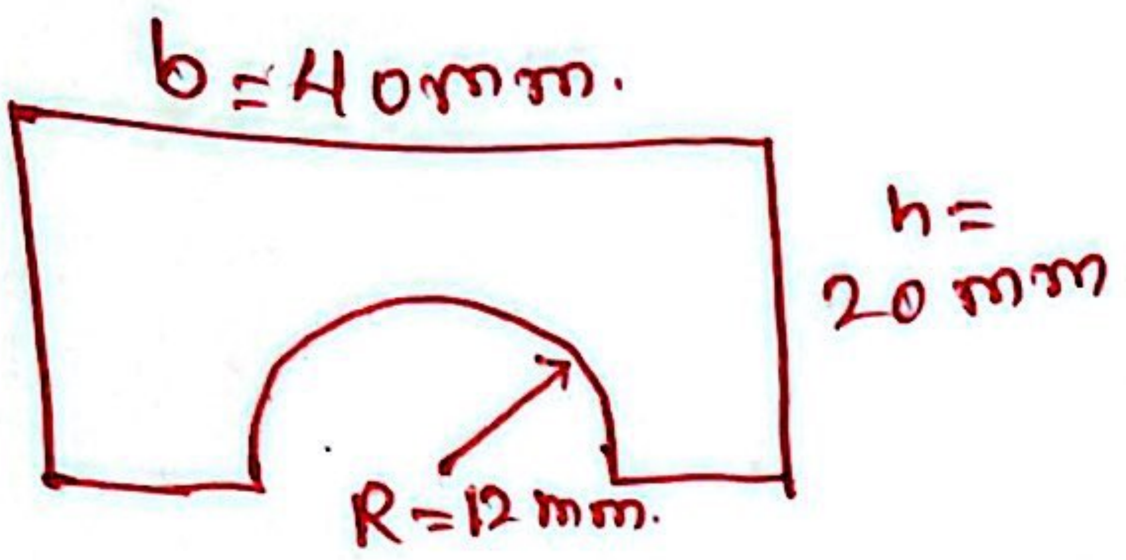
Q3.



Marking:

for the ambiguity.

R = 6mm.

↳ marks are awarded.

Area of semi circle, & rectangle (full)

$$A_c = \frac{\pi R^2}{2}, \quad A_r = bh.$$

Hence the Position of the NA, from bottom.,

$$y_{NA} = \frac{\left(A_r \frac{h}{2} - A_c \frac{4R}{3\pi}\right)}{A_r - A_c} = 11.93 \text{ mm.} \quad \text{—— } 2.$$

Second moment of area about NA,

$$I = \frac{1}{12} bh^3 + A_r \left(y_{NA} - \frac{h}{2}\right)^2 - \left[0.11 R^4 + A_c \times \left(y_{cm} - \frac{4R}{3\pi}\right)^2\right]$$

$$= 1.6792 \times 10^4 \text{ mm}^4 \quad \text{—— } 3.$$

~~If~~ *

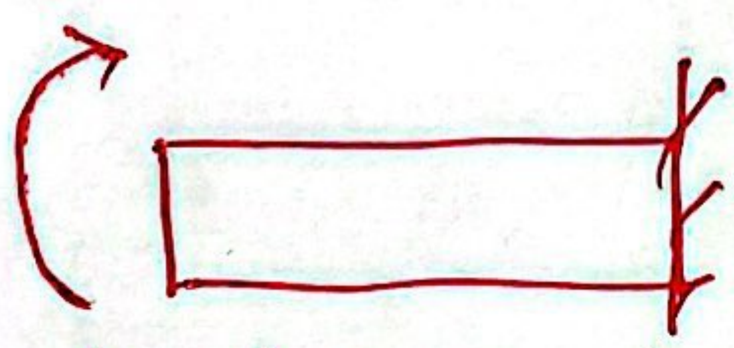
there could be two cases possible.

*If you discuss only one case — 4

method — 2

write answer — 2

Case 1.



If ans is wrong and you fail to desribe method just wrote some numbers → 0

Lower part is in tension,

Stress at bottom, (limiting case)

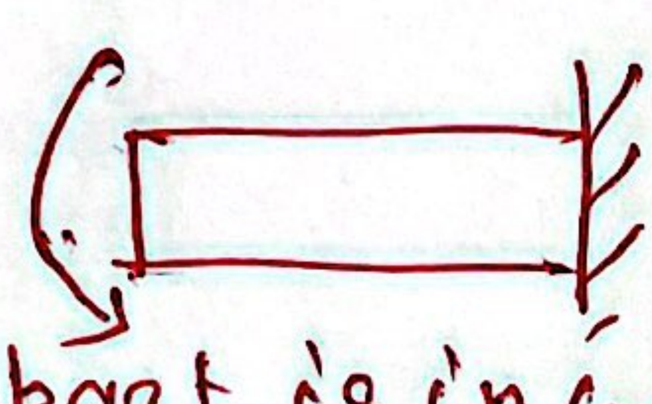
$$\frac{M_t \, y_{NA}}{I} = 80 \Rightarrow M_t = 112.56 \text{ KN-m.}$$

Stress at top, (Limiting case)

$$\& \quad \frac{M_c (h - y_{NA})}{I} = 100 \Rightarrow M_c = 208.19 \text{ KN-m.}$$

thence the value of max moment applieed would be min of these H values i.e. 112.56 KN-m. Ans

Case II



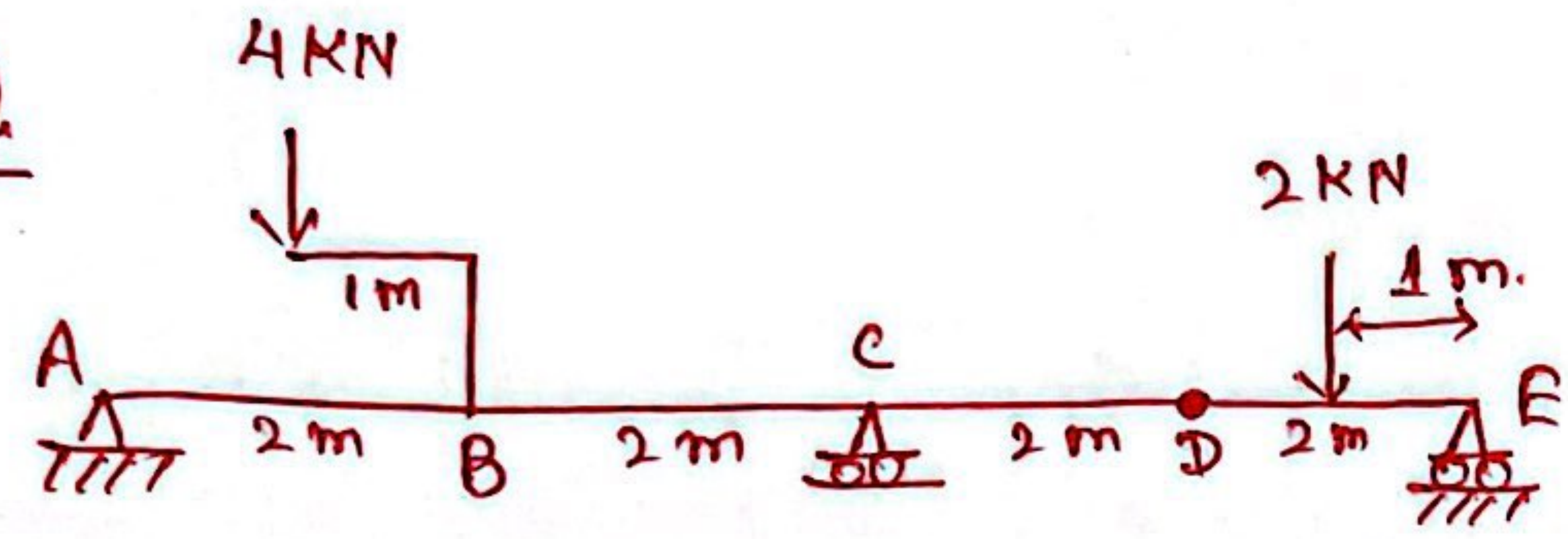
Lower part is in compres-ion.

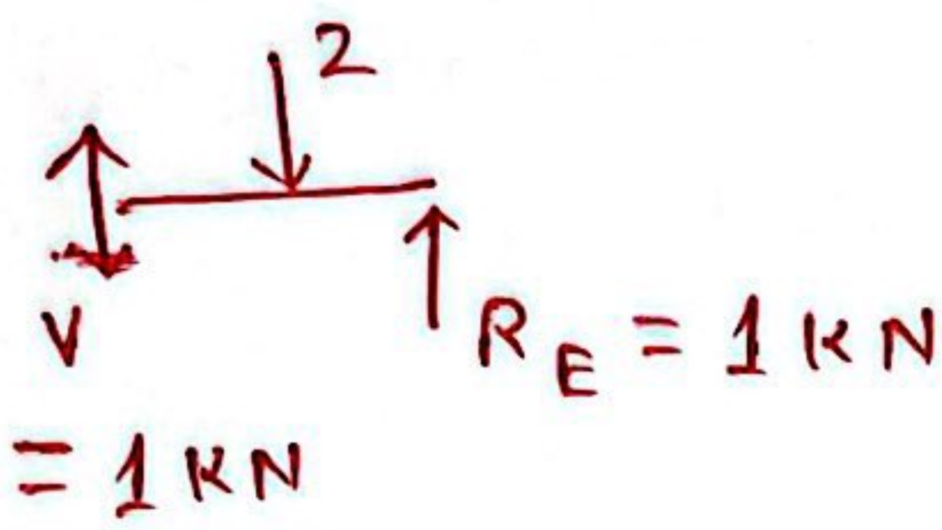
Then, ~~If~~ If M_t is the moment ~~for at~~ for the stress at top to reach limiting case,

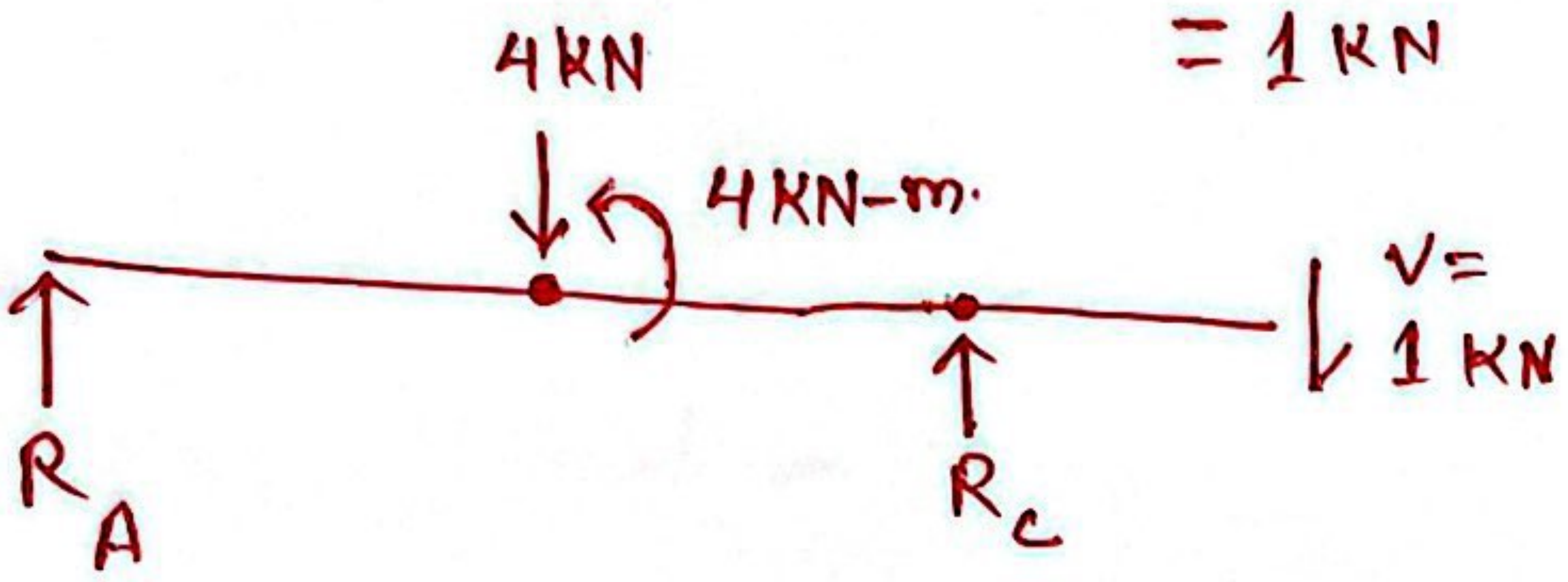
$$M_t = \frac{80 \times I}{h - y_{NA}} = 161 \text{ KN-m}$$

& If M_c is moment for stress at bottom to reach limiting case, $M_c = 100 \, I / y_{NA} = 140 \text{ KN-m}$

(6).





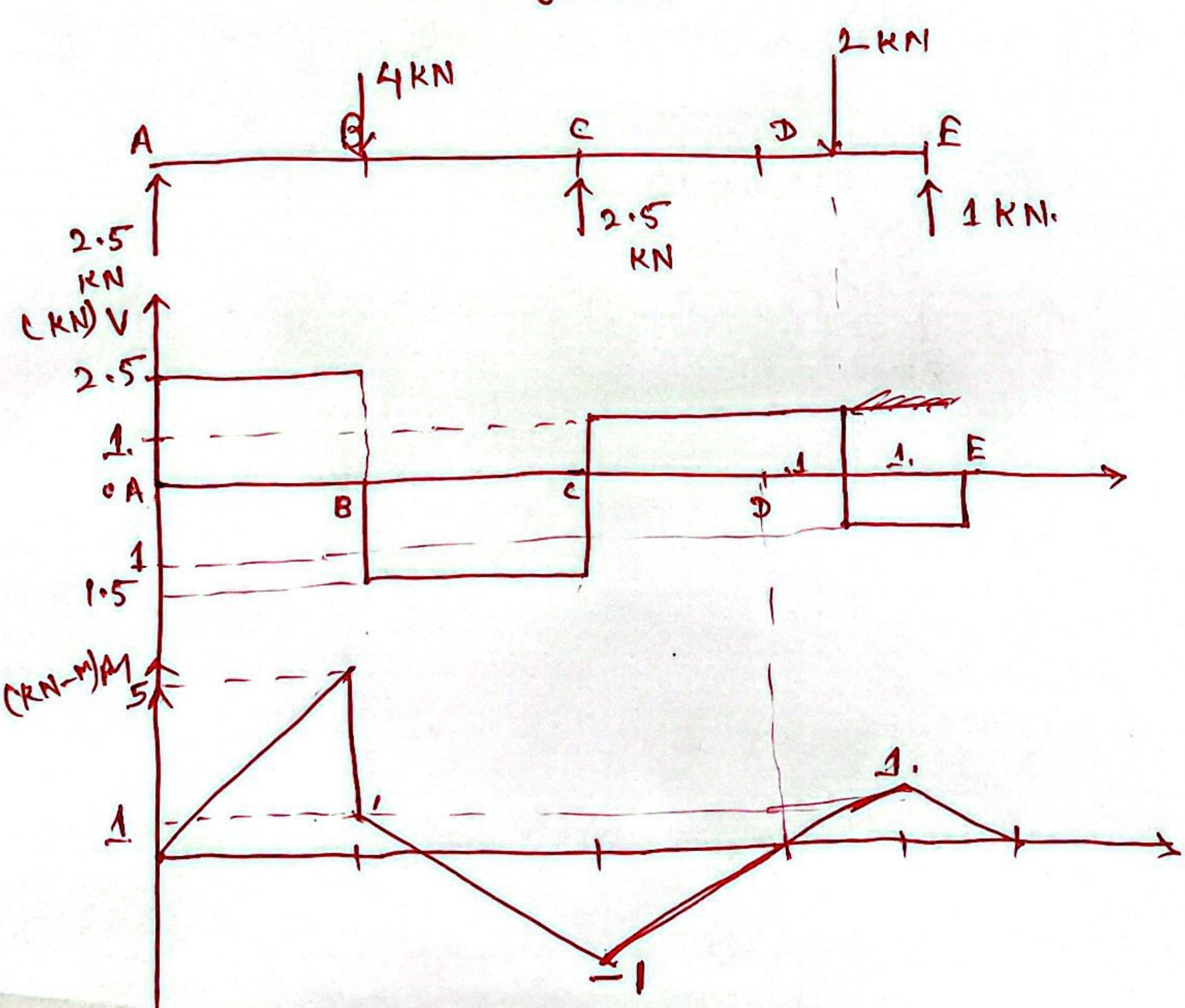


$\Sigma M_A = 0 \Rightarrow R_C \times 4 + 4 = 8 + 6$

$\Rightarrow R_C = \frac{10}{4} KN = 2.5 \text{ KN}$

& $R_A = -2.5 + 4 + 1 = 2.5$ KN.

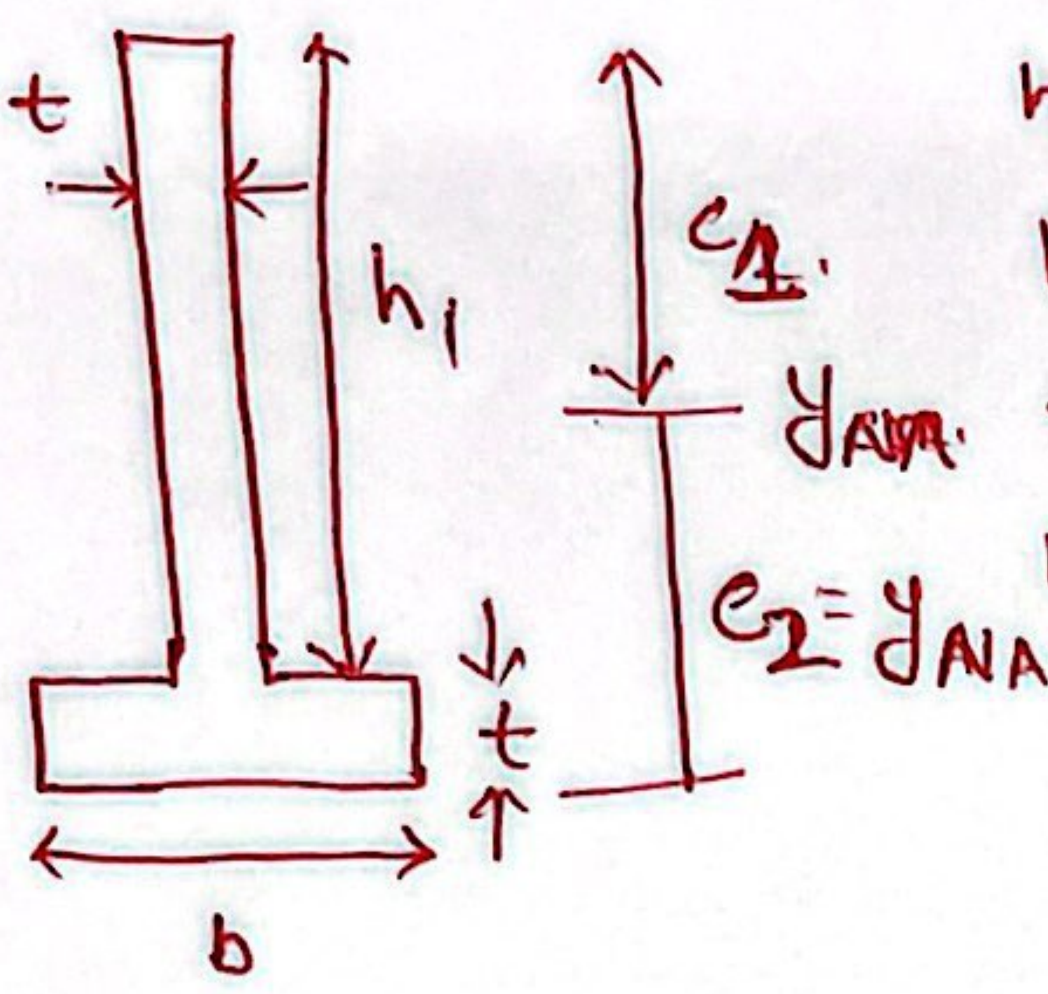
Shear force & B.M diagram.



5

5

7.



$F = 400\ KN/m$

$h_1 = 150mm$

$b = 125mm.$

$t = 13mm$

$h = h_1 + t = 163mm$

Cross-sectional area, A

$$A = bt + h_1 t = 3575 mm^2$$

Position of the NA from the bottom,

$$c_2 = y_{NA} = \frac{bt\frac{t}{2} + ht\left(t + \frac{h_1}{2}\right)}{A} = 50.95 mm.$$

$$c_1 = h - c_2 = 112.045 mm. \quad — (2)$$

Second moment of area, I about NA.

$$I = \frac{1}{12} t h_1^3 + (t h_1)\left(c_2 - \left(h - \frac{h_1}{2}\right)\right)^2 + \frac{1}{12} bt^3 + bt\left(c_2 - t/2\right)^2$$

$$= 9.5616 \times 10^6 mm^4 \quad — (3)$$

at the height of weld,

$$Q = b \times t \times (c_2 - t/2) = 7.2239 \times 10^4 mm^3 \quad — (2)$$

hence the max shear force supported,

$$V_{max} = \frac{2FI}{Q} = 1,05.94 KN \quad — (3)$$