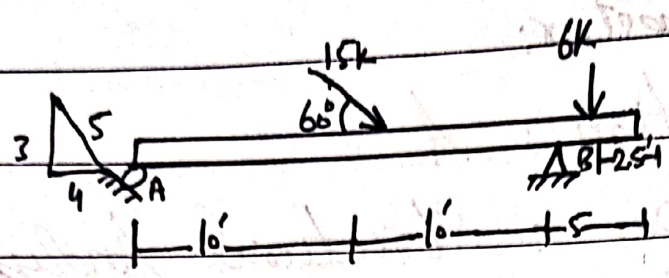
Name: Malak Mirat Qadir
ID : 7829

Section : A
Paper : Structural Analysis (1)
Instructors : Engr. Saqib Khan
Date : 22-08-2020
Exam : Mid-Term

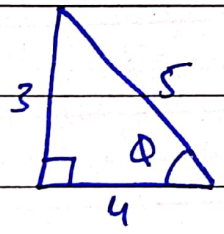
Q. No #1

ANS #1



Sol:-

First of all we have to find the angle for the roller support.



∵ Using Trigonometry

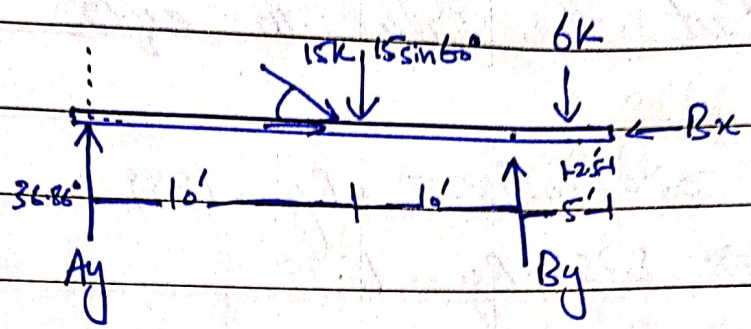
$$\sin\theta = \frac{P}{H}$$

$$\sin\theta = \frac{3}{5}$$

$$\theta = \sin^{-1}\left(\frac{3}{5}\right)$$

$$\boxed{\theta = 36.86^\circ}$$

So Now



1. $\Sigma F_x = 0 \quad \overset{+}{\rightarrow} \overset{-}{\leftarrow}$

$15\cos 60° - Bx - Ay\sin 36.86° = 0$

$\boxed{7.5 - Bx - 0.599\,Ay = 0}$ — ①

2. $\Sigma F_y = 0 \uparrow + \downarrow -$

$Ay\cos 36.86° + By - 6K - 15\sin 60° = 0$

$0.80\,Ay + By - 18.99 = 0$

$\boxed{0.80\,Ay + By = 18.99}$ — ②

3. $\Sigma M_B = 0 \circlearrowleft + \circlearrowright -$

$(Ay\cos 36.86 \times 20) - (15\sin 60° \times 10) + 6 \times 2.5 = 0$

$16\,Ay - 190 + 15 = 0$

$16\,Ay - 175 = 0$

$Ay = 175/16$

$$A_y = 10.9375K$$

Put the value in eq (2)

$$\Rightarrow 0.80(10.9375) + B_y = 18.99$$

$$\Rightarrow 8.75 + B_y = 18.99$$

$$\Rightarrow B_y = 18.99 - 8.75$$

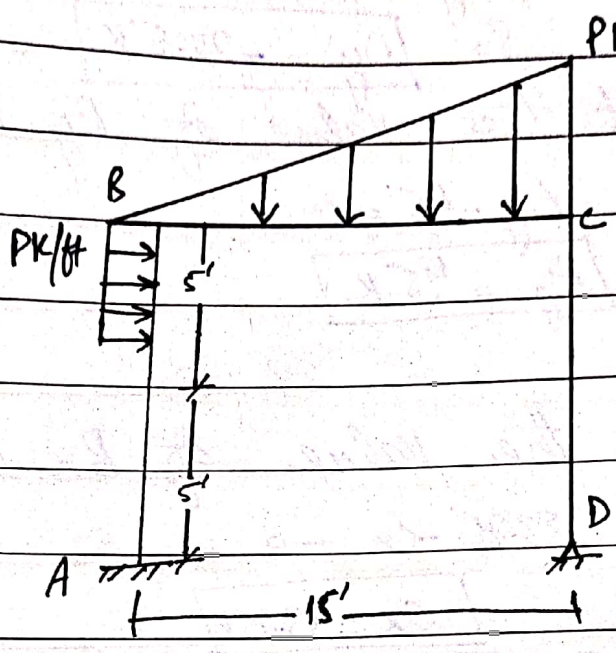
$$\Rightarrow B_y = 10.25K$$

Put the value of A_y in eq (1)

$$\Rightarrow 7.5 - B_x - 0.599(10.9375) = 0$$

$$B_x = 0.9375K$$

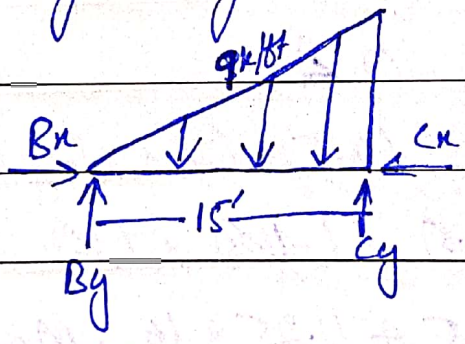
Q. No: 02



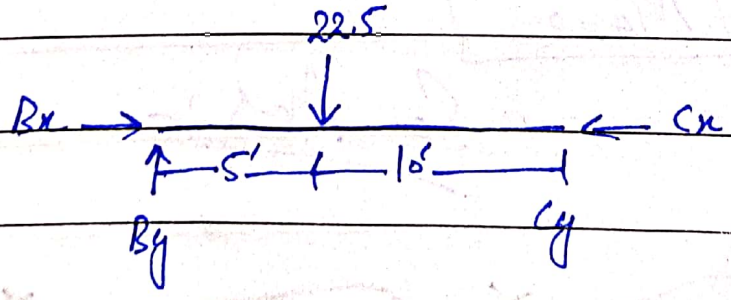
Sol: ID = 7829

① Free body diagram

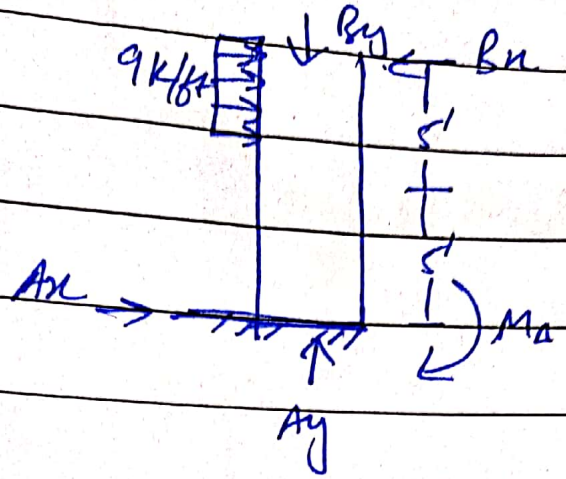
UVL



B.D



17b



(i) $\Sigma F_x = 0 \rightarrow + \leftarrow -$

$A_x + (9 \times 5) - B_x = 0$

$A_x - B_x = -45 \rightarrow (3)$

(ii) $\Sigma F_y = 0 \uparrow + \downarrow -$

$A_y - B_y = 0$

(iii) $\Sigma M = 0 \circlearrowleft + \circlearrowright -$

$(9 \times 5) \times (2.5 + 5) - B_x \times 10 = 0$

$45 \times 7.5 = 10 B_x$

$\boxed{B_x = 33.75 K}$

Put the value in eq (3)

$A_x - 33.75 = -45$

$A_x = -45 + 33.75$

$\boxed{A_x = -11.25 K}$

$$\text{Area} = \frac{1}{2}bh$$

$$= \frac{1}{2}(15 \times 9)$$

$$= 67.5$$

$$\text{Dist} = \frac{1}{3}(b) = \frac{1}{3}(15) = 5'$$

i- $\Sigma F_x = 0 \rightarrow + \leftarrow -$

$$B_x - C_x = 0 \rightarrow (1)$$

ii- $\Sigma F_y = 0 \uparrow + \downarrow -$

$$B_y + C_y = 67.5K \rightarrow (2)$$

(iii). $\Sigma M_B = 0 \circlearrowleft + \circlearrowright -$

$$(67.5 \times 5) - C_y \times 15 = 0$$

$$\Rightarrow 337.5 = C_y 15$$

$$\boxed{C_y = 22.5K}$$

Put the value in eq (ii)

$$B_y + 22.5 = 67.5$$

$$\boxed{B_y = 45K}$$

Now since C and D are at same line that load is transfered So

$C_y = 22.5K$

So $\boxed{D_y = -22.5K}$

Put the value of B_y in (ii)

$A_y - 45 = 0$

$\boxed{A_y = 45K}$

Put the value of B_x in eq (i)

$33.75 - C_x = 0$

$\boxed{C_x = 33.75K}$

So $\boxed{D_x = -33.75K}$

$M_B = 0$ ↺+

$\Rightarrow -(9\times5)(2.5) - (A_x \times 10) + M_A = 0$

$\Rightarrow -(112.5) - (-11.25) \times (10) + M_A = 0$

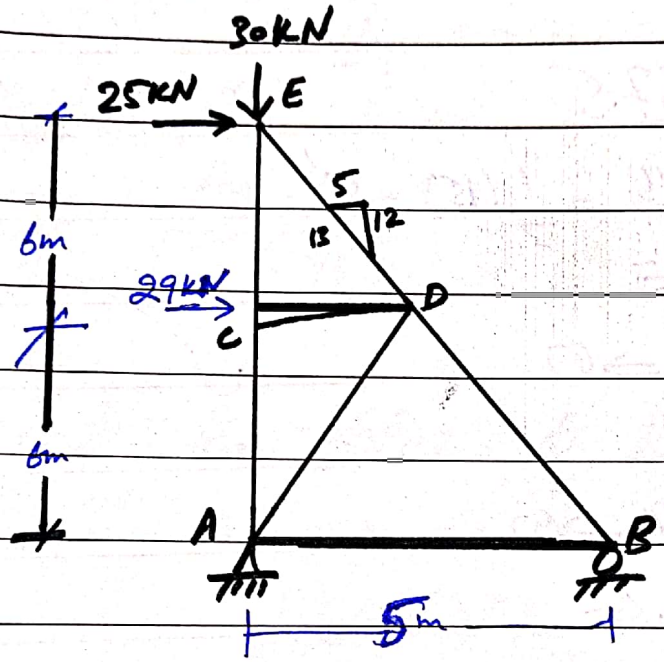
$\Rightarrow -112.5 + 11.25 \times 10 + M_A = 0$

$\boxed{M_A = 0}$

So Ans :-

Q. No#03:-

Ans: 03:-



Sol:- $\sum M_A = 0 \quad \curvearrowright +$

$-5B_y + 29 \times 6 + 25 \times 12 = 0$

$\boxed{B_y = 234\,KN}$

$\sum F_y = 0 \quad \uparrow +$

$-30 + A_y + B_y = 0$

$-30 + A_y + 234 = 0$

$A_y = 30 - 234$

$\boxed{A_y = -204\,KN}$

$\Sigma F_x = 0$

$A_x = 25 + 29 = 54\,kN$

$A_x = 54\,kN$

$Q = ?$

$\tan Q = \frac{12}{5} \Rightarrow Q = \tan^{-1}\left(\frac{12}{5}\right) = 67.38°$

$Q = 67.38°$

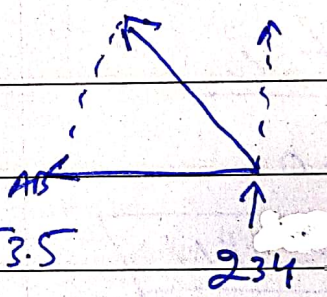
Using Method of Joint:-

Joint B:-

$\Sigma F_y = 0 \uparrow +$

$234 + BD \sin Q = 0$

$\Rightarrow BD = \frac{-234}{\sin(67.38)} = -253.5$



$\Sigma F_x = 0 \rightarrow +$

$-AB - BD \cos Q = 0$

$\Rightarrow AB = -BD\cos Q = -(-253.5)\cos(67.38)$

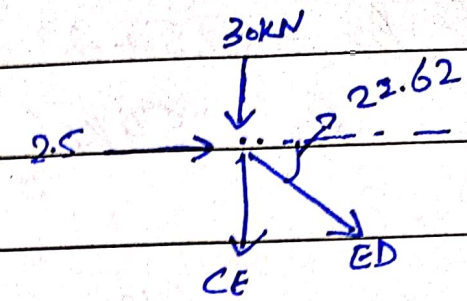
$\boxed{AB = 97.5\,kN}$

Joint E:-

$\Sigma F_x = 0$

$25 + ED\cos(22.62) = 0$

$\boxed{ED = -27.08\,KN}$



$\Sigma F_y = 0$ ↑+

$-30 - CE - ED\sin(22.62) = 0$

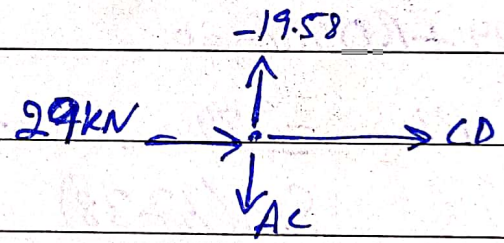
$-30 - CE - (-27.08)\sin(22.62) = 0$

$CE = -19.58\,KN$

Joint C

$\Sigma F_x = 0$

$\boxed{CD = -29\,KN}$

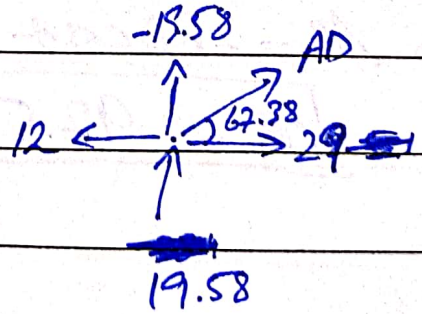


$\Sigma F_y = 0$

$\boxed{AC = 19.58\,KN}$

Joint 'A'

Let α is the angle b/w AD and AB



$\frac{5}{12} = \frac{x}{6}$

$x = 2.5$

$$\tan\theta = \frac{6}{2.5}$$

$$\Rightarrow \theta = \tan^{-1}\left(\frac{6}{2.5}\right) = 67.38^\circ$$

Now $\Sigma F_x = 0 \rightarrow +$

$$-19.58 + 29 + AD\cos(67.38) = 0$$

$$\boxed{AD = 8.4\ KN}$$

So the forces in each member are calculated.