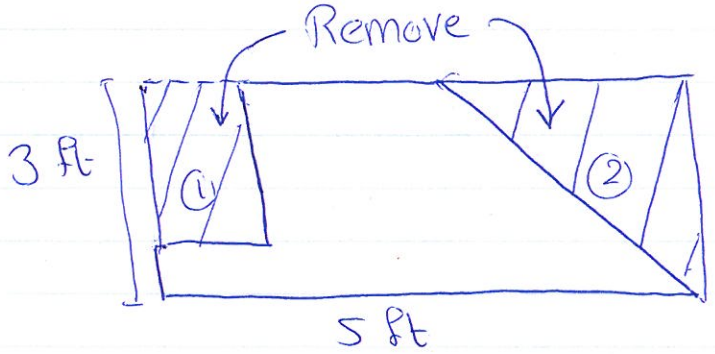
7 March 2012

$$W = \sum_{i=1}^{N} \Delta W_i \quad \Rightarrow \text{Force Equivalency}$$

$$\bar{X} \cdot W = \sum_{i=1}^{N} X_i \Delta W_i \quad \Rightarrow \text{Moment Equivalency}$$

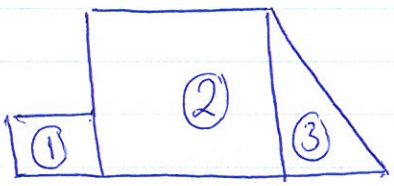
Example 7.10

Ans



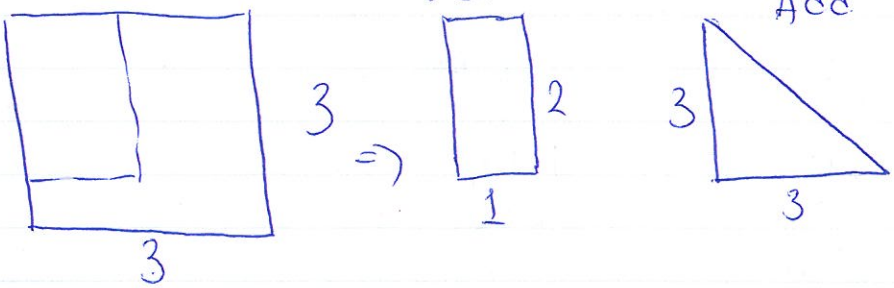
method 1

Start ~~with big~~ piece & remove ① and ②



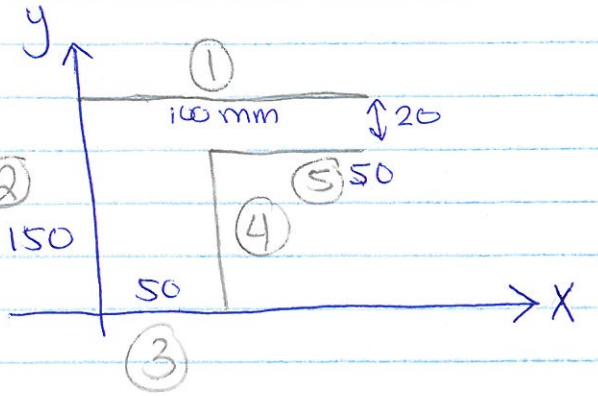
Add ① + ② + ③

method 2



method 3

Q 9.44



Segment (i)	L_i (mm)	x_i (mm)	y_i (mm)
1	100	50	150
2	150	0	75
3	50	25	0
4	130	50	65
5	50	75	130
	480		

Total length, $L = \Sigma L_i = 480$ mm

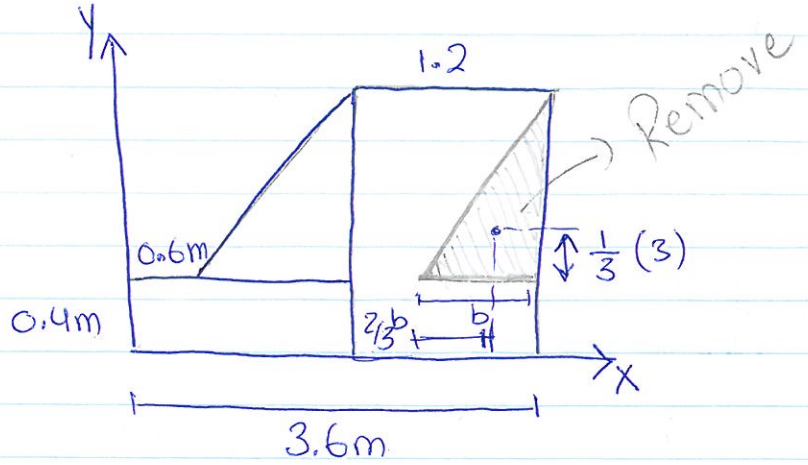
$$\bar{x} = \frac{\Sigma x_i L_i}{\Sigma L_i} = \frac{16{,}500}{480} = \boxed{34.4 \text{ mm}}$$

$x_i L_i$ (mm²)	$y_i L_i$ (mm²)
5,000	15000
0	11,250 ~~7,800~~
1,250	0
6,500	8,450
3,750	6,500
16,500	~~37~~ 41,200

$$\bar{y} = \frac{\Sigma y_i L_i}{\Sigma L_i} = \frac{41{,}200}{480} = \boxed{84.4 \text{ mm}}$$

Q9.56

Ans/



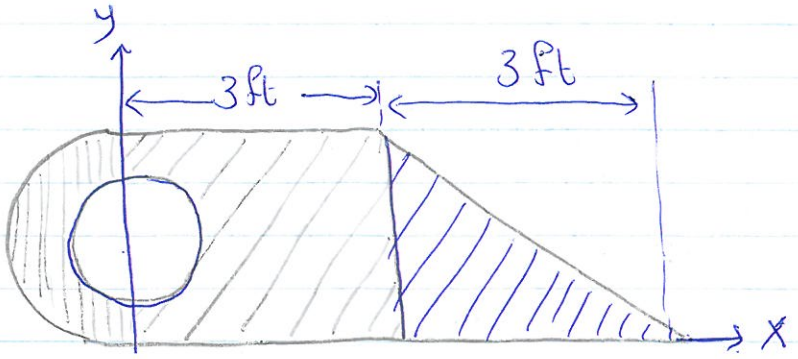
Segment i	A_i = Area (m^2)	x_i (m)	y_i (m)	$x_i A_i$ (m^3)	$y_i A_i$ (m^3)
+ 3.4 × 1.2	$3.4 \times 1.2 =$ 4.08	3	1.7	12.24	6.936
− 3 × 0.6	$-(\frac{1}{2})(3)(0.6) =$ −0.9	3.4	1.4	−3.06	−1.26
0.4 × 2.4	+0.96	1.2	0.2	1.15	0.192
+ 3 × 1.8	+2.7	1.8	1.4	4.86	3.78
	6.84			15.192	9.648

$$\bar{x} = \frac{\Sigma x_i A_i}{\Sigma A_i} = 2.221\,m$$

$$\bar{y} = \frac{\Sigma y_i A_i}{\Sigma A_i} = 1.411\,m$$

Q 9.60

Ans:



Segment i	Area A_i (m^2)	X_i (m)	y_i (m)	$X_i A_i$ (m^3)	$y_i A_i$ (m^3)
+ (1.5)	$\frac{1}{2} \times \pi \times 1.5^2 = 3.534$	$\frac{-4r}{3\pi}$ (1.5) $= -0.637$	1.5	-2.25	5.301
− (1)	$-\pi(1)^2 = -3.142$	~~$\pi(1)^2$~~ 0	1.5	0	-4.713
+ 3 × 3	9	1.5	1.5	13.5	13.5
+ 3, 3	4.5	4	1	18	4.5
	13.893			29.25	18.59

$$\bar{X} = \frac{\Sigma X_i A_i}{\Sigma A_i} = \frac{29.25}{13.893} = 2.11 \text{ ft}$$

$$\bar{y} = \frac{\Sigma y_i A_i}{\Sigma A_i} = \frac{18.59}{13.89} = 1.34 \text{ ft}$$

Q9.76)

Ans.

Segment i	Volume V_i (m^3)	x_i (m)	y_i (m)	$x_i V_i$ (m^4)	$y_i V_i$ (m^4)
Cone 	$\frac{1}{3}\pi R^2 a$	$\frac{3}{4}a$	0		0
Cylinder 	$\pi R^2 b$	$a+\frac{b}{2}$	0		0
Hemisphere 	$\frac{2}{3}\pi R^3$	$a+b+\frac{3c}{8}$	0		0

$$\bar{x} = \frac{\Sigma x_i V_i}{\Sigma V_i} =$$

$$\bar{y} = \frac{\Sigma y_i V_i}{\Sigma V_i} =$$

"Kinematics"

Chapter 12

$\bar{r} = s \cdot \bar{u}$

distance from origin = s , position vector = $\bar{r}$

Velocity ⇒ refers to the position vector (net change)

Speed ⇒ add all the ~~speeds up~~ distances up.

Instantaneous velocity ⇒ velocity at a given time.