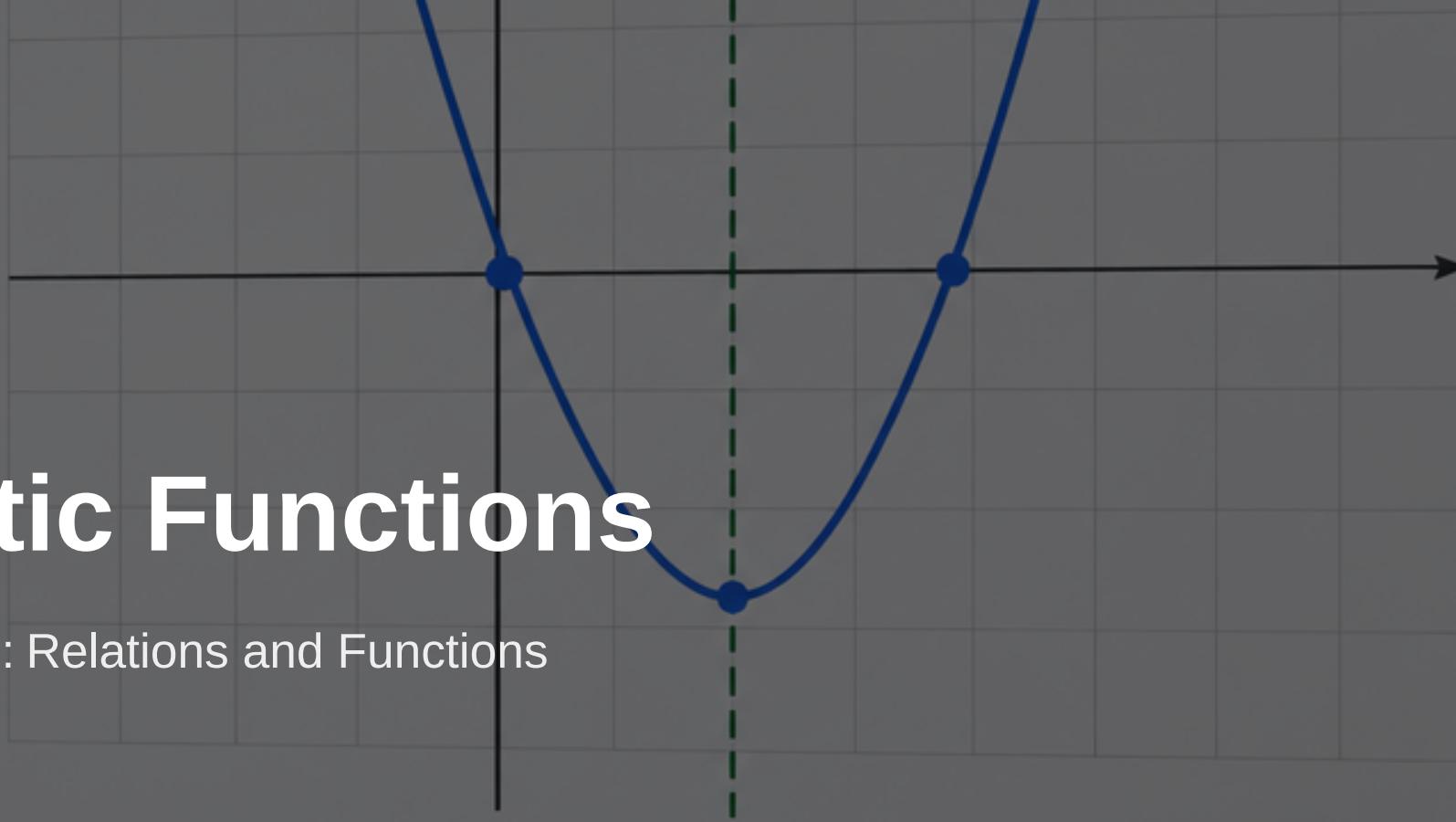


Quadratic Functions

Mathematics 20-1: Relations and Functions



Learning Intentions and Success Criteria

- I can analyze a quadratic function in vertex form $y=a(x-p)^2+q$ to state vertex, domain, range, direction of opening, axis of symmetry, and intercepts.
- I can analyze a quadratic function in standard form $y=ax^2+bx+c$ to identify the same graph characteristics and use them to solve problems.
- I can solve quadratic equations using appropriate algebraic and graphical strategies.
- I can solve linear-quadratic and quadratic-quadratic systems in two variables.
- I can solve linear and quadratic inequalities in two variables.
- I can solve quadratic inequalities in one variable.

Two Forms, One Parabola

Vertex Form: $y = a(x - p)^2 + q$

Vertex is at (p, q) . Direction of opening depends on the sign of a : opens upward if a is greater than 0, downward if a is less than 0. Axis of symmetry is $x = p$. Domain is all real numbers; range depends on q and the direction of opening. Find x - and y -intercepts by substitution.

Standard Form: $y = ax^2 + bx + c$

The same characteristics, vertex, domain and range, direction of opening, axis of symmetry, and intercepts, can be identified from standard form, often by completing the square or using $x = -b/(2a)$ to locate the axis of symmetry, then using these features to solve applied problems.

Solving a Quadratic Equation: A General Approach

1

Set equation to zero

Write the equation in the form $ax^2 + bx + c = 0$.

2

Choose a strategy

Factoring, completing the square, or the quadratic formula, depending on the structure of the equation.

3

Solve for x

Apply the chosen method to find the roots, which may be real or non-real.

4

Verify and interpret

Check solutions in the original equation and interpret them in context of the problem.

Beyond a Single Equation: Systems and Inequalities

Linear-Quadratic Systems

Solve algebraically and graphically to find intersection points of a line and a parabola.

Quadratic-Quadratic Systems

Solve algebraically and graphically to find intersection points of two parabolas.

Two-Variable Inequalities

Solve linear and quadratic inequalities in two variables, graphing regions on a coordinate plane.

One-Variable Quadratic Inequalities

Solve quadratic inequalities in one variable, expressing solutions as intervals.

Bringing It Together

This unit developed algebraic and graphical reasoning about quadratic functions in both vertex and standard form, including vertex, domain, range, direction of opening, axis of symmetry, and intercepts. Students solved quadratic equations, linear-quadratic and quadratic-quadratic systems, and both two-variable and one-variable quadratic inequalities.

Given a real-world scenario modeled by a quadratic function, such as the height of a projectile over time, what graph characteristics would you check first to answer a question about maximum height or time of impact, and why?