**Approximating Area Under a Curve**

*Time:* 60 – 80 minutes

*Standard: College Board AP Calculus Standards*

APC.15 The student will use integration techniques and appropriate integrals to model physical, biological, and economic situations. The emphasis will be on using the integral of a rate of change to give accumulated change or on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. Specific applications will include

a) the area of a region;

*Procedure:*

1. Introduction
   1. Counting Squares
      1. Provide students with the graph of a function on a grid.
      2. Ask them to approximate the area between the curve and the x-axis
      3. Discuss techniques, and who was likely the most accurate
   2. Using Shapes
      1. Provide students with the graph of a new function without a grid.
      2. Ask them to approximate this new area between the curve and the x-axis.
      3. Discuss techniques (hopefully using approximate shapes), and accuracy.
2. Sketchpad
   1. Rectangular and Trapezoidal Accumulation
      1. See pg. 6 of the handout found [here](http://www.dynamicgeometry.com/General_Resources/Classroom_Activities/KCPT/The_First_Week_of_Calculus.html)
      2. Download the Trapezoidal Accumulation sketch.
      3. Allow students to work in pairs, answering questions as they go.
      4. Discuss after each page of the activity.
3. Follow-up/Assessment
   1. Give students a new graph.
   2. Ask them to find the most accurate approximation for the area in 5 minutes.
   3. Have students present their solutions and discuss the methods they used, balancing accuracy against time.