Volume by Cross Sections
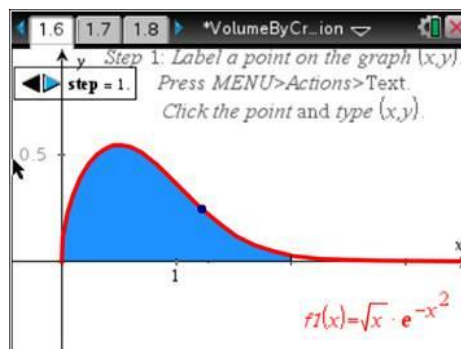*VolumeByCrossSections.tns*

Name _____

Class _____

Part 1 – Setting Up The Problem And Understanding The Concept

A first step to solve calculus volume problems is to label the point and differential. You know the volume of an object is the area of the base times its height. So the differential *dV* equals area·*dx* or area·*dy*.

1. Typically the cross section is perpendicular to an axis. If the shape formed is perpendicular to the *x*-axis, what is the differential?

2. The function may define the base with cross sections that form a variety of shapes.

   a) What is the area of a square?

   b) What is the area of a semicircle?

3. Consider a function that defines the base of a solid where the cross sections, perpendicular to the *x*-axis, form equilateral triangles. Let the base of the triangle be parallel to the *y*-axis. What is the area of the triangle? Draw a sketch and justify your answer.

4. If the length of one of the sides of this equilateral triangle is 1 cm, calculate the area. Show your calculation. Confirm on page 1.5 by using **MENU > Measurement > Area**. Click the triangle.

5. On page 1.6, there are instructions about labeling a point on the graph. Label the point (*x*, *y*) and the differential on the graph to the right.

On page 1.7 you can move *dx* to get a visual of the shape. Your teacher may instruct you how to improve this visual with **Geometry Trace**.

6. Let the first quadrant region enclosed by the graph of $y = \sqrt{x} \cdot e^{-x^2}$ and the line $x = 2$ be the base of a solid. If the cross sections perpendicular to the *x*-axis are equilateral triangles, what is the volume of the solid? Show your work. (This is a non-calculator active type of exam question.)

Part 2 – Homework

Questions 1 and 2 are non-calculator, multiple-choice exam-like problems. Show all your work. On Question 3, show the set up. Enjoy the dynamic visual aid on the TI-Nspire after the question.

To use Geometry Trace, select **Geometry Trace** from Trace menu, click once (don't grab) on the object that you would like to see leave a trail, e.g., the semicircle, square, or points. Then, press play. Press ⎡esc⎤ to exit **Geometry Trace** mode. If desired, select **menu > Trace > Erase Geometry Trace** to erase the trace.

1. Let the first quadrant region enclosed by the graph of $y = \dfrac{1}{x}$ and the lines $x = 1$ and $x = 4$ be the base of a solid. If the cross sections perpendicular to the *x*-axis are semicircles, what is the volume of the solid? Show your work.

2. Let the base of a solid be the first quadrant region enclosed by the *x*-axis, the *y*-axis, and the graph of $y = 1 - \dfrac{x^2}{4}$. If all the cross sections perpendicular to the *y*-axis are squares, what is the volume of the solid? Show your work.

3. Let the base of a solid be the first quadrant region enclosed by the *x*-axis and one arch of the graph $y = \sin(x)$. If all cross sections perpendicular to the *x*-axis are squares, then approximately what is the volume of the solid? Show your set up.