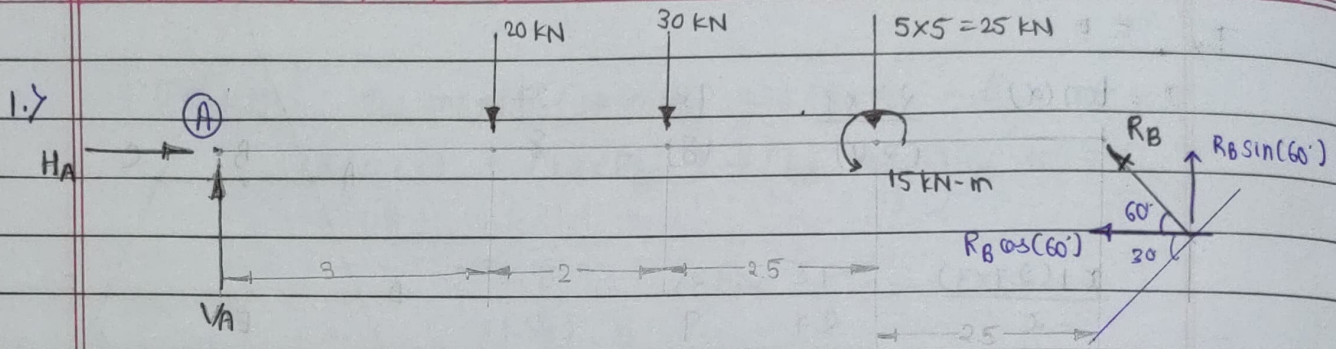


BEAMS ASSIGNMENT



$$① \sum F_x = 0$$

$$H_A = R_B \cos 60^\circ \quad [2H_A = R_B] \quad \text{--- (1)}$$

$$② \sum M_A = 0$$

$$\Rightarrow -(20 \times 3) + -(30 \times 5) + (25 \times 7.5) + 15 + 10 \times R_B \sin(60^\circ) = 0$$

$$-60 - 150 + 187.5 + 15 + 10 \times R_B \sin(60^\circ) = 0$$

$$[R_B = 44.17 \text{ kN}]$$

From (1),

$$[H_A = 22.08 \text{ kN}] (\rightarrow)$$

$$③ \sum F_y = 0$$

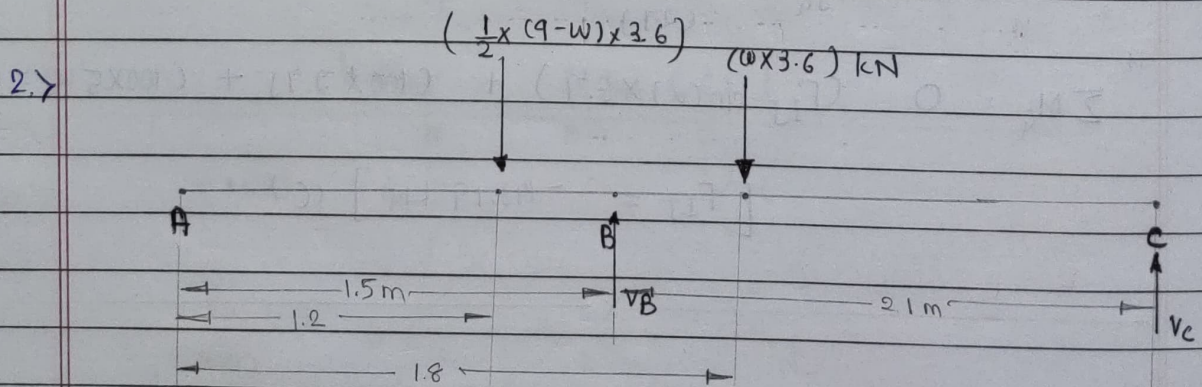
$$\Rightarrow V_A + R_B \sin(60^\circ) = 20 + 30 + 25$$

$$V_A + 38.25 = 75$$

$$[V_A = 36.75 \text{ kN} (\uparrow)]$$

$$\text{ANS: } V_A = 36.75 \text{ kN} (\uparrow) \quad R_B = 44.17 \text{ kN}$$

$$H_A = 22.08 \text{ kN} (\rightarrow)$$



$$① \sum F_x = 0 \quad [H_B = 0] \quad \text{--- (1)}$$

$$② \sum F_y = 0 \quad V_B + V_C = 3.6w + 1.8(9 - w)$$

$$[V_B + V_C = 16.2 + 1.8w] \quad \text{--- (2)}$$

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$$\textcircled{3} \sum M_c = 0 \quad (1.8 \times 3.6w) + (1.8(9-w) \times 2.4) = V_B \times (2.1)$$

$$\Rightarrow \frac{7}{6} V_B = 3.6w - 2.4w + (9 \times 2.4)$$

$$V_B = \frac{6}{7} (1.2w + 21.6) \quad \text{--- (2)}$$

$$\textcircled{4} \sum M_B = 0$$

$$(0.3 \times 3.6w) = (1.8(9-w) \times 0.3) + (2.1 \times V_c)$$

$$\Rightarrow (0.3 \times 1.8) (2w + w - 9) = 2.1 V_c$$

$$\frac{(1.8)}{(7)} (3w - 9) = V_c \quad \text{--- (3)}$$

* But, the R_x at 'C' is zero

$$V_c = 0$$

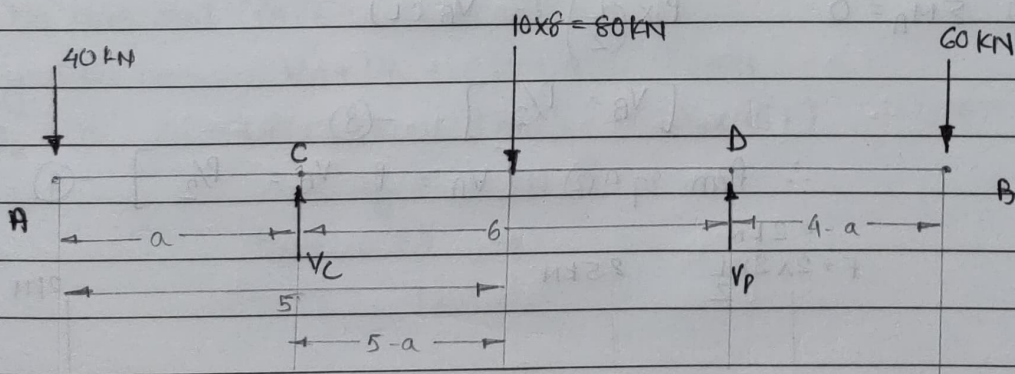
$$3w - 9 = 0$$

$$[w = 3 \text{ kN/m}]$$

ANS.

$$\text{From (2), } V_B = \frac{6}{7} (1.2w + 21.6) = \frac{6}{7} (25.2) = [21.6 \text{ kN}]$$

3.



$$\text{Total Length} = 9 + 6 + 4 - 9 = 10$$

$$\therefore \text{Force due to uniform load} = 10 \times 8 = 80 \text{ kN}$$

$$\sum F_y = 0 \quad V_c + V_d = 60 + 40 + 80$$

$$= 180$$

$$\text{but } V_c = V_d$$

$$\Rightarrow [V_d = V_c = 90 \text{ kN}]$$

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$$\sum M_A = 0$$

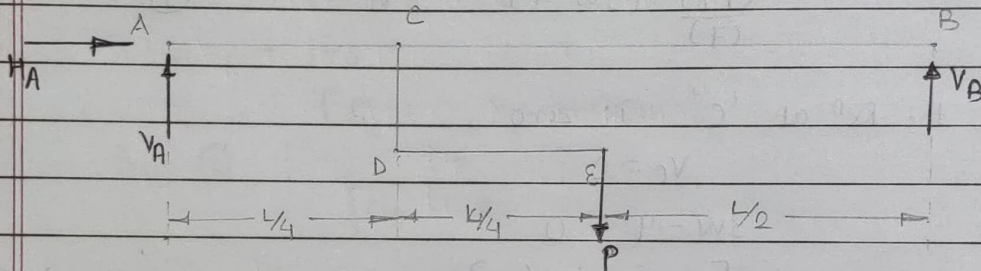
$$(V_C \times a) - (60 \times 5) + (V_D (9+6)) - (60 \times 10) = 0$$

$$\Rightarrow 90(2a+6) = 400 + 600 = 1000$$

$$2a+6 = \frac{1000}{90}$$

$$[a = 2.56 \text{ m}]$$

4. >



$$\textcircled{1} \quad \sum F_x = 0 \quad H_A = 0 \quad \textcircled{-1}$$

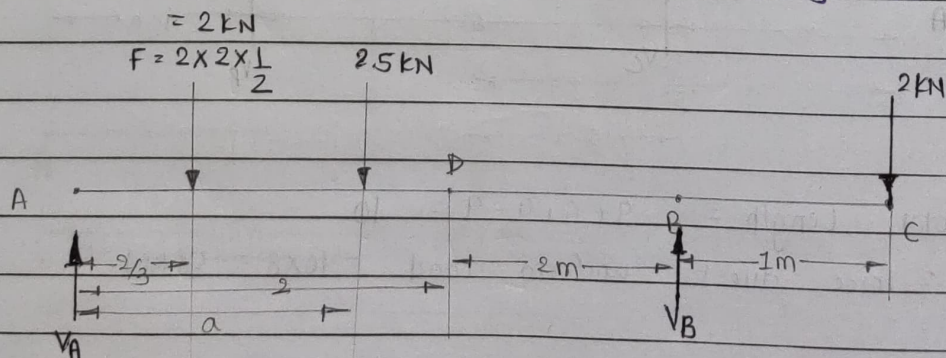
$$\textcircled{2} \quad \sum F_y = 0 \quad V_A + V_B = P \quad \textcircled{-2}$$

$$\textcircled{3} \quad \sum M_A = 0 \quad P \times \left(\frac{L}{2}\right) = V_B (L)$$

$$[V_B = P/2] \quad \textcircled{-3}$$

$$\therefore \text{from eqn } \textcircled{2} \quad [V_A = P - V_B = P/2] \quad \textcircled{-4}$$

5. >



$$\sum F_y = 0 \quad V_A + V_B = 2 + 2.5 + 2 = 6.5 \text{ kN}$$

$$\text{but } (V_A = V_B)$$

$$\therefore [V_A = V_B = 3.25 \text{ kN}]$$

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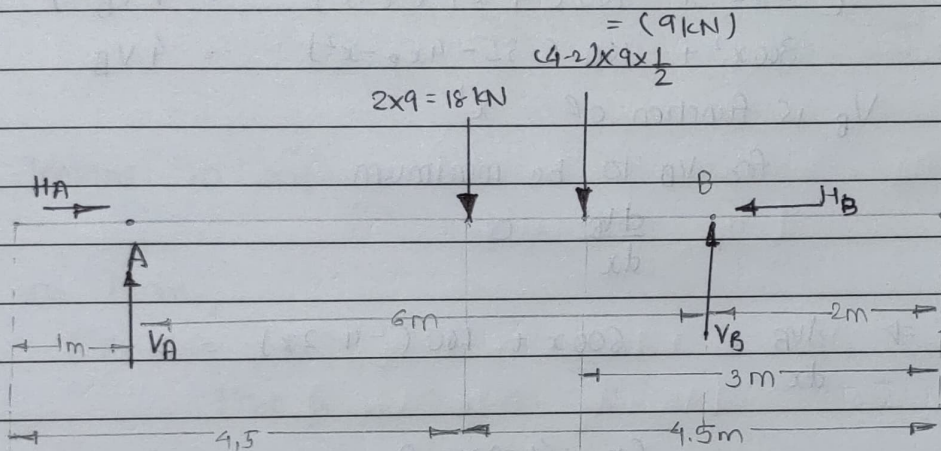
$$\Sigma M_A = 0 \quad \left(\frac{2}{3} \times 2\right) + (2.5 \times a) + (2 \times 5) = (V_B \times 4)$$

$$\frac{4}{3} + 10 + 2.5a = 3.25 \times 4 = 13$$

$$2.5a = \left(\frac{5}{3}\right)$$

$$\left[a = \frac{2}{3} = 0.667 \text{ m}\right]$$

6.7



① ∴ No horizontal force $[H_A = H_B = 0]$

$$\text{② } \Sigma F_y = 0 \quad V_A + V_B = 18 + 9 = 27 \text{ kN}$$

$$\text{③ } \Sigma M_A = 0 \quad (18 \times 3.5) + (9 \times 5) = (V_B \times 6)$$

$$\left[V_B = 18 \text{ kN}\right]$$

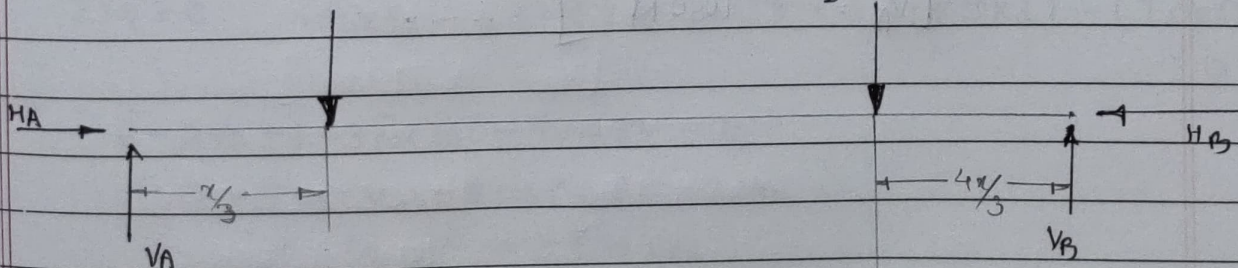
$$V_A = 27 - V_B$$

$$\left[V_A = 9 \text{ kN}\right]$$

7.7

$$\frac{1}{2} \times 1800 \times x = 900x \text{ kN}$$

$$\frac{1}{2} \times 600 \times (4-x) = 300(4-x)$$



$$\Sigma F_x = 0$$

$$H_A = H_B = 0$$

(No horizontal force)

(U19CS012)

$$\Sigma F_y = 0 \quad V_A + V_B = 900x + 300(4-x)$$

$$V_A + V_B = 1200 + 600x$$

$$\Sigma M_A = 0$$

$$\left(900x \times \frac{x}{3} \right) + \left(300(4-x) \left(4 - \left(\frac{4-x}{3} \right) \right) \right) = V_B(4)$$

$$300x^2 + 100(4-x)(12-4+x) = 4V_B$$

$$[300x^2 + 100(4-x)(8+x) = 4V_B]$$

$$300x^2 + 100(32-4x+x^2) = 4V_B$$

V_B is function of 'x'

for V_B to be minimum

$$\frac{dV_B}{dx} = 0$$

$$\Rightarrow \frac{dV_B}{dx} = 600x + 100(-4+2x) = 0$$

$$6x - 4 + 2x = 0$$

$$[x = 1 \text{ m}]$$

$$\rightarrow \therefore 4V_B = 300 + 100(32-4-1)$$

$$4V_B = 300 + 2700$$

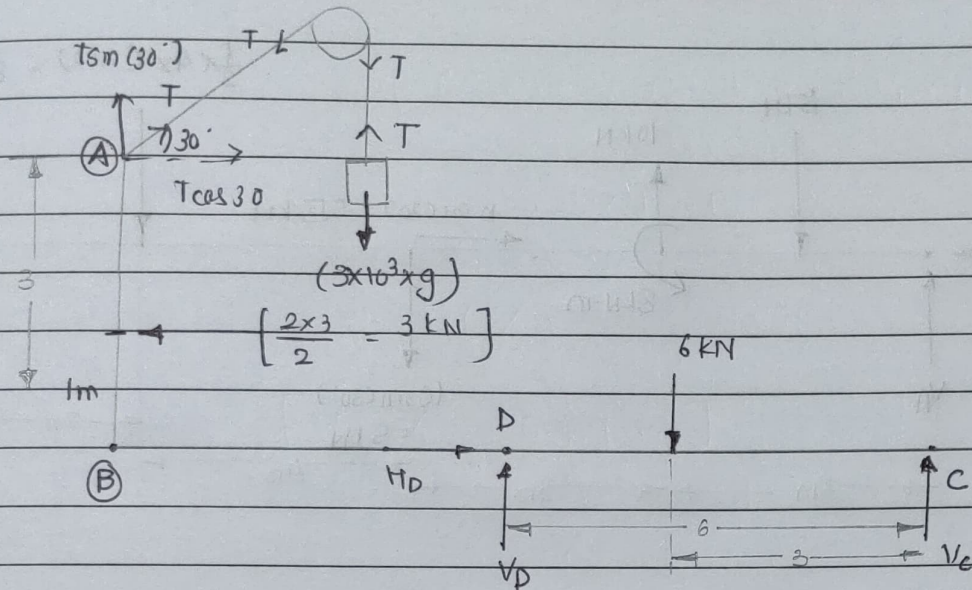
$$[V_B = \frac{3000}{4} = 750 \text{ N}]$$

$$V_A = 1200 + 600 - 750$$

$$[V_A = 1050 \text{ N}]$$

(U19CS012)

8.7



(1) Tension in rope = 3 kN
 $[T = 3 \text{ kN}]$

(2) On Beam,
 $\sum F_x = 0$

$$T \cos 30^\circ - 3 + H_D = 0$$

$$H_D = 3 - 3 \cos(30^\circ)$$

$$[H_D = 0.402 \text{ kN}]$$

(3) $\sum F_y = 0$

$$T \sin(30^\circ) + V_D + V_C = 6 \text{ kN}$$

$$\frac{3}{2} + V_D + V_C = 6$$

$$[V_D + V_C = 4.5 \text{ kN}]$$

$$\sum M_C = 0 \quad (6 \times 3) - (6 \times V_D) + (1 \times 3) - (T \cos 30^\circ \times 3) - (T \sin 30^\circ \times 9) = 0$$

$$6 - 2V_D + 1 - 3 \cos 30^\circ - 9 \sin 30^\circ = 0$$

$$7 - 3 \cos(30^\circ) - 9 \sin(30^\circ) = 2V_D$$

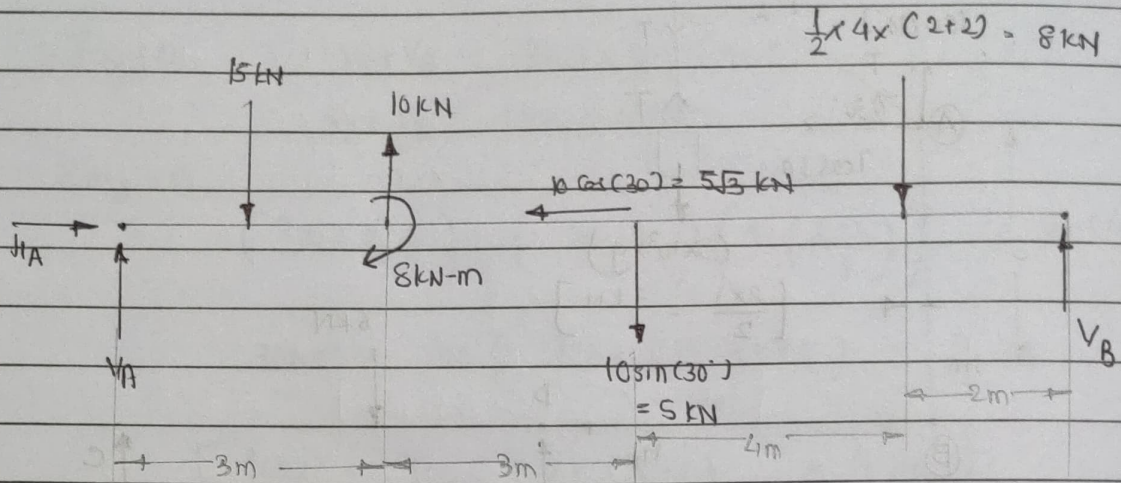
$$V_D = -0.049 \text{ kN}$$

$$[V_D = 0.05 \text{ kN}]$$

$$V_C = 4.5 + 0.05 = [V_C = 4.55 \text{ kN} (\uparrow)]$$

(U19CS012)

9.7



$$\textcircled{1} \sum F_x = 0$$

$$H_A = 10 \cos(30^\circ) = 8.66 \text{ kN}$$

$$[H_A = 8.66 \text{ kN}]$$

$$\textcircled{2} \sum F_y = 0$$

$$V_A - 15 + 10 - 5 - 8 + V_B = 0$$

$$[V_A + V_B = 18 \text{ kN}]$$

$$\textcircled{3} \sum M_A = 0$$

$$(15 \times 3) - (10 \times 6) + 8 + (5 \times 6) + (8 \times 10) - (12 \times V_B) = 0$$

$$[22.5 - 30 + 8 + 30 + 80 = 12V_B]$$

$$V_B = \frac{110.5}{12}$$

$$[V_B = 9.21 \text{ kN}]$$

$$V_B + V_A = 18$$

$$V_A = 18 - V_B$$

$$= 18 - 9.21$$

$$[V_A = 8.79 \text{ kN}]$$

Submitted By: U19CS012 (D-12)

BHAGYA RANA