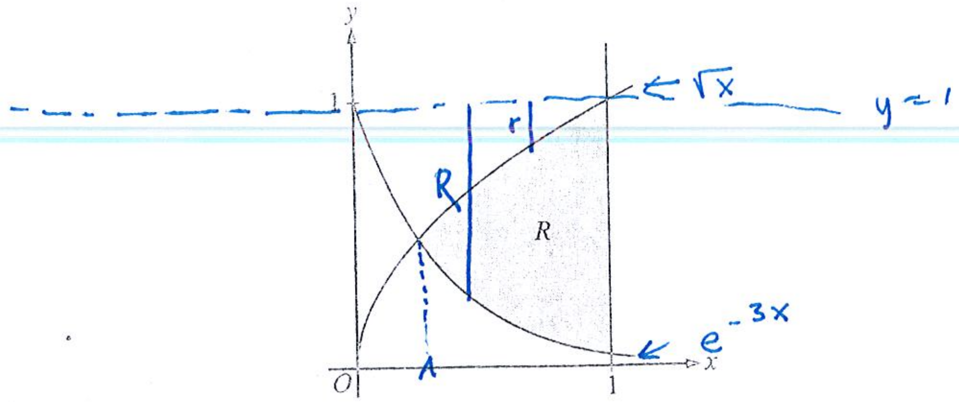
A graphing calculator is required for some problems or parts of problems.



1. Let R be the shaded region bounded by the graphs of $y = \sqrt{x}$ and $y = e^{-3x}$ and the vertical line $x = 1$, as shown in the figure above.

   (a) Find the area of R.

   (b) Find the volume of the solid generated when R is revolved about the horizontal line $y = 1$.

   (c) The region R is the base of a solid. For this solid, each cross section perpendicular to the x-axis is a rectangle whose height is 5 times the length of its base in region R. Find the volume of this solid.

a. let $A = 0.2387$

$$\int_A^1 \sqrt{x} - e^{-3x}\, dx = 0.442$$

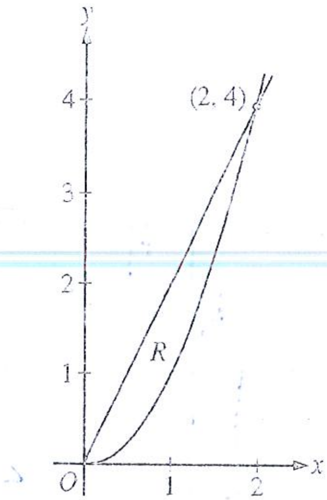
b.

$$\pi \int_A^1 (1 - e^{-3x})^2 - (1 - \sqrt{x})^2\, dx = 0.725$$

c.

$$\int_A^1 5(\sqrt{x} - e^{-3x})^2\, dx = 1.554$$

No calculator is allowed for these problems.



4. Let R be the region in the first quadrant enclosed by the graphs of $y = 2x$ and $y = x^2$, as shown in the figure above.

$x = y/2$ $\quad$ $x = \sqrt{y}$

(a) Find the area of R.

(b) The region R is the base of a solid. For this solid, at each x the cross section perpendicular to the x-axis has area $A(x) = \sin\left(\frac{\pi}{2}x\right)$. Find the volume of the solid.

(c) Another solid has the same base R. For this solid, the cross sections perpendicular to the y-axis are squares. Write, but do not evaluate, an integral expression for the volume of the solid.

a. $A = \int_0^2 2x - x^2 \, dx$ $\quad$ $\underline{\underline{OR}}$ $\quad$ $\int_0^4 \sqrt{y} - y/2 \, dy$

$= x^2 - \frac{1}{3}x^3 \Big]_0^2$

$= (4 - \frac{8}{3}) - (0) = \frac{4}{3}$

b. $V = \int_0^2 \text{Area} \, dx = \int_0^2 \sin(\frac{\pi}{2}x) \, dx$

$= -\frac{2}{\pi} \cos(\pi/2 \, x) \Big]_0^2$

$= (-\frac{2}{\pi} \cos\pi) - (-\frac{2}{\pi} \cos 0)$

$= (-\frac{2}{\pi} \cdot -1) - (-\frac{2}{\pi} \cdot 1) = \frac{2}{\pi} + \frac{2}{\pi} = \frac{4}{\pi}$

c. $V = \int_0^4 (\sqrt{y} - y/2)^2 \, dy$