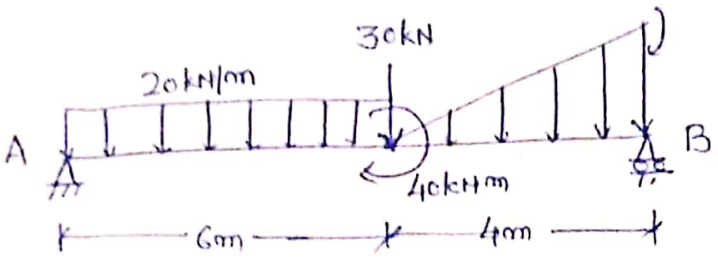
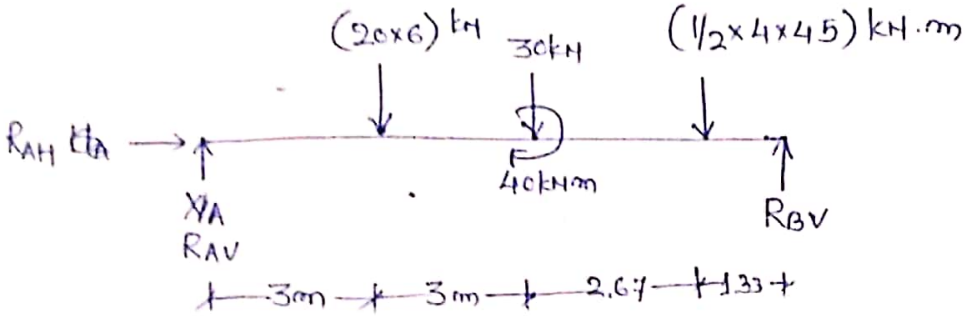
5.1 Calculate the support reactions for the beam.





$\Sigma F_x = 0$

$\Rightarrow R_{AH} = 0$ (there is no horizontal force acting)

$\Sigma F_y = 0$

$\Rightarrow R_{AV} - (20\times6) - 30 - (1/2\times4\times45) + R_{BV} = 0$

$\Rightarrow R_{AV} + R_{BV} = 240$ kN ——— (i)

$\Sigma M_A = 0$

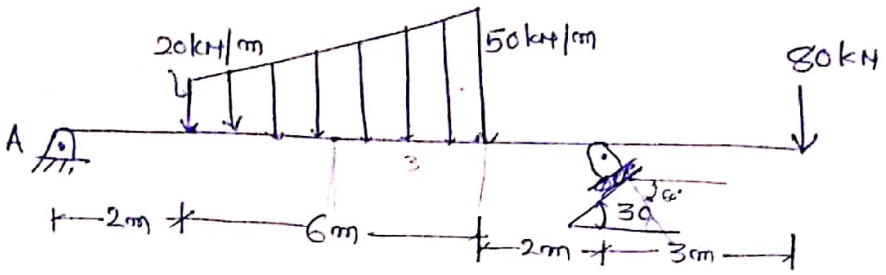
$\Rightarrow (R_{BV}\times10) - (1/2\times4\times45\times8.67) - (30\times6) - 40 - (20\times6\times3) = 0$

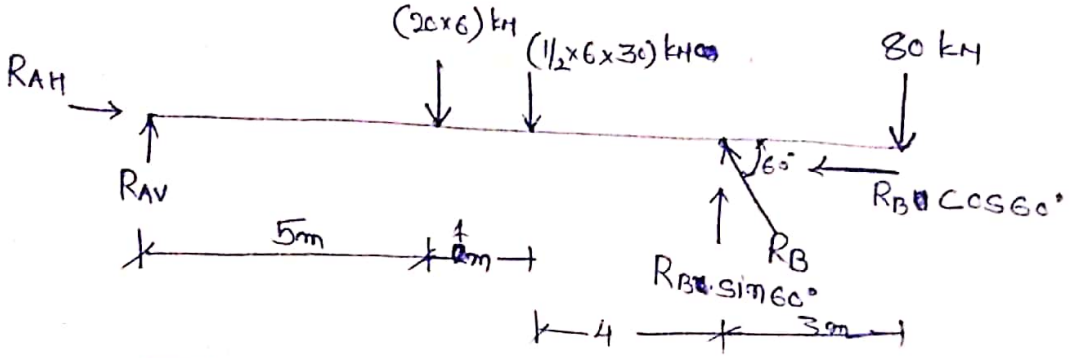
$\Rightarrow R_{BV} = +136.03$ kN (↑) ——— (ii)

$\Rightarrow$ Using eq^n (i)

$R_{AV} = 240 - 136.03 = +103.97$ kN (↑)

Ex 2 Find the support reactions at A and B.





$\Sigma F_x = 0$

$\Rightarrow R_{AH} - R_B \cdot \cos 60^\circ = 0$

$\Rightarrow R_{AH} = R_B \cos 60^\circ$ ——— (i)

$\Sigma F_y = 0$

$\Rightarrow R_{AV} - (20\times6) - (1/2\times6\times30) + R_B \sin 60^\circ - 80 = 0$

$\Rightarrow R_{AV} + R_B \sin 60^\circ = 290 \text{ kN}$ ——— (ii)

$\Sigma M_A = 0$

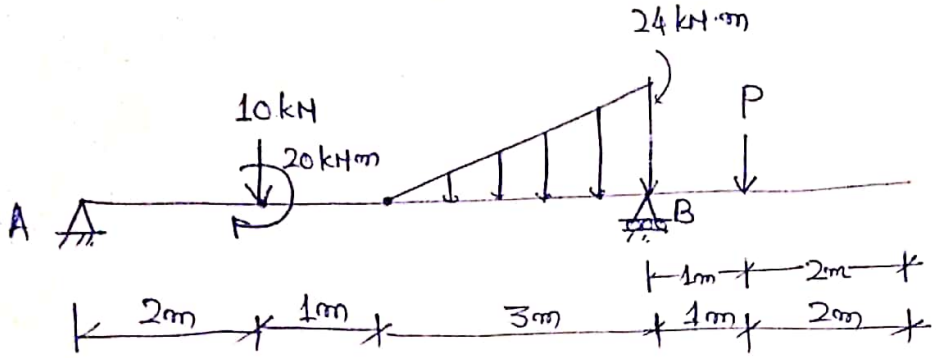
$\Rightarrow -(80\times13) + (R_B \sin 60^\circ \times 10) - (1/2\times6\times30\times6) - (20\times6\times5) = 0$

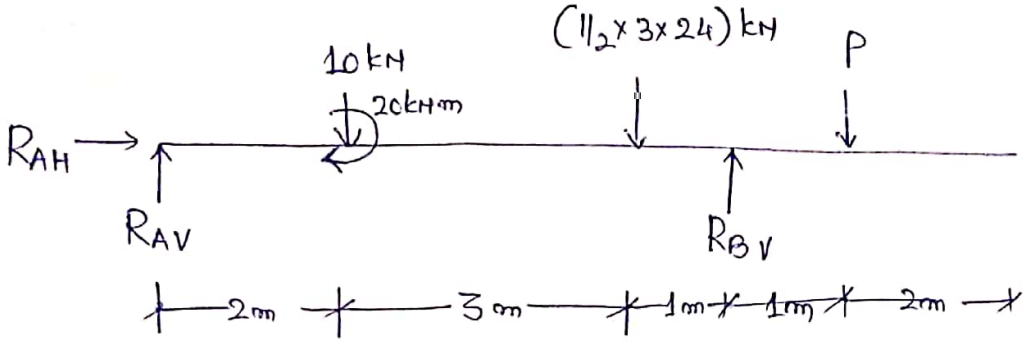
$\Rightarrow R_B = 251.72 \text{ kN} \ (\uparrow)$ ——— (iii)

Using eq^n (i) $R_{AH} = 125.86 \text{ kN} \ (\rightarrow)$

Using eq^n (ii) $R_{AV} = 72 \text{ kN} \ (\uparrow)$

3 Find analytically the support reaction at B and the load P for the following beam if the reaction of support A is zero.





$\Sigma F_x = 0$

$\Rightarrow R_{AH} = 0$

$\Sigma F_y = 0$

$\Rightarrow R_{AV} - 10 - (1/2 \times 3 \times 24) + R_{BV} - P = 0$

$\Rightarrow R_{AV} + R_{BV} = P + 46$ ——— (i)

$\Rightarrow R_{BV} = P + 46$ ($R_{AV} = 0$)

$\Sigma M_A = 0$

$\Rightarrow -(P \times 7) + (R_{BV} \times 6) - (1/2 \times 3 \times 24 \times 5) - (10 \times 2) - 20 = 0$

$\Rightarrow R_{BV} \times 6 = 220 + 7P$ ——— (ii)

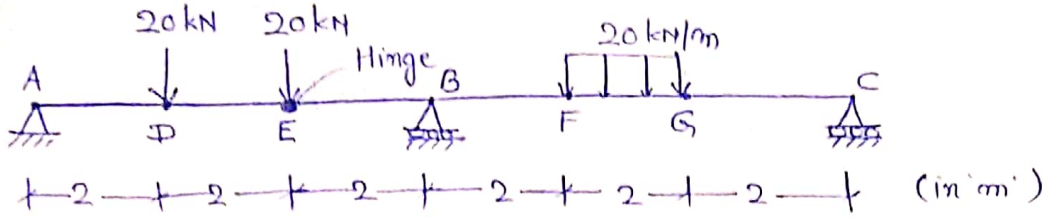
Using eqn (i) and (ii)

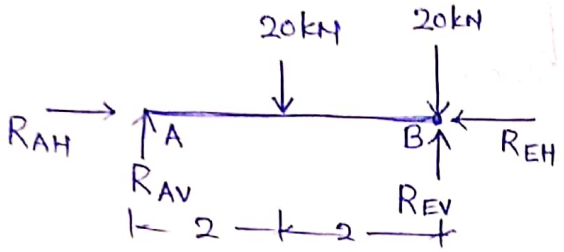
$\Rightarrow (P + 46) \times 6 = 220 + 7P$

$\Rightarrow 6P + 276 = 220 + 7P$

$\Rightarrow P = 56$ kN (↓)

d the support reactions of the beam





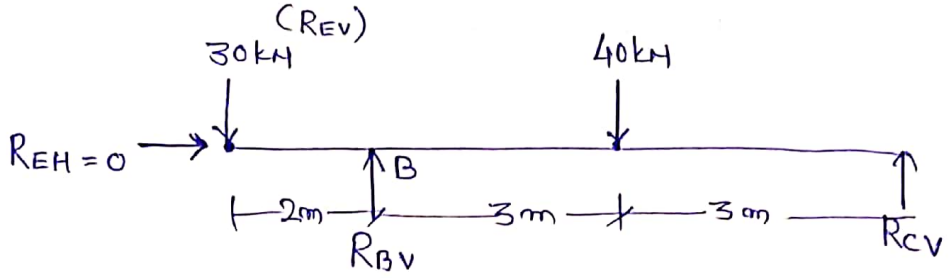
$\Sigma F_x = 0 \Rightarrow R_{AH} = R_{EH} = 0$ (since No horizontal load)

$\Sigma F_y = 0 \Rightarrow R_{AV} + R_{EV} = 20 + 20 = 40$ kN

$\Sigma M_A = 0 \Rightarrow (R_{EV} \times 4) - (20 \times 4) - (20 \times 2) = 0$

$\Rightarrow R_{EV} = 30$ kN (↑)

$\Rightarrow R_{AV} = 10$ kN (↑)

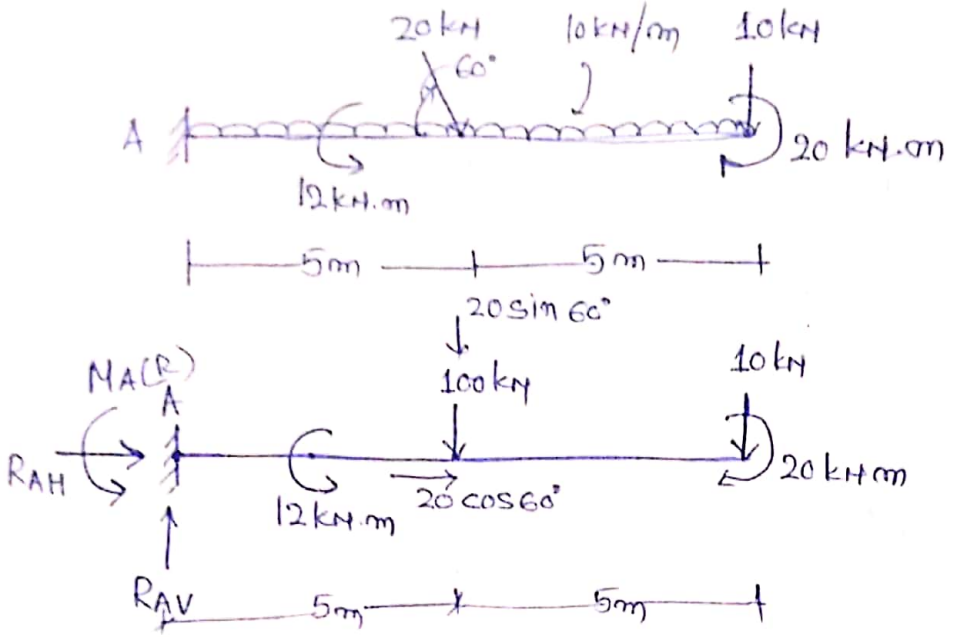


$\Sigma F_y = 0 \Rightarrow R_{BV} + R_{CV} = 30 + 40 = 70$ kN.

$\Sigma M_B = 0 \Rightarrow +(30 \times 2) - (40 \times 3) + (R_{CV} \times 6) = 0$

$\Rightarrow R_{CV} = \frac{120 - 60}{6} = 10$ kN (↑)

$\Rightarrow R_{BV} = 60$ kN (↑)



$\Sigma F_x = 0$

$\Rightarrow R_{AH} + 20\cos 60^\circ = 0$

$\Rightarrow R_{AH} = -20\cos 60^\circ = -10 \text{ kN}$

$\Rightarrow R_{AH} = 10 \text{ kN} \ (\leftarrow)$

$\Sigma F_y = 0$

$\Rightarrow R_{AV} - 20\sin 60^\circ - 100 - 10 = 0$

$\Rightarrow R_{AV} = 127.32 \text{ kN} \ (\uparrow)$

$\Sigma M_A = 0$

$\Rightarrow +M_A + 12 - (100 \times 5) - (20 \times \sin 60^\circ \times 5)$

$- (10 \times 10) - 20 = 0$

$\Rightarrow M_A = -694.60 \text{ kN.m}$

$\Rightarrow M_A = 694.60 \text{ kN.m} \ (\circlearrowleft)$

$\Sigma M_A = 0$

$\Rightarrow M_{A(R)} + M_A = 0$

$\Rightarrow M_{A(R)} - 694.60 = 0$

$\Rightarrow M_{A(R)} = 694.60 \text{ kN.m} \ (\circlearrowleft)$