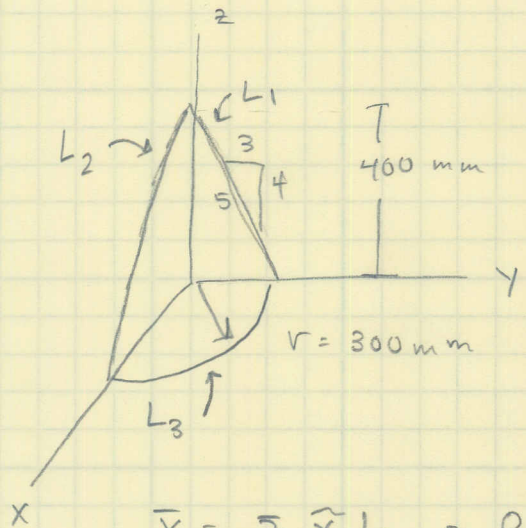
9-49 Find centroid of composite shape



L_1 centroid (0, 150, 200)

L_2 centroid (150, 0, 200)

L_3 centroid $\left(\frac{2r}{\pi}, \frac{2r}{\pi}, 0\right)$

$L_1 = 500$ mm

$L_2 = 500$ mm

$L_3 = \frac{\pi}{2} r = 471$

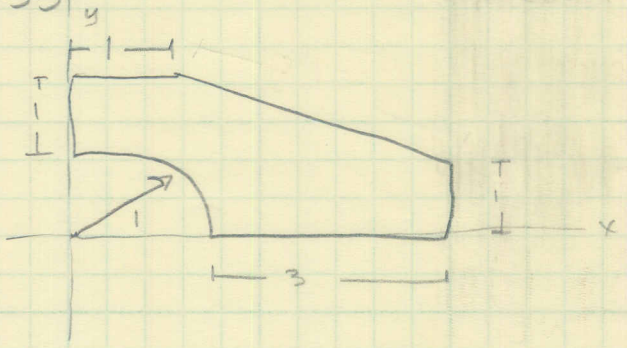
$$\bar{X} = \frac{\Sigma \tilde{x} L}{\Sigma L} = \frac{0(500) + (150)(500) + \frac{2(300)}{\pi}(471)}{500 + 500 + 471}$$

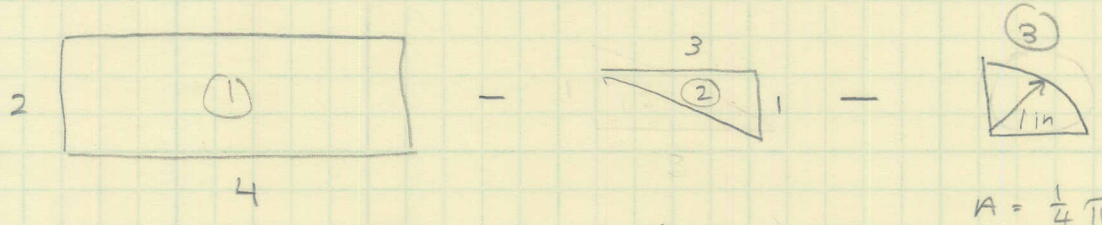
$$\bar{X} = \frac{165000}{1471.24} = \boxed{112 \text{ mm}}$$

$\boxed{\bar{y} = 112 \text{ mm}}$ (due to symmetry)

$$\bar{Z} = \frac{\Sigma \tilde{z} L}{\Sigma L} = \frac{(200)(500) + (200)(500) + 0}{1471.24} = \boxed{136 \text{ mm}}$$

9-55





$A = 8$
$C = (2, 1)$

$A = \frac{1}{2}(3)(1) = 1.5$
$C = (3, \frac{2}{3}(2))$

$A = \frac{1}{4}\pi r^2 = 0.785$
$C = \frac{4r}{3\pi}, \frac{4r}{3\pi}$

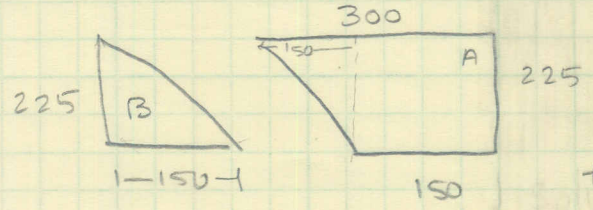
segmt	Area	$\tilde{x}$	$\tilde{y}$	$\Sigma \tilde{x} A$	$\Sigma \tilde{y} A$
(1)	8	2	1	16	8
(2)	1.5	3	1.33	4.5	1.995
(3)	0.785	0.425	0.425	0.33	0.33
	5.715			11.17	5.675

$$\bar{x} = \frac{\Sigma \tilde{x} A}{\Sigma A} = \frac{11.17}{5.715} = \boxed{1.95 \text{ in}}$$

$$\bar{y} = \frac{\Sigma \tilde{y} A}{\Sigma A} = \frac{5.675}{5.715} = \boxed{0.993 \text{ in}}$$

* Note difference from ans in back of book

9-65



thickness = 30

$m_B = \frac{1}{2}(150_{mm})(225_{mm})(30_{mm})\left[8.740 \frac{Mg}{m^3}\right] = 4.424625\ kg$

$V_{iB} = 5.06 \times 10^{-4}\ m$

$m_{a\,triangle} = \frac{1}{2}(150_{mm})(225_{mm})(30_{mm})\left[7.85 \frac{Mg}{m^3}\right] = 3.97\ kg$

$V_{triangle} = 5.06 \times 10^{-4}\ m$

$m_{a\,sq} = (150)(225)(30)\left[7.85 \frac{Mg}{m^3}\right] = 7.948\ kg$

$V_{sq} = (150)(225)(30) = 1.01 \times 10^{-3}\ m$

Segment	mass	$\tilde{x}$(m)	$\tilde{z}$	$\Sigma \tilde{x} m$	$\Sigma \tilde{z} m$
B triangle	4.42	0.05	0.075	0.221	0.3315
A triangle	3.97	0.1	0.15	0.397	0.5955
A sq	7.9418	0.225	0.1125	1.788	0.894
	16.34			2.406	1.82

$\bar{x} = \frac{\Sigma \tilde{x} m}{\Sigma m} = \frac{2.406}{16.34} = \boxed{0.147\ m}$ * note slightly different ans from back of book

$\bar{z} = \frac{\Sigma \tilde{z} m}{m} = \frac{1.82}{16.34} = \boxed{0.111\ m}$