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ID: 7832
Subject: Structure I
Program: BEC
Exam: mid terms summer
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Question No # 1

Answer:

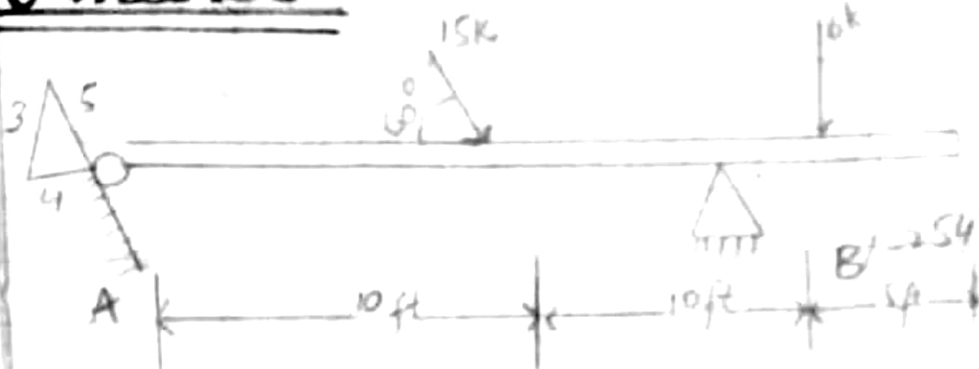


Figure # 01

SOLUTION:-

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



By Using Trigonometry:

$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenous}}$$

$$\sin \theta = P/H$$

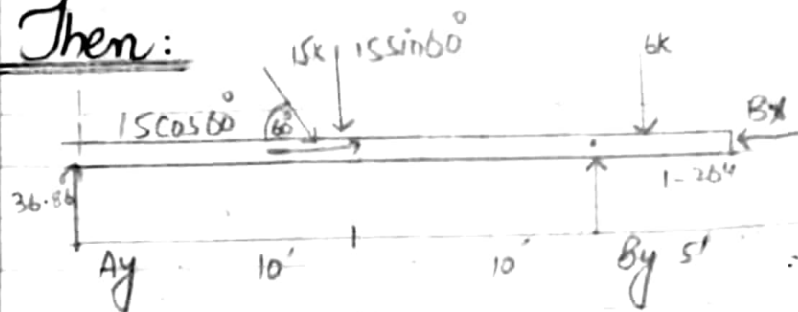
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$$\sin \theta = \frac{3}{5} \quad \therefore \text{To find angle}$$

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

$$\theta = 36.86^\circ$$

Then:



$$\underline{1.} \quad \sum F_x = 0 \quad \rightarrow \leftarrow$$

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

$$7.5 - B_x - 0.599 A_y = 0 \rightarrow \textcircled{1}$$

$$\underline{2.} \quad \sum F_y = 0 \quad \uparrow + \downarrow -$$

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

$$0.80 A_y + B_y - 18.99 = 0$$

$$0.80 A_y + B_y = 18.99 \rightarrow \textcircled{2}$$

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3. $\Sigma M_B = 0$ $\swarrow + \searrow -$

$$(A_y \cos 36 \cdot 86 \times 20) - (15 \sin 60^\circ \times 10) + 6 \times 2.5 = 0$$

$$16A_y - 170 + 15 = 0$$

$$16A_y - 175 = 0$$

$$A_y = \frac{175}{16}$$

$$A_y = 10.9375 \text{ k}$$

Now put these value in equ (2)

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

$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75$$

$$B_y = 10.25 \text{ k}$$

Now:

Put the value of A_y in equ (1)

$$\Rightarrow 7.5 - B_x - 0.599(10.9375) = 0$$
$$B_x = 0.9375 \text{ k}$$

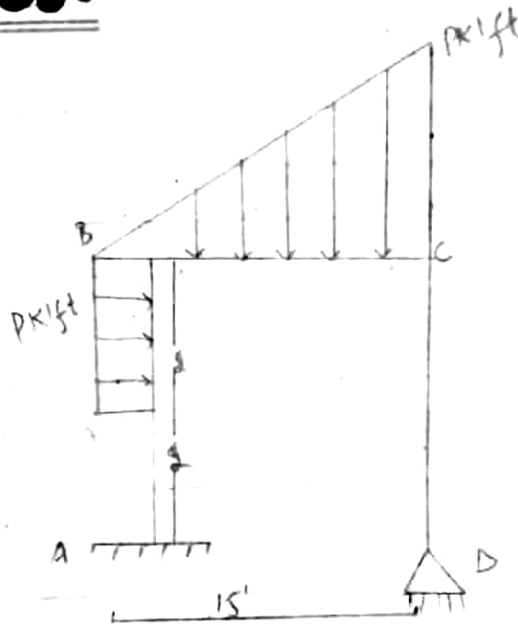
$$\leftarrow \rightarrow$$
$$\uparrow \downarrow = 0$$

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Question No # 2

Answer:

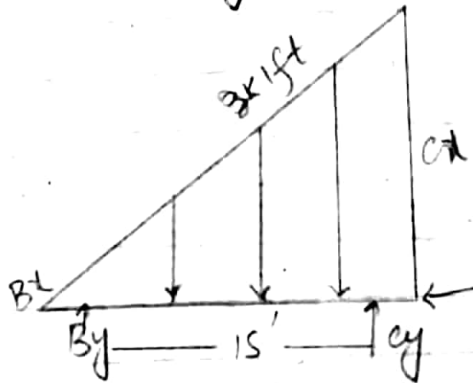


SOLUTION:

ID = 7883

1) Free body diagram.

UVL

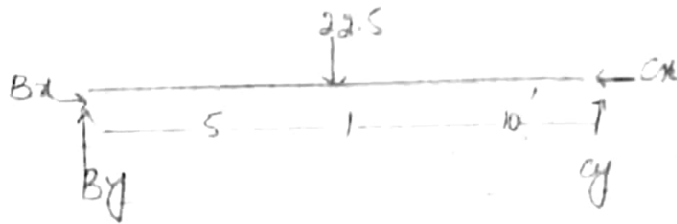


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⑤

⑤

B.D



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

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

$$= \frac{1}{2} (30)$$

$$= 15$$

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

$$= \frac{1}{3} (15)$$

$$= 5$$

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

$$B_x - C_x = 0 \quad \rightarrow \text{①}$$

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

$$B_y + C_y = 30 \quad \rightarrow \text{②}$$

$$(iii) \sum M_B = 0 \quad \downarrow + \quad \uparrow -$$

$$(30 \times 2) - C_y \times 15 = 0$$

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b

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$$60 - c_y \times 15 = 0$$

$$60 - 15c_y = 0$$

$$\frac{60}{15} = \frac{15c_y}{15}$$

$$c_y = 60/15$$

$$c_y = 4k$$

Now:

Put the value in eqn (2)

$$B_y + 4k = 30$$

$$B_y = 30 - 4$$

$$B_y = 26k$$

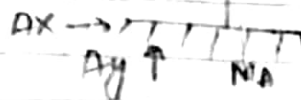
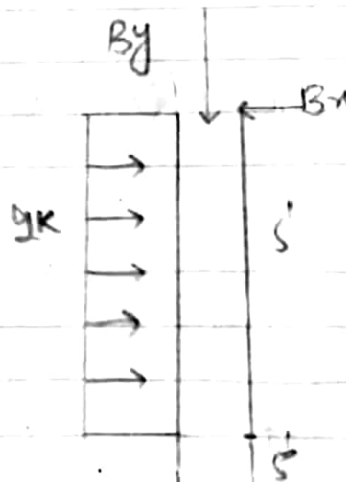
$$(i) \sum F_x = 0 \quad \rightarrow \leftarrow$$

$$A_x + (4 \times 2) - B_x = 0$$

$$A_x - B_x = -8k \quad (3)$$

$$(ii) \sum F_y = 0 \quad \uparrow \downarrow$$

$$A_y - B_y = 0$$



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⑦

$$(iii) \sum M_A = 0 \quad \downarrow + \quad \uparrow -$$

$$(4 \times 2) \times (2.5 + 2) - B_x \times 4 = 0$$

$$8 \times 4.5 - 4B_x = 0$$

$$36 - 4B_x = 0$$

$$\frac{36}{4} = \frac{4B_x}{4}$$

$$B_x = 9 \text{ K}$$

Now,

Put the value in equ (3)

$$A_x - 9 \text{ K} = -8$$

$$A_x = 9 - 8$$

$$A_x = 1$$

Now,

Since C and D are at same time thus load is transferred so.

$$C_y = 4 \text{ K}$$

So,

$$D_y = -4 \text{ K}$$

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Put the value of B_y in eqn (4)

$$A_y - B_y = 0$$

$$A_y - 26K = 0$$

$$A_y = 26K$$

Put the value of B_x in eqn (1)

$$B_x - C_x = 0$$

$$9K - C_x = 0$$

$$C_x = 9$$

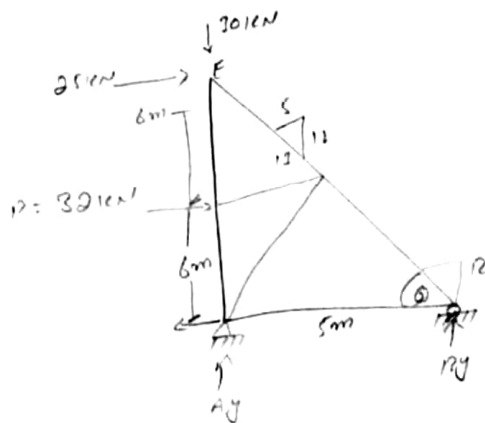
\mathcal{R}^3 lies on same plane.

$$\text{So, } D_x = -9.$$



Q #3
Ans

page #09



Sol:

$$\sum M_A = 0 \quad (+)$$

$$-5R_y + 32 \times 6 + 25 \times 12 = 0$$

$$\Rightarrow R_y = 98.4 \text{ kN}$$

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

$$-30 + A_y + R_y = 0$$

$$A_y = 30 - R_y = 30 - 98.4$$

$$A_y = -68.4 \text{ kN}$$

$$\sum F_x = 0$$

$$A_x = 25 + 32 = 57 \text{ kN}$$

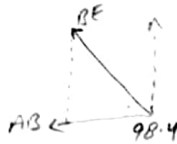
$$\tan \phi = 12/5$$

$$\phi = \tan^{-1}(12/5) \Rightarrow 67.38^\circ$$

using method of Joints: page # 10

Joint B:

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



$$98.4 + BE \sin \phi = 0$$

$$F_{BE} = \frac{-98.4}{\sin(67.68^\circ)} \Rightarrow -106.37 \text{ kN}$$

$$\sum F_x = 0 \rightarrow +$$

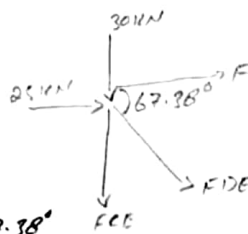
$$-F_{AB} - BE \cos \phi = 0$$

$$= F_{AB} = -BE \cos \phi$$

$$F_{AB} \Rightarrow -(-106.37) \cos(67.38^\circ)$$

~~_____~~
 $F_{AB} = 40.91 \text{ kN}$

Joint E:



$$\sum F_x = 0 \rightarrow +$$

$$\Rightarrow 25 + F_{DE} \cos 67.38^\circ$$

$$\Rightarrow F_{DE} = \frac{-25}{\cos 67.38^\circ}$$

$$\Rightarrow F_{DE} = -65 \text{ kN} \text{ (Compression)}$$

$$\sum F_y = 0 \uparrow$$

$$\Rightarrow -30 - F_{CE} + 65 \sin 67.38$$

$$\Rightarrow F_{CE} = 30 \text{ kN} \text{ tension}$$

$$(d) \sum F_x = 0 \rightarrow +$$

$$\Rightarrow -F_{AB} + 65 \times \cos 67.38 = 0$$

$$\Rightarrow F_{AB} = 25.11 \text{ kN tension}$$

Now Joint C

$$\sum F_x = 0$$

$$\Rightarrow F_{CD} = -32 \text{ kN} \text{ Compression}$$

$$\sum F_y = 0$$

$$\Rightarrow F_{AC} = 30 \text{ kN tension}$$

Now Joint D

$$\sum F_y = 0 \uparrow$$

$$\Rightarrow 40.91 \times \sin 67.38 + 65 + F_{AD} \sin 67.38$$

$$\Rightarrow F_{AD} = 32.50 \text{ kN (Tension)}$$

