# ASSIGNMENT

NAME:-

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ID:-

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SUBJECT:-

THEORY OF STRUCTURE (II)

# -:ASSIGNMENT:-

## 1:- Choose the best options:-

B is a hinge support and C is roller support. A and D are free ends. A load of 60 kN acts (~~in~~ind) in downward direction at point D. Sign conventions are as usual.

AB = CD = 1m and BC = 3m.

All force options are in KNM.

All deformation options are in M.

E and I are given.

1:- What will be the reaction force at support C?

a) 20
b) 40
c) 80
d) 120

ANSWER:- C

Explaination balance moment about B.

2:- What will be the shape of SFD in this case?

a) Lineas
b) Parabolic
c) Lineas with discontinuity
d) Arbitrary curve

ANSWER:- C

3:- What is the shape of BMD for this diagram?

a) Rectangulas
b) Triangulas
c) Parabolic
d) Arbitrary curve

ANSWER:- B

4:- What will be the peak value of SFD?

a) 20
b) 40
c) 60
d) 80

ANSWER:- C

5:- Where would peak value of BMD lie?

a) A
b) B
c) C
d) D

ANSWER:- C

6:- Which type of joint would replace point A in its conjugate beam?

a) roller
b) pin
c) hinge
d) fixed

ANSWER:- D

7:- The ration of shear stress and shear strain of an elastic material, is

a) Modulus of Rigidity
b) Sheas Modulus
c) Modulus of Elasticity
d) Both (a) and (b)

ANSWER:-

D

8:- Stress may be defined as

a) Force per Unit length
b) Force per Unit volume
c) Force per Unit area
d) None of these

ANSWER:-

C

9:- Stress may be expressed in Newtons

a) Per millimeter square (N/mm2)
b) Per centimeter square (N/cm2)
c) Per meter square (N/m2)
d) None of these

ANSWER:-

A

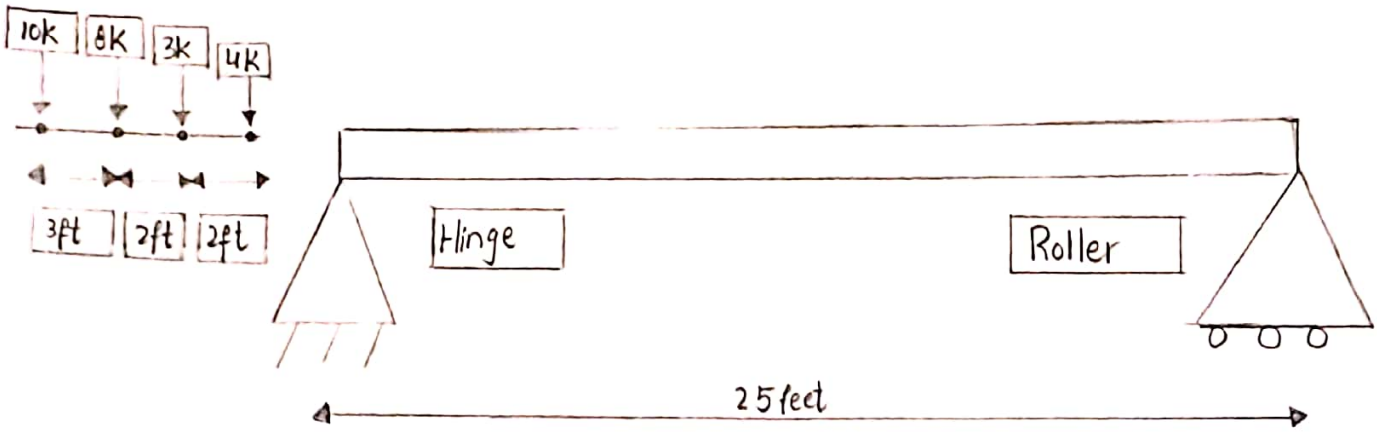
10. According to Muller Breslau theorem on conjugate beam slope is equal

a) Moment
b) Shear
c) Deflection
d) None of these

ANSWER:- B

# Question No 2

Find maximum live moment in grider by using Absolute max shear and max moment method.



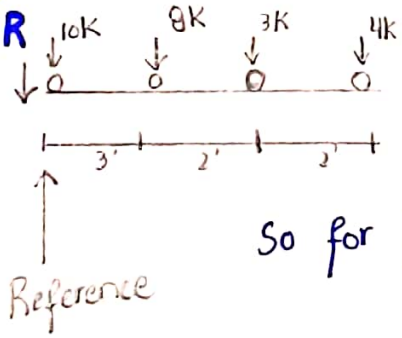

## APPROACH:-

(1) Calc force resultant ($F_R$)

(2) Place each concentrated load equidistance from the centerline as resultant ($F_R$)

(3) Use statics and equation.

## ① FORCE RESULTANT $F_R$



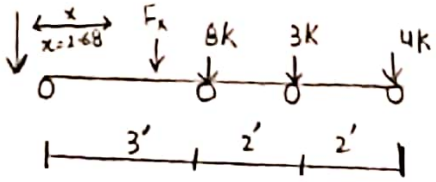

So for finding force resultant

$$\bar{x} = \frac{\Sigma F_x}{\Sigma f}$$ (so taking one side reference)

$$= \frac{(10)(0) + 8(3) + 3(5) + 4(7)}{10+8+3+4}$$

$$\bar{x} = 2.68 \text{ ft}$$

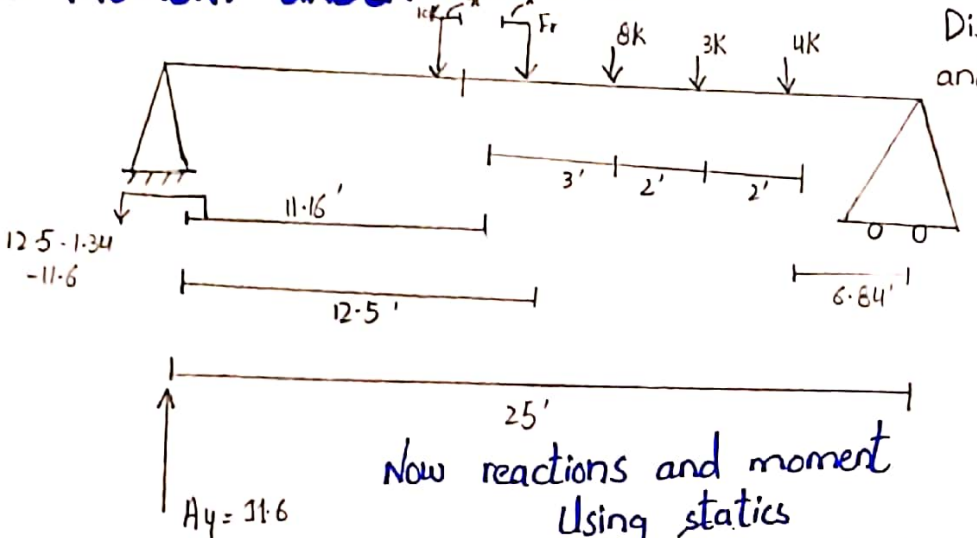
So we got net force resultant if taking reference from left.




Now likely brute force method

I need this first side load 10k and Fr to be equidistance from centerline

## (ii) MAX. MOMENT UNDER 10K LOAD:-




Distance b/w 10 kips and Fr

$\bar{x} = \frac{2.68}{2}$

$= 1.34'$

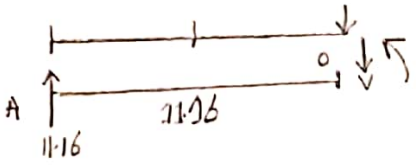
Now reactions and moment

Using statics

$\circlearrowleft + \Sigma M_B = 0 : 4(6.34) + 3(8.84) + 8(10.84) + 10(13.84) - A_y(25) = 0$

$A_y = 11.16$ kips

For Finding moment let us use Cut and sectioning




$\circlearrowleft + \Sigma M_O = -(11.16)(11.16) + M_{ax} = 0$

$M_{max}$ at 10 kips = 124.55 kips ft

## (iii) Max. MOMENT UNDER 8 KIPS:

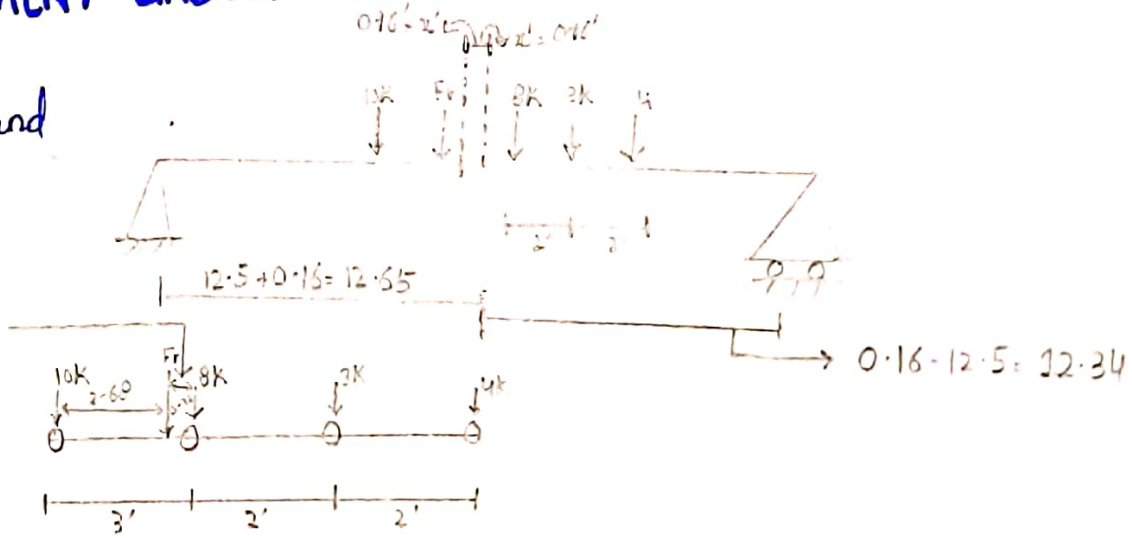
(Distance b/w Fr and 8 kips)

$= 3 - 2.68$

$= 0.32$

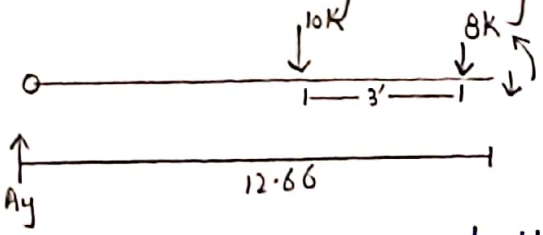
$\bar{x} = \frac{0.32}{2}$

$= 0.16$




Now its time for reaction and moment

So by cutting




Moment at 8k

and so on - - - - - -

So at the end

We will get $M_{max} = M_{ax}\ (M_{ax}\ 10K + M_{max}\ 8K + M_{max\,3} + M_{max\,4K})$

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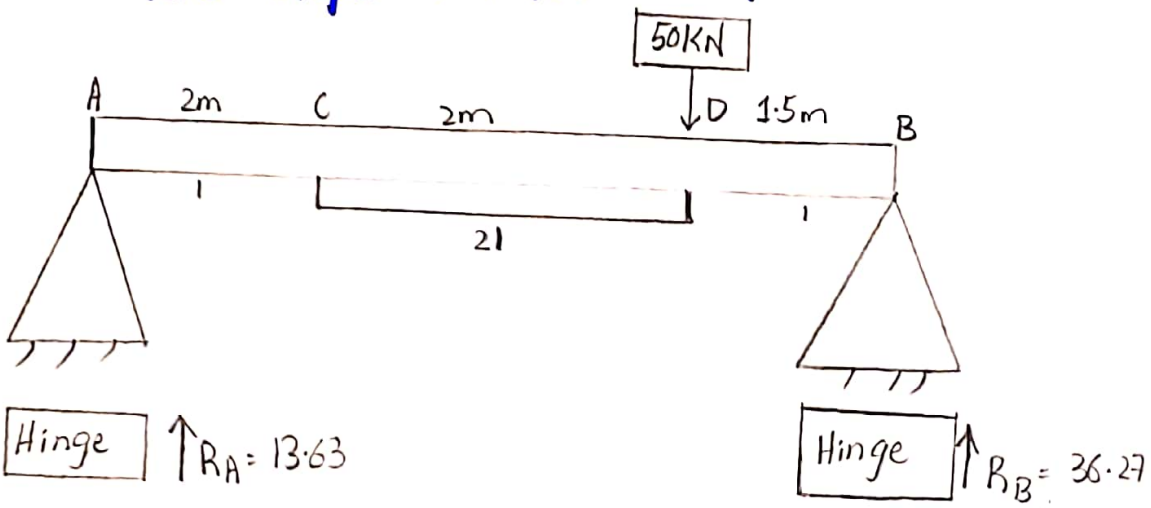
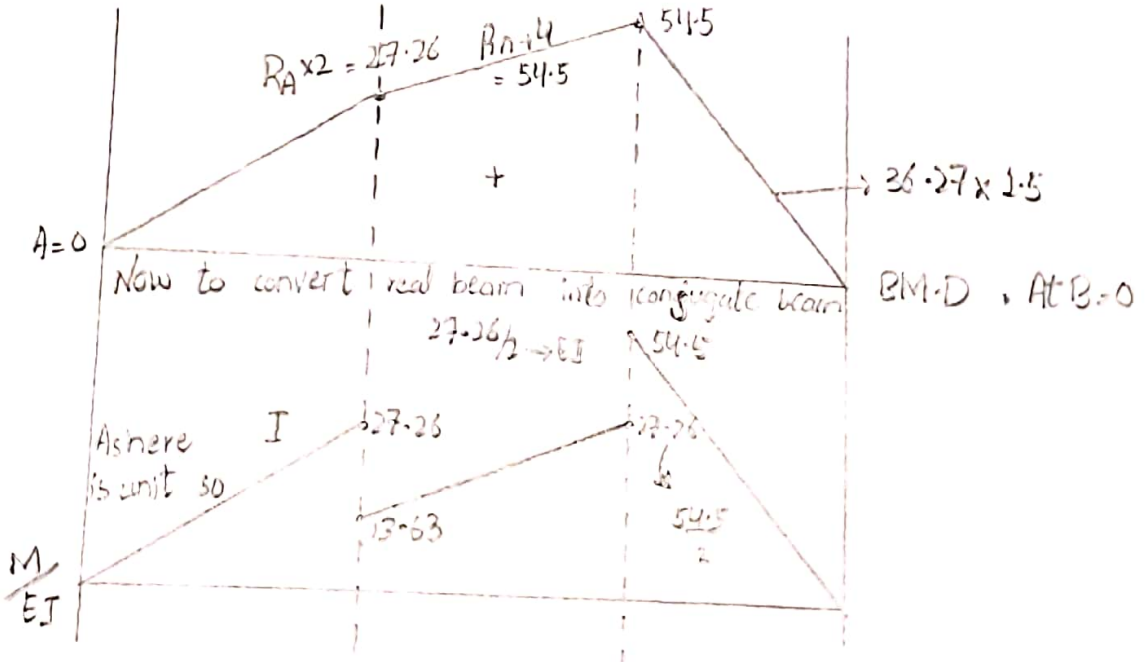
## Question :- 3

**Find slope at A $Q_A$, and deflection at $\Delta D$?**



## Reactions :-

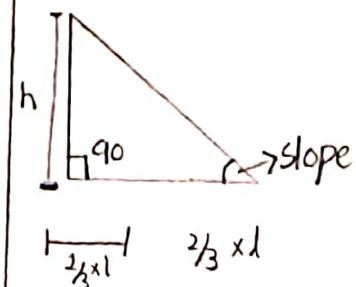
$R_{AX}$ 5·5 − 50 × 1·5

$$R_A = \frac{50 \times 1.5}{5.5} = 13.63\ kN \uparrow$$

$$R_B = \frac{50 \times 4}{5.5} = 36.37\ kN \uparrow$$

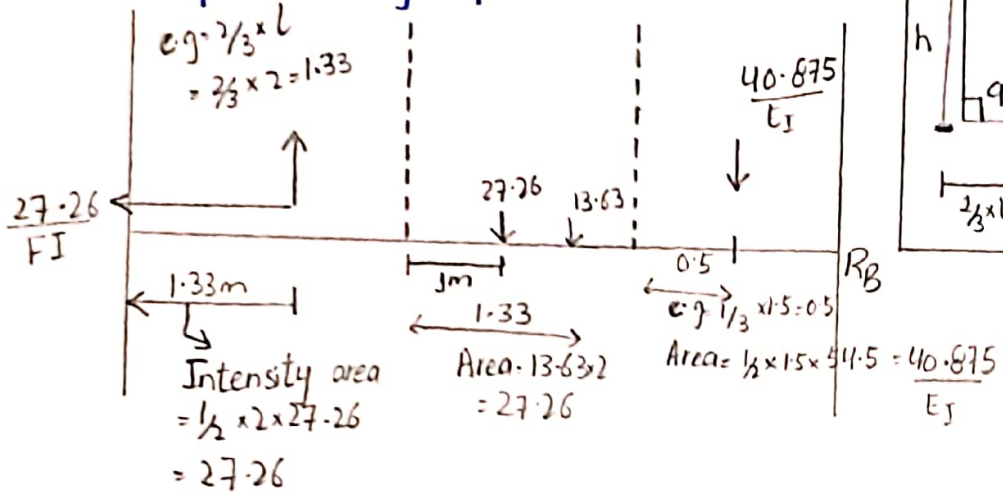
**HINT**


Assymetrical triangle Area = ½ × l × h




Step 2:

So all are positive so it means forces are acting upward.




FOR SLOPE $= 2/3 \times (h) = 2/3 \times 2 = 1.33$

AREA $= \frac{1}{2} \times 2 \times (27.26 - 13.03)$

$= 13.63$

To find reaction

Conjugate beam calculations:

$M_{OA} = 0$

$$= \left(\frac{27.26 \times 1.33}{EI}\right) + \left(\frac{27.26 \times 3}{EI}\right) + \left(\frac{13.63 \times 3.33}{EI}\right)$$

$$+ \left(\frac{40.875 \times 4.5}{EI}\right) - (R_B \times 5.5) = 0$$

$$R_B = \frac{63.15}{EI}\ kN \uparrow$$

$\uparrow \Sigma F_y = 0$

$$R_A + R_B = 27.26 + 27.26 + 13.63 + 40.875$$

$$R_A = \frac{45.205}{EI}\ kN(\uparrow)$$

(a) Now slope at (A)

$$\theta_A = S.F_{\curvearrowright A}$$

$$R_A = \frac{45.865}{EI}\ \text{Radian}$$

(b) Deflection @ D

$$\Delta D = B.M.D\ @D$$

$$= \left(R_B \times 1.5\right) - \left(\frac{40.875}{EI} \times 0.5\right)$$

$$= \frac{74.2875}{EI}\ m(\uparrow)$$

END