1. Find the area of the region bounded by $y = x^2 + 1$, $y = 3 - x^2$, $x = -2$, and $x = 2$.

2. Find the volume of the solid obtained by rotating the region bounded by $y = x^2 - 1$, $y = 0$, $x = 1$, $x = 2$ about the x-axis.

3. Find the volume of the solid obtained by rotating the region bounded by $y = x^2$, $y = 0$. $x = 1$, $x = 2$ about

   (a) the y-axis
   (b) $x = 4$

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. A heavy rope, 50 ft long, weighs 0.5 lb/ft and hangs over the edge of a building 120 ft hight. How much work is done in pulling the rope to the top of the building?

6. A spring has a natural length of 20 cm. If a 25-N force is required to keep it stretched to a length of 30 cm, how much work is required to stretch it from 20 cm to 25 cm?

7. A tank is full of water. Find the work required to pump the water out the outlet.
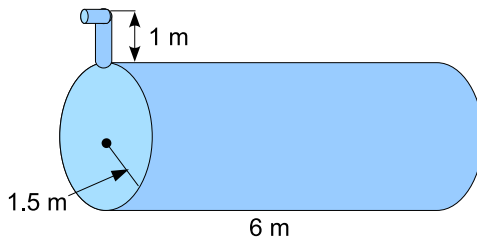
8. Find the average value of $f = \sin^2 x \cos x$ on $[-\pi/2, \pi/4]$.

9. Evaluate the integral

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

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

   (c) $\displaystyle\int_0^1 x^2 e^{-x}dx$

   (d) $\displaystyle\int \sin^3 x \cos^4 x \, dx$

   (e) $\displaystyle\int_0^{\pi/8} \sin^2(2x) \cos^3(2x) \, dx$

   (f) $\displaystyle\int \sin^2 x \cos^4 x \, dx$

(g) $\displaystyle\int_0^{\pi/4} \tan^4 x \sec^2 x \ dx$

(h) $\displaystyle\int \tan x \sec^3 x \ dx$

(i) $\displaystyle\int \sin 3x \cos x \ dx$

(j) $\displaystyle\int_0^{2/3} x^3 \sqrt{4 - 9x^2} \ dx$

(k) $\displaystyle\int \frac{1}{\sqrt{9x^2 + 6x - 8}} dx$

(l) $\displaystyle\int \frac{x^3}{\sqrt{x^2 + 4}} dx$