# Graphing Linear Equations and Identifying Key Features

## Introduction to Graphing Linear Equations

*Graphing linear equations is a fundamental concept in mathematics. In this activity, you will learn how to graph linear equations and identify key features such as x-intercept and axis symmetry.*

A linear equation is an equation in which the highest power of the variable is 1. The general form of a linear equation is y = mx + b, where m is the slope and b is the y-intercept. The x-intercept is the point where the graph crosses the x-axis, and the axis symmetry is the line that divides the graph into two equal parts.

## Section 1: Multiple Choice Questions

*Choose the correct answer for each question.*

1. What is the x-intercept of the linear equation y = 2x + 1?

2. What is the axis symmetry of the linear equation y = x^2 + 1?

3. What is the y-intercept of the linear equation y = -x + 2?

## Section 2: Short Answer Questions

*Show your work and explain your answers.*

1. Graph the linear equation y = x - 2 and identify the x-intercept and y-intercept.

2. Identify the axis symmetry of the linear equation y = 2x + 1.

3. Solve the equation 2x + 1 = 5 for x and graph the solution on a coordinate plane.

## Section 3: Word Problems

*Read each problem carefully and show your work.*

1. Tom has been saving money for a new bike and has $120 in his savings account. He wants to buy a bike that costs $180. If he saves $10 per week, how many weeks will it take him to have enough money to buy the bike? Use a linear equation to model the situation and identify the x-intercept and y-intercept.

2. A company is producing a new product and wants to determine the cost of production. The cost of producing x units is given by the equation C(x) = 2x + 100. Graph the equation and identify the x-intercept and y-intercept.

## Section 4: Graphing Activities

*Graph each equation and identify the x-intercept and y-intercept.*

1. Graph the linear equation y = x + 1 and identify the x-intercept and y-intercept.
2. Graph the linear equation y = -x - 2 and identify the x-intercept and y-intercept.
3. Graph the linear equation y = 2x - 3 and identify the x-intercept and y-intercept.

## Section 5: Challenge Questions

*Show your work and explain your answers.*

1. Graph the system of linear equations:
2. Identify the axis symmetry of the linear equation y = x^3 + 1.



3. Solve the equation x - 2y = 3 for y and graph the solution on a coordinate plane.

## Graphing Quadratic Equations

A quadratic equation is an equation in which the highest power of the variable is 2. The general form of a quadratic equation is y = ax^2 + bx + c, where a, b, and c are constants. The graph of a quadratic equation is a parabola, which is a U-shaped curve that opens upwards or downwards.

### Example 1: Graphing a Quadratic Equation

Graph the quadratic equation y = x^2 + 2x - 3. Identify the x-intercepts, y-intercept, and vertex of the parabola.

### Group Activity: Graphing Quadratic Equations

Work in pairs to graph the following quadratic equations: y = x^2 - 4x + 4, y = x^2 + 2x - 1, and y = x^2 - 2x - 3. Identify the x-intercepts, y-intercept, and vertex of each parabola.

## Identifying Key Features of Quadratic Equations

The key features of a quadratic equation are the x-intercepts, y-intercept, and vertex of the parabola. The x-intercepts are the points where the graph crosses the x-axis, the y-intercept is the point where the graph crosses the y-axis, and the vertex is the lowest or highest point on the graph.

### Case Study: Identifying Key Features

Identify the x-intercepts, y-intercept, and vertex of the quadratic equation $y = x^2 + 4x + 4$. Explain how you found each of these key features.

### Reflection: Understanding Quadratic Equations

Reflect on what you have learned about graphing and identifying key features of quadratic equations. How can you apply this knowledge to real-world problems?

## Solving Systems of Linear and Quadratic Equations

A system of linear and quadratic equations is a set of two or more equations that contain both linear and quadratic terms. To solve a system of linear and quadratic equations, we can use substitution or elimination methods.

### Example 2: Solving a System of Linear and Quadratic Equations

Solve the system of equations: y = x^2 + 2x - 3 and y = 2x - 1. Use the substitution method to find the solution.

### Group Activity: Solving Systems of Linear and Quadratic Equations

Work in pairs to solve the following systems of linear and quadratic equations: y = x^2 - 4x + 4 and y = x - 2, y = x^2 + 2x - 1 and y = 2x + 1. Use the substitution or elimination method to find the solution.

## Applications of Linear and Quadratic Equations

Linear and quadratic equations have many real-world applications, such as modeling population growth, optimizing business processes, and predicting weather patterns. By understanding how to graph and solve linear and quadratic equations, we can make informed decisions and predictions in a variety of fields.

### Case Study: Application of Linear and Quadratic Equations

A company is producing a new product and wants to determine the optimal price to charge. The cost of producing x units is given by the equation C(x) = 2x + 100, and the revenue is given by the equation R(x) = 10x - 0.1x^2. Use linear and quadratic equations to find the optimal price and quantity to produce.

### Reflection: Real-World Applications

Reflect on the real-world applications of linear and quadratic equations. How can you apply this knowledge to your own life or career?

## Assessment and Evaluation

To assess your understanding of graphing and solving linear and quadratic equations, complete the following exercises and problems. Use the concepts and techniques learned in this unit to solve each problem.

### Exercise 1: Graphing Linear Equations

Graph the linear equation y = 2x - 3. Identify the x-intercept and y-intercept.

### Group Activity: Solving Quadratic Equations

Work in pairs to solve the following quadratic equations: x^2 + 4x + 4 = 0, x^2 - 2x - 3 = 0. Use the quadratic formula to find the solutions.

## Conclusion and Review

In this unit, we learned how to graph and solve linear and quadratic equations. We also explored real-world applications of these equations and assessed our understanding through exercises and problems. Review the key concepts and techniques learned in this unit to reinforce your understanding.

### Case Study: Review of Linear and Quadratic Equations

Review the key features of linear and quadratic equations, including x-intercepts, y-intercepts, and vertices. Explain how to graph and solve each type of equation.

### Reflection: Unit Review

Reflect on what you have learned in this unit. What concepts were challenging for you? What strategies can you use to reinforce your understanding of linear and quadratic equations?

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