Discussion 9:

Approximating Areas with Unique Shapes

In this module, you learned that the Fundamental Theorem of Calculus, Part 2, gives a method for using the antiderivative of a continuous function to find the *exact* area between the function's curve and the x-axis over an interval. However, this theorem is only helpful if you can find a formula for an antiderivative. There are many real-world situations in which you might need to calculate the area of something but you don't have a simple function to work with. This is where *approximation* can be helpful.

You also learned in this module that rectangles could be used to approximate the area underneath a curve, and previously you learned that ancient Greeks like Archimedes used regular polygons to approximate the area of a circle. However, rectangles and regular polygons aren't the only geometric shapes with known area formulas.

With your assigned partner or group, discuss the following questions.

1. Why do you think rectangles were chosen in this module as the first geometric shape to use when approximating the area underneath a curve?

2. For what type of basic function could you use a rectangle to find the exact area under the curve?
   (**Hint:** The "curve" of a function could actually be a straight line.)

3. Suppose you wanted to find the area between the x-axis and the line $f(x) = 2x$ over the interval $[0, 5]$. What geometric shape could you use to calculate this area?

4. Suppose you wanted to find the area between the x-axis and the line $f(x) = 2x + 3$ over the interval $[0, 5]$. What geometric shape could you use to calculate this area?

5. Suppose a winding creek is behind a large house and the back of the house makes a straight line roughly parallel to the creek. You set up two fences so that they make a straight line from the corners of the house to the creek. Now

you want to approximate the area of this fenced yard. How could you use the methods of this module to approximate the area?

6. Would rectangles or trapezoids give a better approximation for the area of the yard? What other geometric shape(s) might you use to approximate the area?