1. *Evaluate the integrals in (a) and (b).*

   a. $\int \frac{(2r-1)\cos\sqrt{3(2r-1)^2+6}}{\sqrt{3(2r-1)^2+6}}dr$

   b. $\int \frac{\sin\sqrt{\theta}}{\sqrt{\theta\cos^3\sqrt{\theta}}}d\theta$

2. $\int_1^4 \frac{dy}{2\sqrt{y}(1+\sqrt{y})^2}$

3. *Find the area of the region enclosed by* $y = x^4 - 4x^2 + 4$ *and* $y = x^2$.

4. *Find the volume of the solid generated by revolving the region bounded by the parabola* $y = x^2$ *and the line* $y = 1$ *about the line* $y = -1$.

5. *Volume of a bowl*

   a. *A hemispherical bowl of radius a contains water to a depth h. Find the volume of water in bowl.* $R(y) = \sqrt{a^2 - y^2} \Rightarrow V = \pi \int_{-a}^{-a+h}(a^2 - y^2)dy = \pi \left[a^2y - y^3/3\right]_{-a}^{-a+h} = \pi[a^2h - a^3 - (h-a)^3/3 - (-a^3 + a^3/3)] = \pi[a^2h - 1/3(h^3 - 3h^2a + 3ha^2 - a^3) - a^3/3] = \pi(a^2h - h^3/3 + h^2a - ha^2) = \pi h^2(3a - h)/3$

   b. *Water runs into a sunken concrete hemispherical bowl of radius 5m at the rate of* 0.2 m^3/sec. *How fast is the water level in the bowl rising when the water is 4m deep?*
   Given $\frac{dV}{dh} = 0.2\text{m}^3/\text{sec}$ and $a = 5\text{m}$, find $\frac{dh}{dt}|_{h=4}$. From part (a), $V(h) = \pi h^2(15 - h)/3 = 5\pi h^2 - \pi h^3/3 \Rightarrow \frac{dV}{dh} = 10\pi h - \pi h^2 \Rightarrow \frac{dV}{dt} = \frac{dV}{dh}\cdot\frac{dh}{dt} = \pi h(10-h)\frac{dh}{dt} \Rightarrow \frac{dh}{dt}|_{h=4} = \frac{0.2}{4\pi(10-4)} = \frac{1}{(20\pi)(6)} = \frac{1}{120\pi}$ m/sec.