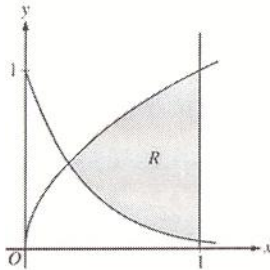
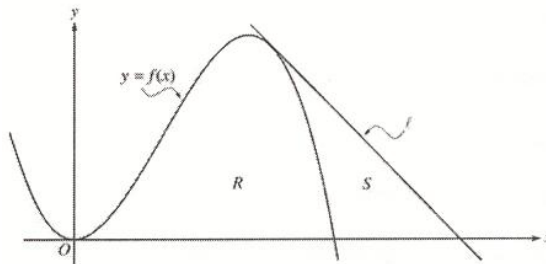


The use of a calculator is REQUIRED on these questions. One problem per side of paper.

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 below.

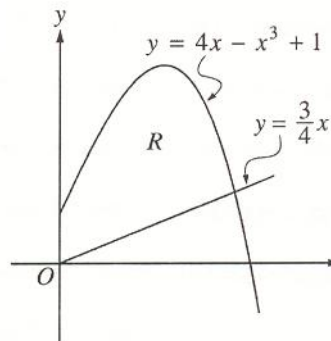


- Find the area of R .
- Find the volume of the solid generated when R is revolved about the horizontal line $y = 1$.
- The region R is the base of a solid. For this solid, each cross section perpendicular to the x -axis is a rectangle whose height is 5 times the length of its base in region R . Find the volume of this solid.



2. Let f be the function given by $f(x) = 4x^2 - x^3$, and let ℓ be the line $y = 18 - 3x$, where ℓ is tangent to the graph of f . Let R be the region bounded by the graph of f and the x -axis, and let S be the region bounded by the graph of f , the line ℓ , and the x -axis as shown below.

- Show that ℓ is tangent to the graph of $y = f(x)$ at the point $x = 3$.
- Find the area of S .
- Find the volume of the solid generated when R is revolved about the x -axis.



3. Let R be the region in the first quadrant bounded by the y -axis and the graphs of $y = 4x - x^3 + 1$ and $y = \frac{3}{4}x$
- Find the area of R
 - Find the volume of the solid generated when R is revolved about the x -axis.
 - Write an expression involving one or more integrals that gives the perimeter of R . Do not evaluate.