$$= \frac{1}{L}\cdot\left[\frac{x^2}{2}\right]_0^L$$

$$x_{cm} = \frac{1}{L}\cdot\left(\frac{L^2}{2} - \frac{0}{2}\right) = \frac{1}{L} \times \frac{L^2}{2}$$

$$\boxed{x_{cm} = \frac{L}{2}}$$

$$y_{cm} = \frac{1}{M}\cdot\int y\,dm = \frac{1}{M}\int 0\cdot dm \rightarrow \boxed{y_{cm} = 0}$$

i.e cm of the ~~unif~~ uniform rod is at centre of the rod.

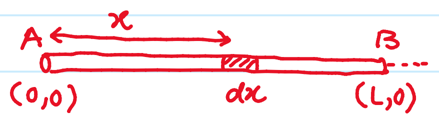
Q1. A uniform rod AB of length L has linear density $\mu(x) = a + \frac{bx}{L}$, where x is measured from A. If the CM of the rod lies at a distance of $(\frac{7}{12})L$ from A, then a and b are related as : **JEE Main (online) 2015**

(a)a = 2b (b) 2a = b (c) a = b (d) 3a = 2b

Q2. Distance of centre of mass of a solid uniform cone from its vertex is Z_0. If the radius of its base is R and its height is h then Z_0 is equal to: **JEE Main (offline) 2015**

(a) $\frac{5h}{8}$ (b) $\frac{3h^2}{8R}$ (c) $\frac{h^2}{4R}$ (d) $\frac{3h}{4}$

$$\lambda = a + \frac{bx}{L}$$



$$dm = \lambda\cdot dx$$

$$= \left(a + \frac{bx}{L}\right)\cdot dx \quad (1)$$

$$M = \int_{x=0}^{x=L} dm = \int_0^L \left(a + \frac{bx}{L}\right)dx$$

$$M = \left[ax + \frac{b}{L}\cdot\frac{x^2}{2}\right]_0^L$$

$$M = aL + \frac{b}{\cancel{L}}\cdot\frac{L^{\cancel{2}}}{2} = L\left(a + \frac{b}{2}\right) \quad (2)$$

$$x_{cm} = \frac{1}{M}\cdot\int_0^L x\,dm = \frac{1}{M}\cdot\int_0^L x\left(a + \frac{bx}{L}\right)dx$$

$$x_{cm} = \frac{1}{M}\cdot\int_0^L \left(ax + \frac{bx^2}{L}\right)dx$$

$$= \frac{1}{M}\left\{\int_0^L ax\,dx + \int_0^L \frac{bx^2}{L}\cdot dx\right\}$$

$$= \frac{1}{M}\left\{\left[a\frac{x^2}{2}\right]_0^L + \left[\frac{b}{L}\cdot\frac{x^3}{3}\right]_0^L\right\}$$

$$x_{cm} = \frac{1}{M}\cdot\left\{\frac{aL^2}{2} + \frac{b}{\cancel{L}}\cdot\frac{L^{\cancel{3}\,2}}{3}\right\} = \frac{L^2}{M}\cdot\left\{\frac{a}{2} + \frac{b}{3}\right\}$$

$$\frac{7}{12}\cancel{L} = \frac{\cancel{L^2}}{\cancel{L}\left(a + \frac{b}{2}\right)}\cdot\left(\frac{a}{2} + \frac{b}{3}\right)$$