 + 24x + 144 = 0$
(A = 1, B = 24, C = 144)

$b^2 - 4ac = 24^2 - 4(1)(144)$

$= 576 - 576 = 0$

There are 1 real roots.

E. $1x^2 + 2x + 2 = 0$
(a = 1, b = 2, c = 2)

$b^2 - 4ac = 2^2 - 4(1)(2)$

$= 4 - 8 = -4$

There are NO real roots.

F. $-5x^2 + 10x = -1$

$-5x^2 + 10x + 1 = 0$
(a = −5, b = 10, c = 1)

$b^2 - 4ac = 10^2 + 4(-5)(1)$

$= 100 + 20 = 120$

There are 2 real roots.

COMPLETE AND TURN IN FOR A DAILY GRADE

① Write in standard form, ② Identify a, b, + c ③ Give the solution.

Solve using POLYSMLT APP

A) $0 = 2x^2 - 3x - 5$

$a = 2 \quad b = -3 \quad c = -5$

$\{2.5, -1\}$

B) $2x + 10 = 4x^2$

$-4x^2 \qquad -4x^2$

$-4x^2 + 2x + 10 = 0$

$a = -4, \ b = 2, \ c = 10$ $\{1.85, -1.35\}$

C) $3x^2 = 27$

$-27 \quad -27$

$3x^2 + 0x + -27 = 0$

$a = 3 \quad b = 0 \quad c = -27$

$\{3, -3\}$

*1) $x^2 - 9 = 0$

2) $5x^2 + 3x - 2 = 0$

3) $-2x^2 + 5x + 3 = 0$

4) $-3x^2 + 15x = 0$

5) $x^2 + 18x + 81 = 0$

6) $-3x^2 - 4x = -20$

7) $4x^2 = 16$

*8) $10 - x^2 = 3x$

*9) $-2x^2 + 6 = 4x$

*10) $3x^2 - 9 = -6x$