MA 221 – FORMULAS

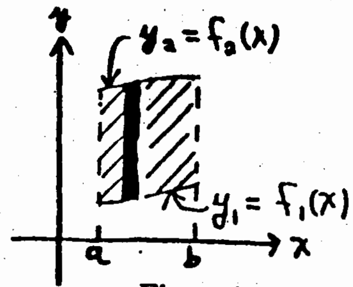

Figure 1

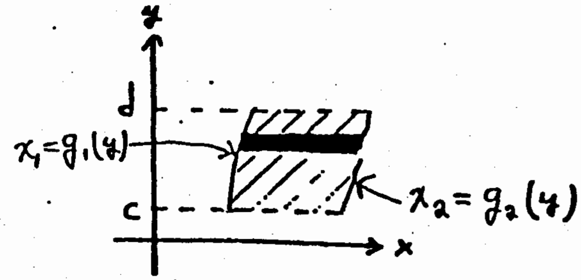

Figure 2

Volumes of Revolution

1. If the region in Fig. 1 is revolved about

(a) the x-axis: $V = \pi \int_a^b [(y_2)^2 - (y_1)^2]dx$ (b) the y-axis: $V = 2\pi \int_a^b x(y_2 - y_1)dx$

2. If the region in Fig. 2 is revolved about

(a) the x-axis: $V = 2\pi \int_c^d y(x_2 - x_1)dy$ (b) the y-axis: $V = \pi \int_c^d [(x_2)^2 - (x_1)^2]dy$

Moments and Centroids

1. For the region in Fig. 1: $M_x = \frac{1}{2}\int_a^b [(y_2)^2 - (y_1)^2]dx,$ $M_y = \int_a^b x(y_2 - y_1)dx$

2. For the region in Fig. 2: $M_x = \int_c^d y(x_2 - x_1)dy,$ $M_y = \frac{1}{2}\int_c^d [(x_2)^2 - (x_1)^2]dy$

The centroid of a plane region having area A is located at $(\overline{x}, \overline{y})$, where

$$\overline{x} = \frac{M_y}{A}, \qquad \overline{y} = \frac{M_x}{A}.$$

Mean and Root Mean Square

$$f_{av} = \frac{1}{b-a}\int_a^b f(x)\,dx, \qquad f_{rms} = \left\{\frac{1}{b-a}\int_a^b [f(x)]^2\,dx\right\}^{1/2}$$

Work

The work done in moving an object along the x-axis from $x = a$ to $x = b$ by a force $f(x)$ is

$$W = \int_a^b f(x)\,dx,$$

Fluid Pressure

The pressure p of a fluid in an open container, at a point y units below the surface, is $p = wy$, where w is the weight per unit volume of the fluid. If ρ is the density of the fluid (mass/unit volume), and g is the gravitational constant, then $w = \rho g$, so $p = \rho g y$.