GM

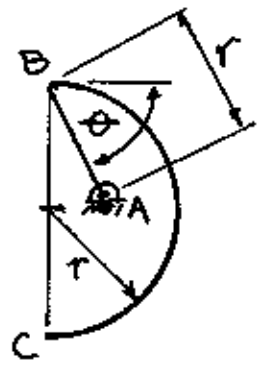
MECH 234 + 235
CENTROIDS

PROB. 5-32
p. 225

Homogeneous wire attached to hinge, A.

Determine θ for equilibrium (balance).

Refer to Sample Prob. 5.2



Think about this!

For equilibrium, there should be No MOMENT about A.

$\Sigma M_A = 0$ ∴ No moment arm.

∴ The center of gravity must lie along a "line of action" thru pt. A ∴ $\bar{x} = 0$ and $\Sigma \bar{x} L = 0$

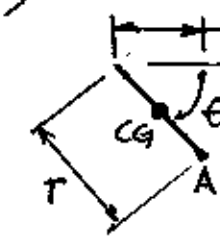
Refer to p. 216

I. Semicircular Arc (turn 90°) + II. Line

$L = \pi r$

$\bar{x} = \frac{2r}{\pi}$ right of A

+



$L = r$

$\bar{x} = \frac{1}{2} r\cos\theta$ left of pt. A ↳ neg. sign

Since $\Sigma \bar{x} L = 0 = \left[\left(\frac{2r}{\pi} - r\cos\theta\right)(\pi r)\right] + \left[\left(-\frac{1}{2} r\cos\theta\right)(r)\right]$

$0 = 2r^2 - \pi r^2 \cos\theta - \frac{1}{2} r^2 \cos\theta$

$2 = \pi\cos\theta + \frac{1}{2}\cos\theta$

$4 = (2\pi + 1)\cos\theta$

$\frac{4}{(2\pi+1)} = \cos\theta \Rightarrow \theta = \cos^{-1}\left[\frac{4}{2\pi+1}\right] = \boxed{56.7° = \theta}$