1. Compute the indefinite integral $\displaystyle\int \frac{1}{x^2\sqrt{100-4x^2}}dx$

Solution: Let $x = 5\sin(\theta)$. Then

$$\int \frac{1}{x^2\sqrt{100-4x^2}}dx = \int \frac{5\cos(\theta)d\theta}{25\sin^2(\theta)\sqrt{100-100\sin^2(\theta)}} =$$

$$= \int \frac{5\cos(\theta)d\theta}{25\sin^2(\theta)10\cos(\theta)} = \frac{1}{50}\int \csc^2(\theta)d\theta = -\frac{1}{50}\cot(\theta) + C$$

$$= -\frac{\sqrt{25-x^2}}{50x} + C$$

2. Compute the area of a circle of radius r by writing an equation for the circle, solving for y, and then integrating.

3. The *complete elliptic integral of the first kind* is $K(k) = \displaystyle\int_0^1 \frac{dt}{\sqrt{(1-t^2)\,(1-k^2t^2)}}$. Show that $K(k) = \displaystyle\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1-k^2\sin^2\theta}}$