

A Rectangle with Maximum Area

Description: Students explore areas of rectangles whose perimeter is fixed. They make a conjecture about what type of rectangle has the most area for a given perimeter and check their conjecture by plotting the side length and area of the rectangle on the coordinate plane.

Technology Strength: By plotting the side length and area of a rectangle with a given (dynamic) perimeter on the coordinate plane, students can discover what type of rectangle has the most area for any given perimeter.

Objectives: For a given perimeter, discover what type of rectangle has the most area

Prerequisites: Understanding of the terms rectangle, triangle, area, and perimeter

Suggested Grade Level: 9 to 10

Sketchpad Level: Challenging

Suggested Duration: 45 minutes. If you are short on time, stop after Q2, omitting the exploration of the problem using the maxima or minima of a graph.

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. Work through the steps on the worksheet and make a copy of the worksheet for each student. See the presentation sketch for an example of completed student work.

Materials: None

Student Worksheet(s): A Rectangle with Maximum Area

Student Sketch: None

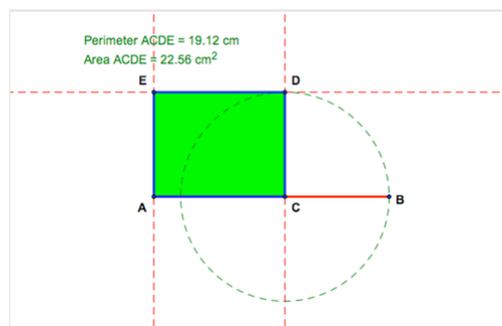
Presentation Sketch: Max Area Rectangle Work.gsp

Vocabulary: Optimize, perimeter, area, locus

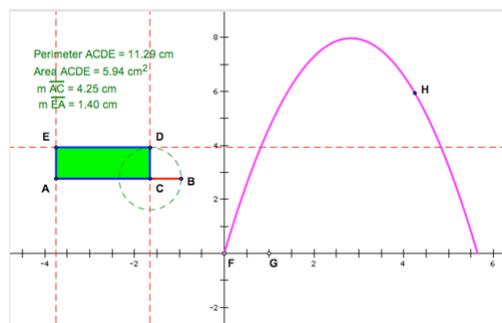
Sketchpad Version: GSP5

Using the Sketch:

Students construct a segment AB and a point C on segment AB and then construct a rectangle $ACDE$ whose perimeter is twice the length of segment AB . To do this, they construct a circle centered at point C with radius CB , and use perpendiculars to segment AB through points A and C , and a parallel line to segment AB through point D , to finish the rectangle, where point D is the intersection of the circle and the perpendicular line through point C .



Students measure the area and perimeter of rectangle $ACDE$, drag point C , and observe how dragging point C affects the area and perimeter. Using their observations, they make a conjecture about what type of rectangle has the most area for any given perimeter. Students check their conjecture by plotting the side length AC and the area of rectangle $ACDE$ on the coordinate plane, labeling the point (*side length*, *area*) as H . Next, they drag point C to see the plotted point H for different side lengths and area. Finally, students construct the locus of this point as point C moves along segment AB and position point C so that point H is at the maximum of the locus.



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: Construct a perpendicular line using Construct Perpendicular Line	Constructing Parallels and Perpendiculars
Step 5: Construct an intersection using Construct Intersection	Constructing Points
Step 6: Construct a parallel line using Construct Parallel Line	Constructing Parallels and Perpendiculars
Step 8: Construct a polygon interior using Construct Interior	Constructing Interiors
Step 9: Measure an area using Measure Area	Measuring Area, Perimeter, and Circumference
Step 9: Measure a perimeter using Measure Perimeter	Measuring Area, Perimeter, and Circumference
Step 11: Measure a distance using Measure Distance	Measuring Length and Distance
Step 12: Plot a point by selecting two values and using Graph Plot as (x,y)	Plotting Points
Step 14: Construct a locus using Construct Locus	Constructing a Locus