Show all work!

1. (8 points) Set up, but do not evaluate, an integral for volume of the solid obtained when the region bounded by \( y = x^2 \), \( x = 0 \), and \( y = 4 \) is revolved about the line \( x = 0 \).

2. (8 points) Set up, but do not evaluate, an integral for volume of the solid obtained when the region bounded by \( y = x^2 \), \( x = 0 \), and \( y = 4 \) is revolved about the line \( y = 0 \).

3. (8 points) Set up, but do not evaluate, an integral for volume of the solid obtained when the region bounded by \( y = x^2 \), \( x = 0 \), and \( y = 4 \) is revolved about the line \( y = 4 \).
4. (8 points) A conical tank resting on its vertex is full of water of density $\rho$ lb/ft$^3$. The tank has radius 5 ft and height 10 ft. Compute the work done to pump all the liquid to a point 3 ft above the top of the tank. Set up the integral but do not evaluate.

![Diagram of a conical tank]

5. (8 points) Find the volume of the solid obtained by revolving the region bounded by the lines $y = 2x$, $y = x$ and $y = 6$ is revolved about the $y$-axis. Set up the integral, but do not evaluate.

6. (8 points) A vertical plate is submerged in water and has the shape shown below (the top edge of the plate is at the top of the water). Find the hydrostatic force on one end of the plate. Use $\omega$ for weight-density. Set up the integral, but do not evaluate.

![Diagram of a vertical plate submerged in water]
7. (10 points) Solve the differential equation: \( \sec(x) \frac{dy}{dx} = e^{y + \sin x} \).

8. (12 points) Use the method of cylindrical shells to find the volume generated by rotating the region bounded by the curves \( y = e^{-x}, y = 0, x = -1 \), and \( x = 0 \) about \( x = 1 \).
9. (12 points) Find the area of the surface obtained by rotating the curve \( y = x^3 \) for \( 0 \leq x \leq 2 \) about the x-axis.

10. (12 points) Find the arc length of the curve \( y = \frac{(x^2 + 2)^{3/2}}{3} \) for \( 0 \leq x \leq 1 \).