1. Evaluate the integral

   (a) $\int t^2 \cos(1 - t^3)dt$

   (b) $\int \frac{x^2}{\sqrt{1-x}}dx$

   (c) $\int x^3 e^{x^2} dx$

2. Let $\mathcal{R}$ be the region in the first quadrant bounded by the curves $y = x^3$ and $y = 2x - x^2$.

   (a) Find the area fo $\mathcal{R}$

   (b) Find the volume obtained by rotating $\mathcal{R}$ about the line $x = -1$.

   (c) Find the volume obtained by rotating $\mathcal{R}$ about the line $y = 2$.

3. Find the volume of the solid obtained by rotating the region bounded by $y = x$ and $y = x^2$ about

   (a) the line $y = -1$

   (b) the y-axis

   (c) the line $x = 4$

4. The base of solid S is the triangular region with vertices (0,0), (2,0), and (0,1). Cross-sections perpendicular to the x-axis are semicircles. Find the volume of S.

5. The solid S has a base in the shape of a triangle with vertices (0,0), (0,2) and (1,2). Cross sections perpendicular to the x-axis are squares. What is the volume ofS?

6. A cable 40 feet long weighing 6 pounds per foot is hanging off the side of a 50 foot tall building. At the bottom of the cable is a bucket of rocks weighing 100 pounds. How much work is required to pull 10 feet of the cable to the top of the building?

7. A spring has a natural length of 20 cm. If a 10 J work is required to keep it stretched to a length 25 cm, how much work is done in stretching the spring from 30 cm to 80 cm?

8. A tank of water is 20 ft long and has a vertical cross section in a shape of an equilateral triangle with sides 2 ft long. The tank is filled with water to a depth of 18 inches. Determine the amount of work needed to pump all of the water to the top of the tank. The weight of water is 62.5 lb/ft^3 .

9. Find the average value of $f = \sin^2 x \cos x$ on $[-\pi/2, \pi/4]$.