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# All Systems Go!

## Systems of Quadratic Equations

### Warm Up

Solve each system of equations.

1. $\begin{cases} y = 2x - 5 \\ y = x - 1 \end{cases}$

2. $\begin{cases} y = -3x + 2 \\ y = 5x - 6 \end{cases}$

3. $\begin{cases} y = -2x + 7 \\ y = -4x + 3 \end{cases}$

4. $\begin{cases} y = 3x + 7 \\ y = x + 1 \end{cases}$

### Learning Goal

- Solve systems of a linear equation and a quadratic equation.

You have solved systems of linear equations graphically by determining the point of intersection and algebraically using substitution. How can you use these same methods to solve systems involving a linear and a quadratic equation?

GETTING STARTED

## Block That Kick!

A punter kicks a football. The height of the football, in meters, is modeled by the function $h(t) = -4.9t^2 + 20t + 0.75$, where $t$ represents time, in seconds. A blocker can only attempt to knock down the football as it travels upward from the punter's foot. The height in meters of the approaching blocker's hands is modeled by the function $h(t) = -0.6t + 3$, where $t$ represents the same time. Can the blocker knock down the football?

1. **Describe the shape of the functions that model the football's height over time and the height of the blocker's hands over time.**

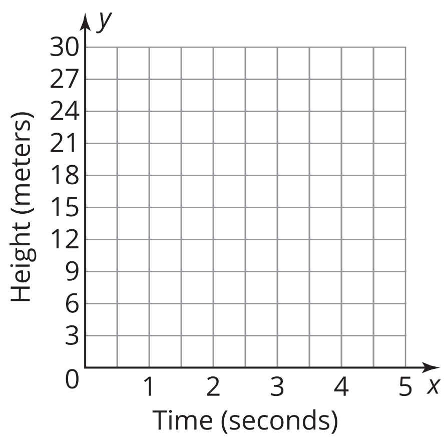
2. **Sketch a graph of the situation. Do you think it is possible for the blocker to knock down the football? Explain your reasoning.**

ACTIVITY
**2.1**

# Modeling a System with a Linear and a Quadratic Equation

A system of equations can involve nonlinear equations, such as quadratic equations. The scenario described in the previous activity models the relationship between a quadratic and a linear equation.

**1. Use technology to sketch the graph of the system described in the previous activity.**




**2. How many solutions does the system have? Explain your reasoning.**

**3. Does every solution make sense in the context of the problem situation? Explain your reasoning.**

**4. Use the graph to approximate at what point the blocker can block the football. Interpret your solution in the context of the problem.**

ACTIVITY
2.2

# Solving a System With a Linear and a Quadratic Equation

Methods for solving a system of nonlinear equations can be similar to methods for solving a system of linear equations.

**1. Consider the system of a linear equation and a quadratic equation shown.**

$$\begin{cases} y = 2x + 7 \\ y = x^2 + 4 \end{cases}$$

**a. Write a new equation you can use to solve this system.**

**b. Solve the resulting equation for *x*.**

**c. Calculate the corresponding values for *y*.**

**d. Identify the solution(s) to the system of equations.**

**Ask yourself:**

Since *y* is equal to two different expressions, can you set the expressions equal to each other?

e. Graph each equation of the system and calculate the points of intersection.

f. What do you notice about the solutions you calculated algebraically and graphically?

2. Think about the graphs of a linear equation and a quadratic equation. Describe the different ways in which the two graphs can intersect and provide a sketch of each case.

**3. Solve each system of equations algebraically over the set of real numbers. Then verify the solution graphically.**

**a.** $\begin{cases} y = -2x + 4 \\ y = 4x^2 + 2x + 5 \end{cases}$

**b.** $\begin{cases} y = -4x - 7 \\ y = 3x^2 + x - 3 \end{cases}$

NOTES

# TALK the TALK

## System Solutions

1. **A system of equations consisting of two linear equations has how many possible solutions?**

2. **A system of equations consisting of a linear equation and a quadratic equation has how many possible solutions?**

3. **Explain why a system of equations consisting of a linear equation and a quadratic equation cannot have an infinite number of solutions.**