

# Quadratic Quandary: Find the Equation of a Parabola

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**Description:** Students approximate a parabola's axis of symmetry, then construct it and the vertex, and use their results to determine the exact equation.

**Technology Strength:** By dragging a vertical line, students can approximate the axis of symmetry. By pressing a button to show new random parabolas, they can check the generality of their constructions and calculations.

**Objectives:** Use the symmetry of a parabola to locate its vertex; use the coordinates of the vertex and another point on a parabola to write its equation in vertex form

**Prerequisites:** Ability to identify the vertex of a parabola; familiarity with the vertex form of the equation for a parabola

**Suggested Grade Level:** 9 to 12

**Sketchpad Level:** Intermediate

**Suggested Duration:** 45 minutes

**Suggested Classroom Setting:** Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

**Preparation:** Review the Activity Notes. Preview the student sketch. Work through the steps on the worksheet and make a copy of the worksheet for each student.

**Materials:** None

**Student Worksheet(s):** Quadratic Quandary: Find the Equation of a Parabola

**Student Sketch:** Quadratic Quandary.gsp

**Presentation Sketch:** Quadratic Quandary Present.gsp

**Vocabulary:** Axis of symmetry

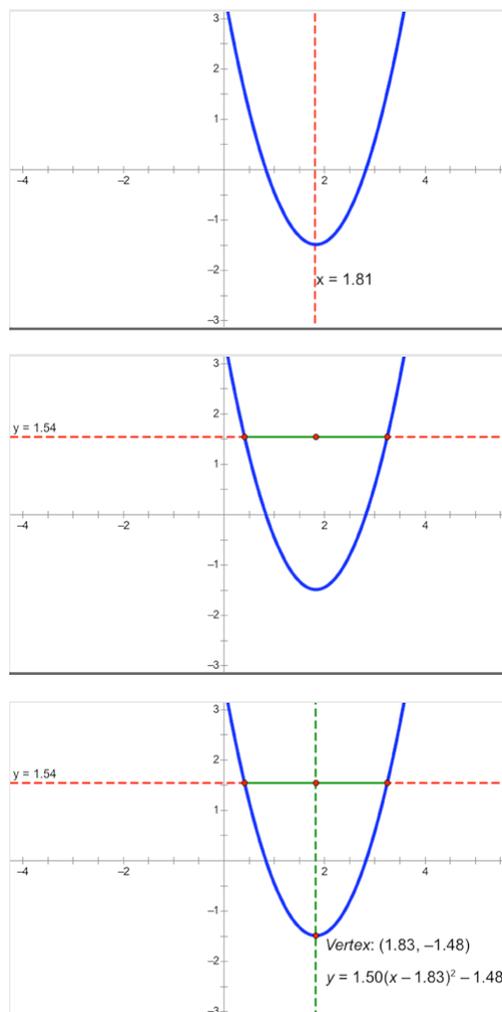
**Sketchpad Version:** GSP5

## Using the Sketch:

Students drag a vertical line to approximate the axis of symmetry of a parabolic graph. They then drag the vertical line out of the way and construct the exact axis of symmetry by intersecting a horizontal line with the parabola and constructing the perpendicular bisector of the segment between the intersection points.

Students use the axis of symmetry to construct the vertex and measure its coordinates, and they check their results by using an action button to randomly change the shape of the parabola. Now that they have the values of  $h$  and  $k$ , students determine the full equation of the parabola by placing a point on the parabola and using the coordinates of the point to determine the value of  $a$ .

In the Explore More, students turn the process of constructing the vertex into a custom tool, and are challenged to make the tool both easier to use and more powerful.



## Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

Sketch Tip	Tip Sheet or Tip Video
Step 3, 7: Construct an intersection using <b>Construct   Intersection</b>	Constructing Points
Step 3: Label an object with the <b>Text</b> tool	Using the Text Tool
Step 4: Construct a segment with the <b>Straightedge</b> tool	Using the Straightedge Tool
Step 6: Find the equation of a line or circle using <b>Measure   Equation</b>	Measuring Slopes and Equations
Step 11: Calculate an expression using <b>Number   Calculate</b>	Using the Calculator
Step 12: Create a custom tool by pressing the <b>Custom</b> tool icon and choosing <b>Create New Tool</b>	Creating Custom Tools