AP Calculus
7.3 Worksheet (day 4)

All work must be shown in this course for full credit. Unsupported answers may receive NO credit.

1. Let R be the region bounded by the graphs of $y = x^2 + 4$, $y = 8$, and $x = 0$, set up and evaluate the integral that gives the volume of the solid generated by revolving R about the y – axis.

      a) Use the disc method

      b) Use the shell method

Questions 2 and 3 were done on the last worksheet using 2 rectangles and the washer method. Try doing them again using the shell method.

2. [Calculator] A region in the first quadrant is enclosed by the graphs of $y = e^{2x}$, $x = 1$, and the coordinate axes. If the region is rotated about the y-axis, what is the volume of the solid generated?

3. [Calculator] Let R be the region in the first quadrant enclosed by the graph of $y = (x+1)^{1/3}$, the line $x = 7$, the x-axis, and the y-axis. What is the volume of the solid generated when R is revolved about the y-axis?

4. Find the volume of the solid formed by revolving the region bounded by the graphs of $y = x$ and $y = 4x - x^2$ about the y-axis.

5. The shaded region R, shown in the figure below, is rotated about the y-axis to form a solid who volume is 10 cubic inches. Of the following, which best approximates k?

A) 1.51

B) 2.09

C) 2.49

D) 4.18

E) 4.77
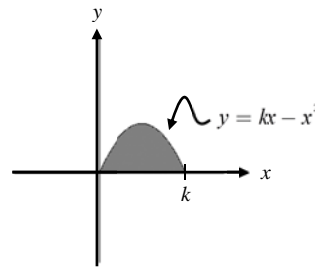
6. Set up an integral and use your calculator to find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the lines $y = 2$ and $x = 0$ about … (*if possible, set up the problem two different ways*).

a) … the x-axis.

b) … the y-axis.

c) … the line $y = 2$

d) … the line $x = 4$.

7. [Calculator] The amount of water in a storage tank, in gallons, is modeled by a continuous function on the time interval $0 \le t \le 7$, where t is measured in hours. In this model, rates are given as follows:

i) The rate at which water enters the tank is
$f(t) = 100t^2 \sin\left(\sqrt{t}\right)$ gallons per hour for $0 \le t \le 7$.

ii) The rate at which water leaves the tank is
$$g(t) = \begin{cases} 250 & \text{for } 0 \le t < 3 \\ 2000 & \text{for } 3 < t \le 7 \end{cases} \text{ gallons per hour.}$$
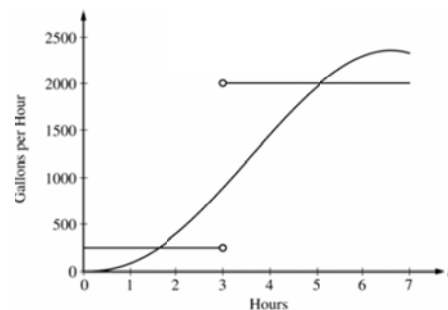
The graphs of f and g, which intersect at $t = 1.617$ and $t = 5.076$, are shown in the figure to the right. At time $t = 0$, the amount of water in the tank is 5000 gallons.

a) How many gallons of water enter the tank during the time interval $0 \le t \le 7$? Round your answer to the nearest gallon.

b) For $0 \le t \le 7$, find the time intervals during which the amount of water in the tank is decreasing. Give a reason for your answer.

c) For $0 \le t \le 7$, at what time t is the amount of water in the tank the greatest? To the nearest gallon, compute the amount of water at this time. Justify your answer.

8. [Calculator] Let R be the region in the first and second quadrants bounded above by the graph of $y = \dfrac{20}{1+x^2}$ and below by the horizontal line $y = 2$.

   a) Find the area of R.

   b) Find the volume of the solid generated when R is rotated about the x-axis.

   c) The region R is the base of a solid. For this solid, the cross sections perpendicular to the x-axis are semicircles. Find the volume of this solid.