NASRULLAH

7870

B

STRUCTURE ANALYSIS I

22 AUG' 2020

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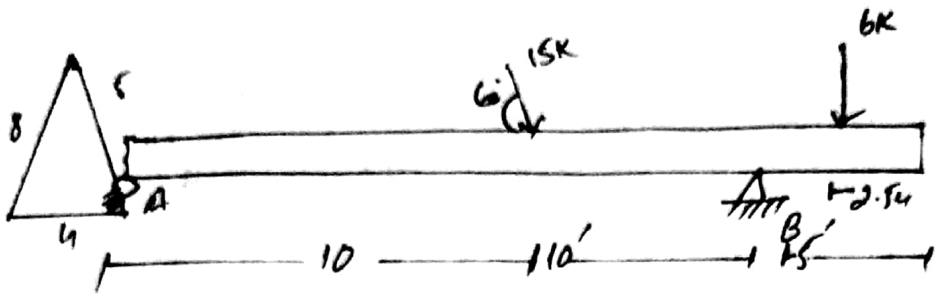
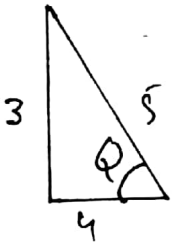
(2)



Solution

1st of all we have to Find the angle for the roller Support



∴ Using trignometry

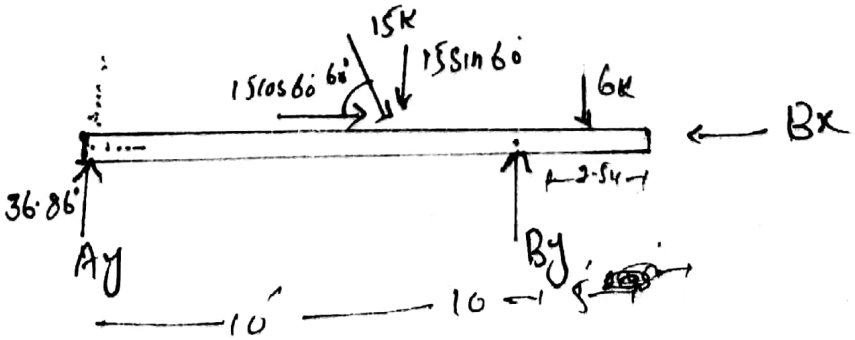
$\sin Q = P/H$

$\sin Q = 3/5$

$Q = \sin^{-1}(3/5)$

$Q = 36.86°$

SO NOW,



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1- $\Sigma F_x = 0$. $\xrightarrow{+}$ $\xleftarrow{-}$

$15\cos 60 - B_x - A_y \sin 36.86^\circ = 0$

$7.5 - B_x - 0.599 A_y = 0$ — ①

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

$A_y \cos 36.86^\circ + B_y - 6k - 15\sin 60^\circ = 0$

$0.80 A_y + B_y - 18.99 = 0$

$0.80 A_y + B_y = 18.99$ — ②

3- $\Sigma M_B = 0$ $\curvearrowright +$ $\curvearrowleft -$

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

$16 A_y - 190 + 15 = 0$

$16 A_y - 175 = 0$

$A_y = 175/16$

$\boxed{A_y = 10.9375 k}$

put the value in eq ②

$$0.80(10.9375) + By = 18.99$$

$$8.75 + By = 18.99$$

$$By = 18.99 - 8.75$$

$$\boxed{By = 10.25\,K}$$

put the value of Ay in (1)

$$7.5 - 1Bx - 0.599(10.9375) = 0$$

$$\boxed{Bx = 0.9375\,K}$$

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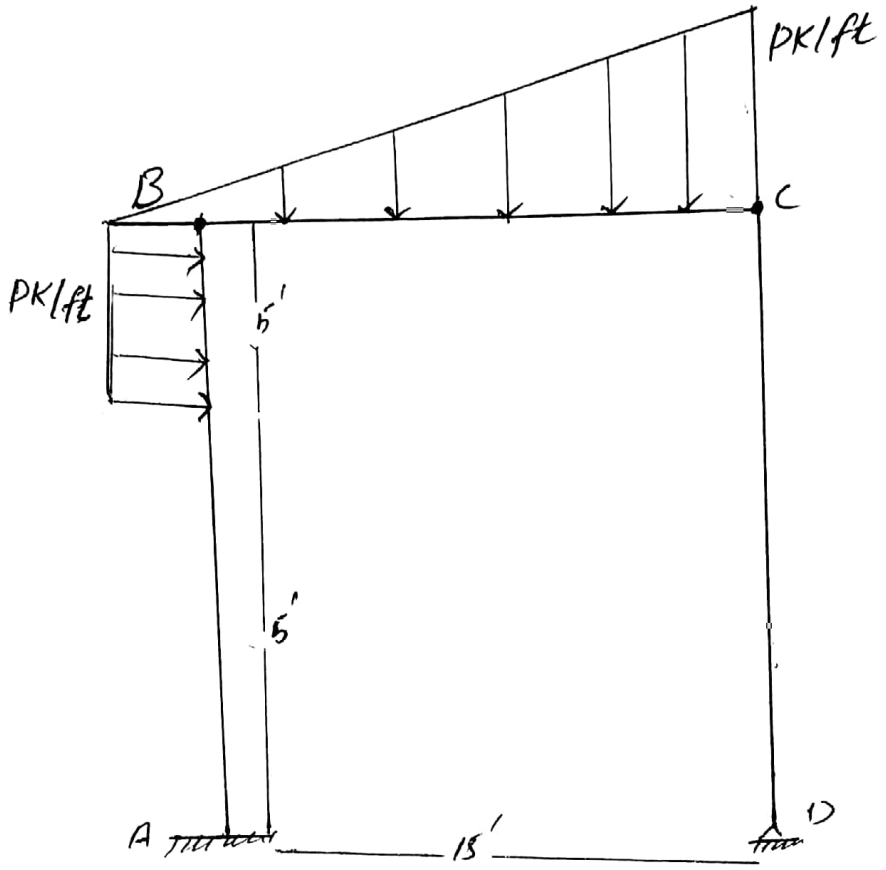
Q2



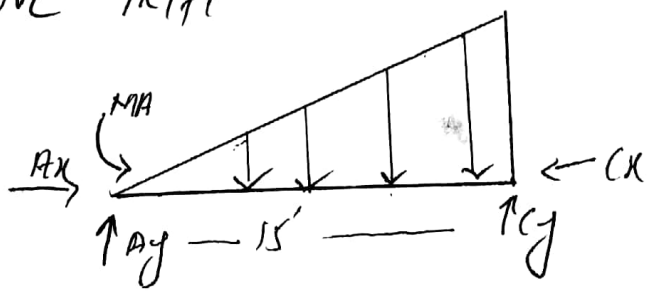
Solution

ID 7870

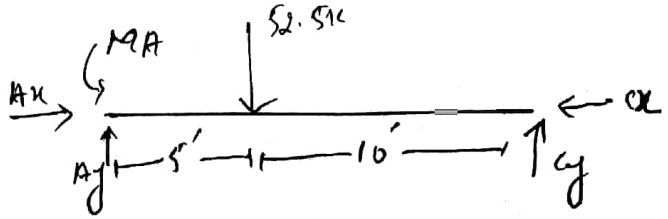
SO ID = 7

1 Free body Diagram

UVL 7K/ft



F.B.D



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$$\text{Area} = \frac{1}{2}bh = \frac{1}{2}\,15 \cdot 7$$

$$= 52.5K$$

$$\text{Distance} = \frac{1}{3}(b)$$

$$= \frac{1}{3}(18)$$

$$= 5'$$

i- $\Sigma F_x = 0 \rightarrow_{+} \leftarrow_{-}$

$$Ax - Cx = 0 \quad -(a)$$

Now

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

$$Ay + Cy - 52.5 = 0$$

$$Ay + Cy = 52.5K \quad -(1)$$

iii) - $\Sigma M_A = 0 \circlearrowleft +$

$$(52.5 \times 5) - Cy \times 15 = 0$$

$$\boxed{Cy = -17.5K}$$

put the value in (1)

$$Ay - 17.5 = 52.5K$$

$$\boxed{Ay = 70K}$$

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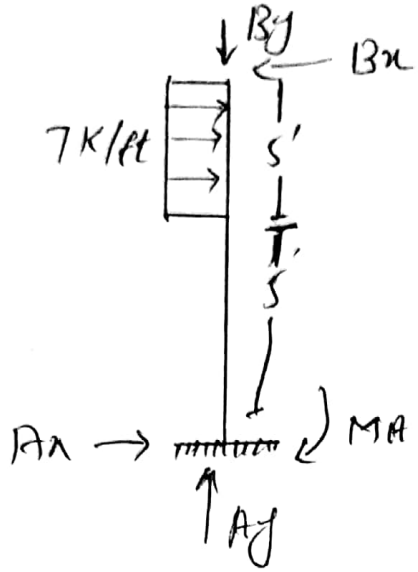

i) $\Sigma F_x = 0 \rightarrow + \leftarrow -$

$$Ax + (7 \times 5) - Bx = 0$$

$$Ax - Bx - 35 - (1)$$

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

$$Ay - By = 0 \quad -(2)$$

iii) $\Sigma M_A = 0 \circlearrowleft + \circlearrowright -$

$$(7 \times 5) \times (2.5 + 5) - Bx \times 10 = 0$$

$$262.5 - 10\,Bx = 0$$

$$\boxed{Bx = 26.25K}$$

Put the value of Bx in (1)

$$\boxed{Ax = 8.75K}$$

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put the value of By in (2)

$70 - By = 0$

$\boxed{By = 70k}$

put the value of Ax in (a)

$\boxed{Cx = 8.75k}$

Since D is hinge and in the projection of point C thus

$\boxed{Dx - 8.75k}$

$\boxed{Dy = 17.5k}$

$MB = 0 \curvearrowleft^{+}$

$-(7 \times 5)(2.5) - (8.75 \times 10) + MA = 0$

$(-87.5) + 87.5 + MA = 0$

$\boxed{MA = 0}$

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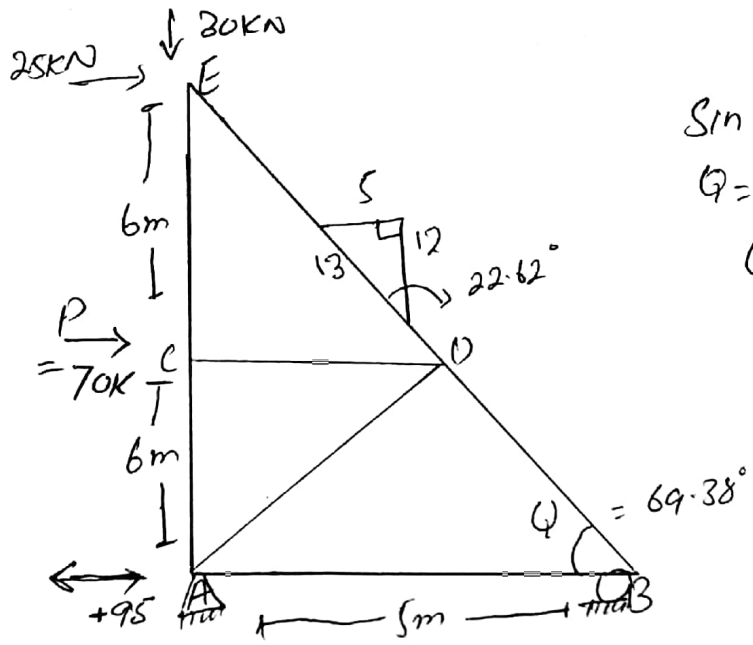
Q3



$\sin\theta = P/H$

$\theta = \sin^{-1}(5/13)$

$\theta = 22.62$

$\theta = ?$

$$\Sigma M_A = 0 \curvearrowright^{+}$$

$$(25\times12) - (By\times5) + (70\times6) = 0$$

$$300 + 420 = 5By$$

$$\boxed{By = 144N}$$

$$\Sigma Fy = 0 \uparrow + \downarrow -$$

$$Ay + By - 30 = 0$$

$$Ay + 144 - 30 = 0$$

$$\boxed{Ay = -114N}$$

$$\Sigma Fx = 0 \rightarrow + \leftarrow -$$

$$25 + 70 + Ax = 0$$

$$\boxed{Ax = -95}$$

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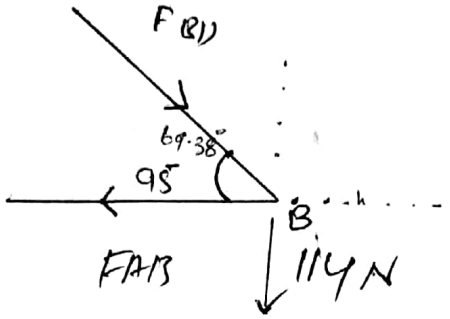
joint B



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

$-95 + F_{AB} = 0$

$\boxed{F_{AB} = 95\,N \rightarrow (T)}$

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

$-F_{BD}\cos 69.38 + 114.0 = 0$

$0.35^{-} F_{BD} = -114.0$

$\boxed{F_{BD} = -325.71\,N\,(C)}$

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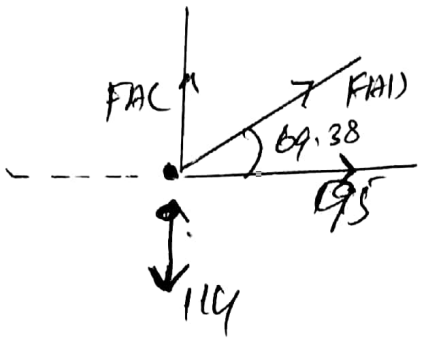
Joint B



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

$F_{AB} \sin 69.38^\circ + 95 = 0$

$0.94 F_{AB} = -95$

$\boxed{F_{AB} = -101.1\,N}$ (C)

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

$-114 + F_{AC} + F_{AB} \cos 6.9.38 = 0$

$F_{AC} + 114 - 101 \times 0.35 = 0$

$\boxed{F_{AC} = 149.385\,N}$ (T)

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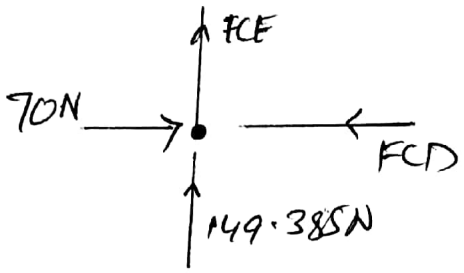
Joint C



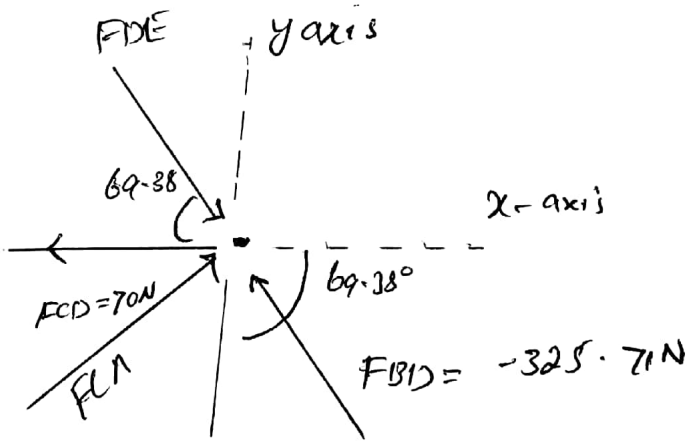
$\Sigma F_x = 0 \quad \rightarrow + \quad \leftarrow -$

$$\boxed{F_{CD} = 70K} \quad (T)$$

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

$$\boxed{F_{CE} = -149.385N} \quad (C)$$

Joint D



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

$$-70 + F_{DE} \sin 69.38 - 325.71 \cos 69.38^\circ = 0$$

$$F_{DE} * 0.94 = 184.70$$

$$\boxed{F_{DE} = 196.5N}$$

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