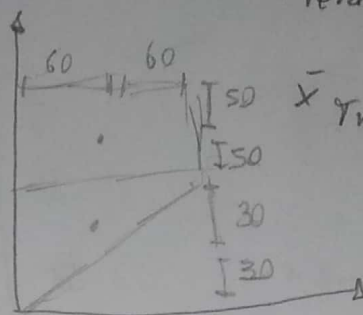
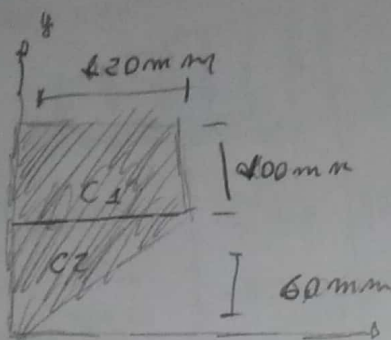


5.1



$$\bar{x}_{\text{retangulo}} = \frac{mm}{2}$$

$$\bar{x}_{\text{triangulo}} = \frac{z}{3} \cdot mm$$

	$A \text{ mm}^2$	$\bar{x} \text{ mm}$	$\bar{y} \text{ mm}$	$\bar{x} A \text{ mm}^3$	$\bar{y} A \text{ mm}^3$
I	12000	60	110	720000	1320000
II	3600	40	40	144000	144000
Σ	15600			864000	1464000

RETANGULO

Area retangulo

$$A = 120 \cdot 100 = 12000$$

$$\bar{x} = \frac{mm}{2} = \frac{120}{2} = 60$$

$$\bar{y} = \frac{60}{2} + \frac{100}{2} = 110$$

$$\bar{x}_A = A \text{ mm}^2 \cdot \bar{x} \text{ mm} = 12000 \cdot 60 = 720000$$

$$\bar{y}_A = 12000 \cdot 110 = 1320000$$

TRIANGULO

A120

Triangulo

$$A = \frac{mm \cdot mm}{2} = \frac{120 \cdot 60}{2} = 3600$$

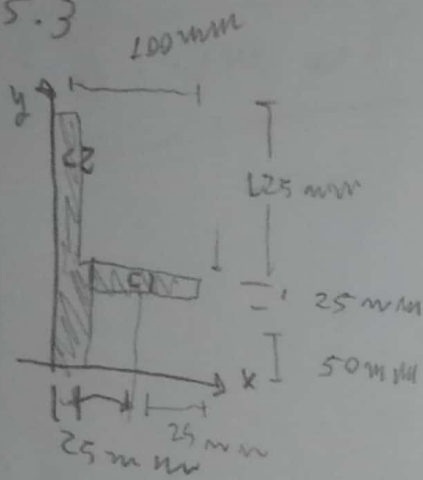
$$\bar{x} = \frac{z}{3} \cdot 60 = 40$$

$$\bar{y} = \frac{z}{3} \cdot 60 = 40$$

$$\bar{x}_A = 40 \cdot 3600 = 144000$$

$$\bar{y}_A = 3600 \cdot 40 = 144000$$

5.3



	A	\bar{x}	\bar{y}	$\bar{x}A$	$\bar{y}A$
I	5000	12,5	100	62500	500000
II	1875	50	50	93750	93750
Σ	6875			156250	593750

$$\bar{x} = \frac{\Sigma \bar{x}A}{\Sigma A} = \frac{156250}{6875} = 22,73 \text{ mm}$$

$$\bar{y} = \frac{\Sigma \bar{y}A}{\Sigma A} = \frac{593750}{6875} = 86,29 \text{ mm}$$

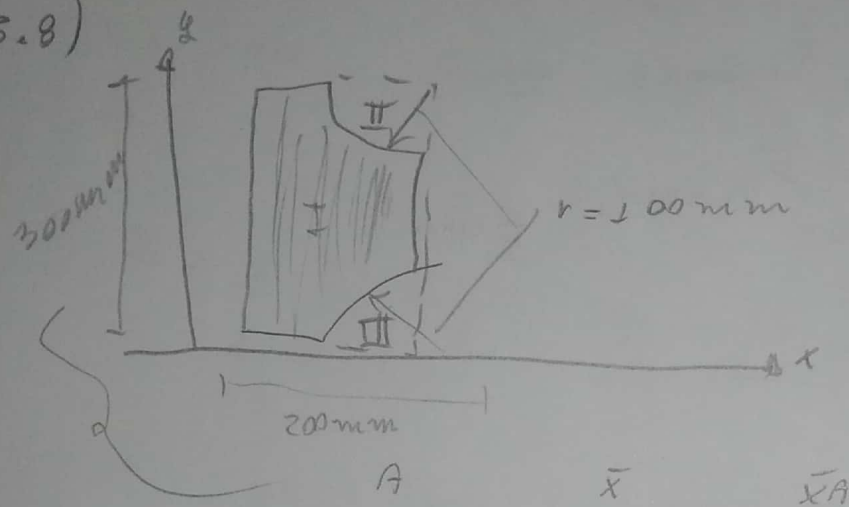
$$\bar{x} = C2 = \frac{25}{2} = 12,5 \quad \bar{y} = C2 = \frac{100}{2} = 50$$

$$\bar{x} = C1 = \frac{50}{2} = 25 \quad \bar{y} = C1 = 25$$

$$A = C1 = 200 \cdot 25 = 5000$$

$$A = C2 = 75 \cdot 25 = 1875$$

S.8)



	A	\bar{x}	$\bar{x} A$
I	60000	100	6000000
II	- 7853,98	30,23	- 237425,81
III	- 7853,98	30,23	- 237425,81
Σ	44292		5525148,37

I
II
 Σ

$$200 \times 300 = 60000$$

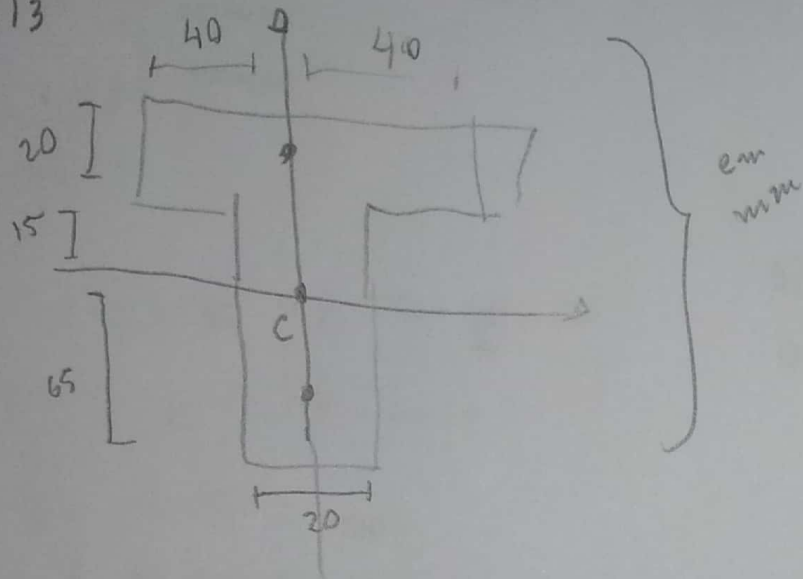
$$A_{II} = A_{III} = - \frac{\pi r^2}{4} = - \frac{\pi (100)^2}{4} = - 7853,98$$

$$x_{II} = x_{III} = 200 - \frac{4r}{3\pi} = 200 - \frac{4 \cdot 100}{3\pi} = +30,23$$

$$\frac{\Sigma \bar{x} A}{\Sigma A} = \frac{5525148,37}{44292} = 124,7$$

$$\frac{\sum A}{\sum A} = \frac{5525148,37}{44292} = 124,7$$

5.13



$$\begin{aligned} Q_1 &= \sum y A \\ &= (25)(70 \cdot 80) + (7,5)(15 \cdot 20) \\ &= 40000 + 2250 \\ &= 42250 \text{ mm}^3 \end{aligned}$$

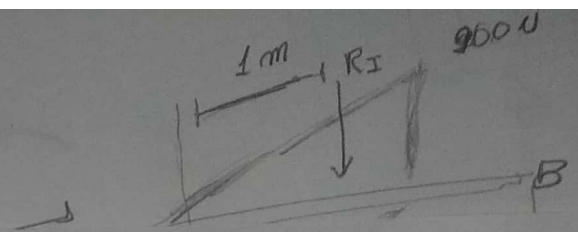
$$\begin{aligned} Q_2 &= \sum y A \\ &= (-32,5)(65 \cdot 20) \\ &= -42250 \text{ mm}^3 \end{aligned}$$

$$Q_1 = Q_2 = Q \sum y A = 0$$

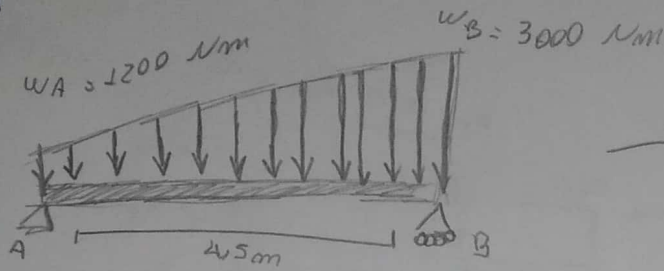
C é o centro e

$$Q = \sum y A = 0$$

\bar{x} mm	\bar{y} mm	$x A$ mm ³	$y A$ mm ³
105	15	661500	94500
225	150	2025000	1350000
		2686500	1444500



5.49



$$\begin{aligned} r_A &= 1,5 \text{ m} \\ r_B &= 3 \text{ m} \\ r_{BA} &= 4,5 \text{ m} \end{aligned} \quad \left. \begin{array}{l} \text{até a} \\ \text{posição} \\ C \end{array} \right\}$$

Resultante I

$$\begin{aligned} R_I &= \frac{1}{2} \cdot (1200 \cdot 4,5) \\ &= 2700 \text{ N} \end{aligned}$$

$$\begin{aligned} \downarrow R &= R_I + R_{II} \\ &= 9450 \text{ N} \end{aligned}$$

Reações

$$\sum M_A = 0$$

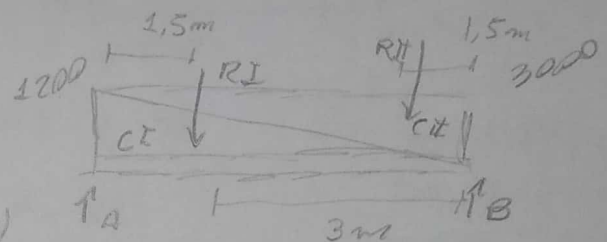
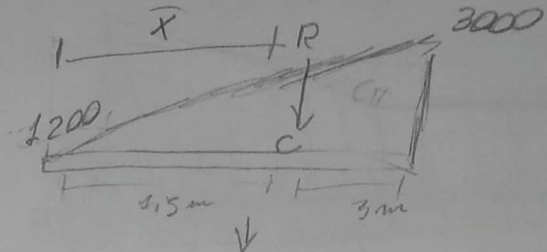
$$\begin{aligned} r_{BA} \cdot B - x \cdot R &= 0 \\ 4,5 \cdot B - 2,7 \cdot 9450 &= 0 \end{aligned}$$

$$B = \frac{(2,7 \cdot 9450)}{4,5}$$

$$B = 5400 \text{ N}$$

Resultante II

$$\begin{aligned} R_{II} &= \frac{1}{2} (3000 \cdot 4,5) \\ &= 6750 \text{ N} \end{aligned}$$



$$\begin{aligned} \bar{x} &= \frac{(r_A \cdot R_I) + (r_B \cdot R_{II})}{R} \\ &= \frac{(1,5 \cdot 2700) + (3 \cdot 6750)}{9450} \end{aligned}$$

$$\bar{x} = 2,7 \text{ m}$$

$$\sum F_y = 0$$

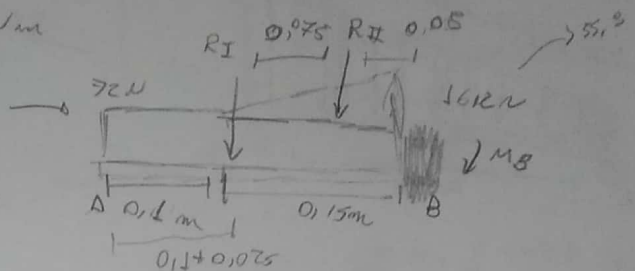
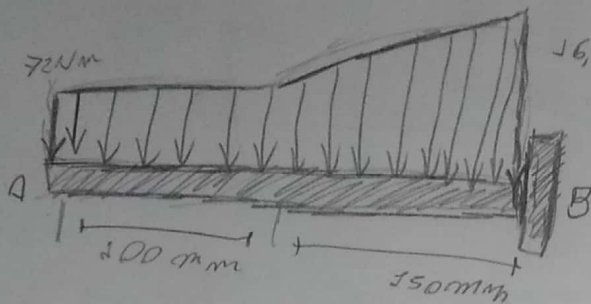
$$B - R + A = 0$$

$$5400 - 9450 + A = 0$$

$$A = 9450 - 5400$$

$$A = 4050 \text{ N}$$

5.52



$$R_I = (72) \cdot (0.125 + 0.125) \\ = 72 \cdot 0.25 \\ = 18.75$$

$$R_{II} = \frac{1}{2} \cdot (0.125) \cdot (55.8) \\ R_{II} = 4.185$$

$$\uparrow \sum F_y = 0$$

$$B - 18.75 - 4.185 = 0$$

$$B = 18.75 + 4.185$$

$$B = 23.6$$

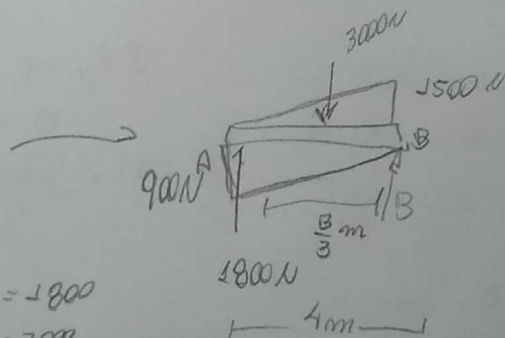
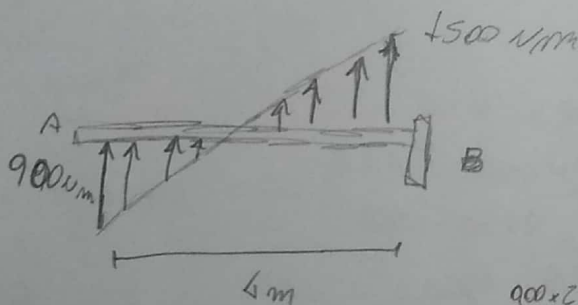
$$\sum M_B = 0$$

$$(0.125) \cdot R_{II} + (0.125) \cdot R_I - M_B = 0$$

$$M_B = 0.125 \cdot 4.185 + 0.125 \cdot 18.75$$

$$M_B = 2.553$$

2.53



$$900 \times 2 = 1800 \\ 1500 \times 2 = 3000$$

$$\uparrow \sum F_y = 0$$

$$B + 1800 - 3000 = 0$$

$$B = 3000 - 1800$$

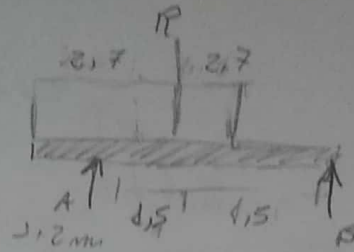
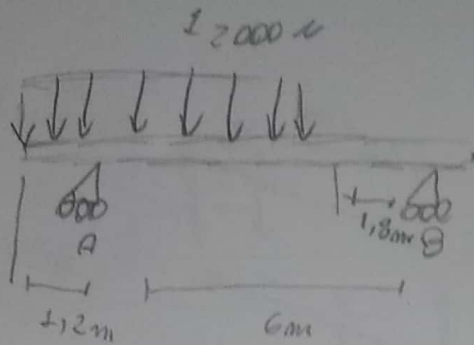
$$B = 1200 \text{ N}$$

$$\sum M_B = 0$$

$$M_B + 3000 \left(\frac{4}{3} \right) - 1800 \left(\frac{8}{3} \right)$$

$$M = 800 \text{ Nm}$$

5.54



$$R = (12000) \cdot (2.7 + 2.7)$$

$$= 64800$$

$$\sum M_A = 0$$

$$6 \cdot B - 1.5 (64800) = 0$$

$$6B = +1.5 \cdot 64800$$

$$B = 16200 \text{ N}$$

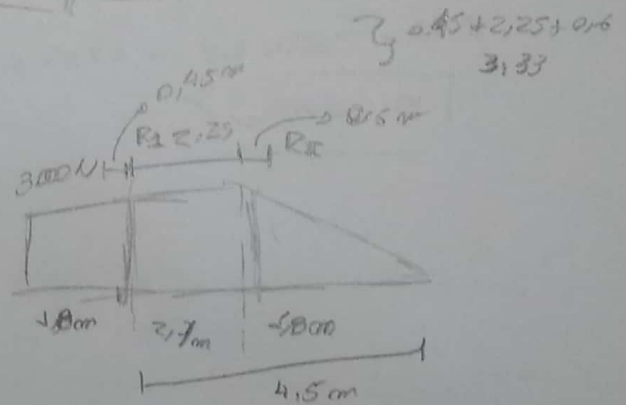
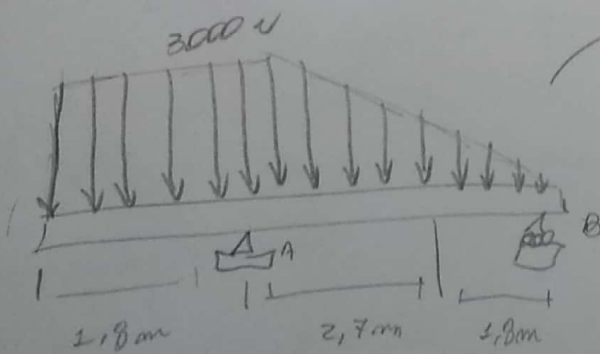
$$\sum F_y = 0$$

$$A - 64800 + 16200 = 0$$

$$A = 64800 - 16200$$

$$A = 48600$$

5.55



$$R_1 = (3000) \cdot 4.5$$

$$= 13500 \text{ N}$$

$$R_2 = (3000) \cdot 1.8 \cdot \frac{1}{2}$$

$$= 5400 \text{ N} \cdot \frac{1}{2}$$

$$= 2700 \text{ N}$$

$$\sum M_A = 0$$

$$(+B \cdot 4.5) - R_1 \cdot 0.45 - R_2 \cdot (3.33)$$

$$4.5B - 13500 \cdot 0.45 + 2700 \cdot 3.3$$

$$B = 3330 \text{ N}$$

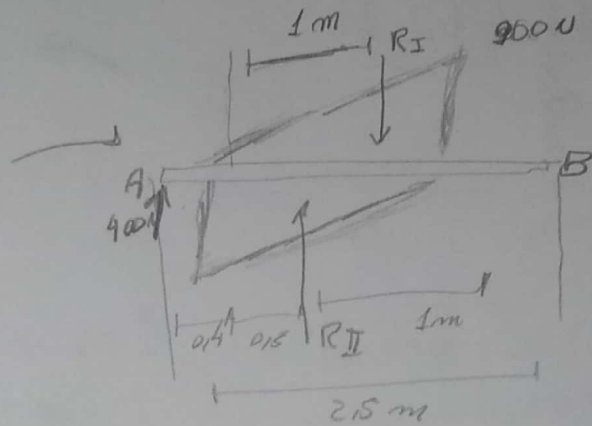
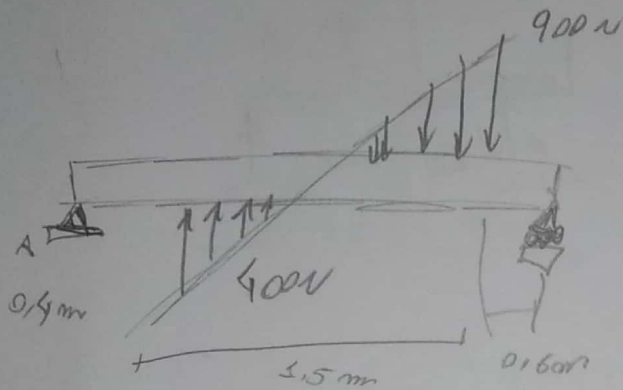
$$\sum F_y = 0$$

$$A + B - 2700 - 13500$$

$$A = 2700 + 13500 - 3330$$

$$A = 12870 \text{ N}$$

5.56



$$R_I = \frac{1}{2} \cdot (900) \cdot 1,5$$

$$R_I = 675 \text{ N}$$

$$R_{II} = \frac{1}{2} (400) \cdot 1,5$$

$$R_{II} = 300 \text{ N}$$

$$\sum M_A = 0$$

$$(2,5 \cdot B) + (300 \cdot (0,4 + 0,5)) - (675 \cdot (0,4 + 1)) = 0$$

$$2,5B = -300 \cdot 0,9 + 675 \cdot 1,4$$

$$B = 270 \text{ N}$$

$$\sum F_y = 0$$

$$A + B + R_{II} - R_I$$

$$A = -270 - 300 + 675$$

$$A = 105$$