3.2 - Complex Numbers

Warmup

1. $\sqrt{-36}$

2. $\sqrt{-40}$

3. $\sqrt{5} \cdot \sqrt{-10}$

4. $2\sqrt{-3} + 4\sqrt{-3}$

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

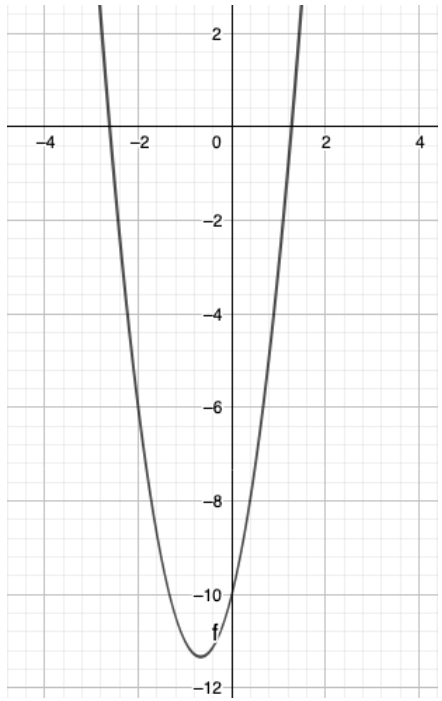
The Quadratic Formula

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

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

Solve for one solution

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

$$x = -2$$

Solve for two solutions

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

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

3.4 - Using the Quadratic Formula

Solve for imaginary solutions

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

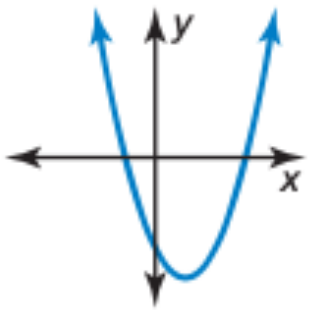
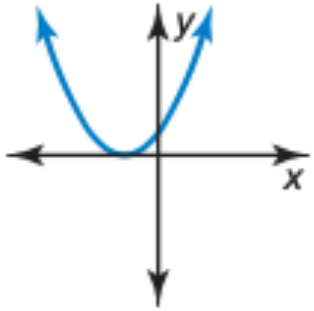
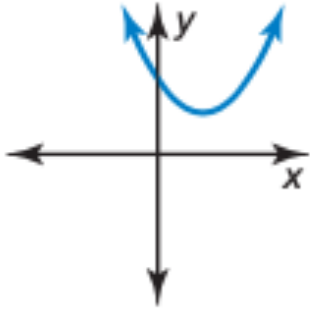
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

3.4 - Using the Quadratic Formula

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ ← 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 $y = ax^2 + bx + c$	 Two x-intercepts	 One x-intercept	 No x-intercept

3.4 - Using the Quadratic Formula

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

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

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

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

3.4 - Using the Quadratic Formula

Equation for object launched: $h = -16t^2 + v_0 t + h_0$

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

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

3.4 - Using the Quadratic Formula

Find the Quadratic

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

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

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

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

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

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

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

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

3.4 - Using the Quadratic Formula

Find the Quadratic

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

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