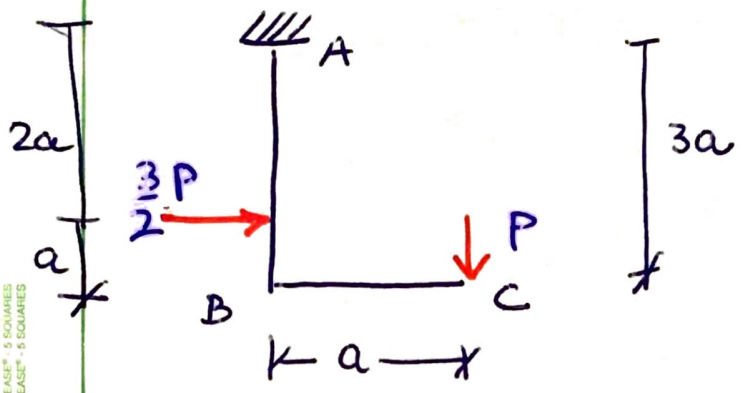
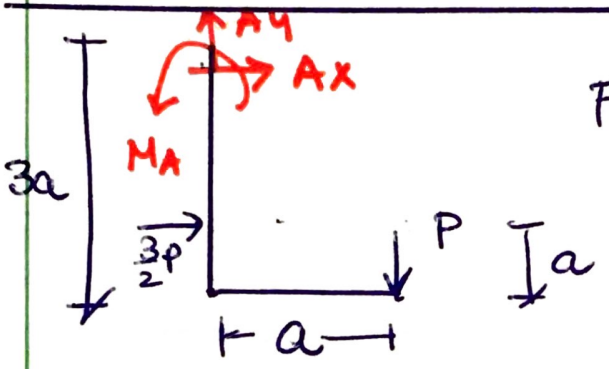
PROBLEM 1 | MIDTERM 2_SP20



- Determine the reactions @ support A in terms of P and a (P, a are known)
- Draw the structure w/ the reactions with correct sign.



FBD
- Has to include forces & distances
- Each reaction (1 point) x3
- distances (1 point)

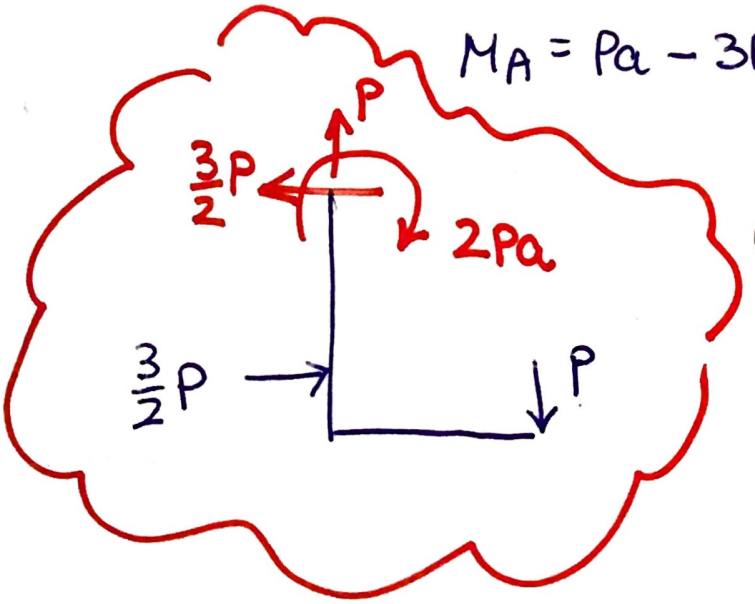
EQ EQUATIONS

$\overset{+}{\rightarrow} \Sigma F_x = 0 \quad \frac{3}{2}P + A_x = 0 \rightarrow \boxed{A_x = -\frac{3}{2}P}$ (1)

$+\uparrow \Sigma F_y = 0 \quad A_y - P = 0 \rightarrow \boxed{A_y = P}$ (1)

$\overset{+}{\circlearrowleft} \Sigma M_A = 0 \quad M_A - Pa + \frac{3}{2}P(2a) = 0$ (3)

$M_A = Pa - 3Pa = -2Pa$



(b) 3 points { 1 P; 1 3/2 P; 1 2Pa }

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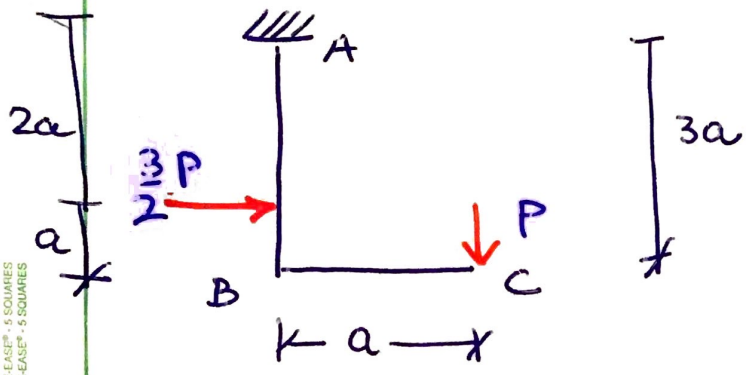
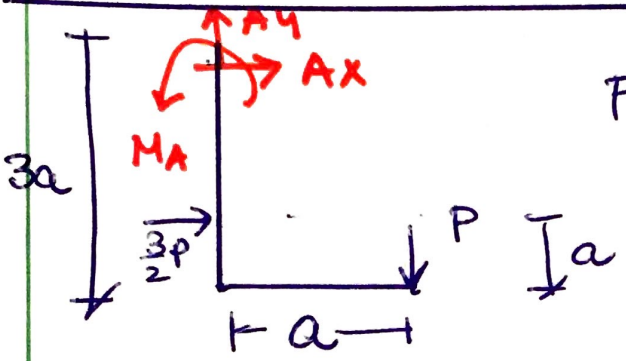


- Determine the reactions @ support A in terms of P and a (P, a are known)
- Draw the structure with reactions with correct sign.



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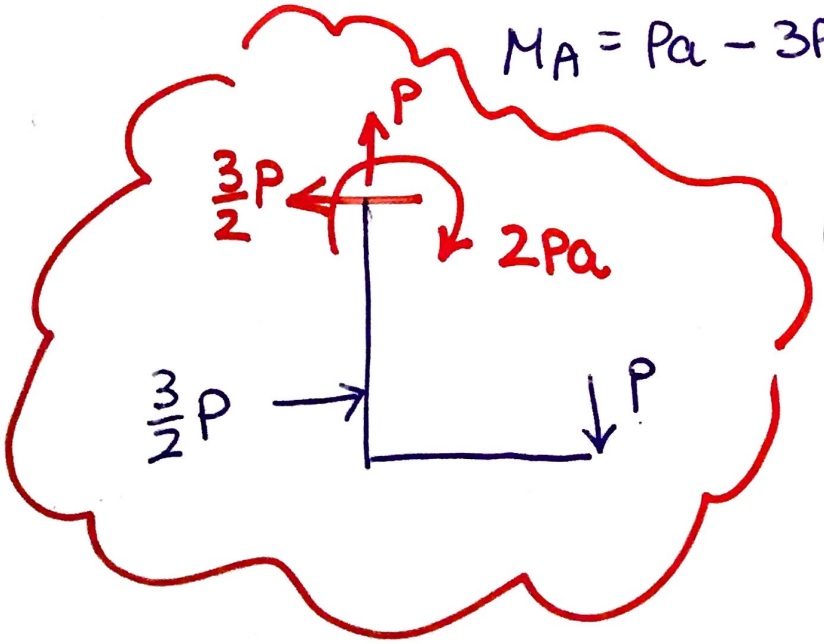

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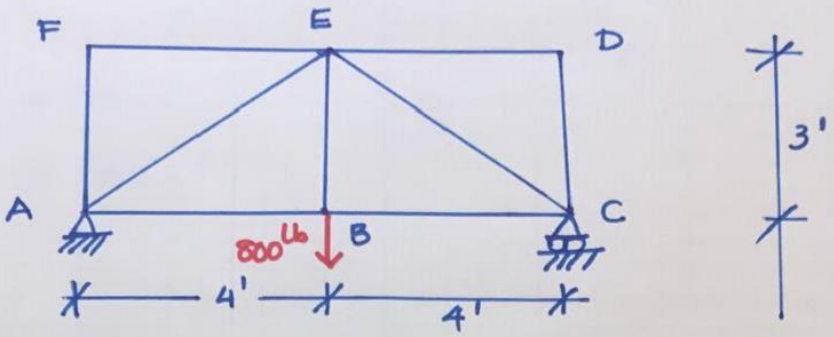
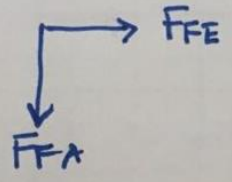


(a) Reactions

(b) Forces @ FE, FA, AE & DC - State if T or compr.

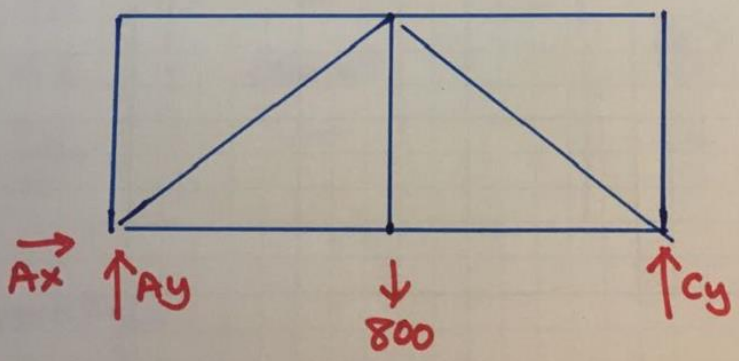
Node F



$\pm \Rightarrow \Sigma F_x = 0 \Rightarrow \boxed{F_{FE} = 0}$

$+\uparrow \Sigma F_y = 0 \Rightarrow \boxed{F_{FA} = 0}$

Reactions @ A & C are 400 lb by symmetry



$\boxed{A_x = 0}$

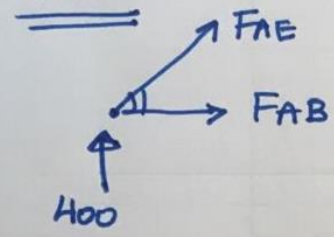
$+\circlearrowleft \Sigma M_A = 0$ $\quad -800(4) + C_y(8) = 0$

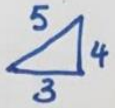
$8C_y = 4(800) \rightarrow \boxed{C_y = 400}$

$+\uparrow \Sigma F_y = 0$ $\quad A_y + C_y = 800$

$\hookrightarrow \boxed{A_y = 400 \text{ lb} (\uparrow)}$

Node A





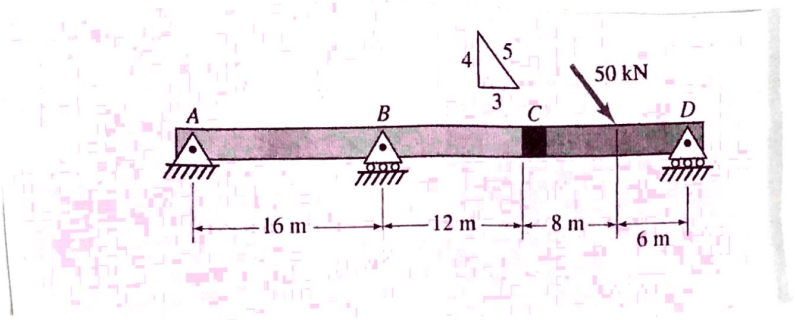
$\overset{+}{\rightarrow} \Sigma F_x = 0$ $\quad F_{AE}\frac{4}{5} + F_{AB} = 0$ no need

$F_A\ 3/5 + 400 = 0 \Rightarrow F_{AE} = -400(5/3)$

$$\boxed{F_{AE} = -666.67 \text{ lb}}$$ (C)

Member	Magnitude (lb)	T/C
FE	0	—
FA	0	—
AE	666.67	(C)
DC	0	—

By symmetry



The ~~Con~~tinous beam shown in the figure has an applied load of 50KN @ an angle shown. Support A is a pin, B and D are rollers and C is a hinge.

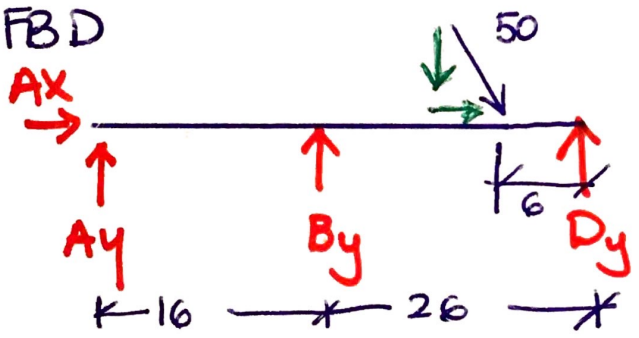
a) How many unknows does this problem have?

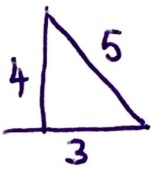
b) Calculate the reactions at A, B, C and D.

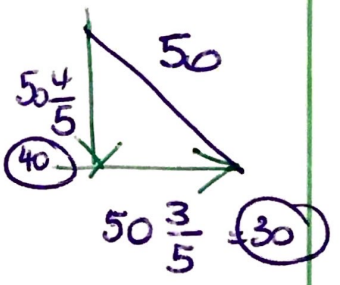
c) Show reactions with their correct signs

Draw the beam ξ

FBD







$\rightarrow \Sigma F_x = 0$ $\quad Ax + 30 = 0 \rightarrow \boxed{Ax = -30\ KN}$

$+\circlearrowleft \Sigma M_A = 0$ $\quad By(16) + Dy(26+16) - 40(20+16) = 0$

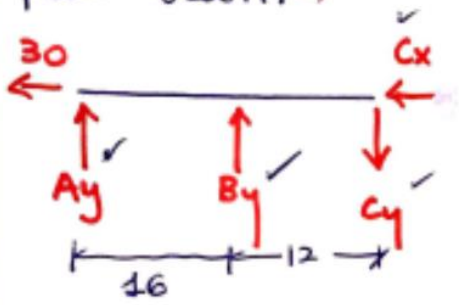
$16\,By + 42\,Dy = 1440$

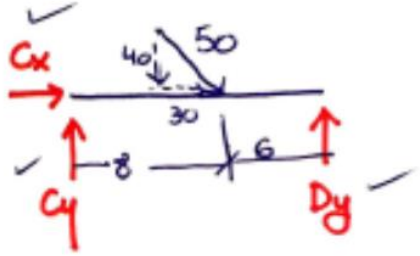
$$\boxed{8By + 21Dy = 720} \quad (1)$$

This problem has 6 unknowns Ax Ay, By, Dy, Cx Cy

$+\uparrow \Sigma F_y = 0 \qquad A_y + B_y + D_y - 40 = 0$ (2)

Split beam → to get more equations.





$\Sigma M_A = 0$

$B_y(16) - C_y(12+16) = 0$

$B_y = \frac{C_y(12+16)}{16} = 1.75 C_y$

$B_y = 1.75(17.14) = 30$

$\boxed{B_y = 30\ KN}$

$+\uparrow \Sigma F_y = 0$

$A_y + B_y - C_y = 0$

$A_y = C_y - B_y = 17.14 - 30$

$\boxed{A_y = -12.86\ KN}$

$\rightarrow \quad C_x + 30 = 0 \rightarrow \boxed{C_x = -30\ KN}$

$+\uparrow \quad C_y + D_y - 40 = 0$ (3)

$+\circlearrowleft \Sigma M_C = 0 \qquad D_y(8+6) = 40(8)$

$\boxed{D_y = 22.9\ KN}$ (4)

(4) into (3)

$C_y = 40 - D_y = 40 - 22.9 = 17.14\ KN$

$\boxed{C_y = 17.14\ KN}$

Into (1)

$$8By + 21\,Dy = 720$$

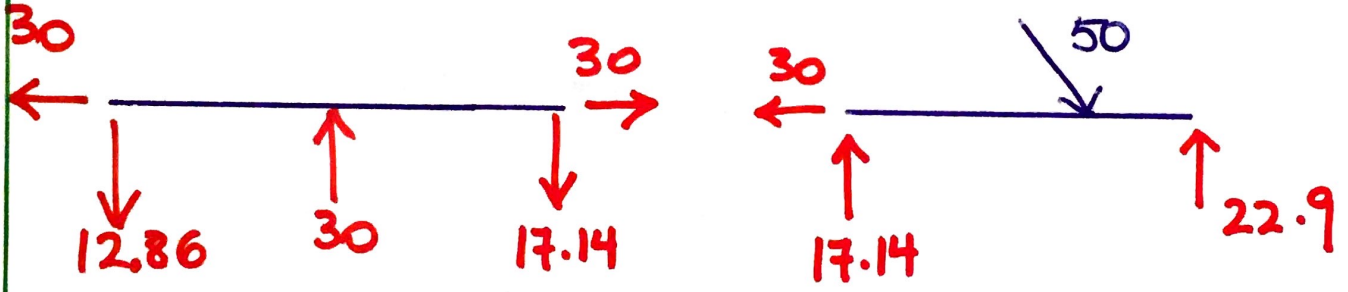
checks ✓

$$8(30) + 21(22.9) = 720$$

Into (2)

$$Ay + By + Dy - 40 = 0$$

$$-12.86 + 30 + 22.9 - 40 = 0$$ ✓



6 points (one per reaction)