

Chapter 3

Quadratic Equations and Complex Numbers

1. Solving Quadratic Equations
2. Complex Numbers
3. Completing the Square
- 4. Using the Quadratic Formula**
5. Solving Nonlinear Systems
6. Quadratic Inequalities



3.4 - Using the Quadratic Formula

2 of 10

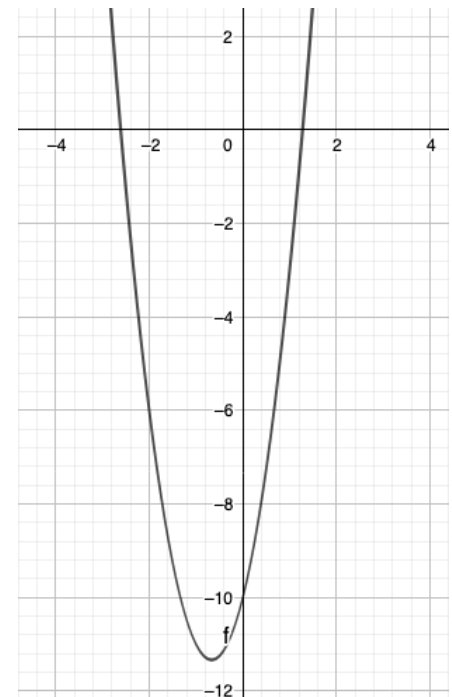
The Quadratic Formula

For equations of this form: $ax^2 + bx + c = 0$

The solution is:

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

$$3x^2 + 4x = 10$$



3.4 - Using the Quadratic Formula

3 of 10

Solve for one solution

$$4x^2 + 3x = -13x - 16$$

$$x = -2$$

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

Solve for two solutions

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

$$x = \frac{1 \pm \sqrt{161}}{10}$$

3.4 - Using the Quadratic Formula

4 of 10

Solve for imaginary solutions

$$5x^2 + 2x = -1$$

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

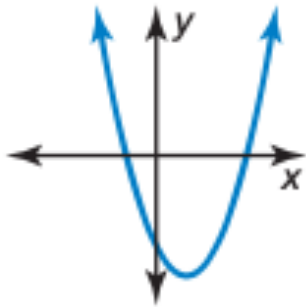
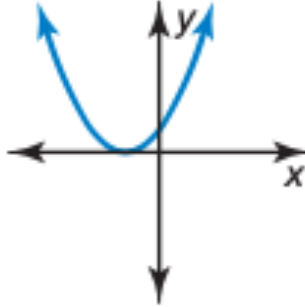
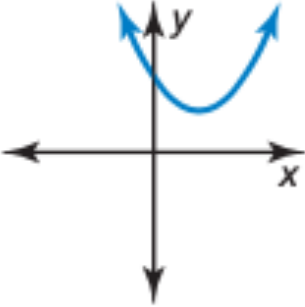
$$x = \frac{-1 \pm 2i}{5}$$

3.4 - Using the Quadratic Formula

5 of 10

Analyzing the Discriminant of $ax^2 + bx + c = 0$

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

Value of discriminant	$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
Number and type of solutions	Two real solutions	One real solution	Two imaginary solutions
Graph of $y = ax^2 + bx + c$	 <p>Two x-intercepts</p>	 <p>One x-intercept</p>	 <p>No x-intercept</p>

3.4 - Using the Quadratic Formula

6 of 10

Find the Discriminant and determine the number and type of solutions. Then find solution(s).

$$4x^2 + 8x + 4 = 0 \quad 0; \text{ one real : } x = -1$$

$$5x^2 = 8x - 13 \quad -196; \text{ two imaginary : } x = \frac{4 \pm 7i}{5}$$

$$4x^2 + 6x = -9 \quad -108; \text{ two imaginary : } x = \frac{-3 \pm 3i\sqrt{3}}{4}$$

3.4 - Using the Quadratic Formula

7 of 10

Equation for object launched: $h = -16t^2 + v_0t + h_0$

v_0 is initial velocity; h_0 is initial height

A juggler tosses a ball into the air. The ball leaves the juggler's hand 4 feet above the ground and has an initial vertical velocity of 40 feet per second. The juggler catches the ball when it falls back to a height of 3 feet. How long is the ball in the air?

about 2.52 sec

What is the maximum height?

29 ft



3.4 - Using the Quadratic Formula

Find the Quadratic

$$x = \frac{-2 \pm \sqrt{-19}}{4}$$

8 of 10

3.4 - Using the Quadratic Formula

9 of 10

Find the Quadratic

$$\left(x - \frac{-2 + \sqrt{-19}}{4}\right) \left(x - \frac{-2 - \sqrt{-19}}{4}\right) = 0$$

$$x = \frac{-2 \pm \sqrt{-19}}{4}$$

$$\left(4x - (-2 + \sqrt{-19})\right) \left(4x - (-2 - \sqrt{-19})\right) = 0$$

$$\left(4x - (-2 + \sqrt{-19})\right) \left(4x - (-2 - \sqrt{-19})\right) = 0$$

$$(4x + 2 - \sqrt{-19})(4x + 2 + \sqrt{-19}) = 0$$

$$(4x + 2)^2 - (\sqrt{-19})^2 = 0$$

$$16x^2 + 16x + 4 - (-19) = 0$$

$$16x^2 + 16x + 23 = 0$$

3.4 - Using the Quadratic Formula

10 of 10

Find the Quadratic

$$x = \frac{-8 \pm \sqrt{-176}}{-10}$$

$$5x^2 - 8x + 12 = 0$$

