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## Solving Quadratic Equations Using the Quadratic Formula

## The Quadratic Formula

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

The Discriminant tells how many & what kind of solutions the quadratic has.

Formula for Discriminant:  $b^2 - 4ac$

Put the quadratic in standard form first!

★ If the discriminant is positive, then you will have 2 real solutions.

★ If the discriminant is negative, then you will have 2 imaginary solutions.

★ If the discriminant is zero, then you will have 1 real solution.

Determine the number & types of roots.

1.  $x^2 - 3x + 4 = 0$

$a=1$   
 $b=-3$   
 $c=4$

$$(-3)^2 - 4(1)(4)$$

$$= 9 - 16 = -7$$

2 imaginary solutions

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

$a=1$   
 $b=-4$   
 $c=4$

$$(-4)^2 - 4(1)(4)$$

$$= 16 - 16 = 0$$

1 real solution

3.  $x^2 - 5x + 4 = 0$

$a=1$   
 $b=-5$   
 $c=4$

$$(-5)^2 - 4(1)(4)$$

$$= 25 - 16 = 9$$

2 real solutions

Solve each equation using the quadratic formula.

4.  $x^2 + 9x + 14 = 0$

$a=1$   
 $b=9$   
 $c=14$

$$x = \frac{-9 \pm \sqrt{(9)^2 - 4(1)(14)}}{2(1)}$$

$$x = \frac{-9 \pm \sqrt{25}}{2}$$

$$x = \frac{-9 \pm 5}{2}$$

$$x = \frac{-9 + 5}{2} = \frac{-4}{2} = \boxed{-2}$$

$$x = \frac{-9 - 5}{2} = \frac{-14}{2} = \boxed{-7}$$

$$5. \quad x^2 + 3x = 7$$

$$\quad \quad \quad -7 \quad -7$$

$$\quad \quad \quad \hline$$

$$x^2 + 3x - 7 = 0$$

$$a = 1$$

$$b = 3$$

$$c = -7$$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(-7)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{37}}{2}$$

$$6. \quad x^2 + 10x + 2 = 0$$

$$a = 1$$

$$b = 10$$

$$c = 2$$

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

$$x = \frac{-10 \pm \sqrt{92}}{2}$$

$$\sqrt{92}$$

$$\begin{array}{r} 2 \sqrt{23} \\ 2 \sqrt{23} \\ \hline 4 \sqrt{23} \end{array}$$

$$x = \frac{-10 \pm 2\sqrt{23}}{2}$$

$$x = -5 \pm \sqrt{23}$$

$$7. \quad 3x^2 - x + 8 = 0$$

$$a = 3$$

$$b = -1$$

$$c = 8$$

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4(3)(8)}}{2(3)}$$

$$x = \frac{1 \pm \sqrt{-95}}{6}$$

$$x = \frac{1 \pm i\sqrt{95}}{6}$$

8. A garden measuring 12 meters by 16 meters is to have a pedestrian pathway installed all around it, increasing the total area to 285 square meters. What will be the width of the pathway?

9. The product of two consecutive negative integers is 1122. What are the numbers?

10. American astronauts working on a space station on the moon toss a ball into the air. The height of the ball is represented by the equation  $f(t) = -2.7t^2 + 13.5t + 14$ , where  $t$  represents time in seconds since the ball was thrown and  $f(t)$  represents the heights of the ball in feet. To the nearest hundredth of a second, after how much time does the ball hit the ground?