1. Find the area of the region bounded by 
   a) \( y = 4 - x^2 \), \( y = 3x \), and \( y = 0 \) \( 0 \leq x \leq 2 \).
   
   b) \( y = 4 - x^2 \), \( y = 3x \), and \( x = 2 \).

2. Find the volume of an object which has a triangular base with vertices (0,0), (0,4),and (6,0) and
   a) cross sections perpendicular to the x- axis are squares.
   b) cross sections perpendicular to the y- axis are semicircles.

3. The region bounded by \( y = 2x^2 \), \( y = 3 - x \), and \( y = 0 \) is rotated
   around the x-axis. Set up the integral to find the volume using
   a) washers.
   b) cylindrical shells.

4. Find the volume of the solid formed when the region bounded by
   \( y = e^{-x} \), \( x = 0 \), \( y = 0 \), and \( x = 1 \) is rotated around
   a) \( y = -1 \)
   b) \( y = 4 \)
   c) \( x = 5 \)

5. A spring has a natural length of 10 cm. The force needed to hold it at 15 cm is 2 N.
   Find the work done in stretching it from 20 cm to 30 cm.

6. A rope is 50 ft long and weighs 75 lbs. The rope hangs over a tall building.
   a) Find the work done in pulling 10 ft of the rope to the top.
   b) Find the work done in pulling the whole rope and a 100 lb weight to the top.
7. Find the work done in pumping the water out of the outlet for the given tank.

a) A trough is full of water. The trough is 6 m wide at the top, 4 m high and 12 m long. The outlet is at the top of the tank.

b) A semispherical tank has a radius of 5 m and is full of water. The outlet is 2 m above the top of the tank.

c) A spherical tank has a radius of 3 m and the water is 5 m deep. The spout is 1 m above the top of the tank.

8. Find the average value of \( f(x) \) over the given interval.

\[
a) \quad f(x) = |x| \quad [-2, 2] \\
b) \quad f(x) = \sqrt{9 - x^2} \quad [0, 3] \\
c) \quad f(x) = \sqrt{9 - x^2} \quad [-3, 3]
\]

9. The average value of \( f(x) \) over \([0,6]\) is 2 and the average value of \( f(x) \) over \([0,4]\) is -1. Find the average of \( f(x) \) over \([4,6]\).

10. Find each integral.

\[
a) \quad \int_{0}^{\pi/6} \sin^3 x \, dx \\
b) \quad \int_{0}^{2} \frac{x^5}{x^3 + 7} \, dx \\
c) \quad \int \, x^2 \sin x \, dx
\]
\[ d) \int \cos^4 x \, dx \]

\[ e) \int \frac{\ln x}{\sqrt{x}} \, dx \]

\[ f) \int \sec^3 x \tan^3 x \, dx \]