Solving Quadratic Equations with Quadratic Formula – Basics

Objective 1: Introduction to the Quadratic Formula

Identify the Values of a, b, and c in a Quadratic Equation

Write the equation in the form: $ax^2 + bx + c = 0$

- a is the coefficient of x^2
- b is the coefficient of x
- c is the constant term

Ex) Find the values of a, b, and c in each equation.

$-5x^2 + 8x - 2 = x + 2$

$3 = 9x - 4x^2$

Quadratic Formula

For a quadratic equation in the form $ax^2 + bx + c = 0$, the solutions are:

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

which can be combined into $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

The quantity under the radical, $b^2 - 4ac$, is called the "Discriminant".

Important Notes for using Quadratic Formula

- The equation must be in the form $ax^2 + bx + c = 0$.
- Be sure to put the entire numerator, $-b \pm \sqrt{b^2 - 4ac}$, over the denominator, $2a$.

Objective 1 Extra Practice

Find the values of $a,\ b,\ c$ in each equation.

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

2. $8x^2 - 2x - 14 = x^2 - 10x - 3$

Objective 2: Use the Quadratic Formula to get Exact Answers

Get Exact Solutions when the Discriminant is a Perfect Square

1. Gather all terms on one side of the equation into the form: $ax^2 + bx + c = 0$.
2. Plug the coefficients into the Quadratic Formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
3. Simplify results to lowest terms. These are exact answers.

Ex) Solve the equation using the Quadratic Formula. Write your answers in simplest form.

$$x^2 = 12 + x$$

Ex) Solve the equation using the Quadratic Formula. Write your answers in simplest form.

$$2 + 7x = -3x^2$$

Objective 2 Extra Practice

Solve each equation using the Quadratic Formula. Write your answers in simplest form.

1. $7x + 4x^2 = -3$

2. $2x^2 = 9x + 5$

Objective 3: Use the Quadratic Formula to get Approximate Solutions

Get Approximate Solutions when the Discriminant is NOT a Perfect Square

1. Gather all terms of the equation on one side, into the form: $ax^2 + bx + c = 0$.
2. Plug the coefficients into the Quadratic Formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
3. Simplify, then use a calculator and round to get approximate solutions.

Ex) Solve the equation using the Quadratic Formula. Round answers to thousandths place.

$$5x = 2 - 2x^2$$

Ex) Solve the equation using the Quadratic Formula. Round answers to hundredths place.

$$x^2 = 3x - 1$$

Objective 3 Extra Practice

Solve each equation using the Quadratic Formula. Round to the ten-thousandths place.

1. $x^2 = 5x + 9$

2. $2x^2 + 11x = -2 - x^2$

Objective 4: Determine if the Quadratic Formula has No Real Solutions

Use the Discriminant to determine if there are No Real Solutions

1. Gather all terms of the equation on one side, into the form: $ax^2 + bx + c = 0$.
2. Plug the coefficients into the Quadratic Formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
3. If the Discriminant $b^2 - 4ac$ is negative, then the equation has *No Real Solutions*.

Ex) Solve the equation using the Quadratic Formula.

$$2x = 5 + x^2$$

Ex) Solve the equation using the Quadratic Formula.

$$4x^2 = x - 6$$

Objective 4 Extra Practice

Solve each equation using the Quadratic Formula. Give the value of the discriminant.

1. $2x^2 + 3x = -7$

2. $4x - 10 = x^2$

Objective 5: Decide Which Approach to Use with the Quadratic Formula

Use the Quadratic Formula to find Exact, Approximate, or No Real Solutions

1. Gather all terms on one side of the equation into the form: $ax^2 + bx + c = 0$.
2. Plug the coefficients into the Quadratic Formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
3. Find the value of the Discriminant $b^2 - 4ac$.
   - If $b^2 - 4ac$ is a perfect square, then simplify to lowest terms to get *Exact Solutions.*
   - If $b^2 - 4ac$ is positive but not a perfect square, then use a calculator and round to get *Approximate Solutions.*
   - If $b^2 - 4ac$ is negative, then state *"No Real Solutions."*

Ex) Solve the equation using the Quadratic Formula. If answers are approximated, round to the ten-thousandths place.

$$-9x + 6 = -2x^2$$

Ex) Solve the equation using the Quadratic Formula. If answers are approximated, round to the ten-thousandths place.

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

Ex) Solve the equation using the Quadratic Formula. If answers are approximated, round to the ten-thousandths place.

$$4x^2 - 10x + 1 = x + 4$$

Objective 5 Extra Practice

Solve each equation using the Quadratic Formula. If answers are approximated, round to the hundredths place.

1. $5x + 3x^2 = 2$

2. $-7 - x = -2x^2$

3. $5x^2 = 3x - 2$