$$V = \int_a^b A(x)\, dx$$ ..... volume when you know a cross−section area function

$$V = \int_a^b \pi \cdot (f(x))^2\, dx$$ ...... disk method about x−axis

$$V = \int_a^b \pi \cdot \left(f(x)^2 - g(x)^2\right)\, dx$$ .... washer method about x−axis

$$V = \int_c^d \pi\left[\left[x_r(y)\right]^2 - \left[x_l(y)\right]^2\right]\, dy$$ ...... washer method about y−axis

$$V = \int_a^b 2\pi x \cdot f(x)\, dx$$ .... cylindrical shells ; rotation of area below y = f(x) rotated about y−axis

$$L = \int_a^b \sqrt{1 + (f'(x))^2}\, dx$$ ...... arclength of a plane curve y = f(x)

$$SA = \int_a^b 2\pi f(x) \cdot \sqrt{1 + (f'(x))^2}\, dx$$ ..... lateral surface area when y = f(x) is rotated about the x−axis

$$x^* = \frac{\sum_{k=1}^{n} \left(m_k \cdot x_k\right)}{\sum_{k=1}^{n} m_k}$$ ...... center of mass for a discrete point−mass system

$$M = \int_a^b \delta(x)\, dx$$ ..... mass of a thin rod with variable density $\delta(x)$

$$x^* = \frac{\int_a^b x \cdot \delta(x)\, dx}{\int_a^b \delta(x)\, dx}$$ .... center of mass for a thin rod with variable density $\delta(x)$

$$x^* = \frac{\int_a^b x(f(x) - g(x))\, dx}{\int_a^b (f(x) - g(x))\, dx} \qquad y^* = \frac{\int_a^b \frac{1}{2} \cdot \left(f(x)^2 - g(x)^2\right)\, dx}{\int_a^b (f(x) - g(x))\, dx}$$ ..... center of mass (x*, y*) for a lamina

(these two will be given on the exam)

$W_k = F_k \cdot D_k = (\text{weight density})^* \; V_k \cdot D_k$ ..... work done in pumping liquids out of tanks.

$F_k = \left(\delta \cdot g \cdot h_k\right) \cdot A_k$ ..... force acting on a 2−D plate subject to hydrostatic pressure.