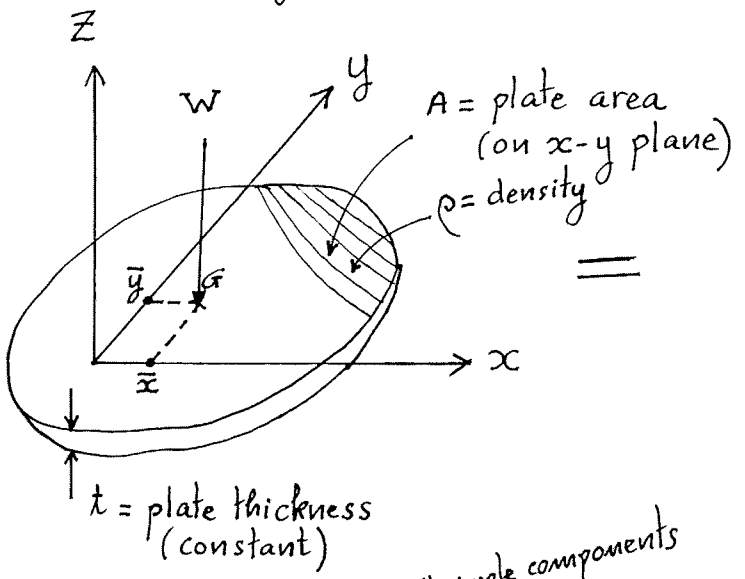
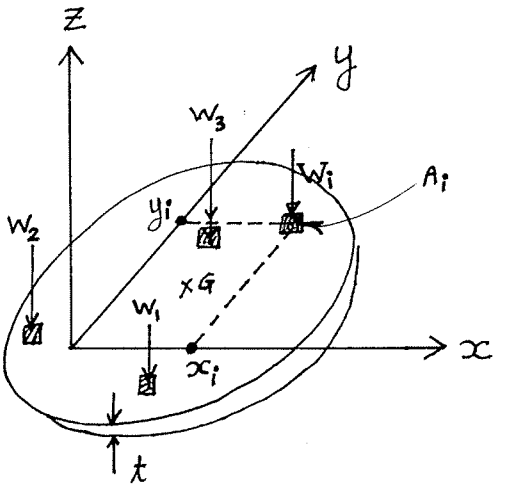
Chapter 5

Distributed Forces; Centroid Locations

Centroids of 2-D Objects



=



n = # simple components

$$|\Sigma F_z| \Rightarrow \quad W = \sum_{i=1} W_i$$

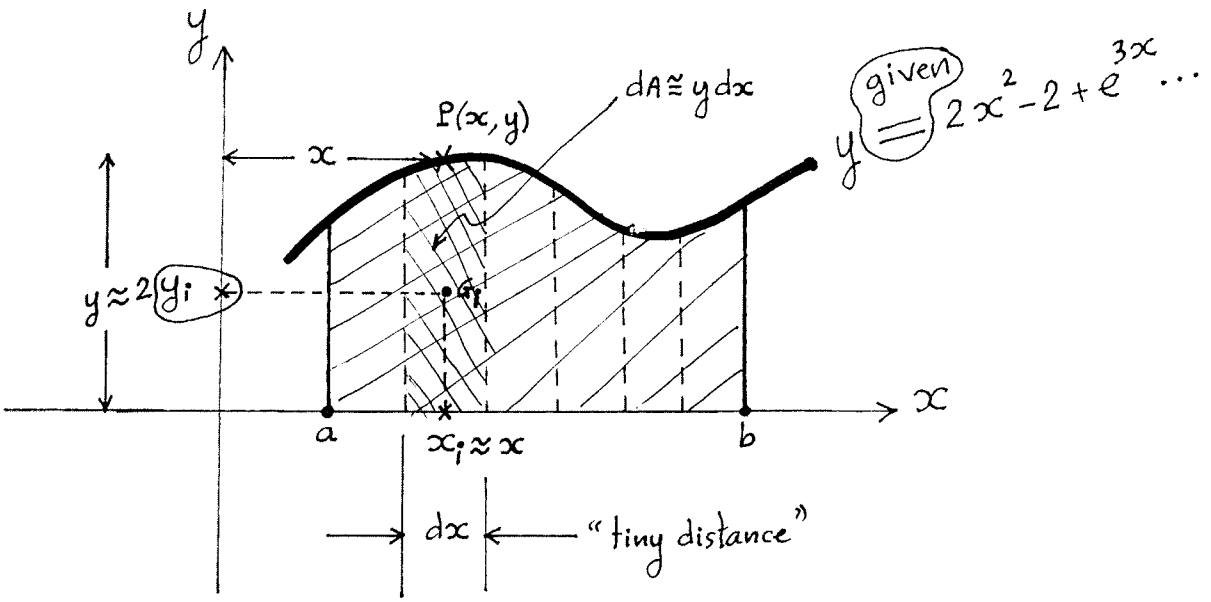
$$|\Sigma M_x| \Rightarrow (\cancel{Wt\rho})\,\bar{y} = \sum_i (\cancel{W_i t\rho})\, y_i \Rightarrow \boxed{A\,\bar{y} = \sum_i A_i y_i}$$

$(Wt\rho)$ $\qquad$ $(W_i t\rho)$

$$|\Sigma M_y| \Rightarrow (\cancel{Wt\rho})\,\bar{x} = \sum_i (\cancel{W_i t\rho})\, x_i \Rightarrow \boxed{A\,\bar{x} = \sum_i A_i x_i}$$

→ Eq. (5.1)

Centroids of 2-D Objects (by Integration)



Equation (5.1) will become :

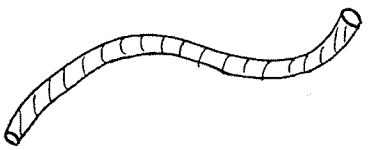
$$A\,\bar{x} = \sum_i x_i A_i = \iint x_i\, dA = \int_a^b x * y\, dx = A\,\bar{x}$$

→ Eq. (5.2)

$$A\,\bar{y} = \sum_i y_i A_i = \iint y_i\, dA = \int_a^b \frac{y}{2} * y\, dx = A\,\bar{y}$$

$2x^2 - 2 + e^{3x} \ldots$

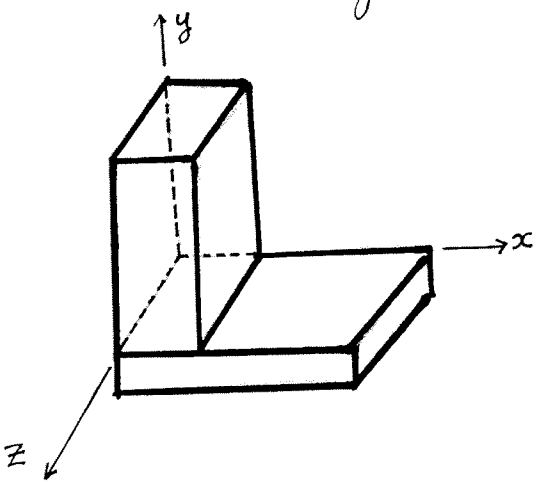
Centroids of 1-D Objects



$$L\,\bar{x} = \sum_i L_i\,x_i \overset{\text{or}}{=} \int_a^b x_i\,dL$$

Eq. (5.3)

Centroids of 3-D Objects



$$\bar{x}\,V = \sum_i x_i V_i \overset{\text{or}}{=} \iiint x_i\,dV$$

$$\bar{y}\,V = \sum_i y_i V_i = \iiint y_i\,dV$$

$$\bar{z}\,V = \sum_i z_i V_i = \iiint z_i\,dV$$

Eq. (5.4)