

MA 221 – FORMULAS

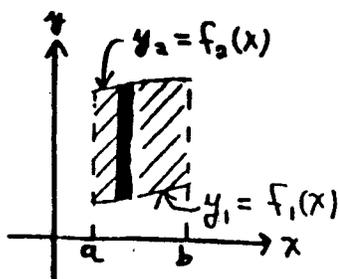


Figure 1

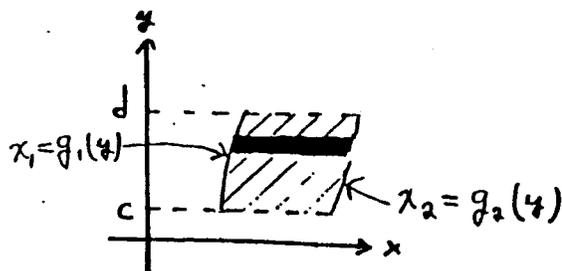


Figure 2

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 (\bar{x}, \bar{y}) , where

$$\bar{x} = \frac{M_y}{A}, \quad \bar{y} = \frac{M_x}{A}.$$

Mean and Root Mean Square

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

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 $p = \rho gy$.