

Patty Paper Parabolas

Description: Students fold a piece of paper so that the creases outline the shape of a parabola. They compare their parabolas with those of other students to see how the shape depends on the positions of the focus and directrix. Students then do the same construction with Sketchpad and explore how moving the focus or directrix changes the shape of the folds. Finally students are challenged to construct the parabola itself (not just the folds) and to prove that their construction matches the geometric locus definition of a parabola.

Technology Strength: By moving from a physical construction to a Sketchpad construction, students relate two different representations of a parabola. By manipulating the focus and directrix, students quickly explore a variety of parabolas and relate the resulting shapes to the geometric locus definition.

Objectives: Use paper-folding to construct a parabola; replicate the paper-folding method of constructing a parabola in Sketchpad; move the focus to change the shape of a parabola; construct the point at which a fold is tangent to the parabola; prove that the resulting Sketchpad parabola matches the geometric definition

Prerequisites: Ability to use Sketchpad to construct the perpendicular bisector of a segment

Suggested Grade Level: 8 to 11

Sketchpad Level: Intermediate

Suggested Duration: 45 minutes

Suggested Classroom Setting: Whole Class, Student Pairs. Even if you do this activity with the whole class, have students do the paper-folding part individually on their own sheets of paper.

Preparation: Review the Activity Notes. For a student-pairs activity, preview the student sketch, work through the steps on the worksheet, and make a copy of the worksheet for each student. Provide the sheets of paper student will use for the paper-folding part of this activity. For a whole-class presentation, use the presentation sketch.

Materials: Three sheets of patty paper or plain white paper per student

Student Worksheet(s): Patty Paper Parabolas

Student Sketch: Patty Paper Parabolas.gsp

Presentation Sketch: Patty Paper Parabolas Present.gsp

Vocabulary: Directrix, focus, locus, parabola

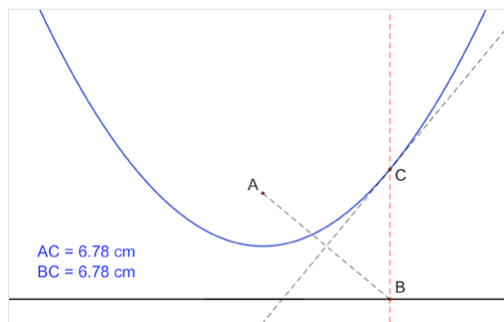
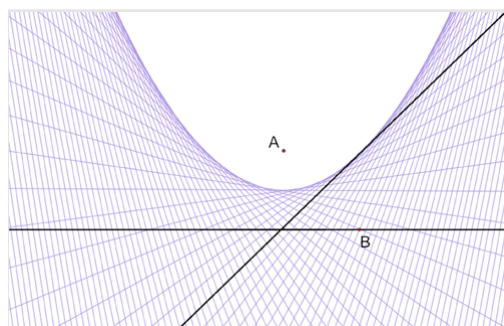
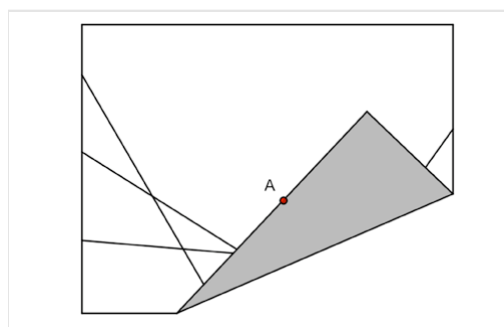
Sketchpad Version: GSP5

Using the Sketch:

In the first part of the activity students construct parabolas by folding paper. (Patty paper is best, but plain white paper will do.) They compare the shapes of their resulting parabolas with their classmates. Students then duplicate their paper-folding constructions using Sketchpad. They use this construction to change the positions of the focus and directrix, and they observe the effect on the shape of the parabola.

Students then construct the parabola itself, rather than the outline revealed by the creases. Using this construction, they are asked to provide a convincing explanation of why the resulting construction truly satisfies the geometric locus definition of the parabola.

Students can explore the student sketch to see other ways to construct parabolas, applications of parabolas, and art based on parabolas.



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 7: Construct a line with the Straightedge tool	Using the Straightedge Tool
Step 10: Construct a midpoint using Construct Midpoint	Constructing Points
Step 10: Construct a perpendicular line using Construct Perpendicular Line	Constructing Parallels and Perpendiculars
Step 12: Trace an object using Display Trace	Tracing
Step 14: Erase traces using Display Erase Traces	Tracing
Step 17: Construct a locus using Construct Locus	Constructing a Locus
Step 19: Change a line's width using Display Line Style	Changing Line and Point Styles