1. Sketch the first quadrant region bounded by the parabola $y = x^2$, the tangent to the parabola at $(1, 1)$, and the $x$-axis, and calculate the area of this region.

2. Suppose $f(x) = x^3$.

a) Find the equation of the tangent line to the graph $y = f(x) = x^3$ at the point $(1, 1)$.

b) Find the finite area bounded by $y = x^3$ and the tangent line to $y = x^3$ at the point $(1, 1)$.

3. Sketch the area $A$ defined by $y = x(1 - x)$ and the $x$-axis.

a) Compute the volume obtained when this area is revolved around the line $y = -2$.

b) Compute the volume obtained when this area is revolved around the line $x = -2$.

4. A sort of raindrop is obtained by revolving the profile curve

$$y = \sqrt{x}(x - C)^2 \text{ for } 0 \leq x \leq C$$

about the $x-$axis. Here $C$ is a positive constant.

a) Sketch the profile curve and the solid of revolution.

b) For which value of $C$ will the raindrop have volume 1? What are the rough dimensions (length and diameter) of this raindrop?

5. A wedge is cut from a cylindrical tree of radius 1. One cut is parallel to the ground. The other cut is at an angle $\theta$ with the ground, and the two cuts meet at the central axis of the tree.

a) What is the area of the shaded triangular slice in terms of $\theta$ and $x$?

b) What is the volume of the wedge?