Objective
·To find a rectangle that will produce the largest area given a fixed perimeter.

Ryan's Puppy Problem

Introduction
Ryan wishes to build a rectangular shaped pen to keep in his new puppy. Ryan has 8 meters of fencing to use. Ryan would like to know the dimensions of the rectangle that would give the largest area for the puppy to wander.

Construction & Exploration

Part I: Constructing a rectangle to model the situation.

1. Draw a segment and place it near the top of the screen.
    Place a point on the segment label point P.

2. Measure the segment and drag one of the endpoints until the
    segment is 4 units long. (This represents the half of the length
    of fencing available for Ryan.)

3. Draw segments from point P to each endpoint.
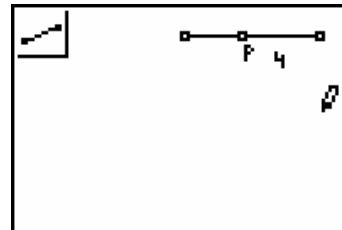
4. Place a point somewhere near the bottom left of the screen.
    Label the point R.

5. Use the compass to construct a circle from point R, with a radius
    that is the length of the shortest of the two segments formed in
    step 3 above.

6. Place a point on the circle formed by the compass. Label the point E.
    Draw a segment from point R to the point on the circle. This is the
    first side in the rectangle.
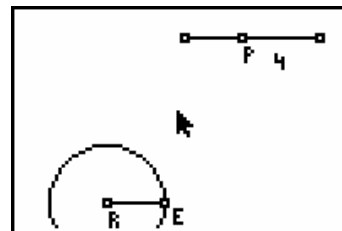
7. Hide the circle.

8. Draw a perpendicular from point E to the side of the rectangle.

9. Use the compass to make a circle from point E, the same
    length as the longest segment from P to the endpoint.
    Find the intersection point of the compass circle and the
    perpendicular line.

10. Draw the segment formed by the intersection point and point E.
    This is the second side of the rectangle.
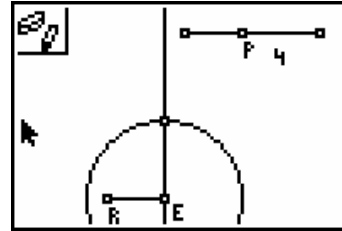
11. Hide the line, and the circle. Be sure the segment on the line is
    still visible.

12. Construct a perpendicular to the second side of the rectangle.
    Use the compass to make a segment the same length as the
    first side of the rectangle. (Remember to draw the segment
    on top of the perpendicular line).

13. Hide the perpendicular line, and the circle.

14. Construct a segment to complete the rectangle.
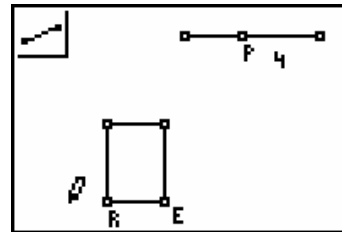
Part II Measuring area.

1. Measure the first and second side of the rectangle.

2. Calculate the area of the rectangle using the two side
    lengths measured in step 1 above.

Part III. Data collection.

1. Fill in the table below by changing the side of the rectangle. To do this move point P on the segment. Be sure to point P so that it completely travels between the two endpoints.

Side Length	Area

2. Once you have filled in the table, exit Cabri Jr. and press STAT, enter the data in the table above into List 1 and List 2. You may have to clear the lists first.

3. Make a scatterplot of the data. Use the arrow keys, not TRACE, to estimate the dimension that produces the largest area.

Questions & Conjectures.

1. What dimension produced the largest area?

2. What particular rectangle seems to produce the largest area for Ryan?

3. Write an algebraic equation for the area of a rectangle in terms of one side length 'x'. Recall the perimeter must be 8.

4. Graph the equation and the scatterplot. Use the equation to find the side length that produces the largest area. How does that answer compare with your estimate?