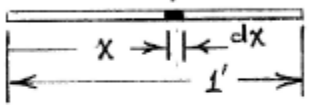


E36 Spring 2005
 Homework 8 Solutions
 5/4,14,44,88,92

$$\boxed{5/4} \quad \bar{x} = \bar{y} = -\frac{2r}{\pi} = -\frac{2(120)}{\pi} = \underline{-76.4 \text{ mm}}$$

$$\underline{\bar{z} = -180 \text{ mm}}$$

$\boxed{5/14}$ $dm = \rho dx$ ($\rho =$ mass per unit length)



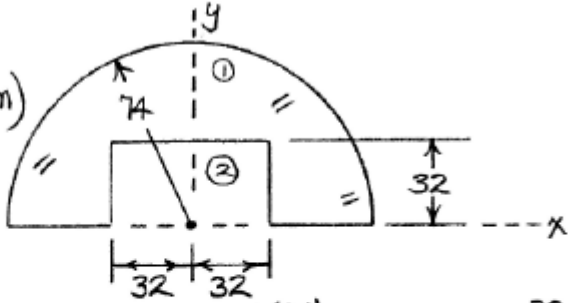
$$m = \int dm = \int \rho dx = \int_0^{l'} \rho_0 \left(1 - \frac{x}{l'}\right) dx$$

$$= \rho_0 \left[x - \frac{x^2}{2l'} \right]_0^{l'} = \frac{3}{4} \rho_0 l'$$

$$\int x dm = \int_0^{l'} x \rho_0 \left(1 - \frac{x}{l'}\right) dx = \rho_0 \left[\frac{x^2}{2} - \frac{x^3}{3l'} \right]_0^{l'} = \frac{\rho_0 l'^3}{3}$$

$$\bar{x} = \frac{\int x dm}{\int dm} = \frac{\rho_0 l'^3 / 3}{3\rho_0 l' / 4} = \underline{\frac{4}{9} l'}$$

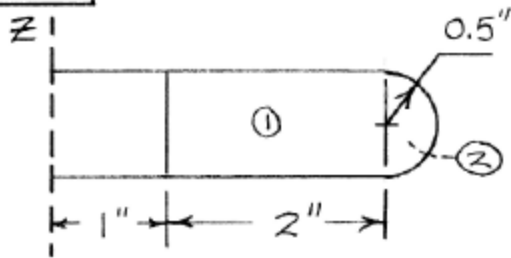
$\boxed{5/44}$
 (Dim. in mm)



$$\bar{Y} = \frac{\sum A \bar{y}}{\sum A} = \frac{\pi \frac{74^2}{2} \left(\frac{4(74)}{3\pi} \right) - 64(32) \left(\frac{32}{2} \right)}{\pi \frac{74^2}{2} - 64(32)}$$

$$= \underline{36.2 \text{ mm}}$$

5/88



$$V_1 = 2\pi \bar{r}_1 A_1 = 2\pi (1+1)(2 \cdot 1) = 25.1 \text{ in.}^3$$

$$V_2 = 2\pi \bar{r}_2 A_2 = 2\pi \left[1+2 + \frac{4(0.5)}{3\pi}\right] \left[\frac{\pi (0.5)^2}{2}\right]$$

$$= 7.93 \text{ in.}^3$$

$$V = V_1 + V_2 = \underline{33.1 \text{ in.}^3}$$

$$A_1 = 1(2\pi \cdot 1) + 2\pi (3^2 - 1^2) = 56.5 \text{ in.}^2$$

$$A_2 = 2\pi \bar{r}_2 A_2 = 2\pi \left[1+2 + \frac{2(0.5)}{\pi}\right] [\pi (0.5)]$$

$$= 32.8 \text{ in.}^2$$

$$A = A_1 + A_2 = \underline{89.3 \text{ in.}^2}$$

5/92 From the solution to Prob. 5/7 ,

$$\bar{r} = 8 - \frac{2}{3} \frac{2(1.5)+2}{1.5+2} = 7.05 \text{ m}$$

$$A = \frac{2+1.5}{2} (2) = 3.5 \text{ m}^2$$

$$\theta = \pi/3$$

$$\text{So } V = \theta \bar{r} A = \frac{\pi}{3} (7.05)(3.5) = 25.8 \text{ m}^3$$

$$W = \rho g V = 2400(9.81)(25.8) = 608(10^3) \text{ N}$$

$$\text{or } \underline{W = 608 \text{ kN}}$$