# Assignment

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Subject : Theory of Structure

1) chose the best option

B is a hinge support and C is a roller support. A and D are force ends. A load of 60kN acts in downward direction at point D

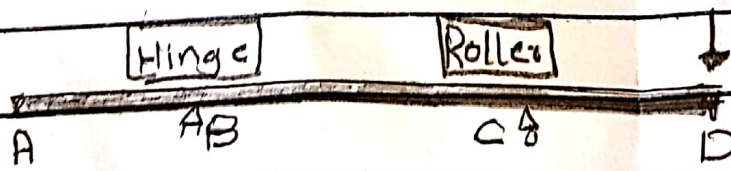
Sign Conventions are as usual.

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

All force options are in kNM.

All deformation option are in M.

E and I are given.



Tip: Use data given above to solve question from (1-6).

**1.** What will be the reaction force at support C?
a) 20
b) 40
c) 80
d) 120

**2.** What will be the shape of SFD in this case?
a) Linear
b) Parabolic
c) Linear with discontinuity
d) Arbitrary curve

**3.** What is the shape of BMD for this diagram?
a) Rectangular
b) Triangular
c) Parabolic
d) Arbitrary curve

**4.** What will be the peak value of SFD?
a) 20
b) 40
c) 60



d) 80

**5.** Where would peak value of BMD lie?
a) A
b) B
c) C
d) D

**6.** Which type of joint would replace point A in its conjugate beam?
a) roller
b) pin
c) hinge
d) fixed

**7.**The ratio of shear stress and shear strain of an elastic material, is

a) Modulus of Rigidity

b) Shear Modulus

c) Modulus of Elasticity

d) Both (a) and (b)

**8**.Stress may be defined as

(a) Force per unit length

(b) Force per unit volume

(c) Force per unit area

(c) None of these

**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

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

a. Moment



b. Shear



c. Deflection

d. None of these

1)
Ans (A)

2)
Ans (C)

3)
Ans (B)

4)
Ans (C)

5)
Ans (C)

6)
Ans (D)

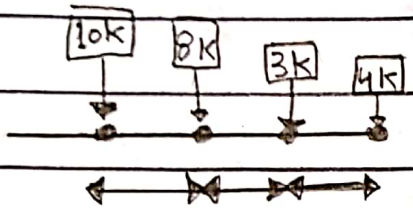
7)
Ans (D)

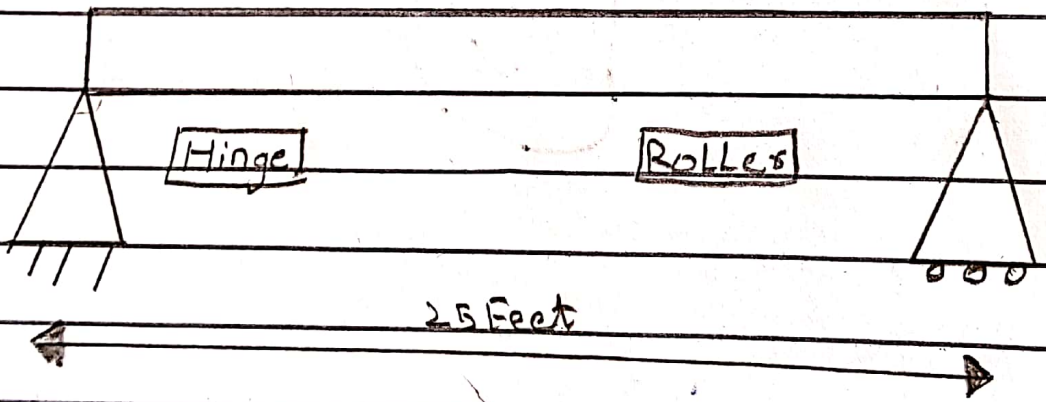
8)
Ans (C)

9)
Ans (A)

Qno 2

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

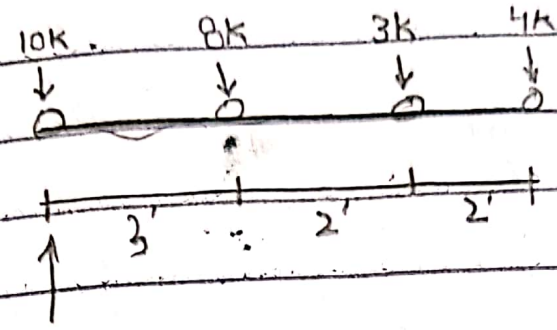



Approach:

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 $F_R$



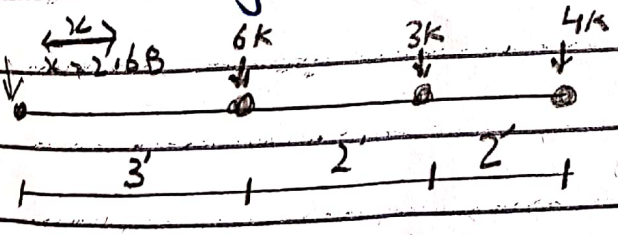

So for finding force resultant

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

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

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

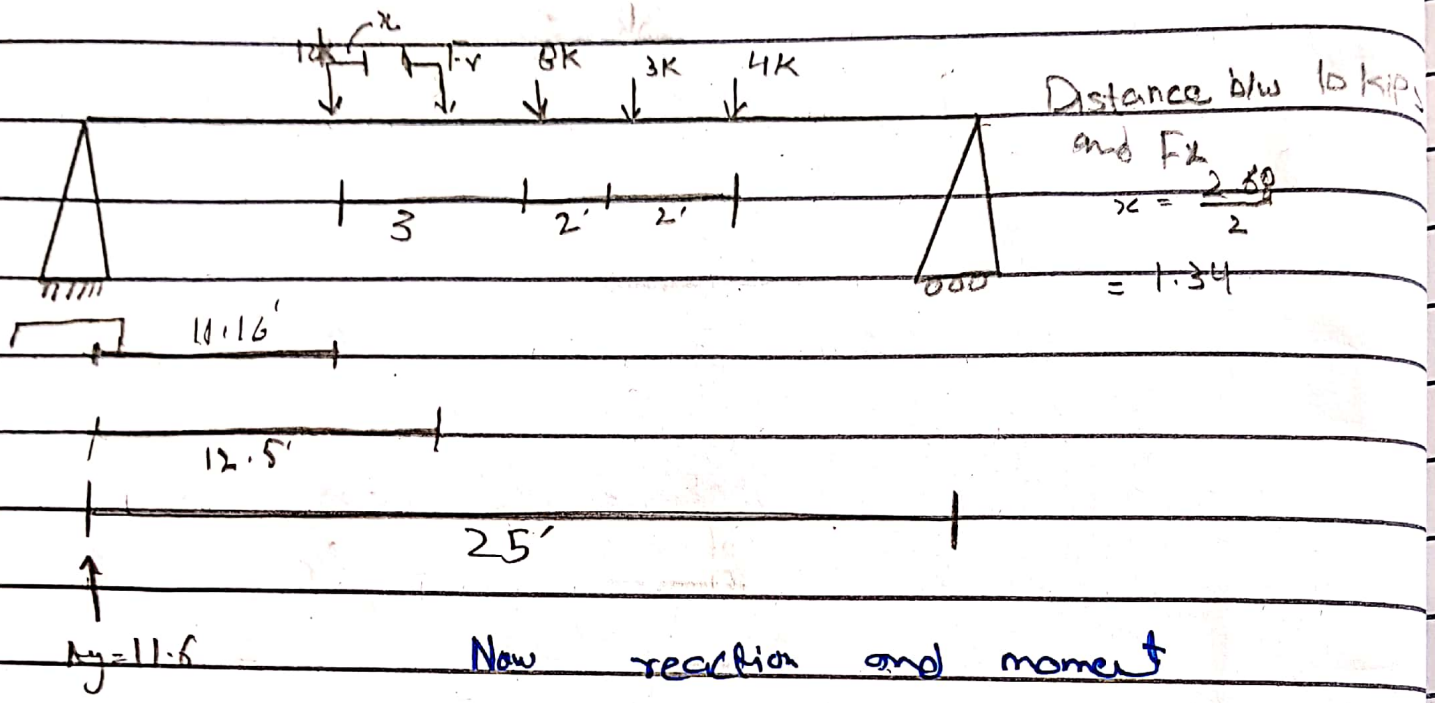
So we got net force resultant if taking refrence from left.




Now likely brute force method I need this first side load 10 k and $F_R$ to be equidistance from centre line:

ii)

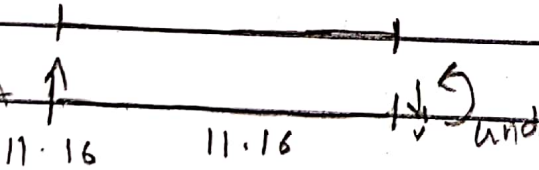
# Max. Moment under 10K Load:-




Now reaction and moment using statics

$\circlearrowleft^{+} \sum M_B = 0,\ 4(6.34) + 3(8.84) + 8(10.84) + 10(13.84) - Ay(25) = 0$

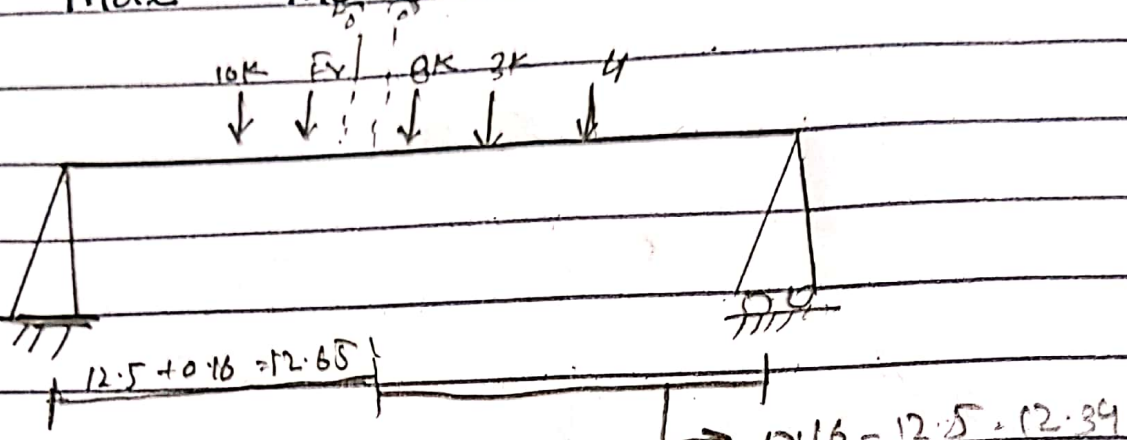
For finding moment let us use cut and sectioning.




$\circlearrowleft^{+} \sum M_{02} = -(11.16)(11.16) + M_{max} = 0$

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

(iii) Max moment under 8 kips:



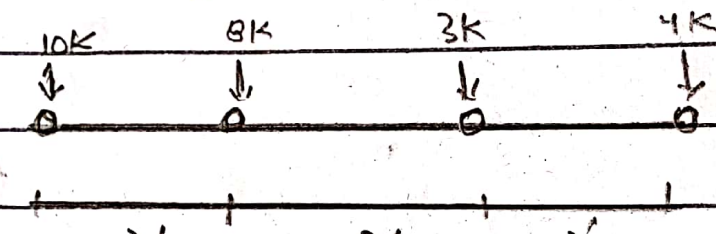

(Distance b/w 8 and 8 kips)

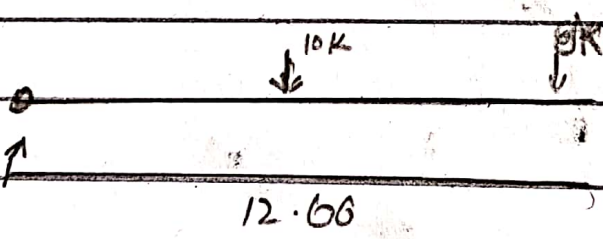
$= 3 - 2.68$

$= 0.32$

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

$= 0.16$



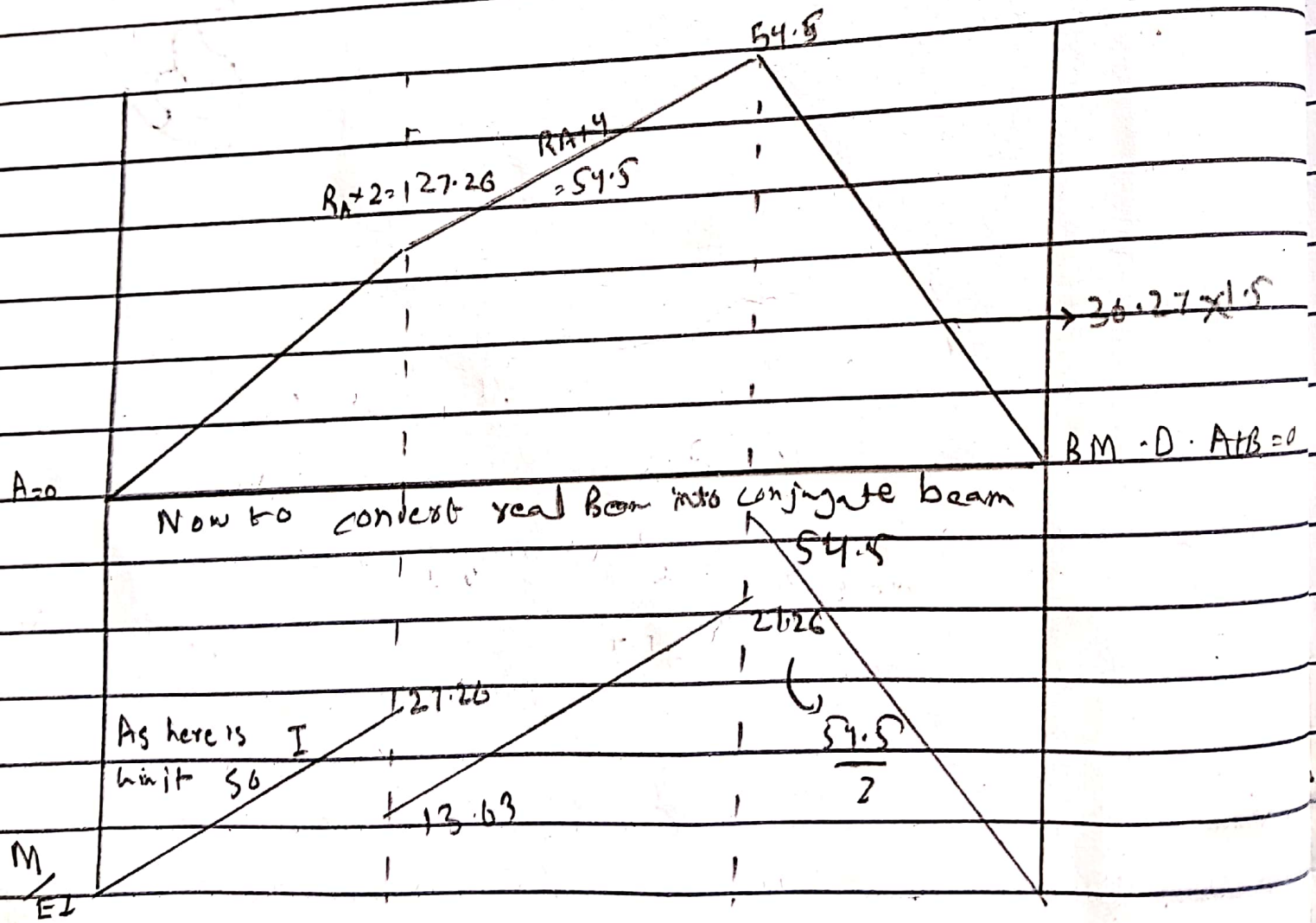

Moment at 8K and So on ---

So at end we will get

$M_{max} = Max(Max\ 10K + M_{max}\ 8K + M_{max\ 3} + M_{max\ 4K})$

Q3:

Find slope at A & A and deflection at A & D



# Reactions

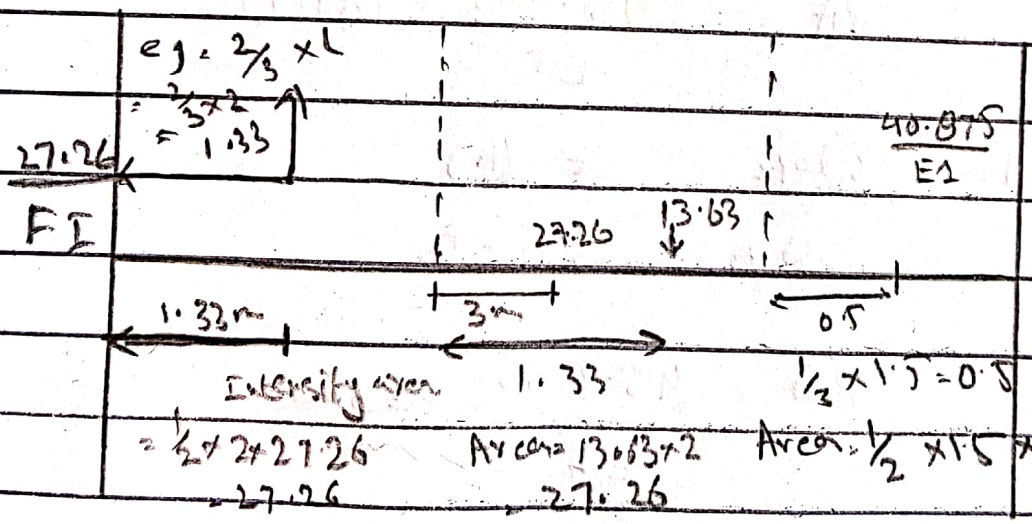
$R_A \times 5.5 - 50 \times 1.5$

$RA = \frac{50 \times 1.5}{5.5} = 13.63\ KN \uparrow$

$RB = \frac{50 \times 4}{5.5} = 36.37\ KN \uparrow$

step 2

So all are positive so it means forces are acting upward




For slope $= \frac{2}{3} \times (h) = \frac{2}{3} \times 2 = 1.33$

Area $= \frac{1}{2} \times 2 \times (27.26 + 13.63)$

$= 13.63$

To find reaction

conjugate beam calculation

$M_{OA} = 0$

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

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

$R_B = \frac{63.15}{EI}$ KN ↑

$+ \uparrow \Sigma F_y = 0$

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

$R_A = \frac{45.205}{EI}$ KN (↑)

a) Now slope at (A)

$\theta A = S.F = A$

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

b) Deflection @ D

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

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

$= \frac{74.2875}{EI}$ m (↑)