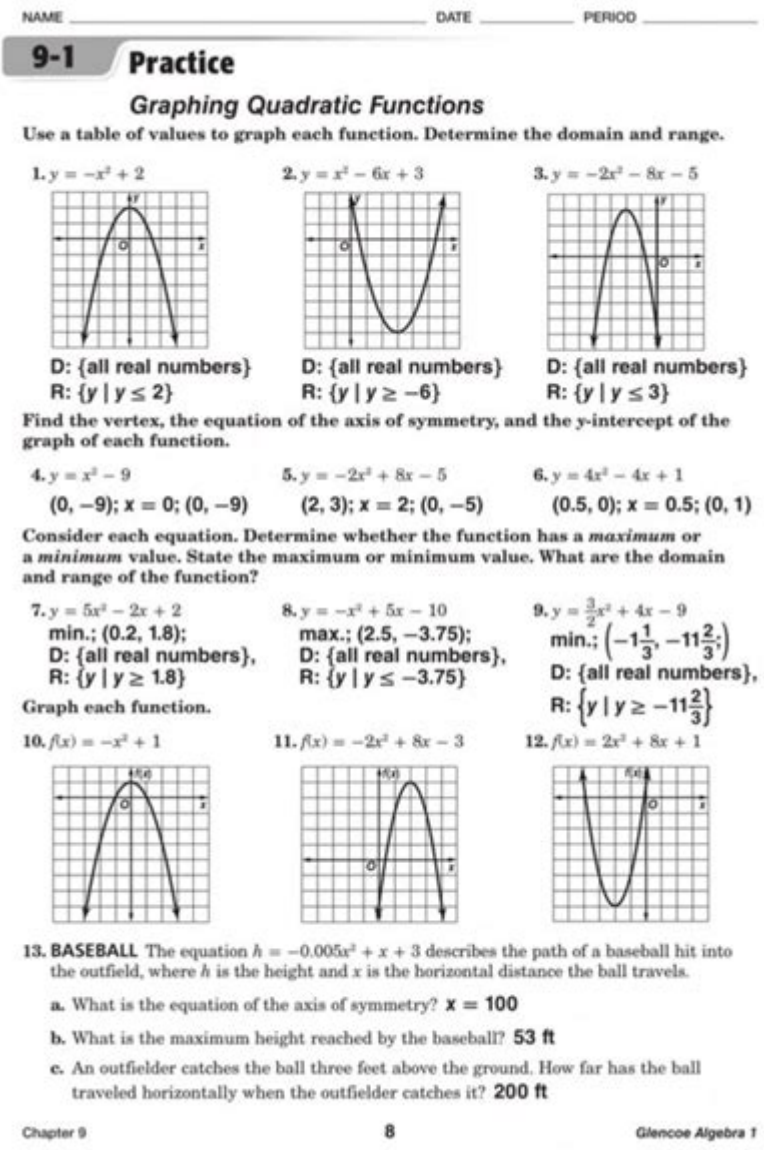
Worksheet Graphing Quadratics From Standard Form



NAME _____ DATE _____ PERIOD _____

9-1 Practice

Graphing Quadratic Functions

Use a table of values to graph each function. Determine the domain and range.

1. $y = -x^2 + 2$

D: {all real numbers}
R: $\{y \mid y \leq 2\}$

2. $y = x^2 - 6x + 3$

D: {all real numbers}
R: $\{y \mid y \geq -6\}$

3. $y = -2x^2 - 8x - 5$

D: {all real numbers}
R: $\{y \mid y \leq 3\}$

Find the vertex, the equation of the axis of symmetry, and the y-intercept of the graph of each function.

4. $y = x^2 - 9$
(0, −9); x = 0; (0, −9)

5. $y = -2x^2 + 8x - 5$
(2, 3); x = 2; (0, −5)

6. $y = 4x^2 - 4x + 1$
(0.5, 0); x = 0.5; (0, 1)

Consider each equation. Determine whether the function has a *maximum* or a *minimum* value. State the maximum or minimum value. What are the domain and range of the function?

7. $y = 5x^2 - 2x + 2$
min.; (0.2, 1.8);
D: {all real numbers},
R: $\{y \mid y \geq 1.8\}$

8. $y = -x^2 + 5x - 10$
max.; (2.5, −3.75);
D: {all real numbers},
R: $\{y \mid y \leq -3.75\}$

9. $y = \frac{3}{2}x^2 + 4x - 9$
min.; $\left(-1\frac{1}{3}, -11\frac{2}{3}\right)$
D: {all real numbers},
R: $\left\{y \mid y \geq -11\frac{2}{3}\right\}$

Graph each function.

10. $f(x) = -x^2 + 1$

11. $f(x) = -2x^2 + 8x - 3$

12. $f(x) = 2x^2 + 8x + 1$

13. **BASEBALL** The equation $h = -0.005x^2 + x + 3$ describes the path of a baseball hit into the outfield, where h is the height and x is the horizontal distance the ball travels.

a. What is the equation of the axis of symmetry? x = 100

b. What is the maximum height reached by the baseball? 53 ft

c. An outfielder catches the ball three feet above the ground. How far has the ball traveled horizontally when the outfielder catches it? 200 ft

Chapter 9 8 Glencoe Algebra 1

Worksheet graphing quadratics from standard form is a fundamental concept in algebra that allows students to understand the properties and behaviors of quadratic functions. Quadratic functions, represented in the standard form \(y = ax^2 + bx + c \), are polynomial expressions that graph as parabolas. This article will delve into how to graph these functions, emphasizing the key components needed for a successful graphing experience. It will cover the standard form of a quadratic function, the significance of its coefficients, the process of finding critical points, and the steps involved in graphing quadratics effectively.

Understanding the Standard Form of Quadratic Functions

Quadratic functions take the form $y = ax^2 + bx + c$, where:

- a: the coefficient of x^2
- b: the coefficient of x
- c: the constant term

The coefficient a determines the direction of the parabola:

- If $a > 0$: the parabola opens upwards.
- If $a < 0$: the parabola opens downwards.

The graph of a quadratic function is symmetric about a vertical line known as the axis of symmetry, which can be calculated using the formula:

$$
x = -\frac{b}{2a}
$$

This axis of symmetry helps in locating the vertex of the parabola, which is the highest or lowest point of the graph, depending on the value of a.

Key Components of Quadratic Functions

When graphing quadratics, it's important to identify the key components that will help in sketching the graph accurately. These components include:

1. Vertex

The vertex is the point where the parabola changes direction. It can be found using the axis of symmetry calculated earlier. To find the corresponding y-coordinate of the vertex, substitute the x-value back into the quadratic equation:

$$
y = a\left(-\frac{b}{2a}\right)^2 + b\left(-\frac{b}{2a}\right) + c
$$

The vertex coordinates are thus $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$.

2. Axis of Symmetry

As previously mentioned, the axis of symmetry is the vertical line that divides the parabola into two mirror-image halves. Its equation is given by:

$$
x = -\frac{b}{2a}
$$

3. Y-Intercept

The y-intercept of a quadratic function is found by evaluating the function at $x = 0$. This gives the point $(0, c)$, where c is the constant term.

4. X-Intercepts (Roots)

The x-intercepts of the quadratic function can be found by solving the equation $ax^2 + bx + c = 0$ using various methods such as factoring, completing the square, or applying the quadratic formula:

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

The discriminant $b^2 - 4ac$ determines the nature of the roots:

- If $b^2 - 4ac > 0$: two distinct real roots (the parabola crosses the x-axis at two points).
- If $b^2 - 4ac = 0$: one real root (the parabola touches the x-axis at one point).
- If $b^2 - 4ac < 0$: no real roots (the parabola does not intersect the x-axis).

Steps to Graph Quadratic Functions from Standard Form

To graph a quadratic function from its standard form, follow these systematic steps:

Step 1: Identify the Coefficients

From the standard form $y = ax^2 + bx + c$, identify the values of a, b, and c.

Step 2: Calculate the Vertex

1. Find the x-coordinate of the vertex using the formula $x = -\frac{b}{2a}$.

2. Substitute this value back into the original equation to get the y-coordinate.

Step 3: Determine the Axis of Symmetry

Use the x-coordinate of the vertex to write the equation of the axis of symmetry.

Step 4: Find the Y-Intercept

Evaluate the function at $x = 0$ to find the y-intercept $(0, c)$.

Step 5: Calculate the X-Intercepts

Use the quadratic formula or another method to find the x-intercepts. If the discriminant is negative, note that the parabola does not touch or cross the x-axis.

Step 6: Plot Key Points

1. Plot the vertex, y-intercept, and x-intercepts on a coordinate plane.
2. Use the axis of symmetry to find additional points by selecting values of x that are equidistant from the axis.

Step 7: Draw the Parabola

Connect the plotted points with a smooth curve, ensuring that the shape reflects the direction of the parabola (upward or downward based on the sign of a).

Example of Graphing a Quadratic Function

Let’s consider the quadratic function $y = 2x^2 - 4x + 1$. We will go through the steps outlined above.

Step 1: Identify the Coefficients

- $a = 2$
- $b = -4$
- $c = 1$

Step 2: Calculate the Vertex

$$
x = -\frac{-4}{2 \cdot 2} = 1
$$
Substituting $x = 1$ back into the equation:

$$
y = 2(1)^2 - 4(1) + 1 = 2 - 4 + 1 = -1
$$

So, the vertex is $(1, -1)$.

Step 3: Determine the Axis of Symmetry

The axis of symmetry is $x = 1$.

Step 4: Find the Y-Intercept

Evaluate the function at $x = 0$:

$$
y = 2(0)^2 - 4(0) + 1 = 1
$$

So, the y-intercept is $(0, 1)$.

Step 5: Calculate the X-Intercepts

Using the quadratic formula:

$$
x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \cdot 2 \cdot 1}}{2 \cdot 2} = \frac{4 \pm \sqrt{16 - 8}}{4} = \frac{4 \pm \sqrt{8}}{4} = \frac{4 \pm 2\sqrt{2}}{4} = 1 \pm \frac{\sqrt{2}}{2}
$$

Thus, the x-intercepts are approximately $(1 + 0.707, 0)$ and $(1 - 0.707, 0)$.

Step 6: Plot Key Points

Plot the points: vertex $(1, -1)$, y-intercept $(0, 1)$, and the x-intercepts.

Step 7: Draw the Parabola

Connect the points with a smooth curve to form the parabola.

Conclusion

Graphing quadratics from standard form is an essential skill in algebra that lays the foundation for understanding more complex functions. By mastering the process of identifying the vertex, axis of symmetry, and intercepts, students can effectively graph any quadratic function. Practice is key, and using worksheets focusing on graphing quadratics will reinforce these concepts and improve graphing skills. As students gain confidence in their ability to graph quadratics, they will find themselves better prepared for advanced mathematical concepts and applications.

Frequently Asked Questions

What is the standard form of a quadratic equation?

The standard form of a quadratic equation is written as $y = ax^2 + bx + c$, where a, b, and c are constants and $a \neq 0$.

How can I identify the vertex of a quadratic function in standard form?

The vertex of the quadratic function can be found using the formula $x = -b/(2a)$ for the x-coordinate, and then substituting this x value back into the equation to find the y-coordinate.

What are the steps to graph a quadratic function from standard form?

To graph a quadratic function from standard form, first identify the vertex, determine the axis of symmetry, calculate the y-intercept (where x=0), plot these points, and then sketch the parabola opening upwards or downwards based on the sign of 'a'.

What does the 'a' value in the standard form of a quadratic indicate about the graph?

'a' determines the direction and width of the parabola. If 'a' is positive, the parabola opens upwards; if negative, it opens downwards. The larger the absolute value of 'a', the narrower the parabola.

How do I find the y-intercept of a quadratic function in standard form?

The y-intercept can be found by evaluating the function at $x = 0$, which gives $y = c$, where c is the constant term in the standard form equation.

Can I find the x-intercepts of a quadratic from standard form? If so, how?

Yes, to find the x-intercepts, you can set the quadratic equation to zero (y = 0) and solve the resulting equation ax^2 + bx + c = 0 using factoring, completing the square, or the quadratic formula.

What is the importance of the axis of symmetry in graphing a quadratic function?

The axis of symmetry is a vertical line that passes through the vertex of the parabola and divides it into two mirror-image halves. Its equation is x = -b/(2a), and it helps in accurately plotting the graph.

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