1. Consider the ellipse
\[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1; \quad a, b > 0. \]

i) (5 pt) Find the volume obtained when the upper half of this ellipse is revolved about the \( x \)-axis.

ii) (5 pt) Find the volume obtained when the right half of this ellipse is revolved about the \( y \)-axis.

iii) (5 pt) What happens to your answers from i) and ii) when \( a = b \)? Does this make sense? Why?

2. (5 pt) Find the volume obtained when the region bounded by \( f(x) = x \) and \( g(x) = x^n, n > 1 \) is revolved about the line \( x = -1 \).

3. Suppose that we have a solid object whose volume at height \( x \) is given by
\[ V(x) = \int_0^x A(t)dt. \]

i) (5 pt) If the volume of this object is given by \( V(x) = \frac{4}{3}\pi x^3 \), determine the cross sectional area at height \( x \).

ii) (5 pt) Given that we know that the volume of a sphere of radius \( R \) is \( \frac{4}{3}\pi R^3 \), explain how the previous part can be used to deduce that the surface area of a sphere is given by \( S = 4\pi R^2 \).