1. Find the volume of the solid generated by revolving the region bounded by 
   \( y = x^2 \) and \( y = x + 2 \) around line indicated.
   a. The line \( x = 3 \).
   b. The line \( y = -1 \).

2. Find the volume of the solid generated when the region bounded by  
   \( y = \ln x \), \( y = 0 \), and \( x = e \), is revolved about the \( x \)-axis. Use the disk method.

3. Find the arc length of the curve \( f(x) = \left(4 - x^{2/3}\right)^{3/2} \) for \( 0 \leq x \leq 2 \).

4. A hemispherical tank with radius 5 ft is full of water. Find the work required to pump the  
   water out of the outlet at the top of the tank. The weight density of water is \( \omega = 62.4 \text{ lb/ft}^3 \).

5. Use the method of cylindrical shells to find the volume generated by rotating the region  
   bounded by the curves \( y = e^x \), \( x = 0 \), \( y = \pi \) about the \( x \)-axis.

6. Find the mass of a cylindrical rod with radius of 3 cm and a length of 20 cm, made of a  
   combination of copper and aluminum in such a way that the density of the rod \( x \) cm from the  
   left end is \( \rho(x) = 8.93 - 0.015x \text{ g/cm}^3 \).

7. Find the hydrostatic force exerted on end of a trough. The shape is a trapezoid whose top is  
   18 inches, base is 12 inches and height is 6 inches.

8. Find the surface area obtained when the curve \( y = \sqrt{25-x^2} \) for \( 0 \leq x \leq 5 \) is rotated about the \( y \)-axis.

9. Find the surface area obtained when the curve \( y = \cos x \) for \( -\frac{\pi}{2} \leq x \leq \frac{\pi}{2} \) is rotated about the \( x \)-axis.

10. For the curve \( y = \sqrt{1-x^2} \) for \( -\frac{1}{2} \leq x \leq \frac{1}{2} \) : Find the length of the curve.

11. The following integral represents the volume of a solid. Describe the solid.  
    \[ \int_{0}^{\pi/2} 2\pi x \cos x \, dx \]
12. Solve the differential equations,

a. \[ \frac{dy}{dx} = \frac{x^2 + 3x + 2}{\sqrt{x}} \]

b. \[ \frac{dy}{dx} = e^{xy}, \quad y(0) = 2. \]

c. \[ \frac{dy}{dx} = \frac{y + 1}{x^2 + 1}, \quad y(0) = 1 \]

13. A water trough is 10 ft long with a triangular shaped cross-section, see below. If the tank is full, how much work is required to pump the water to 2 ft above the top of the tank? Use the weight density, \( \omega \).

For additional problems, check out the review problems for Chapter 6. Note the questions above are simply a sample of questions possible for the exam; it is possible that other types of questions may appear on your exam.