

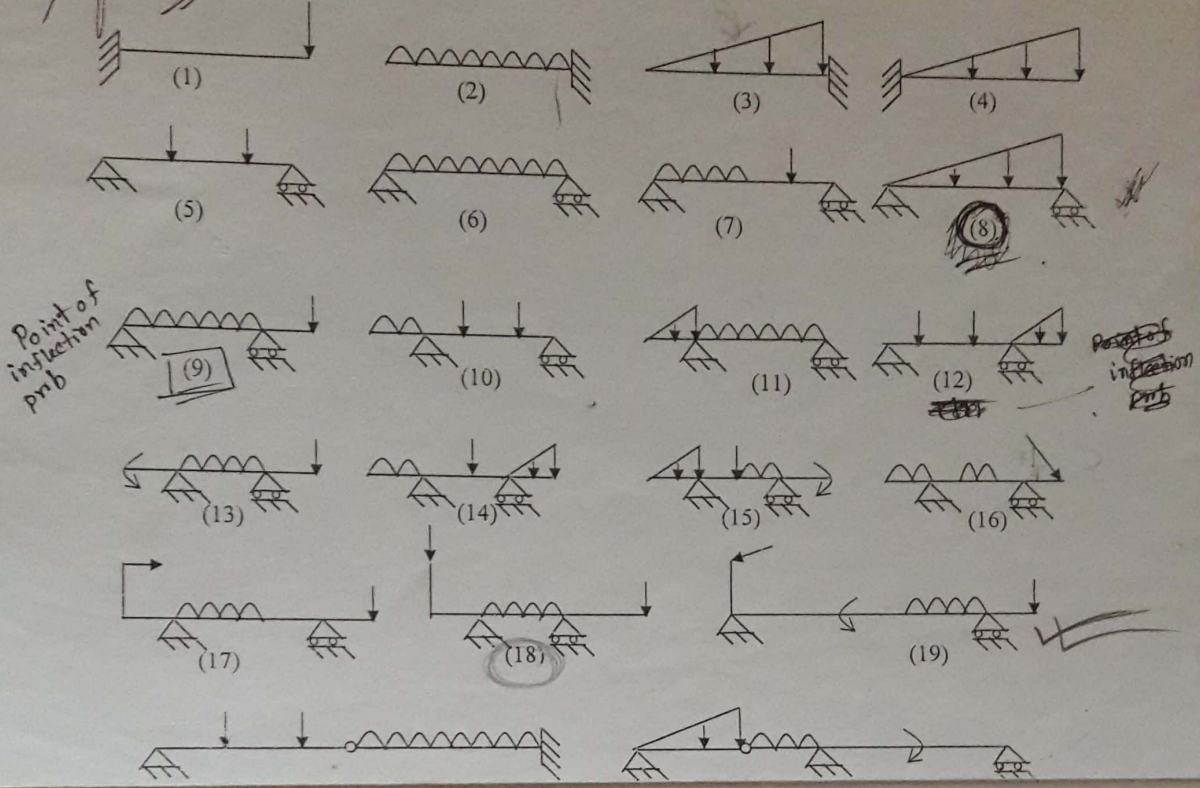
Afrim Sultana Nisha
CE'17
1700082

Tohura Sir sheet solve, lecture,
Question solve

Mameel
18/06/19

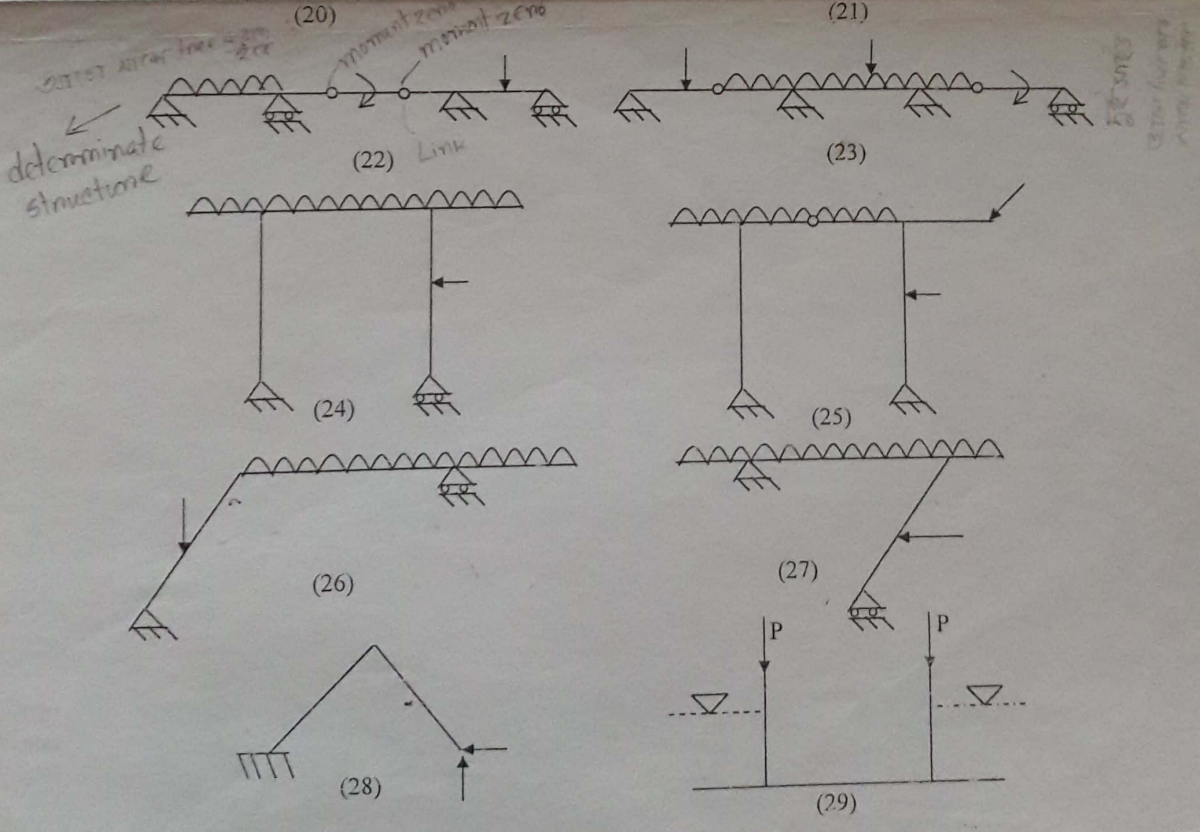
Nisha
1700082

Heavens Light is Our Guide
DEPARTMENT OF CIVIL ENGINEERING
Rajshahi University of Engineering & Technology
CE 2111
(Assume reasonable value)



Point of inflection pnb

Point of inflection pnb

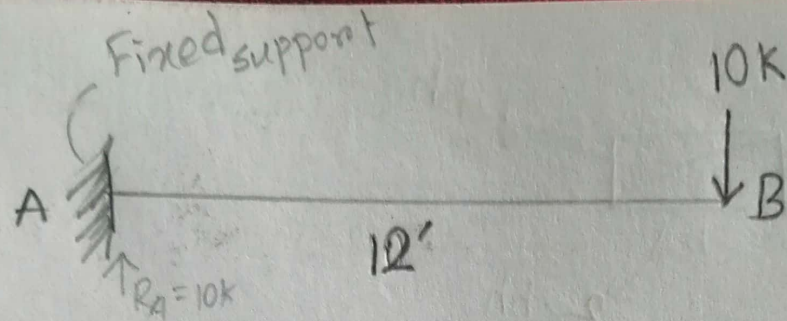


OUTST ATTRA LINE...
determinate structure

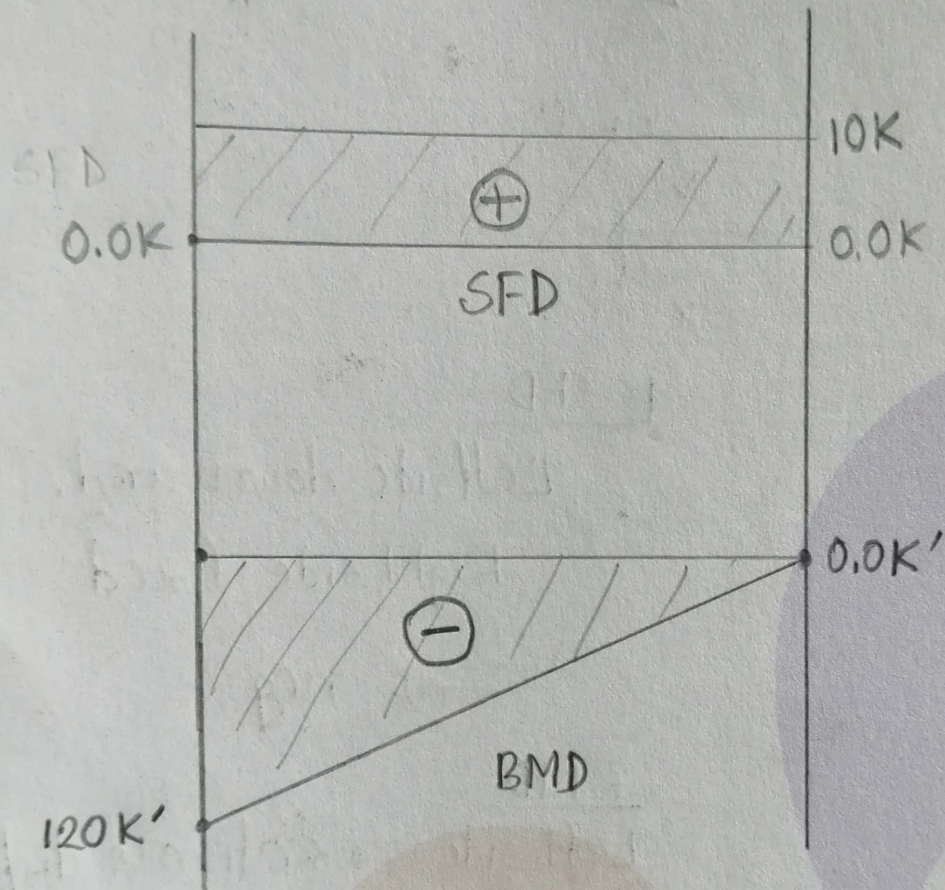
moment zero
Link

Point of inflection pnb

1.

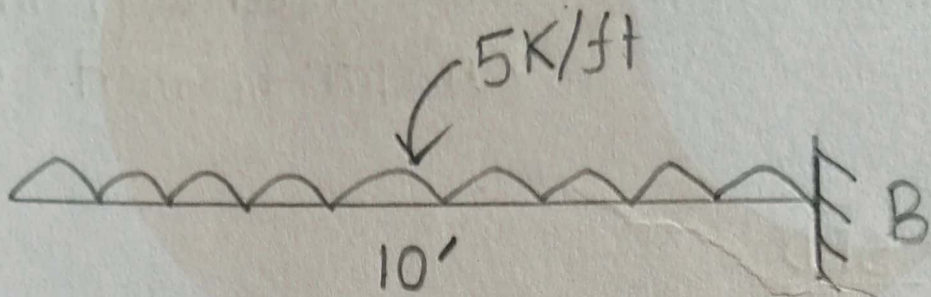


Nisha
1700082



2.

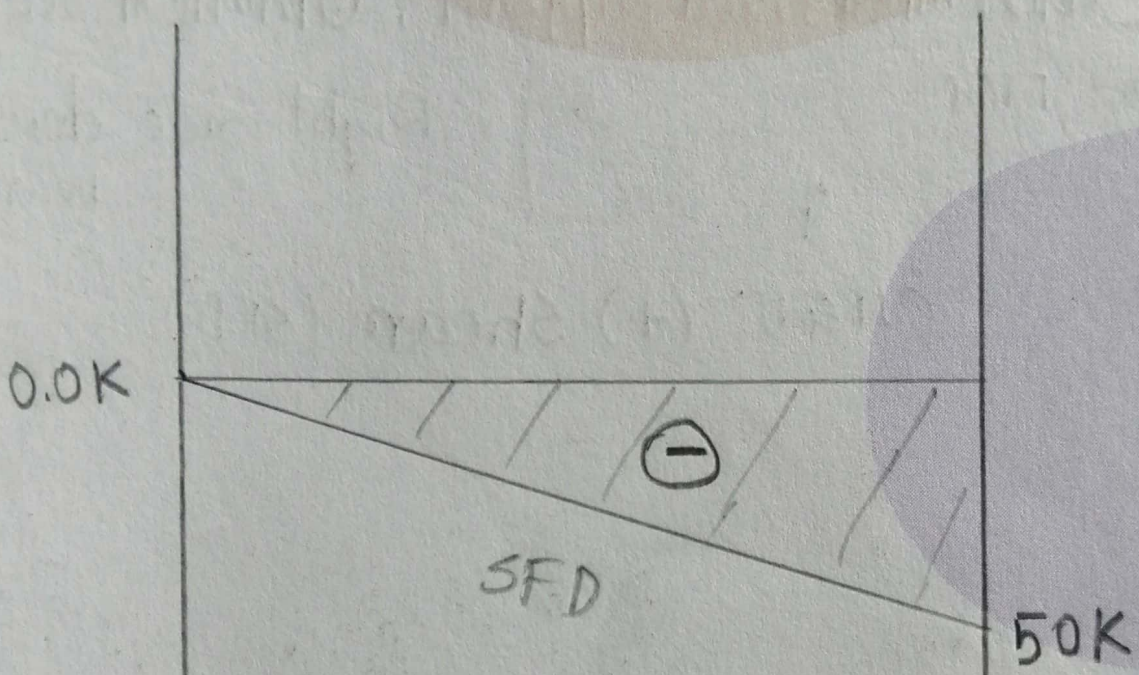
A



10'

B

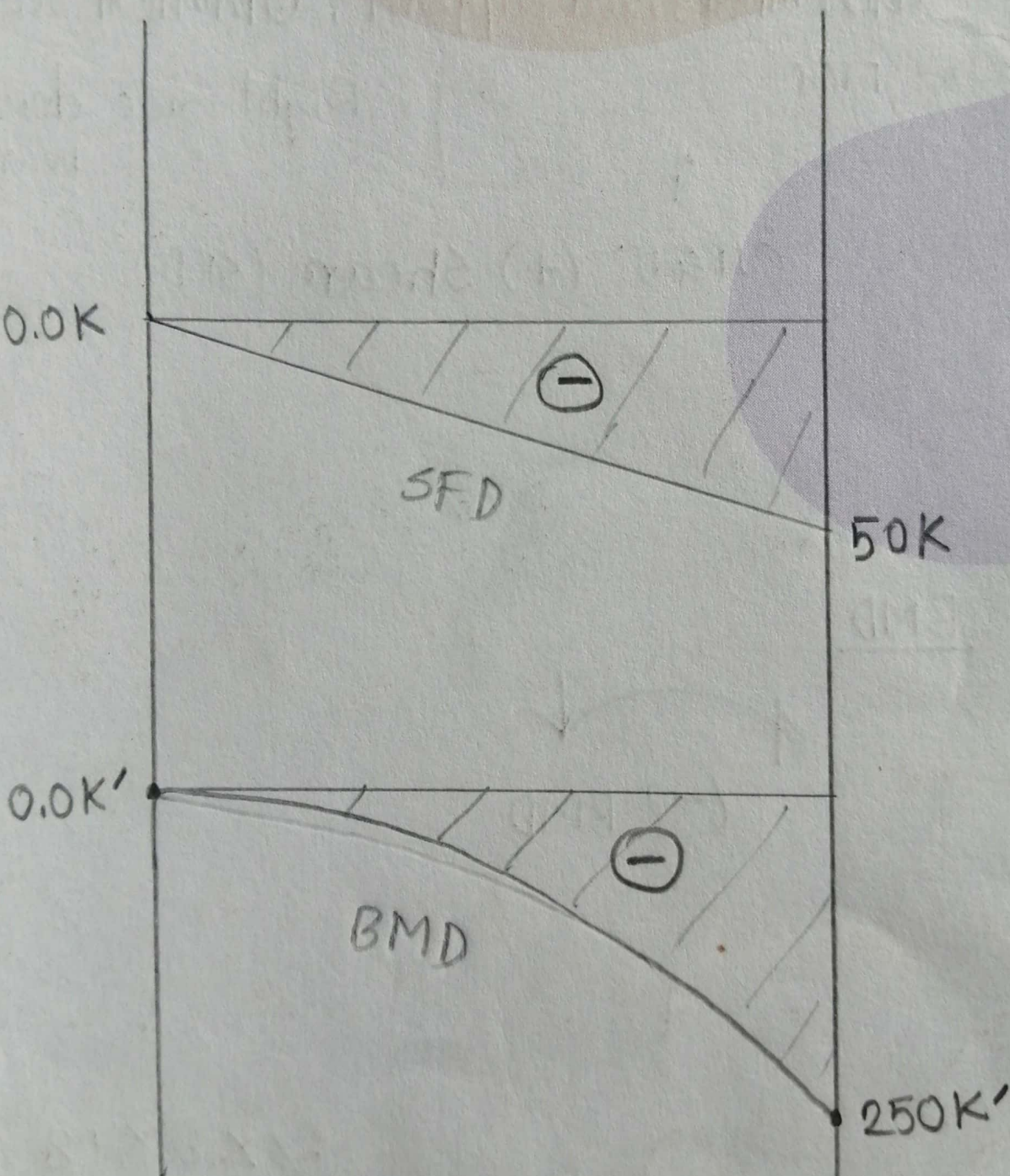
0.0K



SFD

50K

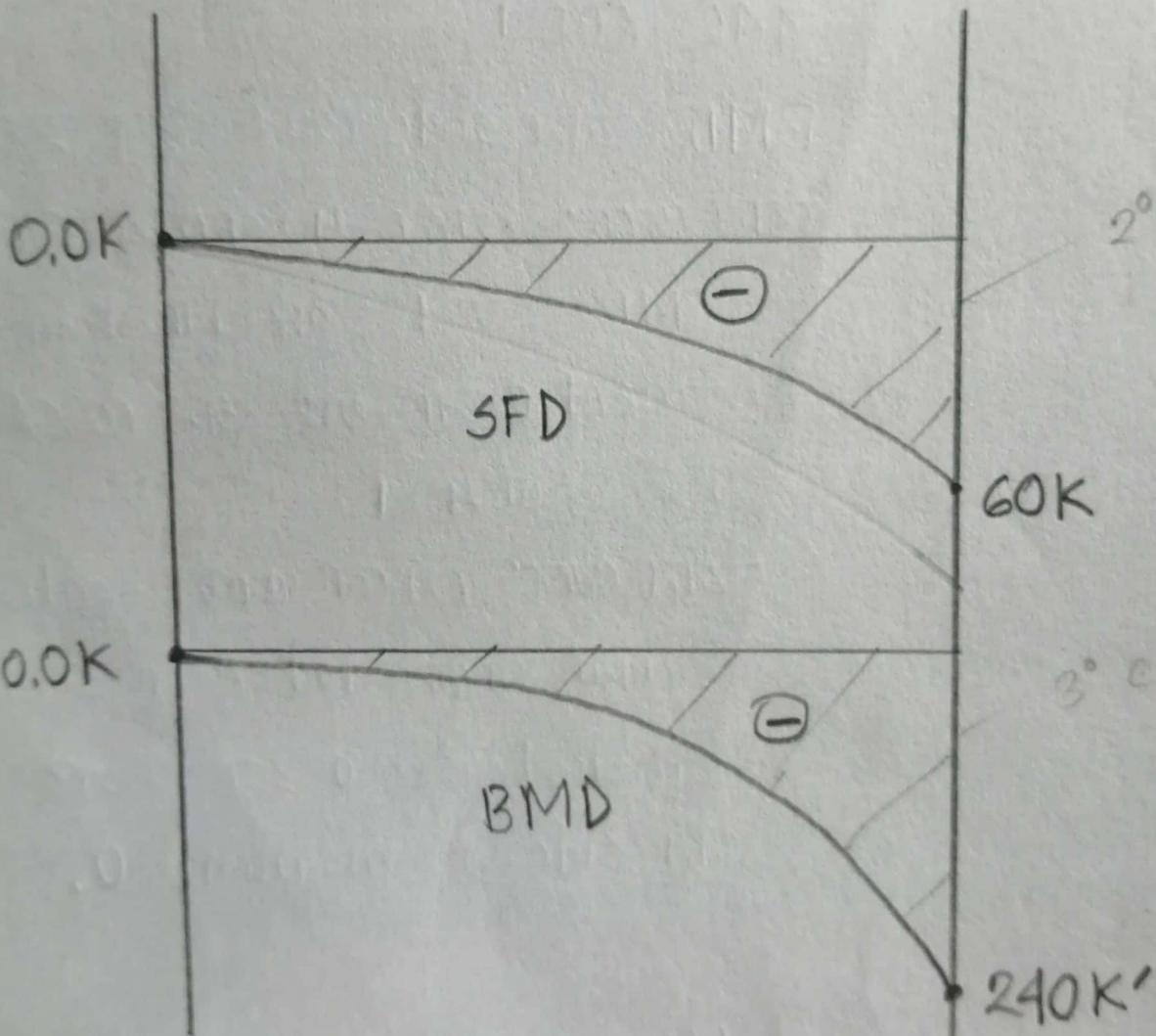
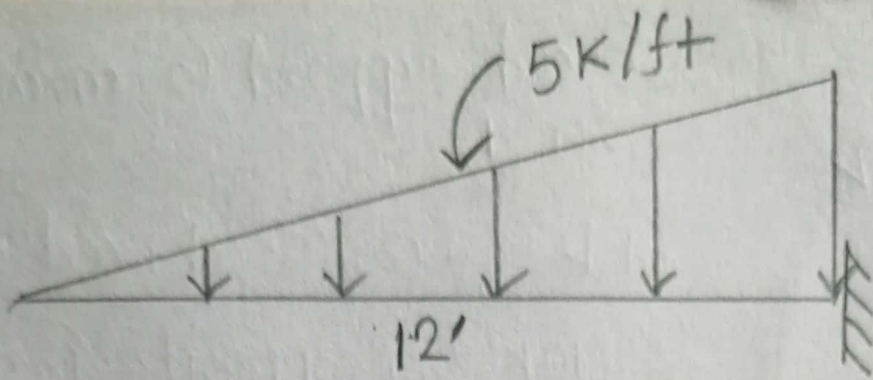
0.0K'



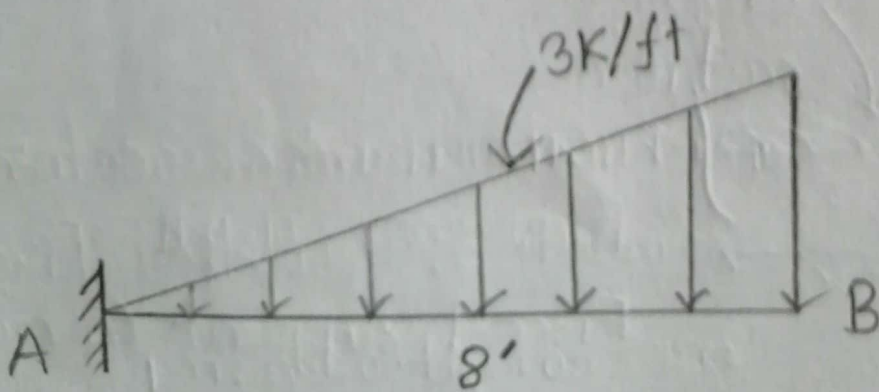
BMD

250K'

3.

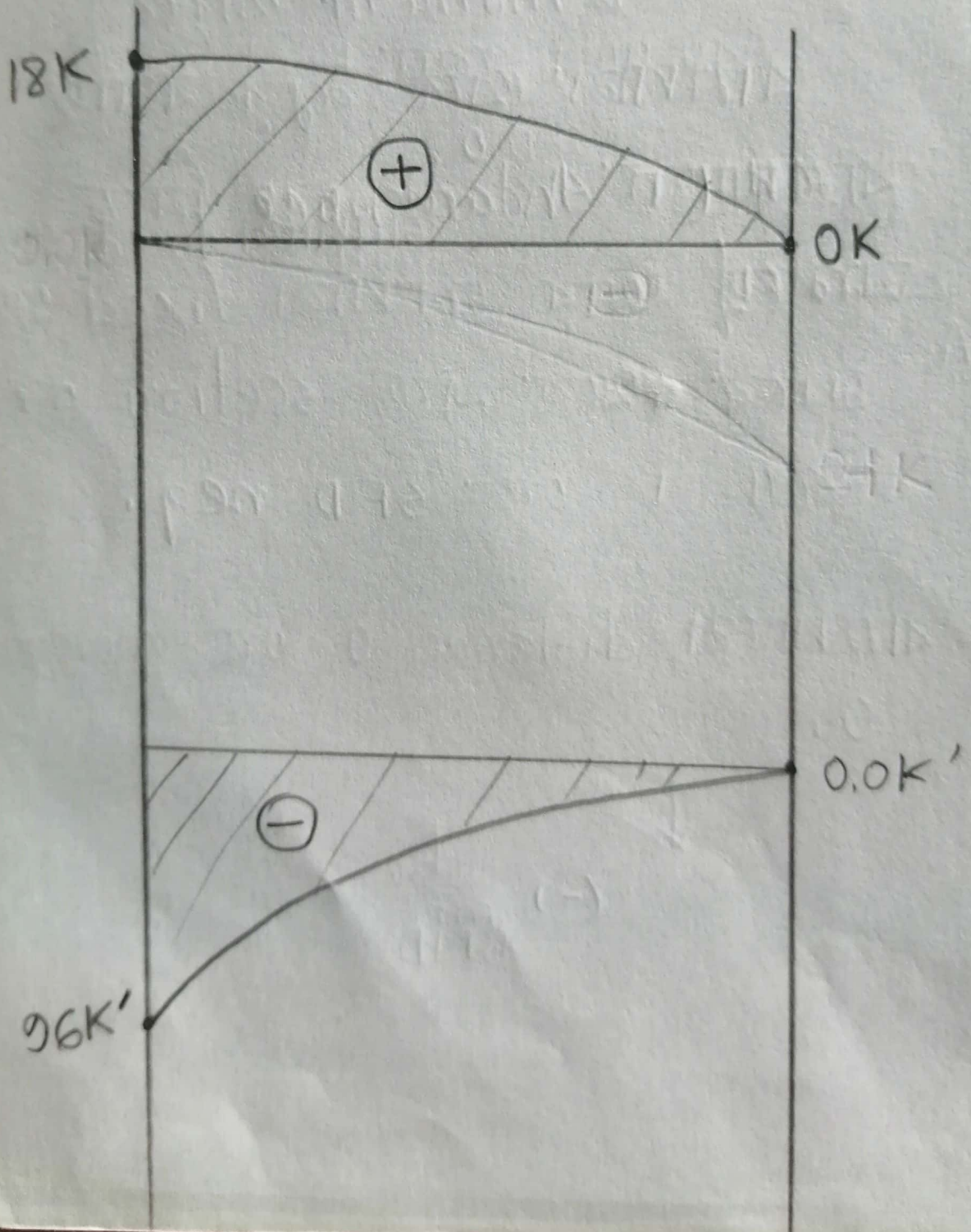
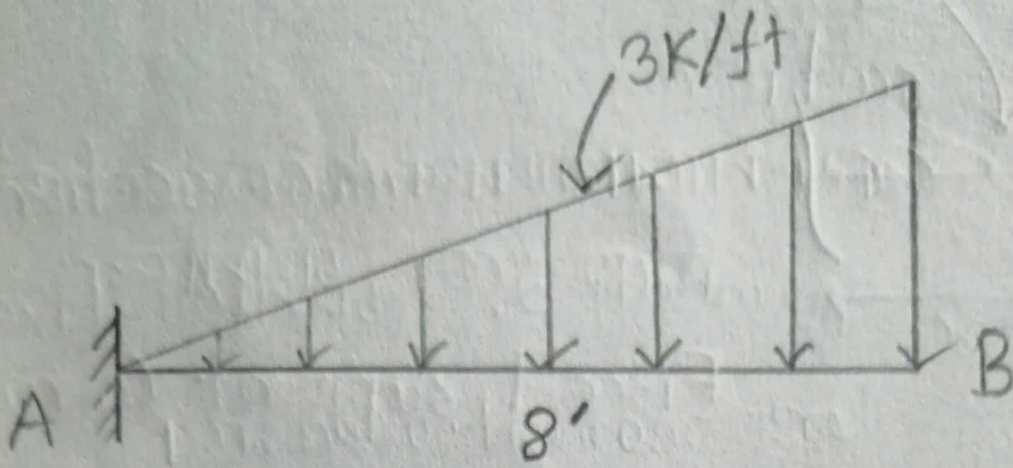


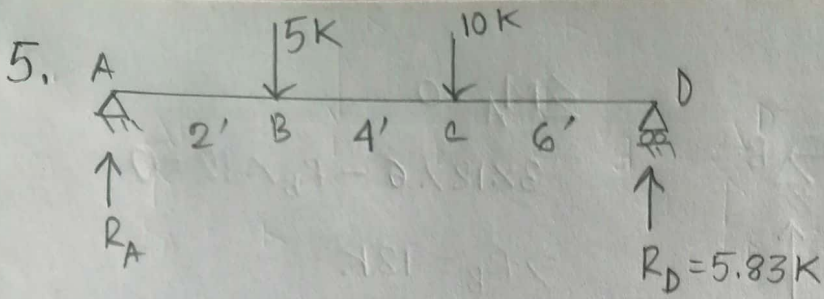
4.



SF
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4.





$$\sum M_A = 0$$

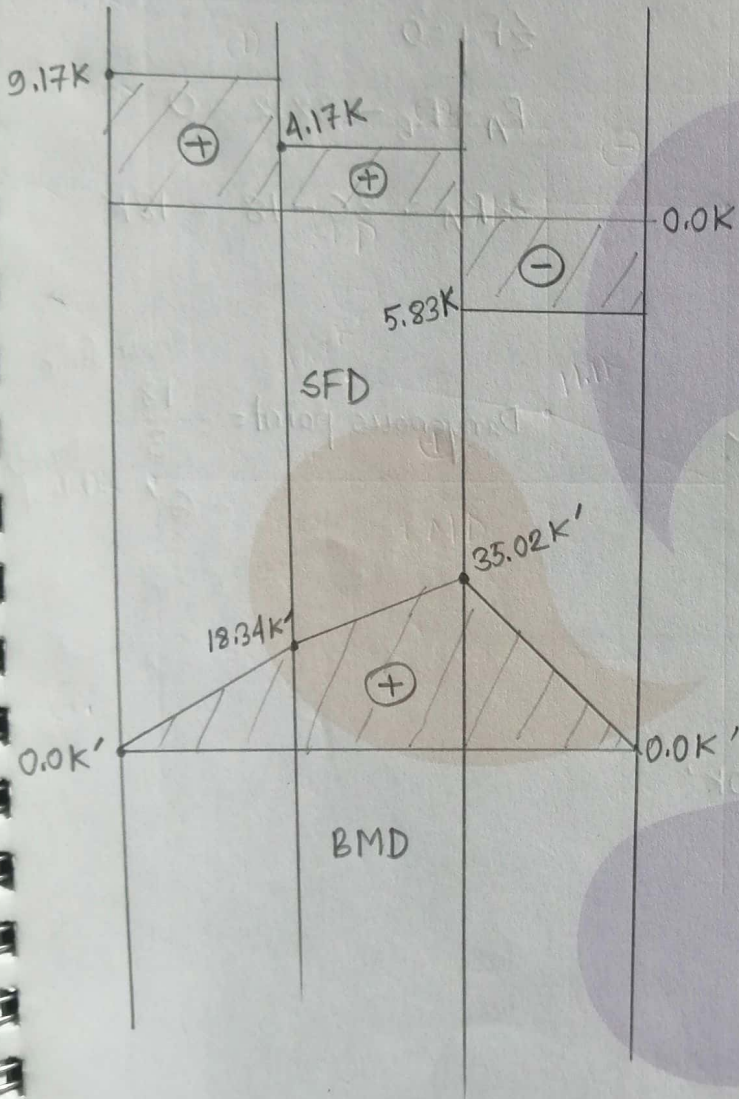
$$\Rightarrow 5 \times 2 + 10 \times 6 - R_D \times 12 = 0$$

$$\Rightarrow R_D = 5.83 K$$

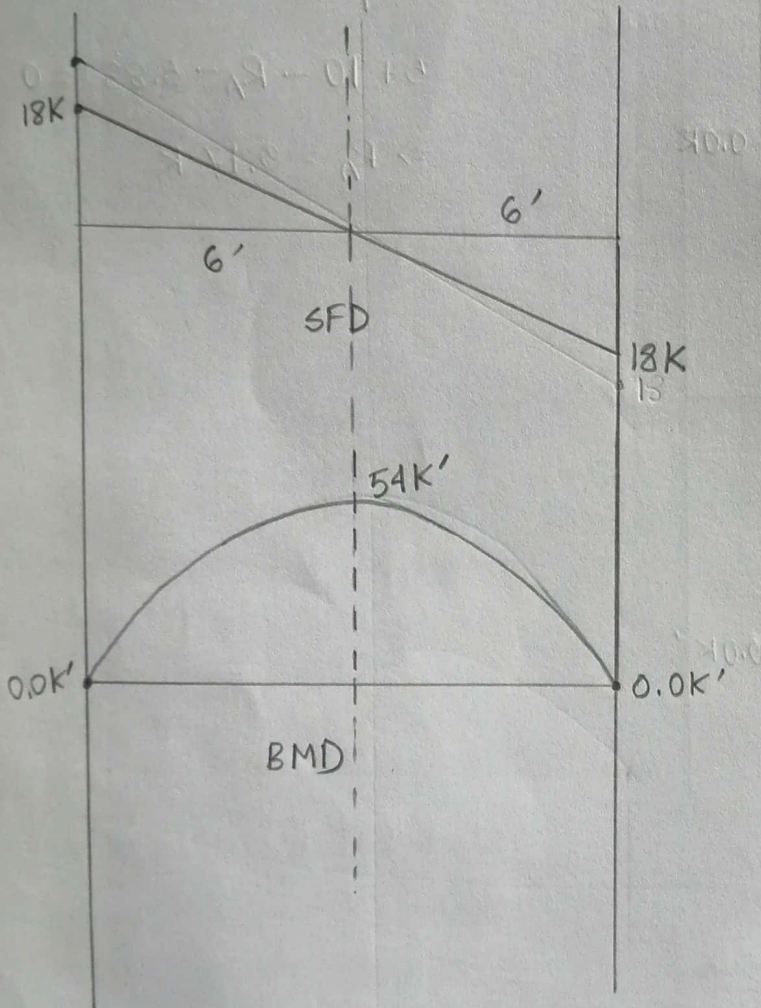
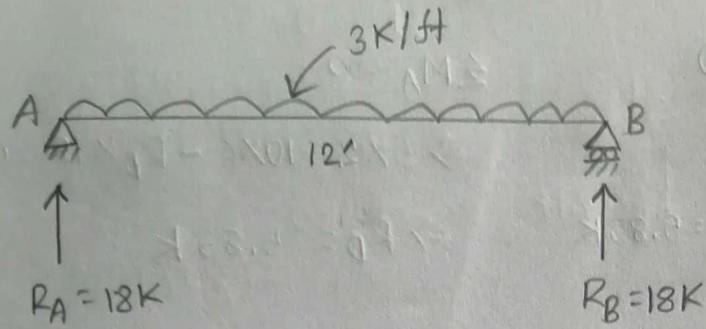
$$\sum F_y = 0$$

$$5 + 10 - R_A - 5.83 = 0$$

$$\Rightarrow R_A = 9.17 K$$



6.



$$\sum M_A = 0$$

$$3 \times 12 \times 6 - R_B \times 12 = 0$$

$$\Rightarrow R_B = 18\text{K}$$

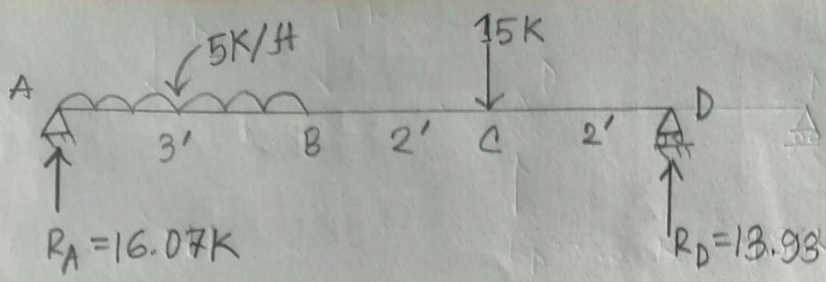
$$\sum F_y = 0$$

$$R_A + R_B - 3 \times 12 = 0$$

$$\Rightarrow R_A = 36 - 18 = 18\text{K}$$

Dangerous point = $\frac{\text{Shear force}}{\text{intensity of load}} = \frac{18}{3} = 6'$

7.



$$\sum M_A = 0$$

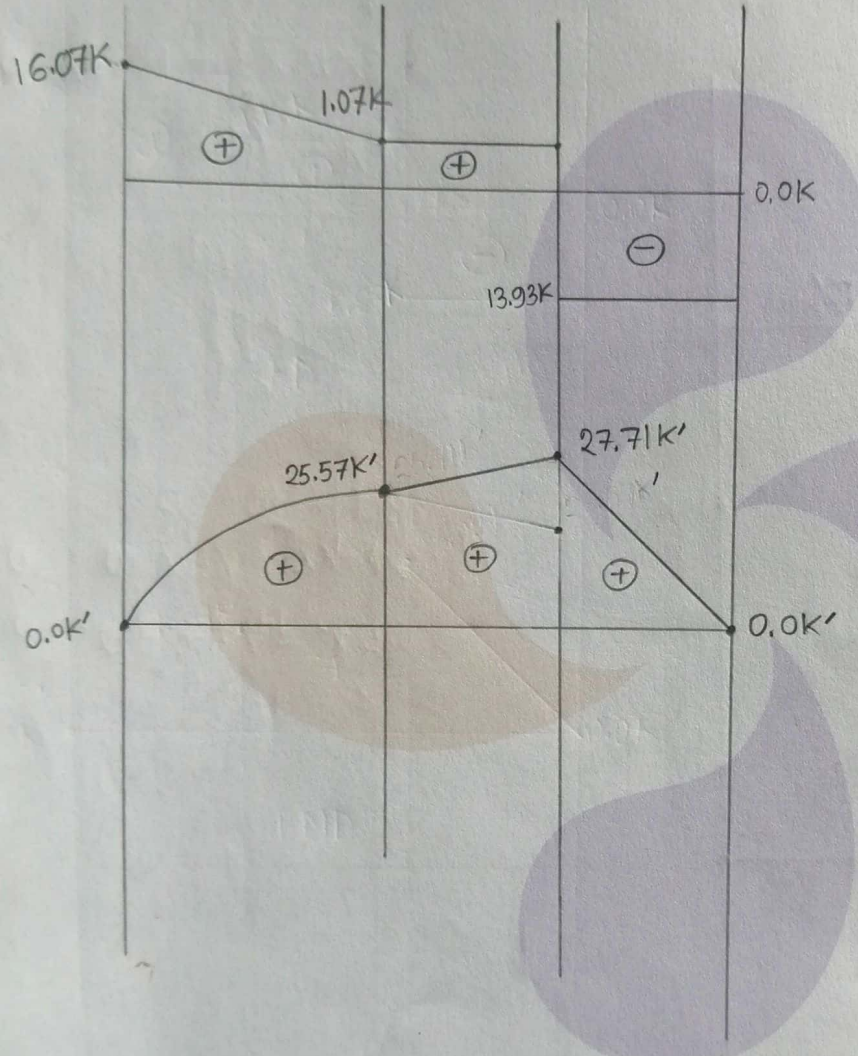
$$5 \times 3 \times 1.5 + 15 \times 5 - R_D \times 7 = 0$$

$$\Rightarrow R_D = 13.93K$$

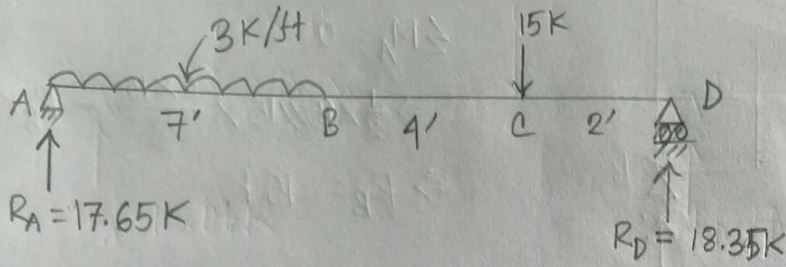
$$\sum F_y = 0$$

$$5 \times 3 + 15 - 13.93 - R_A = 0$$

$$\Rightarrow R_A = 16.07K$$



7.



$$\sum M_A = 0$$

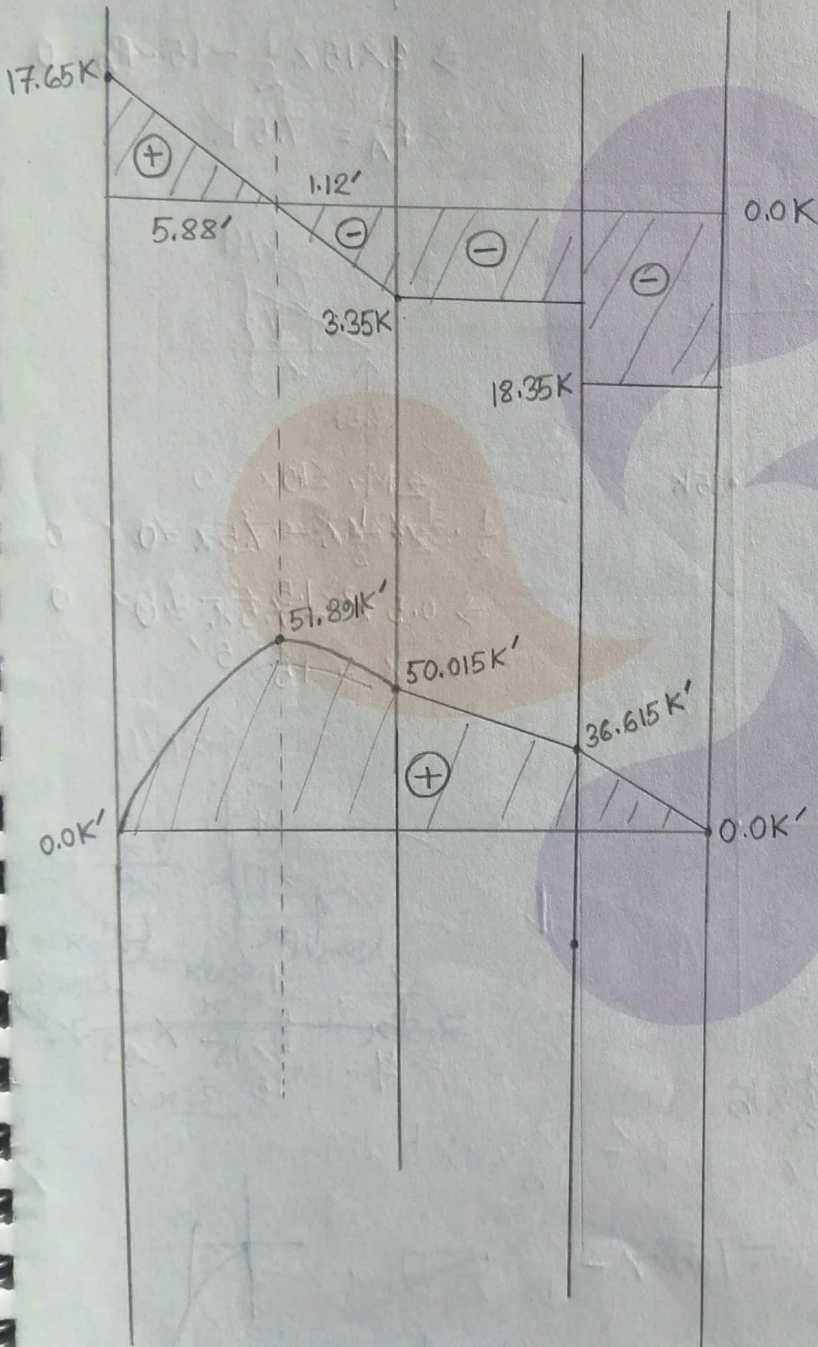
$$\Rightarrow 3 \times 7 \times 3.5 + 15 \times 11 - R_D \times 13 = 0$$

$$\Rightarrow R_D = 18.35K$$

$$\sum F_y = 0$$

$$3 \times 7 + 15 - R_A - 18.35 = 0$$

$$\Rightarrow R_A = 17.65K$$

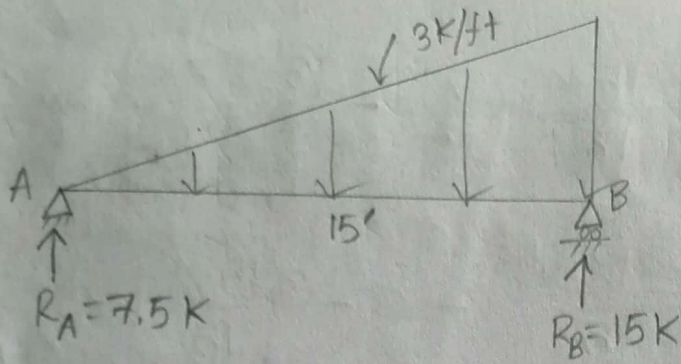


$$\frac{x}{17.65} = \frac{7-x}{3.35}$$

$$\Rightarrow 3.35x = 123.55 - 17.65x$$

$$\Rightarrow x = 5.88$$

98.



$$\sum M_A = 0$$

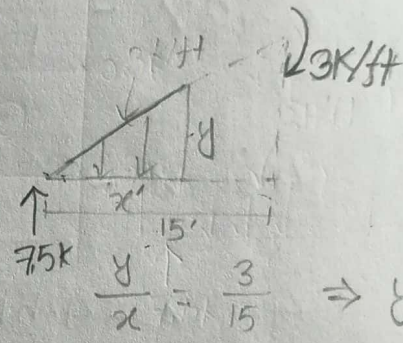
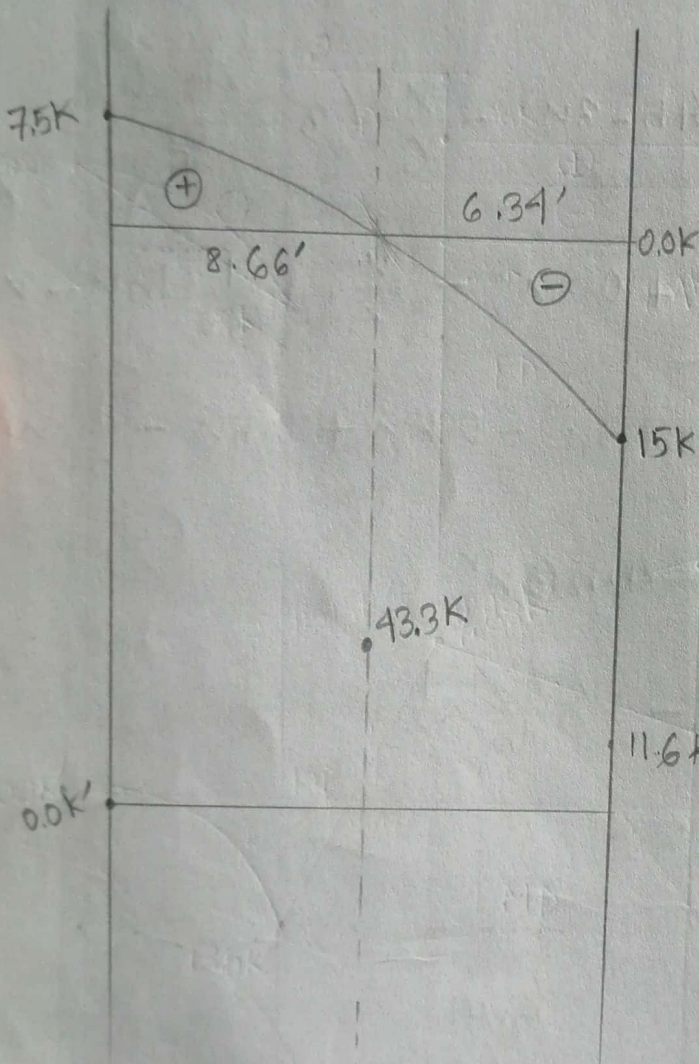
$$\frac{1}{2} \times 3 \times 15 \times \frac{2}{3} \times 15 - R_B \times 15 = 0$$

$$\Rightarrow R_B = 15 \text{ k}$$

$$\sum F_y = 0$$

$$\frac{1}{2} \times 3 \times 15 - 15 - R_A = 0$$

$$\Rightarrow R_A = 7.5 \text{ k}$$



$$\frac{y}{x} = \frac{3}{15} \Rightarrow y = \frac{3x}{15} = \frac{x}{5}$$

$$V_x = 7.5 - x \cdot y \cdot \frac{1}{2}$$

$$0 = 7.5 - x \cdot \frac{x}{5} \cdot \frac{1}{2}$$

$$\Rightarrow x = 8.66'$$

$$\sum F_y = 0$$

$$\Rightarrow 7.5 - \frac{1}{2} x y = 0$$

$$\Rightarrow 7.5 - \frac{1}{2} x \cdot \frac{x}{5} = 0$$

$$\Rightarrow 7.5 - 0.1x^2 = 0$$

$$\Rightarrow 0.1x^2 = 7.5$$

$$\Rightarrow x = 8.66'$$

$$\sum M_x = 0$$

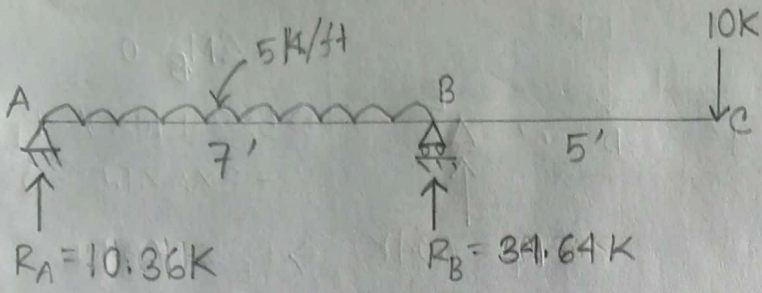
$$7.5x - \frac{1}{2} x y \cdot \frac{x}{3}$$

$$\Rightarrow 7.5x - \frac{1}{6} x^2 \cdot \frac{x}{5} = 0$$

$$\Rightarrow 7.5x(8.66) - \frac{1}{6 \times 5} x^3 = 0$$

$$\Rightarrow 43.3$$

9.



$$\sum M_A = 0$$

$$5 \times 7 \times 3.5 - R_B \times 7 + 10 \times 12 = 0$$

$$\Rightarrow R_B = 34.64 \text{ k}$$

$$\sum F_y = 0$$

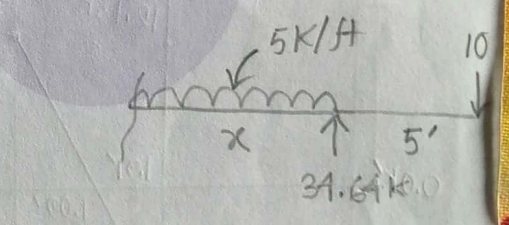
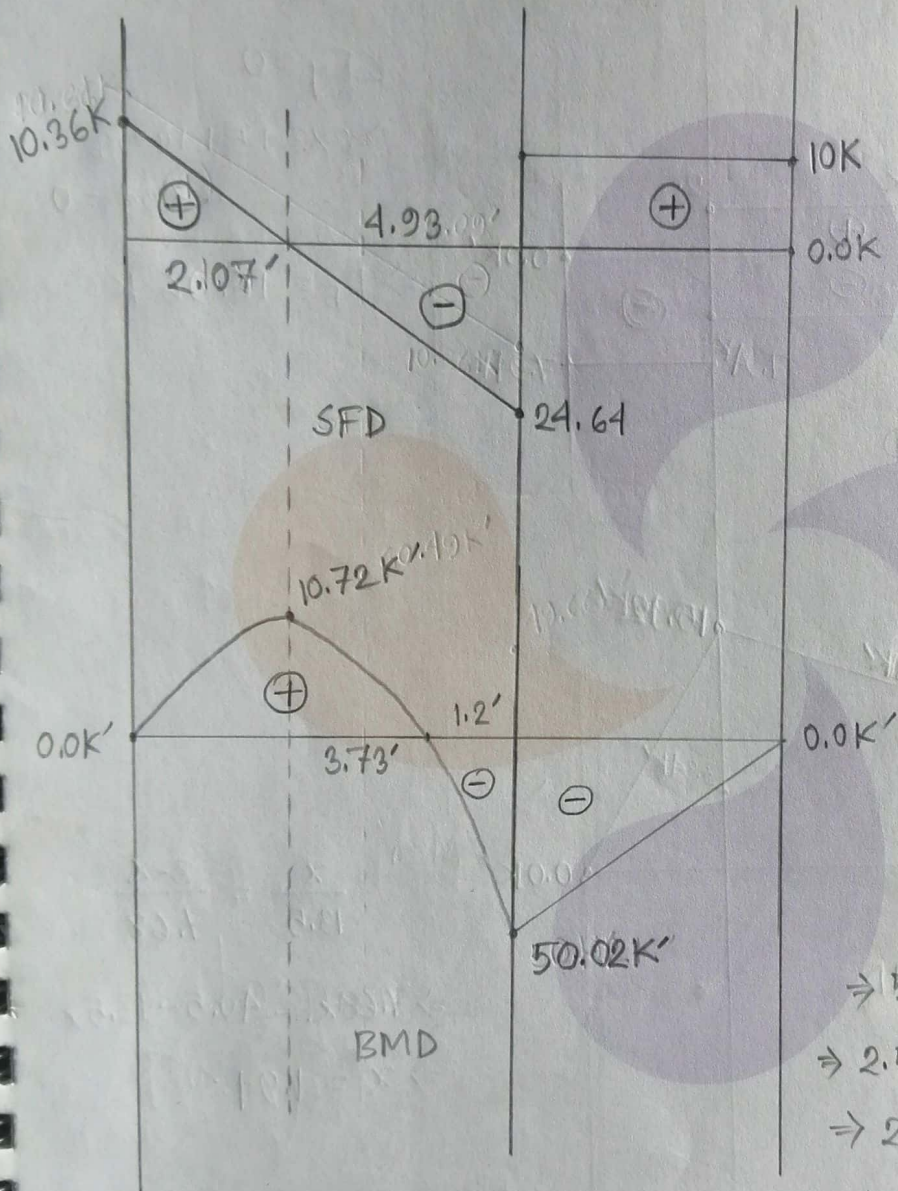
$$5 \times 7 + 10 - R_A - 34.64 = 0$$

$$\Rightarrow R_A = 10.36 \text{ k}$$

$$\frac{x}{10.36} = \frac{7-x}{24.64}$$

$$\Rightarrow 24.64x = 72.52 - 10.36x$$

$$\Rightarrow x = 2.07$$



$$\sum M_x = 0$$

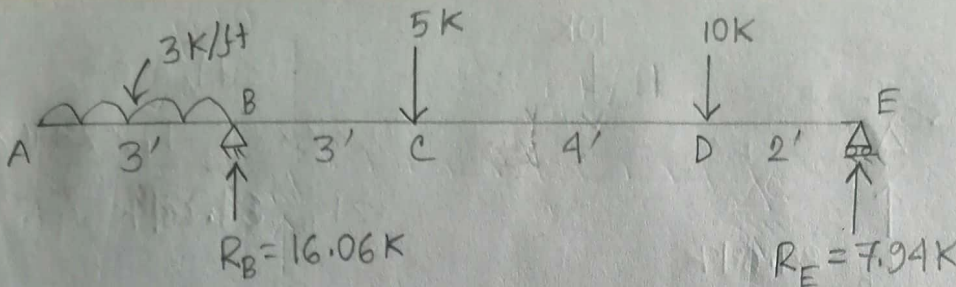
$$\Rightarrow 5x \cdot \frac{x}{2} - 34.64x + 10(5+x) = 0$$

$$\Rightarrow 2.5x^2 - 34.64x + 50 + 10x = 0$$

$$\Rightarrow 2.5x^2 - 24.64x + 50 = 0$$

$$\Rightarrow x = 1.2'$$

10.



$$\sum M_B = 0$$

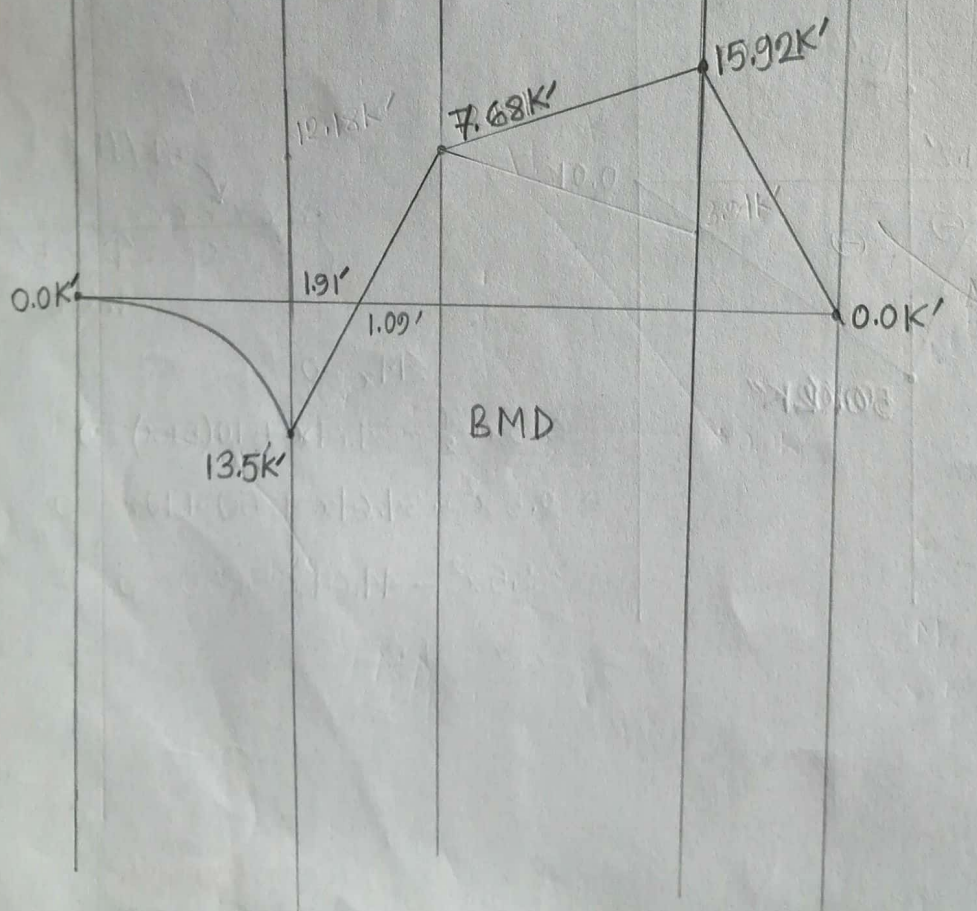
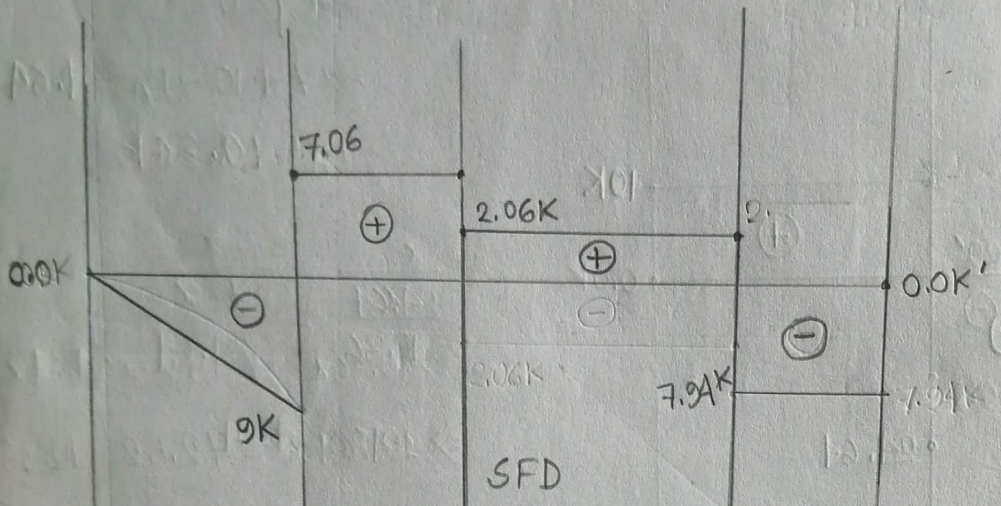
$$\Rightarrow 5 \times 3 + 10 \times 7 - R_E \times 9 - 3 \times 3 \times 1.5 = 0$$

$$\Rightarrow R_E = 7.94 \text{ K}$$

$$\sum F_y = 0$$

$$\Rightarrow 3 \times 3 + 5 + 10 - R_B - 7.94 = 0$$

$$\Rightarrow R_B = 16.06 \text{ K}$$

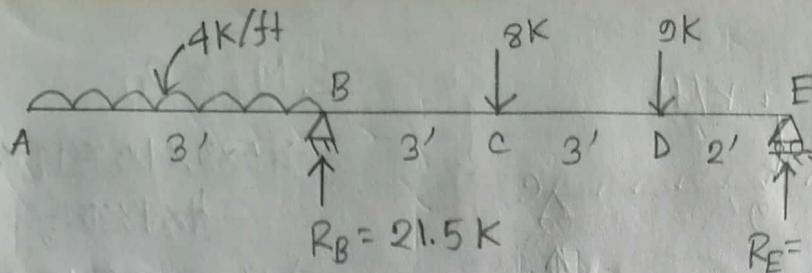


$$\frac{x}{13.5} = \frac{3-x}{7.68}$$

$$\Rightarrow 7.68x = 40.5 - 13.5x$$

$$\Rightarrow x = 1.91 \text{ ft}$$

10.



$$\sum M_B = 0$$

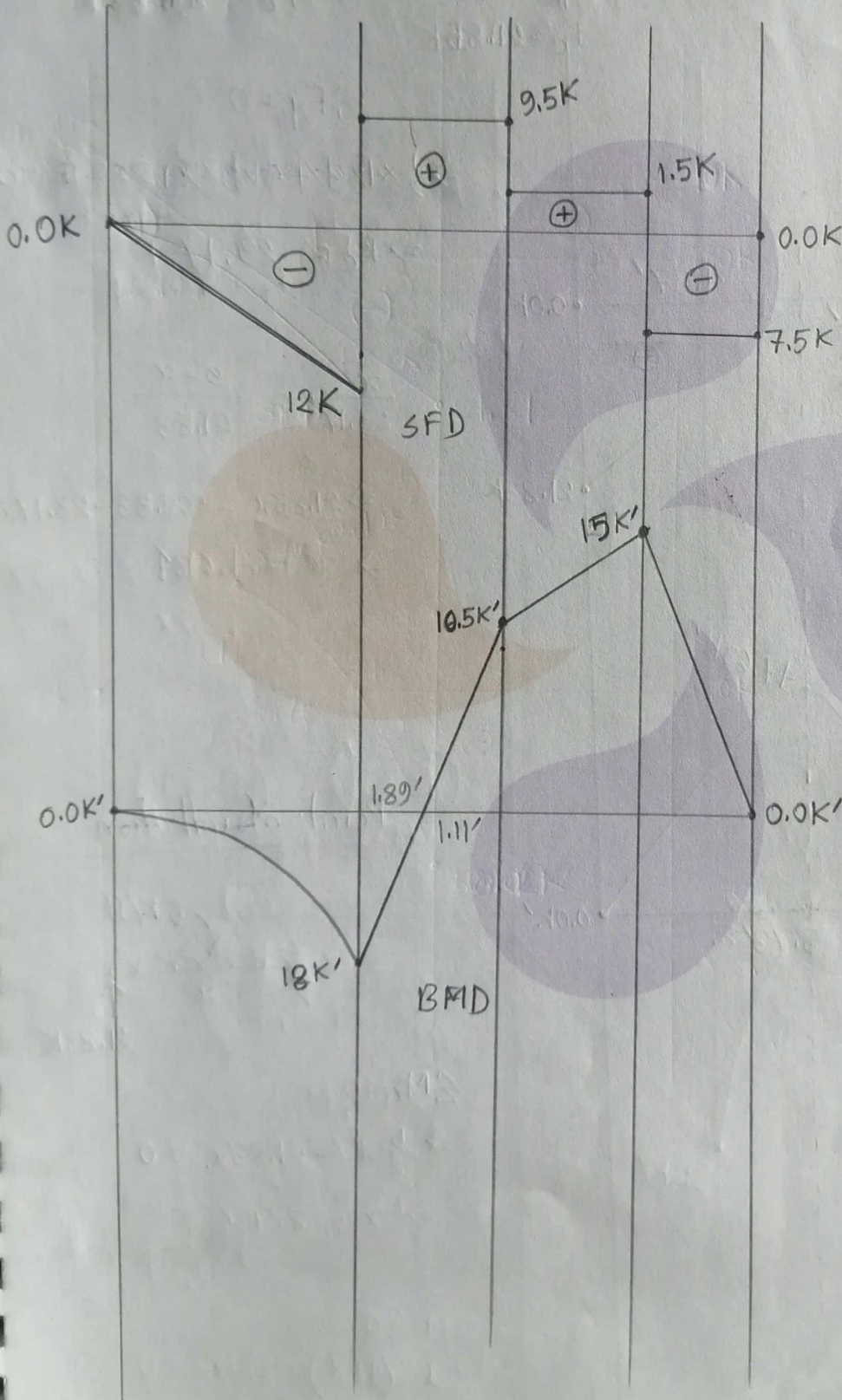
$$8 \times 3 + 9 \times 6 - R_E \times 8 - 4 \times 3 \times 1.5 = 0$$

$$\Rightarrow R_E = 7.5 \text{ K}$$

$$\sum F_y = 0$$

$$4 \times 3 + 8 + 9 - R_B - 7.5 = 0$$

$$\Rightarrow R_B = 21.5 \text{ K}$$

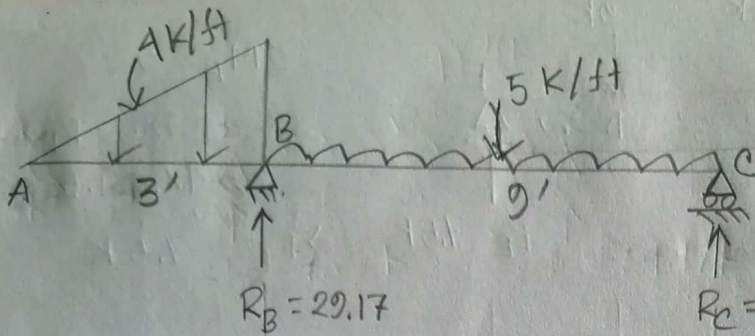


$$\frac{x}{18} = \frac{3-x}{10.5}$$

$$\Rightarrow 10.5x = 54 - 18x$$

$$\Rightarrow x = 1.89'$$

11.



$$\sum M_B = 0$$

$$\Rightarrow 5 \times 9 \times 4.5 - R_C \times 9 - \frac{1}{2} \times 4 \times 3 \times \frac{3}{3} = 0$$

$$\Rightarrow R_C = 21.83 \text{ K}$$

$$\sum F_y = 0$$

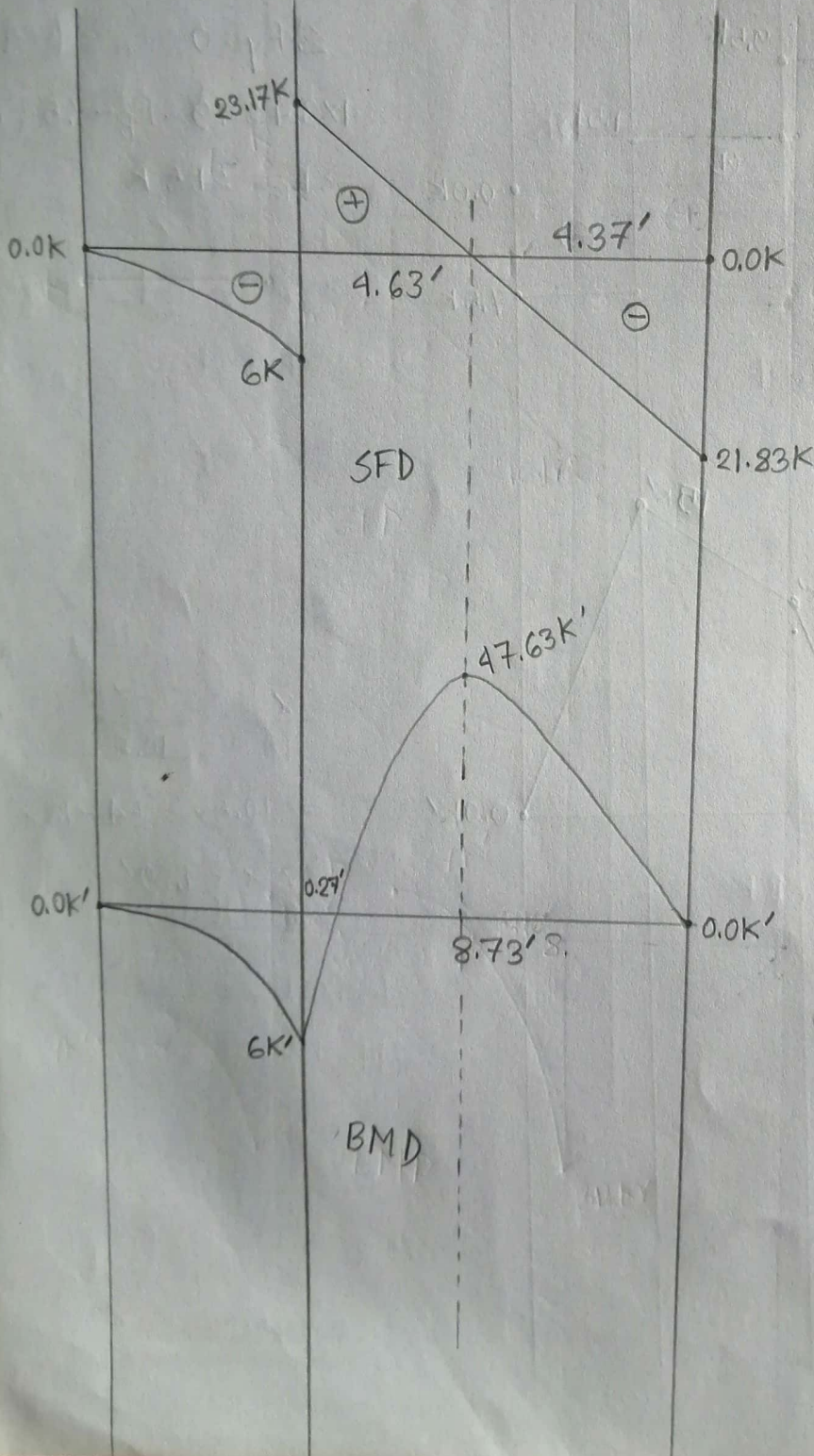
$$\Rightarrow \frac{1}{2} \times 4 \times 3 + 5 \times 9 - 21.83 - R_B = 0$$

$$\Rightarrow R_B = 29.17 \text{ K}$$

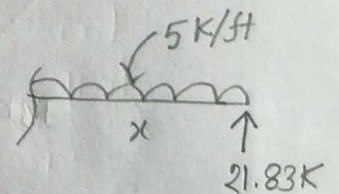
$$\frac{x}{23.17} = \frac{9-x}{21.83}$$

$$\Rightarrow 21.83x = 208.53 - 23.17x$$

$$\Rightarrow x = 4.63'$$



Point of inflection

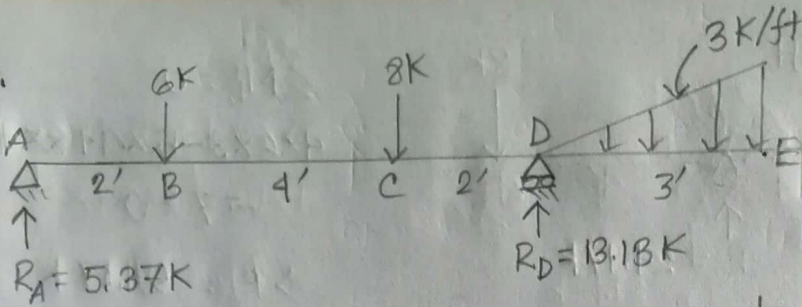


$$\sum M_x = 0$$

$$\Rightarrow \frac{5}{2}x^2 - 21.83x = 0$$

$$\Rightarrow x = 8.73'$$

12.



$$\sum M_A = 0$$

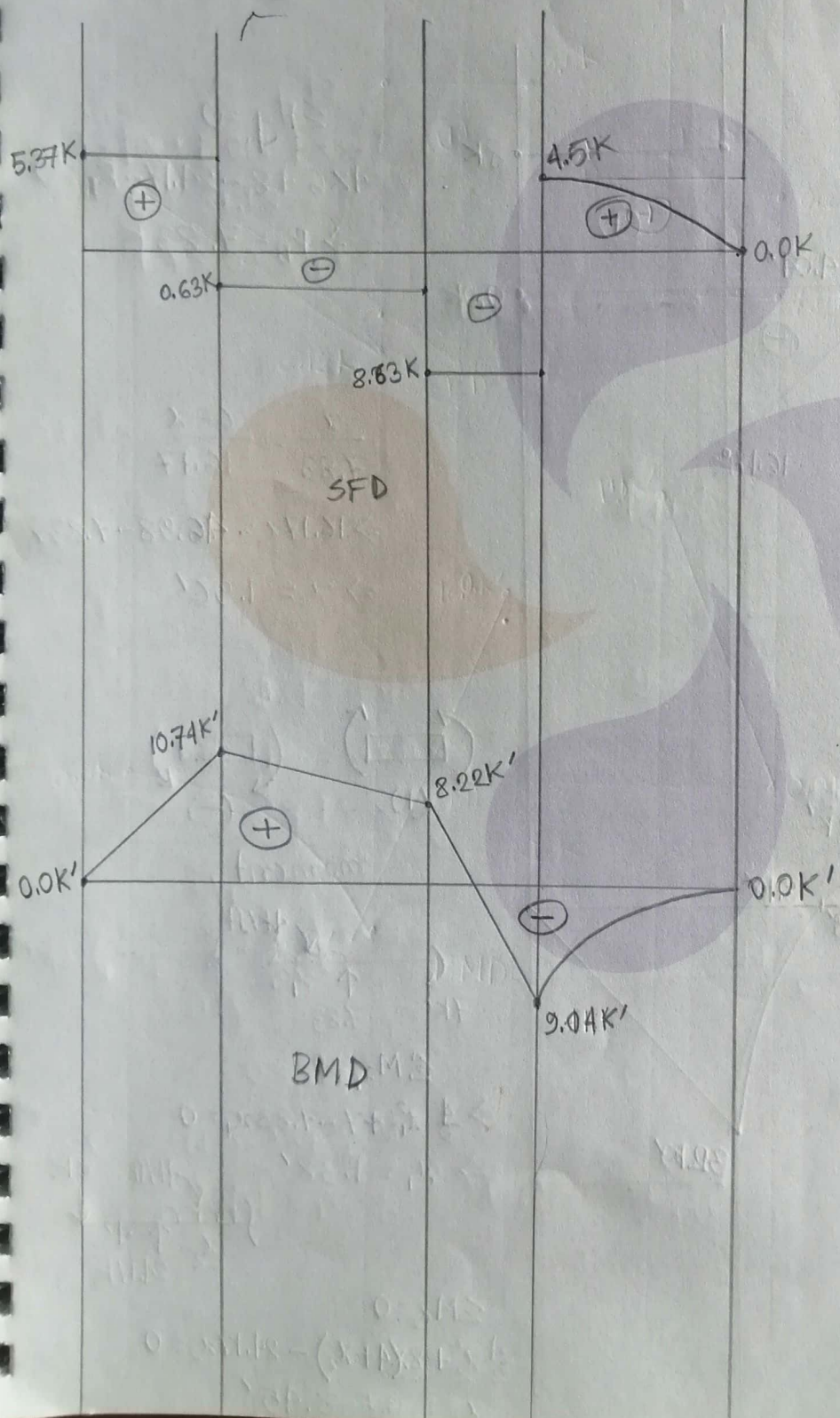
$$\Rightarrow 6 \times 2 + 8 \times 6 - R_D \times 8 + \frac{1}{2} \times 3 \times 3 \times \left(\frac{2 \times 3}{3} + 8 \right) = 0$$

$$\Rightarrow R_D = 13.13 \text{ K}$$

$$\sum F_y = 0$$

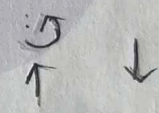
$$6 + 8 + \frac{1}{2} \times 3 \times 3 - 13.13 - R_A = 0$$

$$\Rightarrow R_A = 5.37 \text{ K}$$



~~$$4.5 \times 3 - 3 \times 3 \times \frac{1}{2} \times \frac{1}{3}$$~~

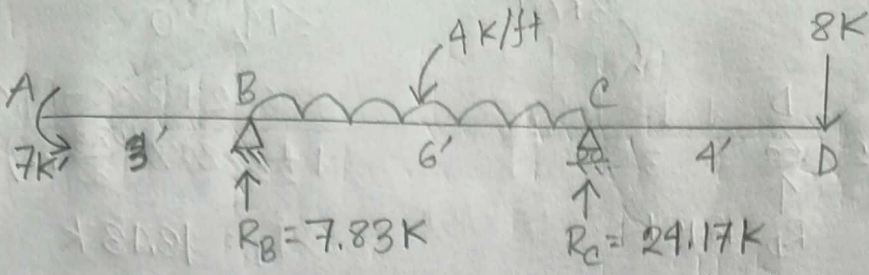
~~$$4.5 \times 3 - 3 \times 3 \times \frac{1}{2} \times \frac{1}{3} \times 3$$~~



$$M_F = 0$$

$$M_F = 0.04 + 4.5 - 4.5$$

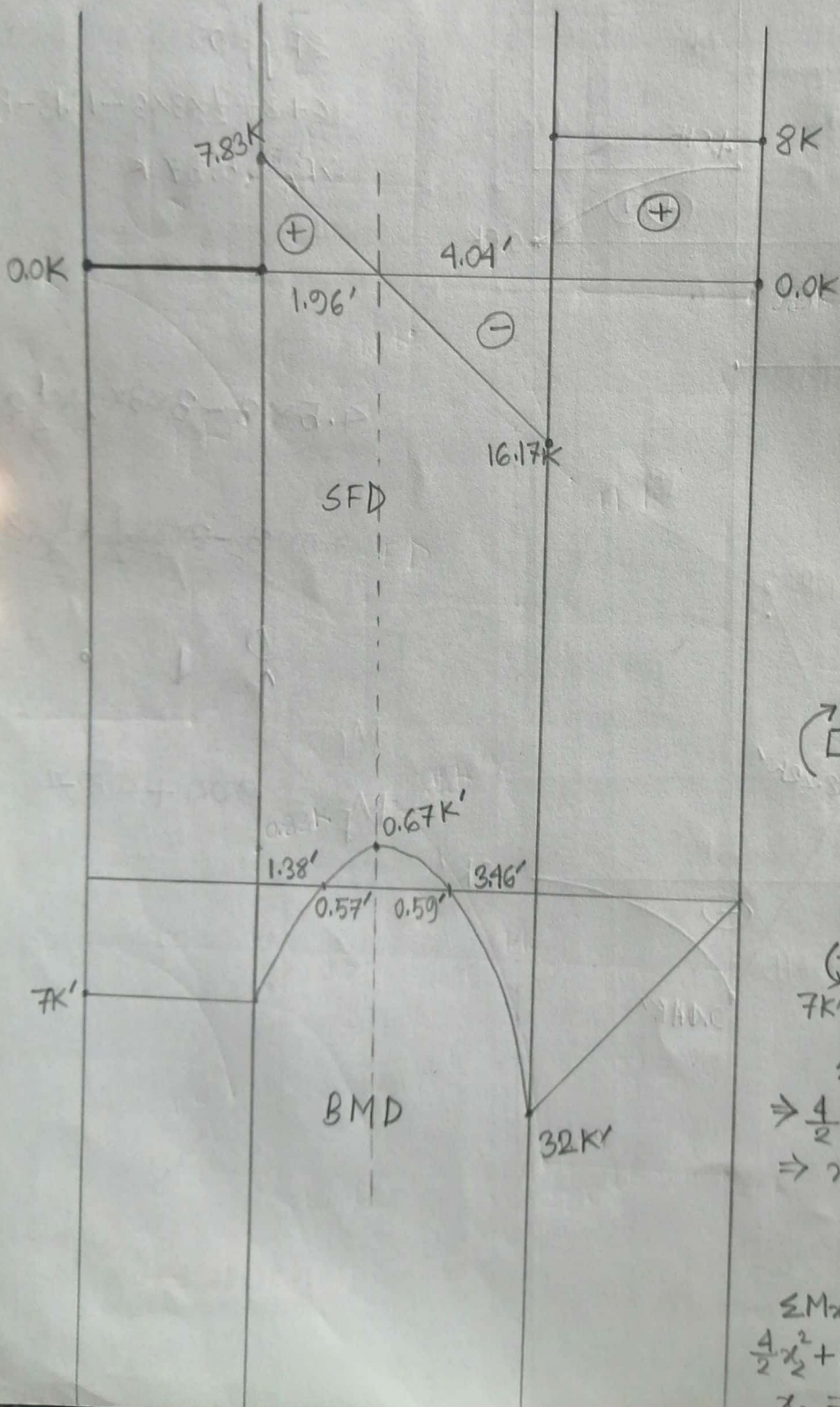
13.



$$\sum M_B = 0$$

$$4 \times 6 \times 3 - R_C \times 6 + 8 \times 10 - 7 = 0$$

$$\Rightarrow R_C = 24.17 \text{ k}$$



$$\sum F_y = 0$$

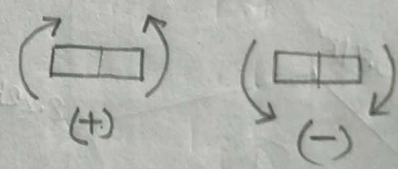
$$4 \times 6 + 8 - 24.17 - R_B = 0$$

$$\Rightarrow R_B = 7.83 \text{ k}$$

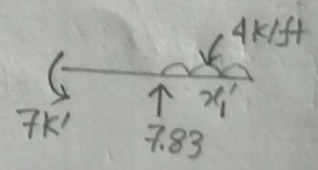
$$\frac{x}{7.83} = \frac{6-x}{16.17}$$

$$\Rightarrow 16.17x = 46.98 - 7.83x$$

$$\Rightarrow x = 1.96'$$



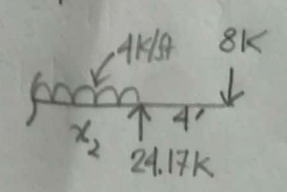
moment



$$\sum M_{x_1} = 0$$

$$\Rightarrow \frac{4}{2} x_1^2 + 7 - 7.83 x_1 = 0$$

$$\Rightarrow x_1 = 1.38'$$

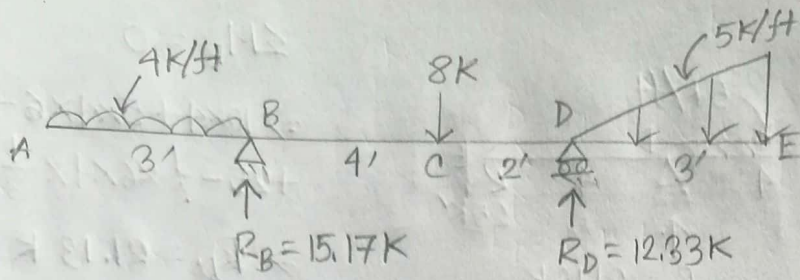


$$\sum M_{x_2} = 0$$

$$\frac{4}{2} x_2^2 + 8(4+x_2) - 24.17 x_2 = 0$$

$$x_2 = 3.45'$$

14.



$$\sum M_B = 0$$

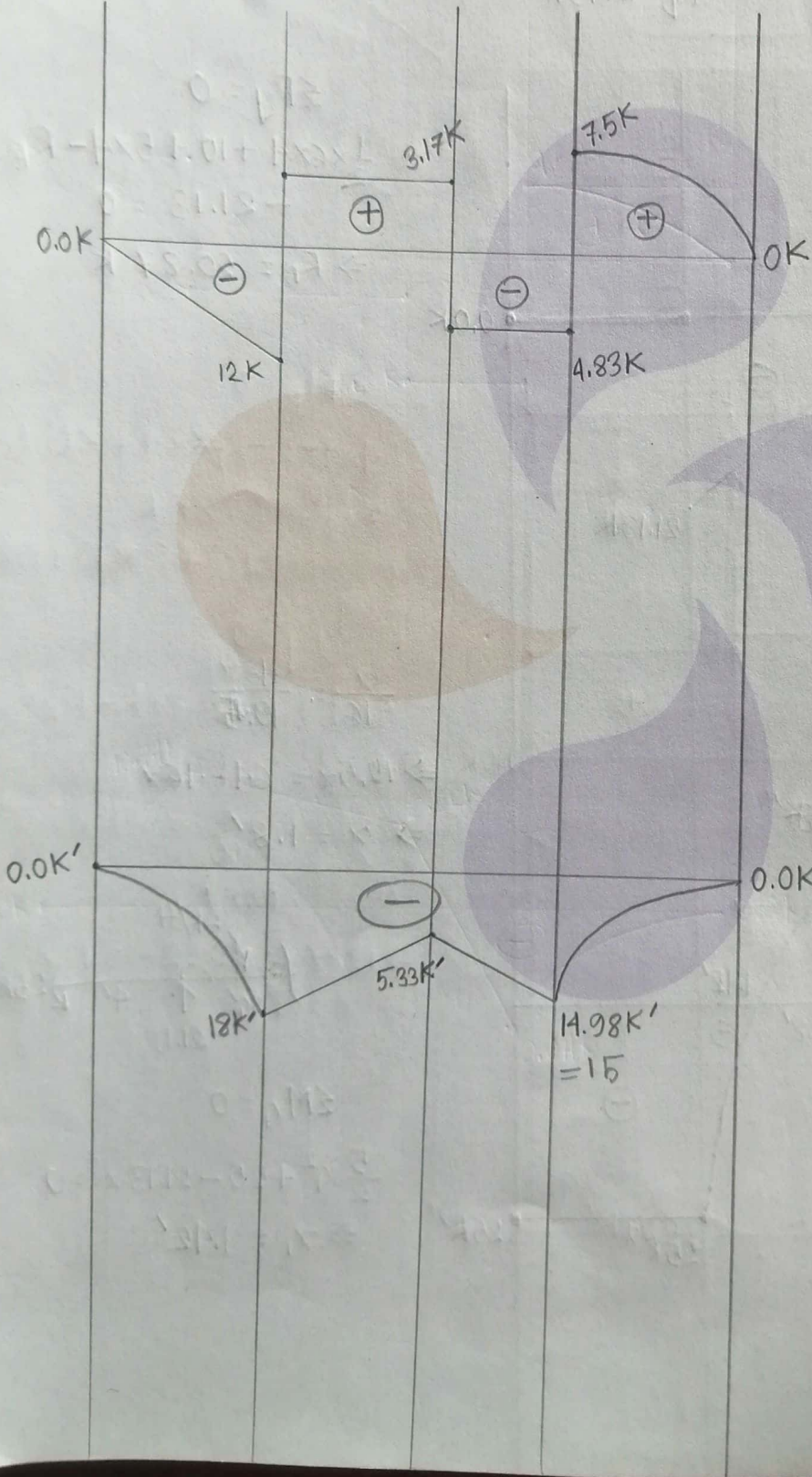
$$8 \times 4 - R_D \times 6 + 4 \times 3 \times 1.5 + \frac{1}{2} \times 5 \times 3 \times \left(\frac{2 \times 3}{3} + 6\right) = 0$$

$$\Rightarrow R_D = 12.33 \text{ k}$$

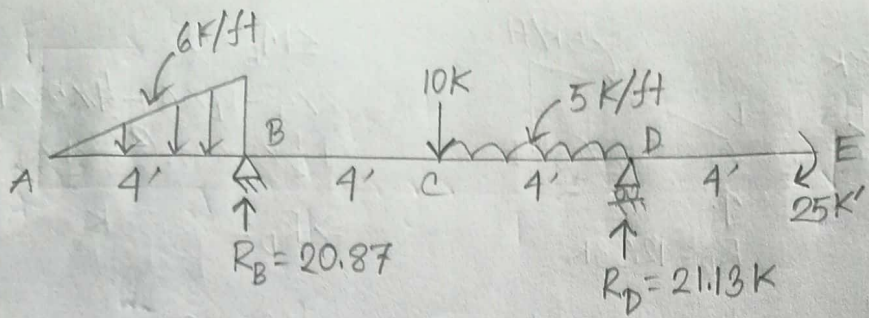
$$\sum F_y = 0$$

$$4 \times 3 + 8 + \frac{1}{2} \times 5 \times 3 - R_B - 12.33 = 0$$

$$\Rightarrow R_B = 15.17 \text{ k}$$



15.



$$\sum M_B = 0$$

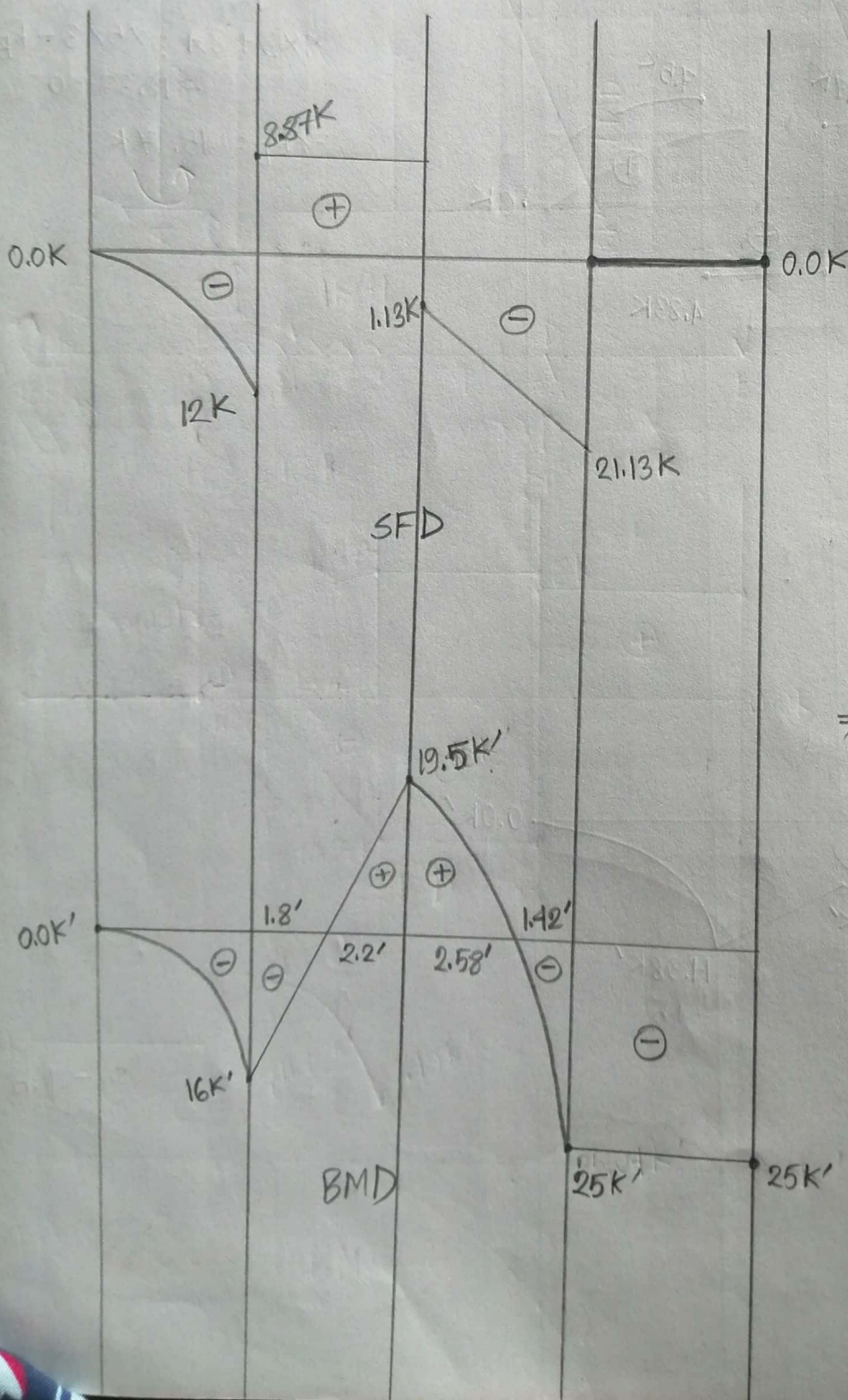
$$\Rightarrow 10 \times 4 + 5 \times 4 \times 6 - R_D \times 8 + 25 - \frac{1}{2} \times 6 \times 4 \times \frac{4}{3} = 0$$

$$\Rightarrow R_D = 21.13 \text{ K}$$

$$\sum F_y = 0$$

$$\frac{1}{2} \times 6 \times 4 + 10 + 5 \times 4 - R_B - 21.13 = 0$$

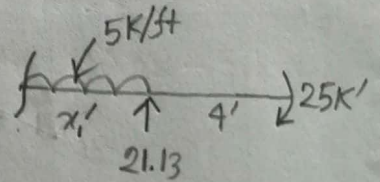
$$\Rightarrow R_B = 20.87 \text{ K}$$



$$\frac{x}{16} = \frac{4-x}{19.5}$$

$$\Rightarrow 19.5x = 64 - 16x$$

$$\Rightarrow x = 1.8'$$

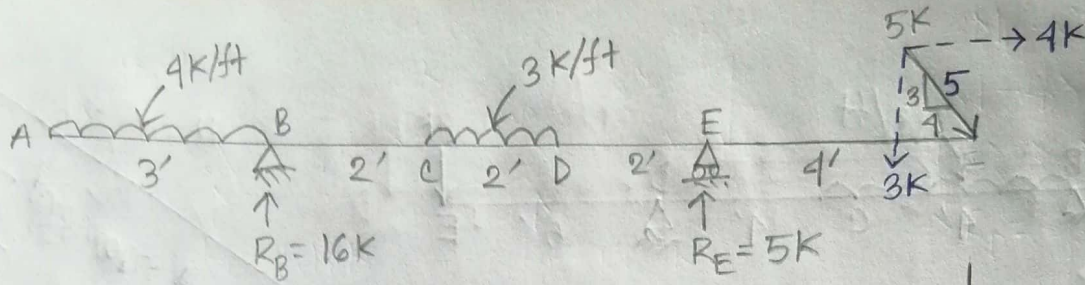


$$\sum M_{x_1} = 0$$

$$\frac{5}{2} x_1^2 + 25 - 21.13 x_1 = 0$$

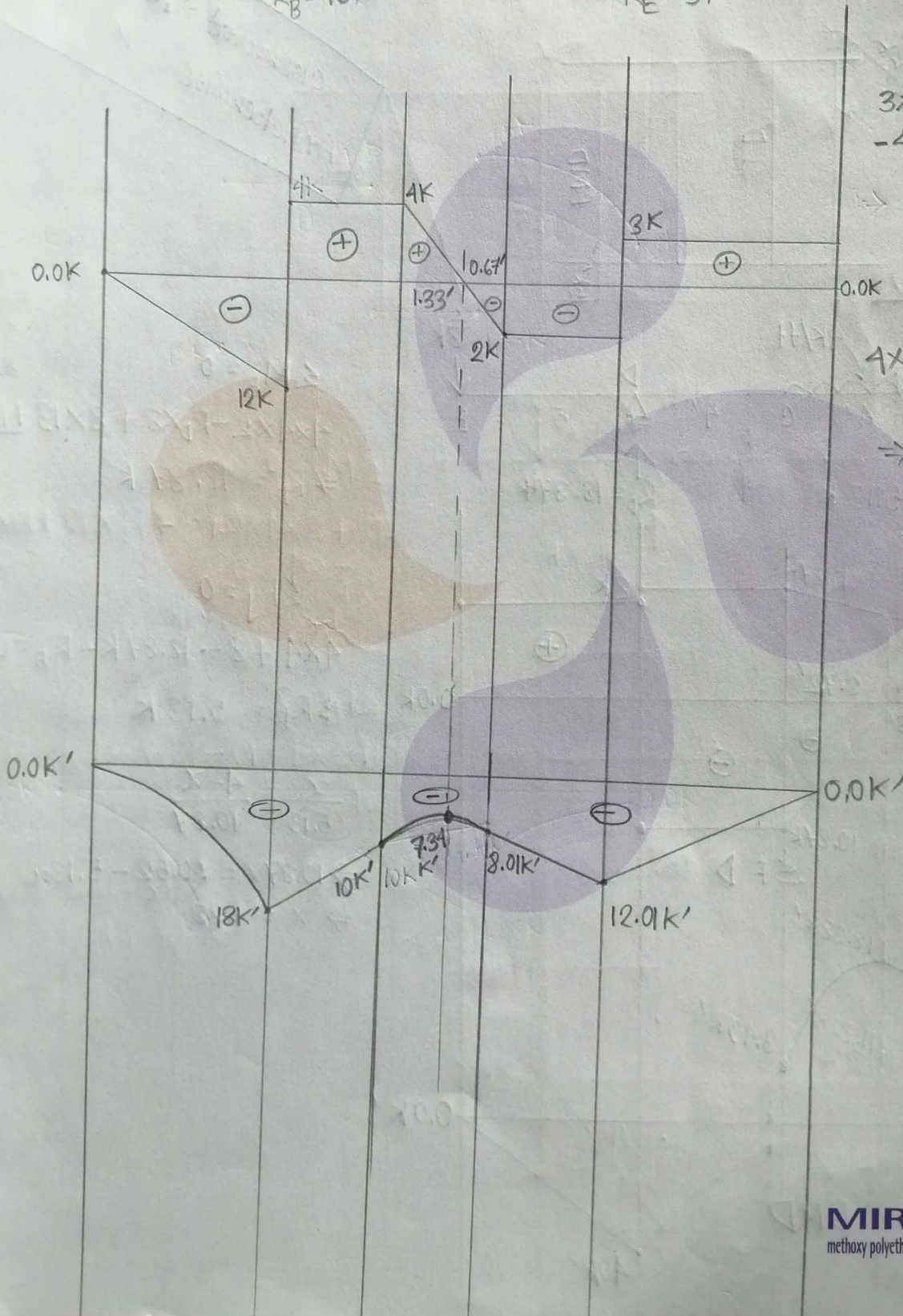
$$\Rightarrow x_1 = 1.42'$$

16.



$$H = \frac{5 \times 4}{5} = 4K$$

$$V = \frac{5 \times 3}{5} = 3K$$



$$\sum M_B = 0$$

$$3 \times 2 \times 3 - R_E \times 6 + 3 \times 10 - 4 \times 3 \times 1.5 = 0$$

$$\Rightarrow R_E = 5K$$

$$\sum F_y = 0$$

$$4 \times 3 + 3 \times 2 + 3 - 5 - R_B = 0$$

$$\Rightarrow R_B = 16K$$

$$\frac{x}{4} = \frac{2-x}{2}$$

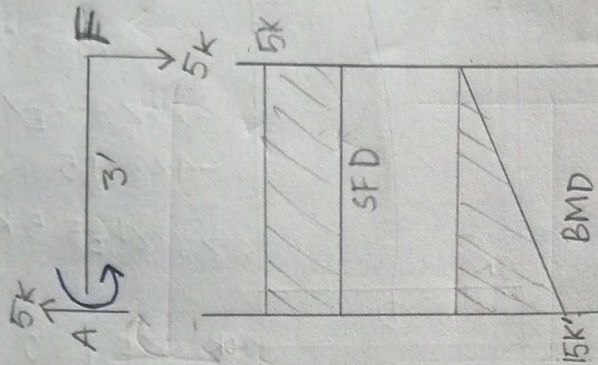
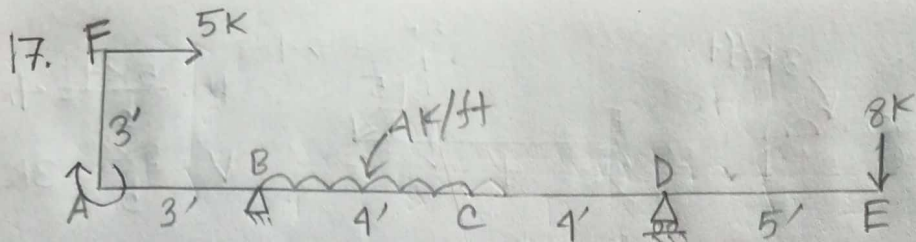
$$\Rightarrow 2x = 8 - 4x$$

$$\Rightarrow x = 1.33$$

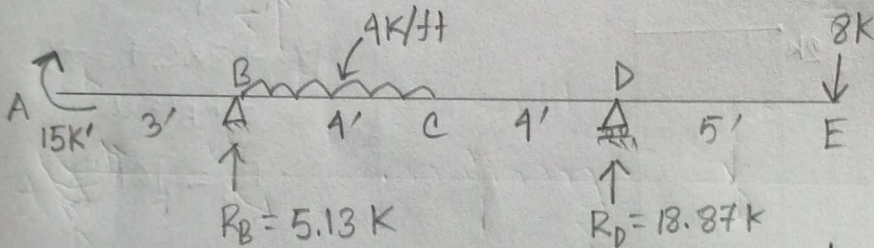
H = $\frac{\text{force (vertical)}}{\text{side (vertical)}} \times \text{horizontal}$

$$H = \frac{5 \times 4}{5} = 4$$





clockwise moment $\rightarrow (+)$
 Anticlockwise " $\rightarrow (-)$



$$\sum M_B = 0$$

$$4 \times 4 \times 2 - R_D \times 8 + 8 \times 13 + 15$$

$$\Rightarrow R_D = 18.87 \text{ K}$$

$$\sum F_y = 0$$

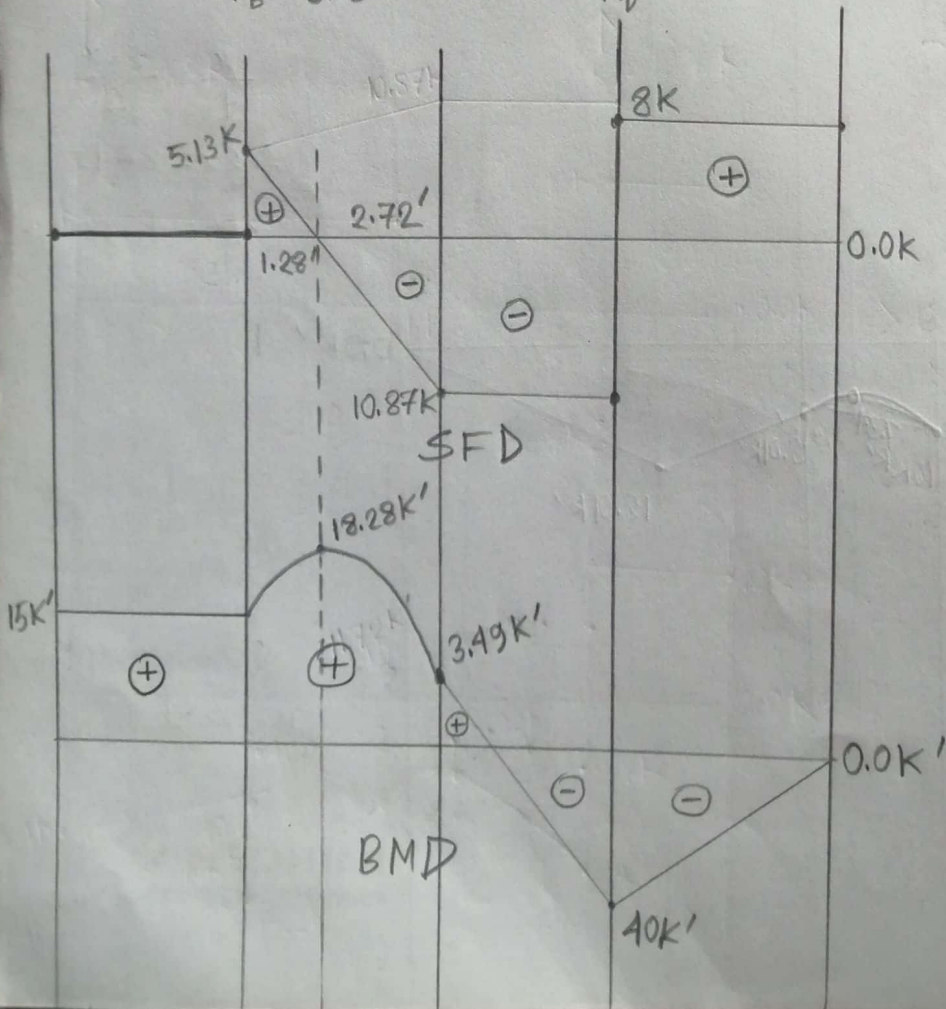
$$4 \times 4 + 8 - 18.87 \text{ K} - R_B = 0$$

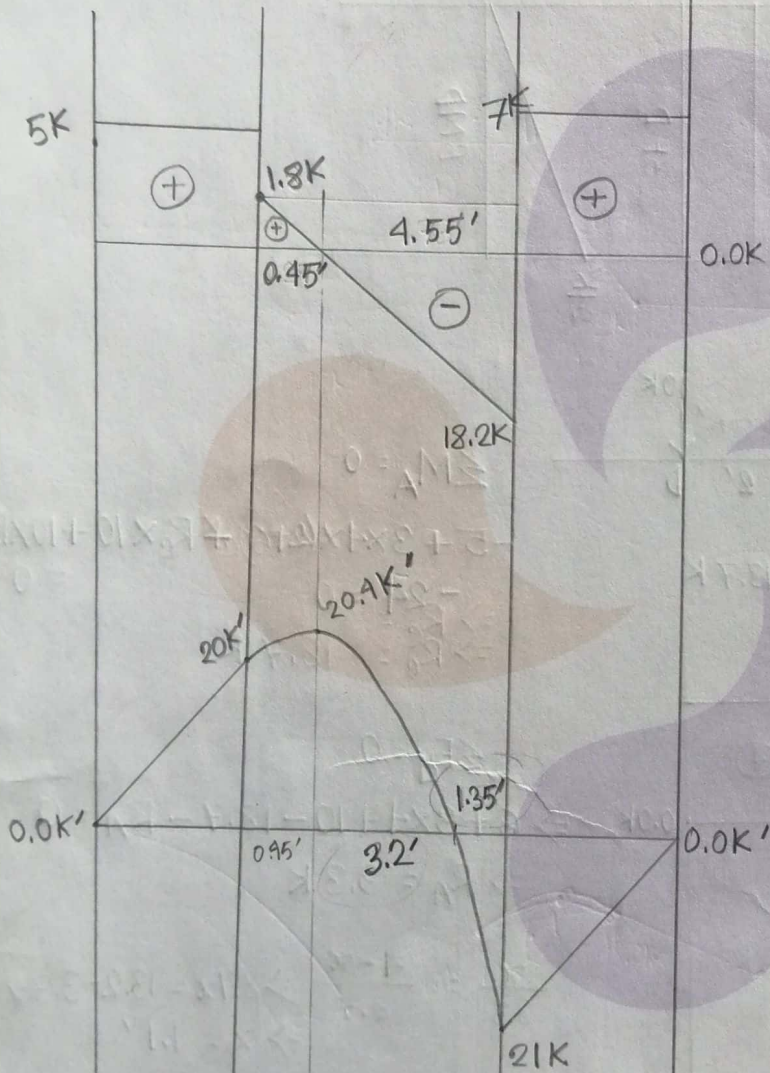
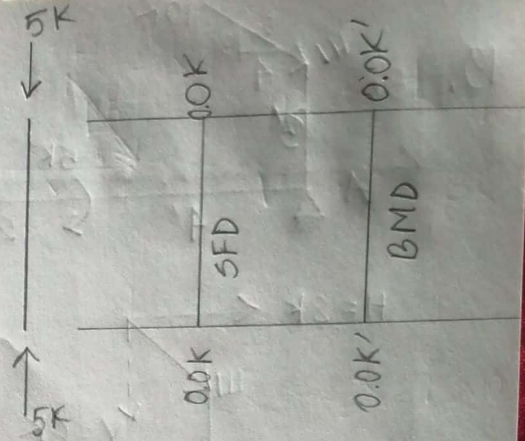
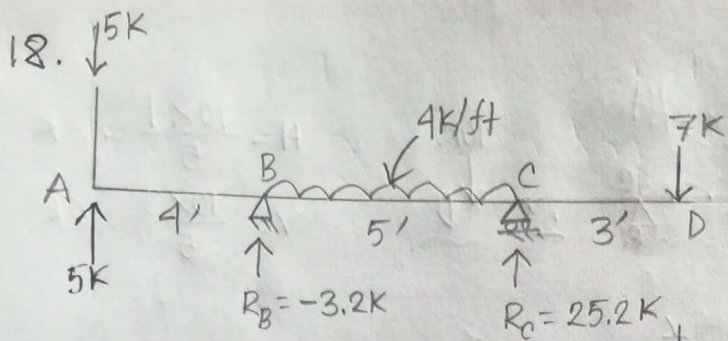
$$\Rightarrow R_B = 5.13 \text{ K}$$

$$\frac{x}{5.13} = \frac{4-x}{10.87}$$

$$\Rightarrow 10.87x = 20.52 - 5.13x$$

$$\Rightarrow x = 1.28$$





$$\sum M_B = 0$$

$$4 \times 5 \times 2.5 - R_C \times 5 + 7 \times 8 + 5 \times 4 = 0$$

$$\Rightarrow R_C = 25.2 \text{ K}$$

$$\sum F_y = 0$$

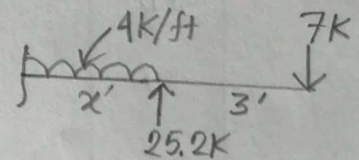
$$4 \times 5 + 7 - 25.2 - 5 - R_B = 0$$

$$\Rightarrow R_B = -3.2 \text{ K}$$

$$\frac{x}{1.8} = \frac{5-x}{18.2}$$

$$\Rightarrow 18.2x = 9 - 1.8x$$

$$\Rightarrow x = 0.45'$$



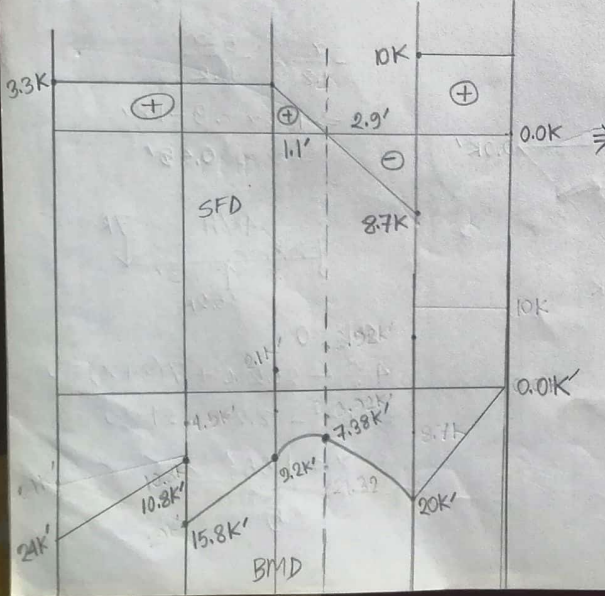
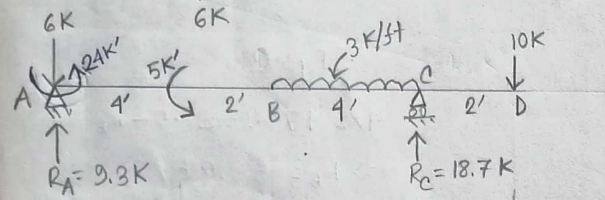
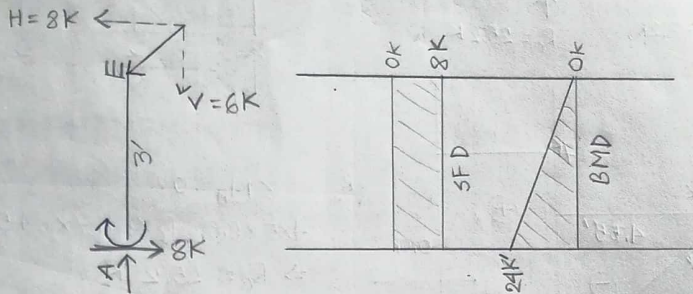
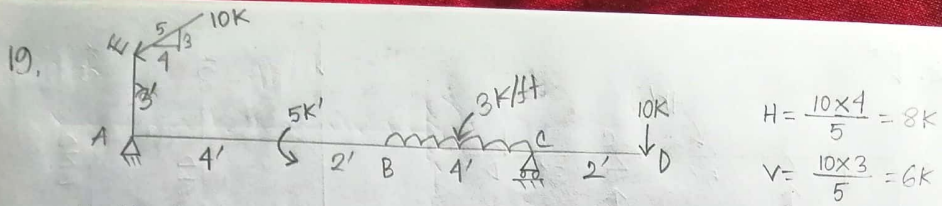
$$\sum M_x = 0$$

$$4 \frac{x^2}{2} - 25.2x + 7(3+x) = 0$$

$$\Rightarrow 2x^2 - 18.2x + 21 = 0$$

$$\Rightarrow x = 1.35'$$

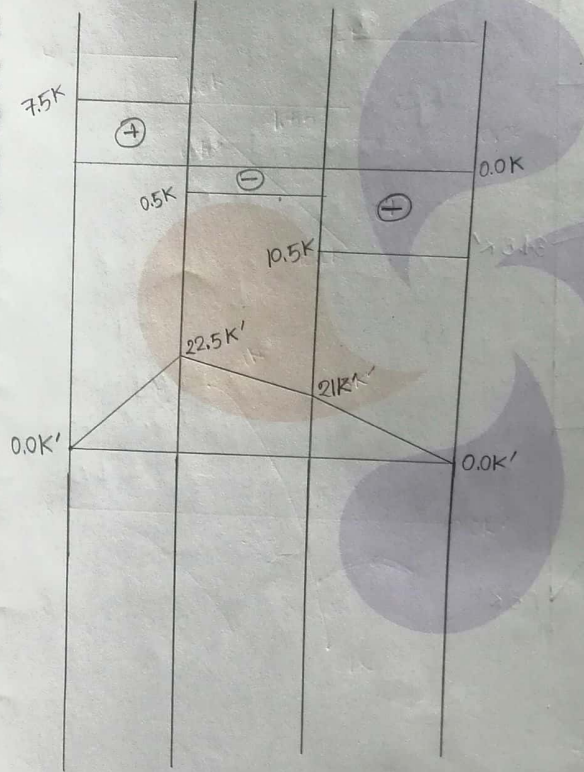
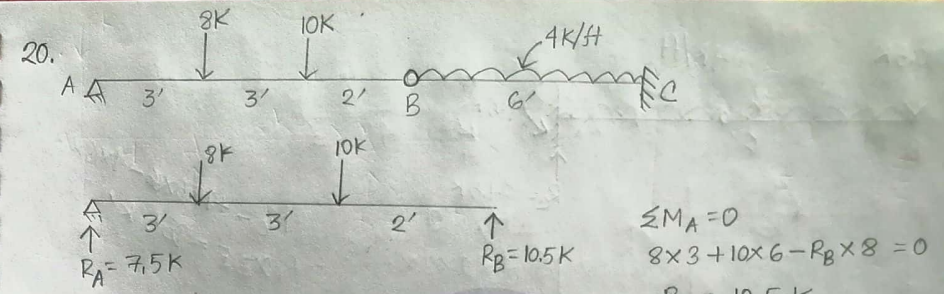
MIRCERA
1.35 methoxy polyethylene glycol-epoetin beta



$\sum M_A = 0$
 $-5 + 3 \times 4 \times (2+6) + R_C \times 10 + 10 \times 12 - 24 = 0$
 $\Rightarrow R_C = 18.7K$

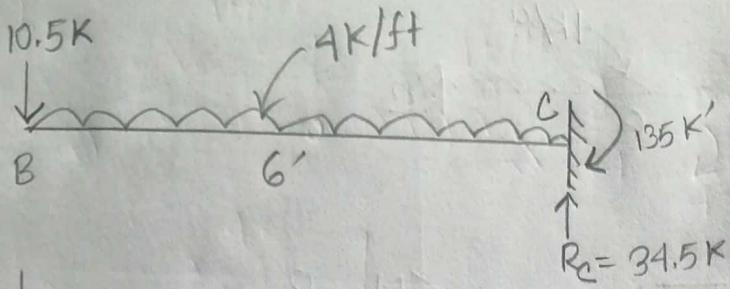
$\sum F_y = 0$
 $\Rightarrow 6 + 3 \times 4 + 10 - 18.7 - R_A = 0$
 $\Rightarrow R_A = 9.3K$

$\frac{x}{3.3} = \frac{4-x}{8.7} \Rightarrow 8.7x = 13.2 - 3.3x$
 $\Rightarrow x = 1.1'$

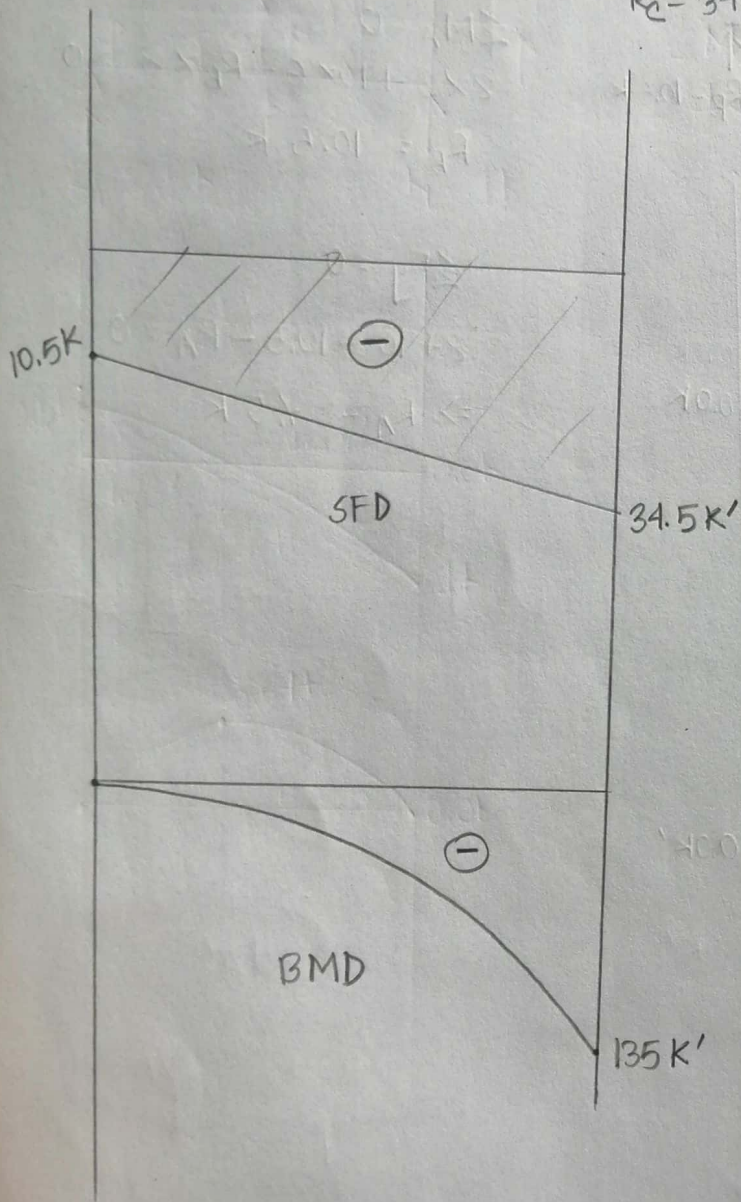


$\sum M_A = 0$
 $8 \times 3 + 10 \times 6 - R_B \times 8 = 0$
 $R_B = 10.5K$

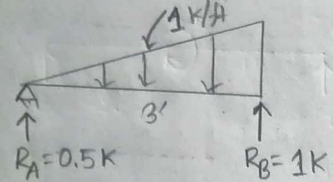
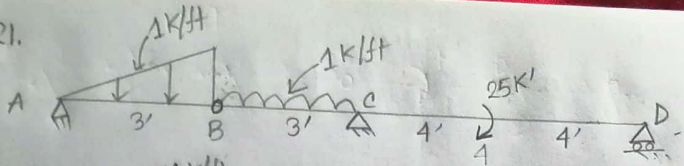
$\sum F_y = 0$
 $8 + 10 - 10.5 - R_A = 0$
 $\Rightarrow R_A = 7.5K$



$$M_c = +10.5 \times 6 - 4 \times 6 \times 3 = -135 \text{ K'}$$



21.



$$\sum M_A = 0$$

$$\frac{1}{2} \times 1 \times 3 \times \frac{2 \times 3}{3} - R_B \times 3 = 0$$

$$\Rightarrow R_B = 1 \text{ k}$$

$$\sum F_y = 0$$

$$\Rightarrow \frac{1}{2} \times 1 \times 3 - 1 - R_A = 0$$

$$\Rightarrow R_A = 0.5 \text{ k}$$

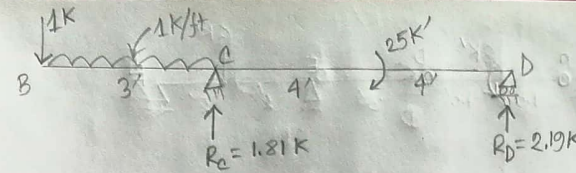
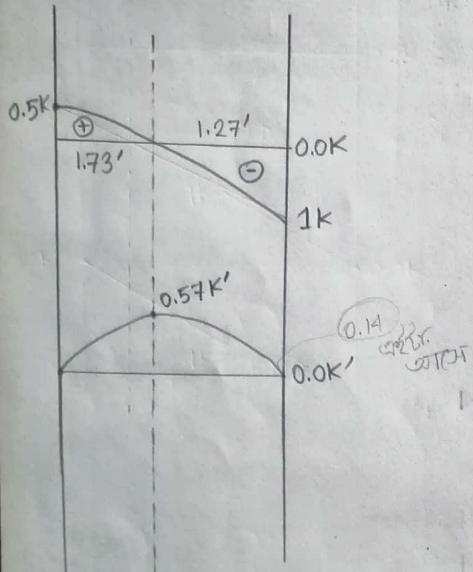
$$\frac{x}{0.5} = \frac{y}{1} \Rightarrow \frac{1.5 - 0.15}{3} = \frac{y}{x}$$

$$\Rightarrow y = \frac{x}{3}$$

$$\therefore \frac{1}{2} \cdot x \cdot y = 0.5$$

$$\Rightarrow \frac{1}{2} \cdot x \cdot \frac{x}{3} = 0.5$$

$$\Rightarrow x = 1.73$$



$$\sum M_C = 0$$

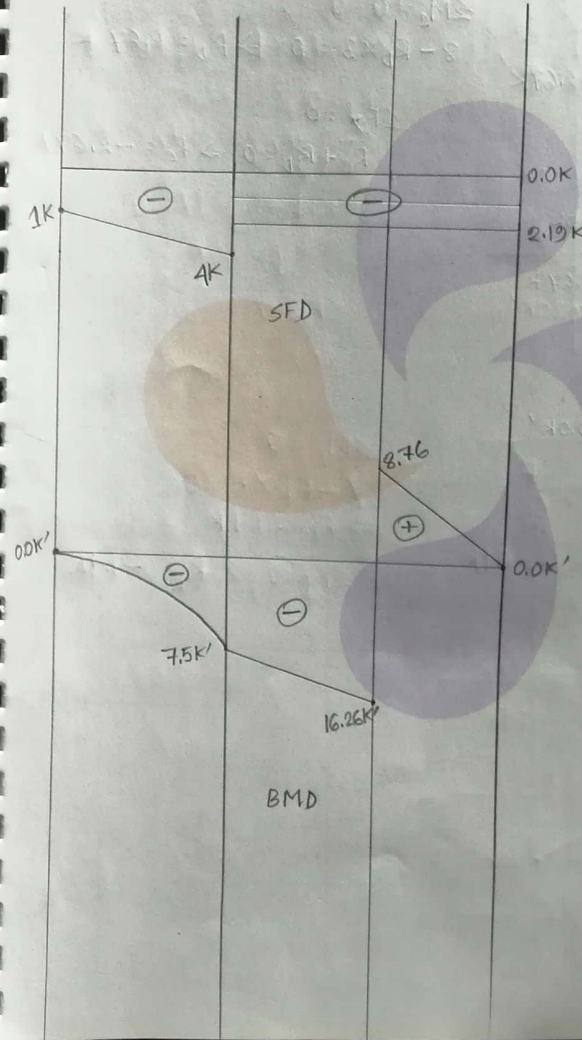
$$\Rightarrow 25 - R_D \times 8 - 1 \times 3 \times 1.5 - 1 \times 3 = 0$$

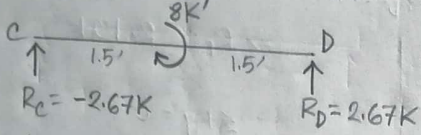
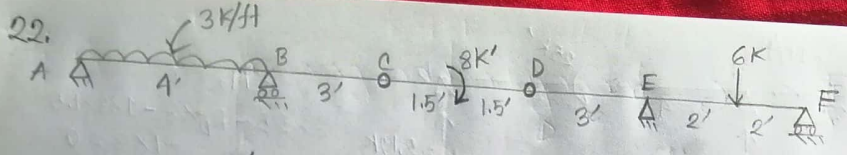
$$\Rightarrow R_D = 2.19 \text{ k}$$

$$\sum F_y = 0$$

$$\Rightarrow 1 + 1 \times 3 - R_C - 2.19 = 0$$

$$\Rightarrow R_C = 1.81 \text{ k}$$



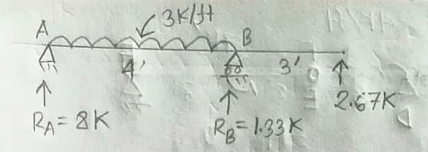
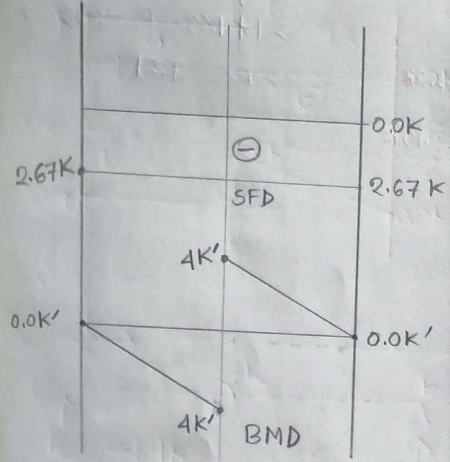


$$\sum M_C = 0$$

$$8 - R_D \times 3 = 0 \Rightarrow R_D = 2.67 \text{ k}$$

$$\sum F_y = 0$$

$$R_C + R_D = 0 \Rightarrow R_C = -2.67 \text{ k}$$



$$\sum M_A = 0$$

$$\Rightarrow 3 \times 4 \times 2 - R_B \times 4 - 2.67 \times 7 = 0$$

$$\Rightarrow R_B = 1.33 \text{ k}$$

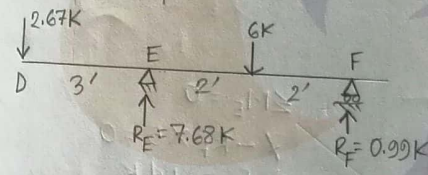
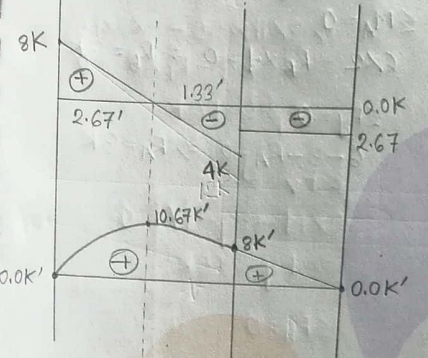
$$\sum F_y = 0$$

$$3 \times 4 - 1.33 - 2.67 - R_A = 0$$

$$\Rightarrow R_A = 8 \text{ k}$$

$$\frac{x}{8} = \frac{4-x}{4} \Rightarrow 4x = 32 - 8x$$

$$\Rightarrow x = 2.67'$$



$$\sum M_E = 0$$

$$6 \times 2 - R_F \times 4 - 2.67 \times 3 = 0$$

$$\Rightarrow R_F = 0.99 \text{ k}$$

$$\sum F_y = 0$$

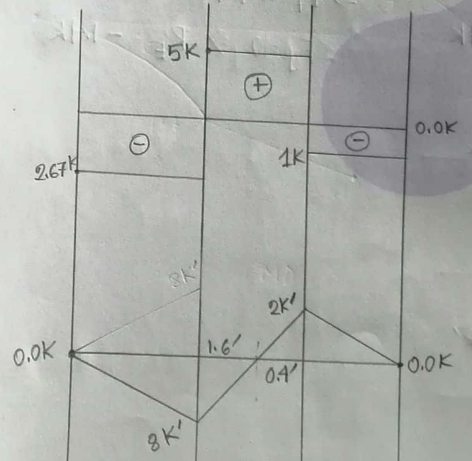
$$2.67 + 6 - 0.99 - R_E = 0$$

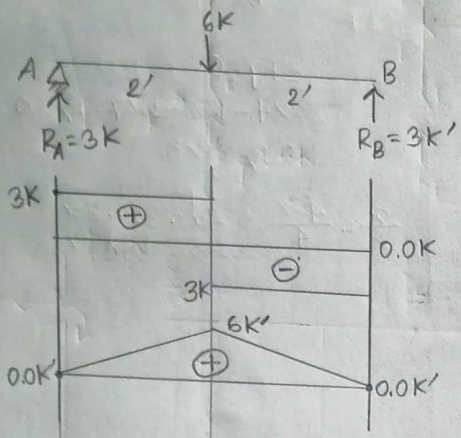
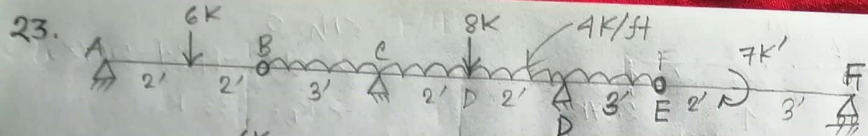
$$\Rightarrow R_E = 7.68$$

$$\frac{x}{8} = \frac{2-x}{2}$$

$$\Rightarrow 2x = 16 - 8x$$

$$\Rightarrow x = 1.6'$$



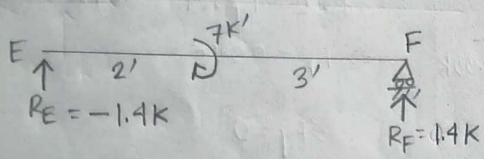


$$\sum M_A = 0$$

$$6 \times 2 - R_B \times 4 = 0 \Rightarrow R_B = 3k$$

$$\sum F_y = 0$$

$$6 - 3 - R_A = 0 \Rightarrow R_A = 3k$$

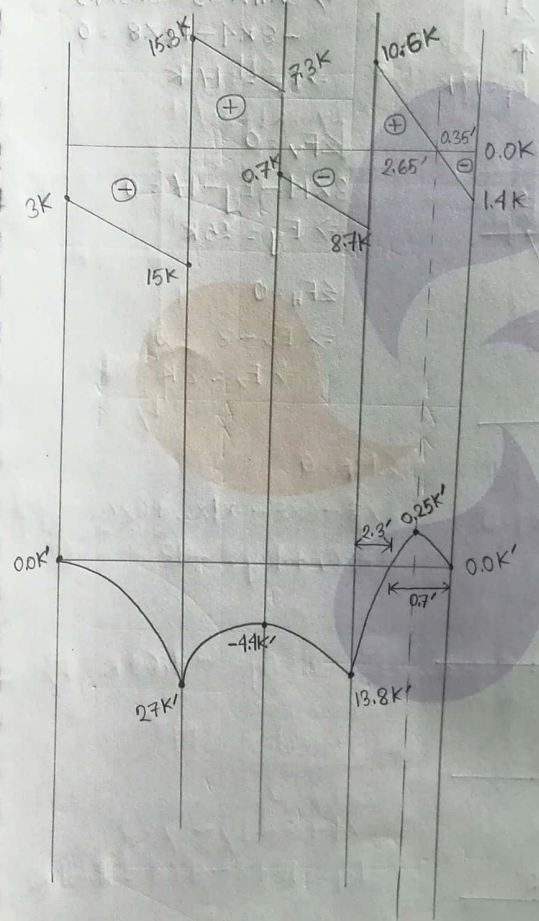
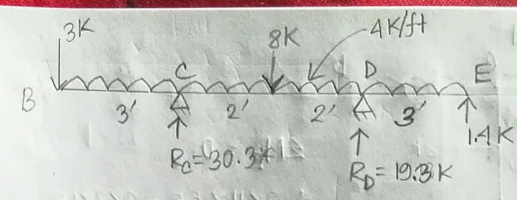
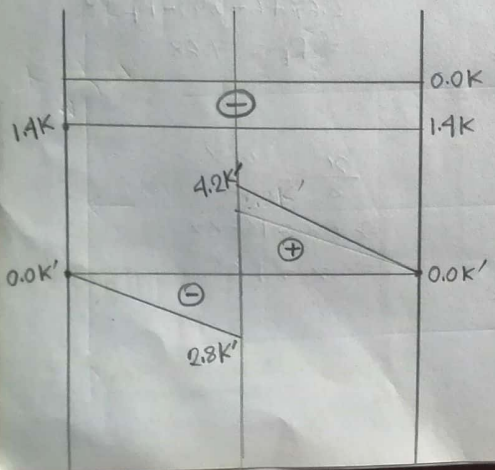


$$\sum M_E = 0$$

$$7 - R_F \times 5 = 0$$

$$\Rightarrow R_F = 1.4k$$

$$\sum F_y = 0 \Rightarrow R_E = -1.4k$$



$$\sum M_C = 0$$

$$8 \times 2 - R_D \times 4 - 1.4 \times 7$$

$$+ 4 \times 7 \times 3.5 - 3 \times 3 - 4 \times 3 \times 1.5 = 0$$

$$\Rightarrow R_D = 19.3k$$

$$\sum F_y = 0$$

$$3 + 8 + 4 \times 10 - 19.3 - R_C - 1.4 = 0$$

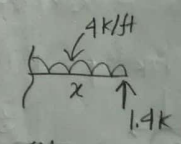
$$\Rightarrow R_C = 30.3k$$

$$\frac{x}{10.6} = \frac{3-x}{1.4}$$

$$\Rightarrow 1.4x = 31.8 - 10.6x$$

$$\Rightarrow x = 2.65$$

Inflection point

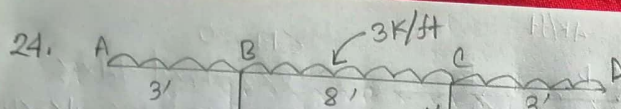


$$\sum M_x = 0$$

$$4x \cdot \frac{x}{2} - 1.4x = 0$$

$$\Rightarrow 2x^2 - 1.4x = 0$$

$$\Rightarrow x = 0.7'$$



$$\sum M_E = 0$$

$$\Rightarrow 3 \times 11 \times 5.5 - 3 \times 3 \times 1.5 - 8 \times 4 - R_F \times 8 = 0$$

$$\Rightarrow R_F = 17 \text{ K}$$

$$\sum F_V = 0$$

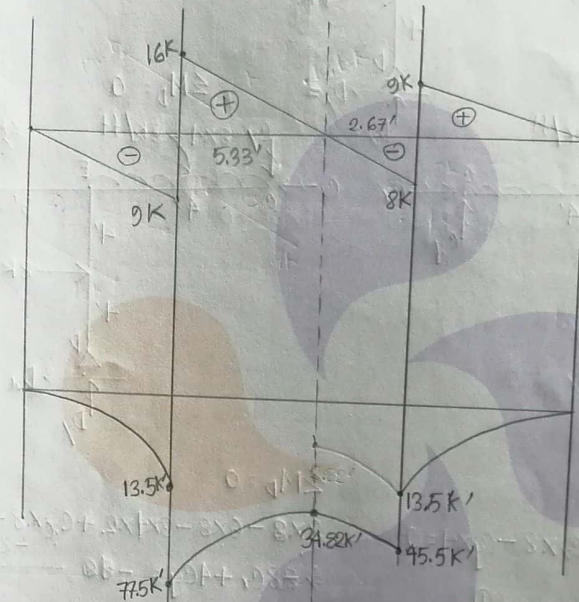
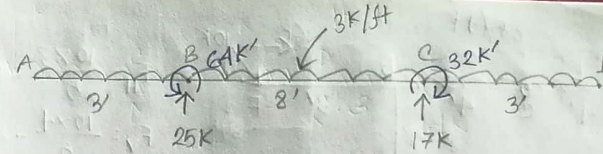
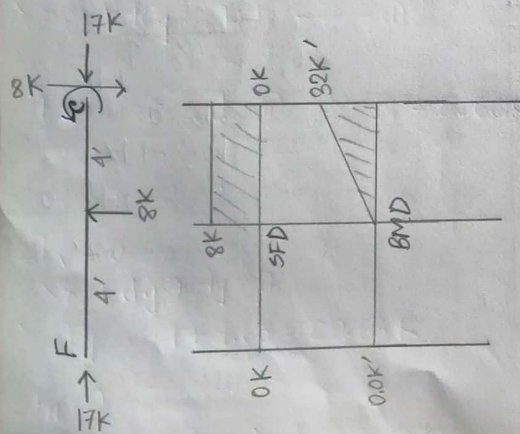
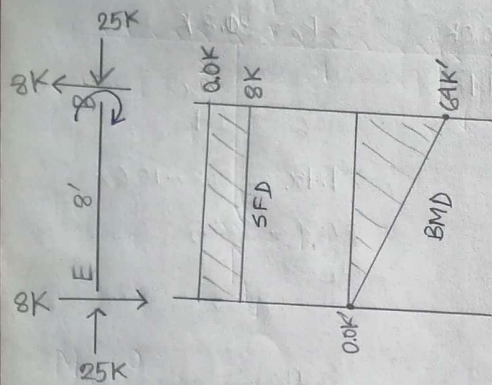
$$3 \times 11 - E_y - 17 = 0$$

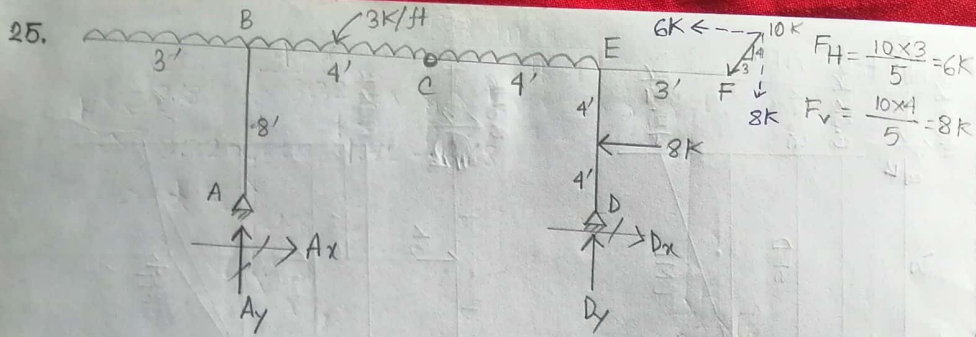
$$\Rightarrow E_y = 25 \text{ K}$$

$$\sum F_H = 0$$

$$\Rightarrow E_x - 8 = 0$$

$$\Rightarrow E_x = 8 \text{ K}$$





$$\sum M_A = 0$$

$$\Rightarrow 3 \times 8 \times 4 + 8 \times 11 - 6 \times 8 - 8 \times 4 - D_y \times 8 - 3 \times 3 \times 1.5 = 0$$

$$\Rightarrow D_y = 11.31 \text{ K}$$

$$\sum F_y = 0$$

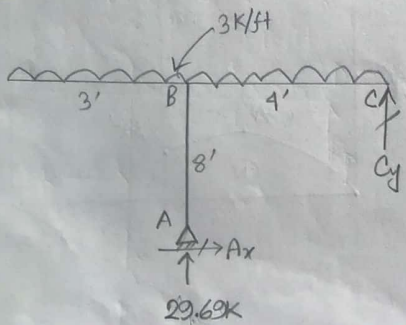
$$\Rightarrow 3 \times 11 + 8 - 11.31 - A_y = 0$$

$$\Rightarrow A_y = 29.69 \text{ K}$$

$$\sum F_x = 0$$

$$6 + 8 - A_x - D_x = 0$$

$$\Rightarrow A_x + D_x = 14 \text{ K} \quad \text{--- (1)}$$



$$\sum M_c = 0$$

$$-3 \times 7 \times 3.5 + 29.69 \times 4 - A_x \times 8 = 0$$

$$\Rightarrow A_x = 5.65 \text{ K}$$

$$\sum F_y = 0$$

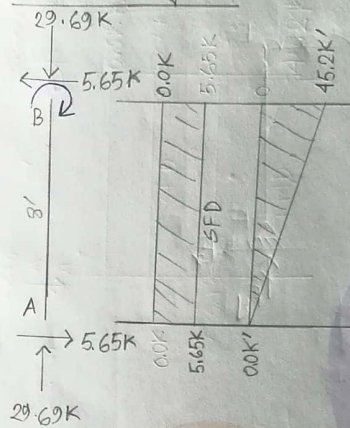
$$\Rightarrow 3 \times 7 - C_y - 29.69 = 0$$

$$\Rightarrow C_y = -8.69 \text{ K} \quad (\downarrow)$$

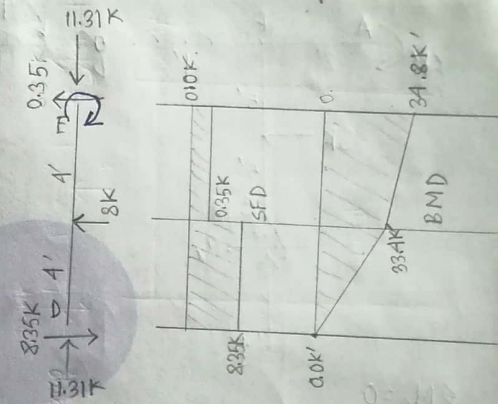
From (1) \Rightarrow

$$D_x = 14 - A_x = 14 - 5.65 = 8.35 \text{ K}$$

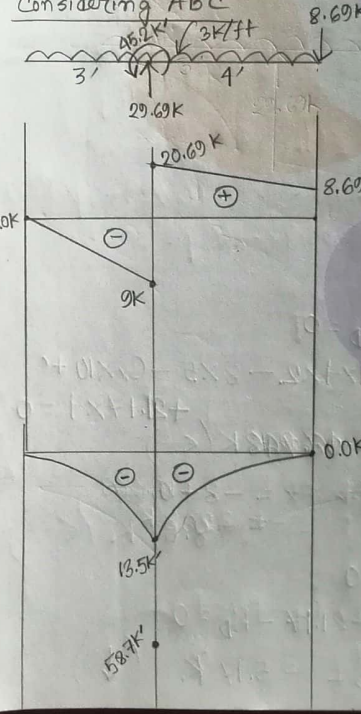
Considering AB



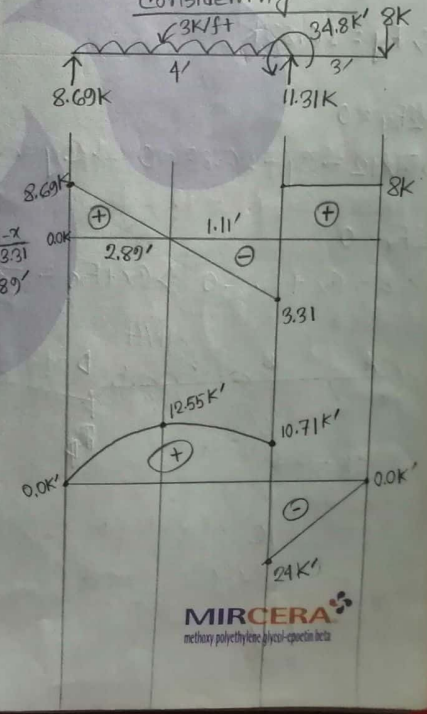
Considering DE



Considering ABC



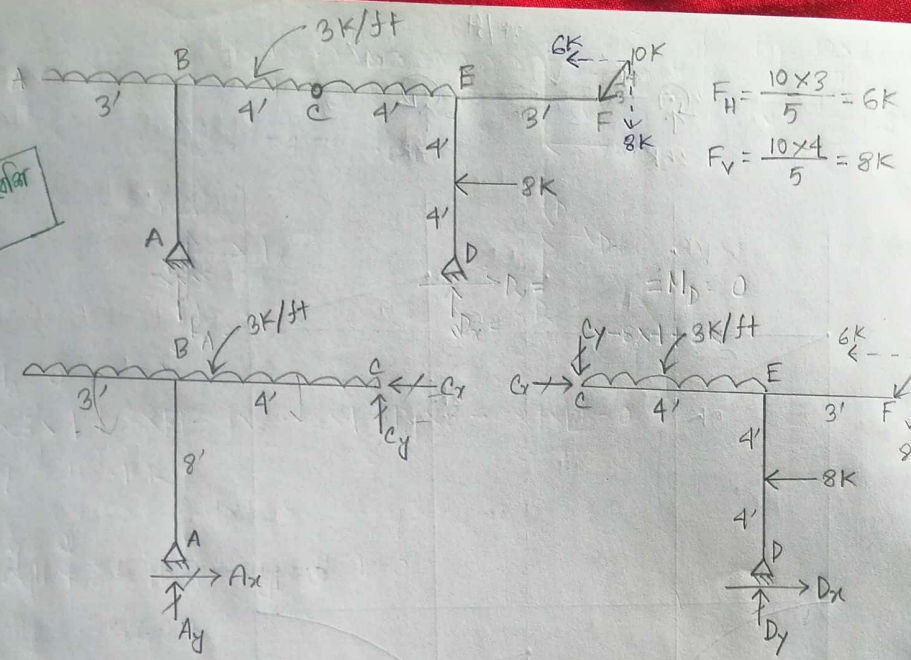
Considering CEF



MIRCERA
methoxy polyethylene glycol-acrylic latex

25.

Time for
solution



$$F_H = \frac{10 \times 3}{5} = 6K$$

$$F_V = \frac{10 \times 4}{5} = 8K$$

$$\sum M_A = 0$$

$$3 \times 4 \times 2 - 3 \times 3 \times 1.5 - C_x \times 8 - C_y \times 4 = 0$$

$$\Rightarrow 8C_x + 4C_y = 10.5 \quad \text{--- (I)}$$

$$\sum M_D = 0$$

$$8 \times 3 - 6 \times 8 - 3 \times 4 \times 2 + C_x \times 8 - C_y \times 4 = 0$$

$$\Rightarrow 8C_x + 4C_y = -80 \quad \text{--- (II)}$$

From (I) and (II) $\Rightarrow C_x = 5.65K$

$C_y = -8.68K$

Consider ABC:

$$\sum F_V = 0$$

$$3 \times 7 + C_y + A_y = 0$$

$$\Rightarrow A_y = 21 + 8.68 = 29.68K$$

$$\sum F_H = 0$$

$$\Rightarrow A_x - C_x = 0 \Rightarrow A_x = 5.65K$$

Consider CDE

$$\sum F_V = 0$$

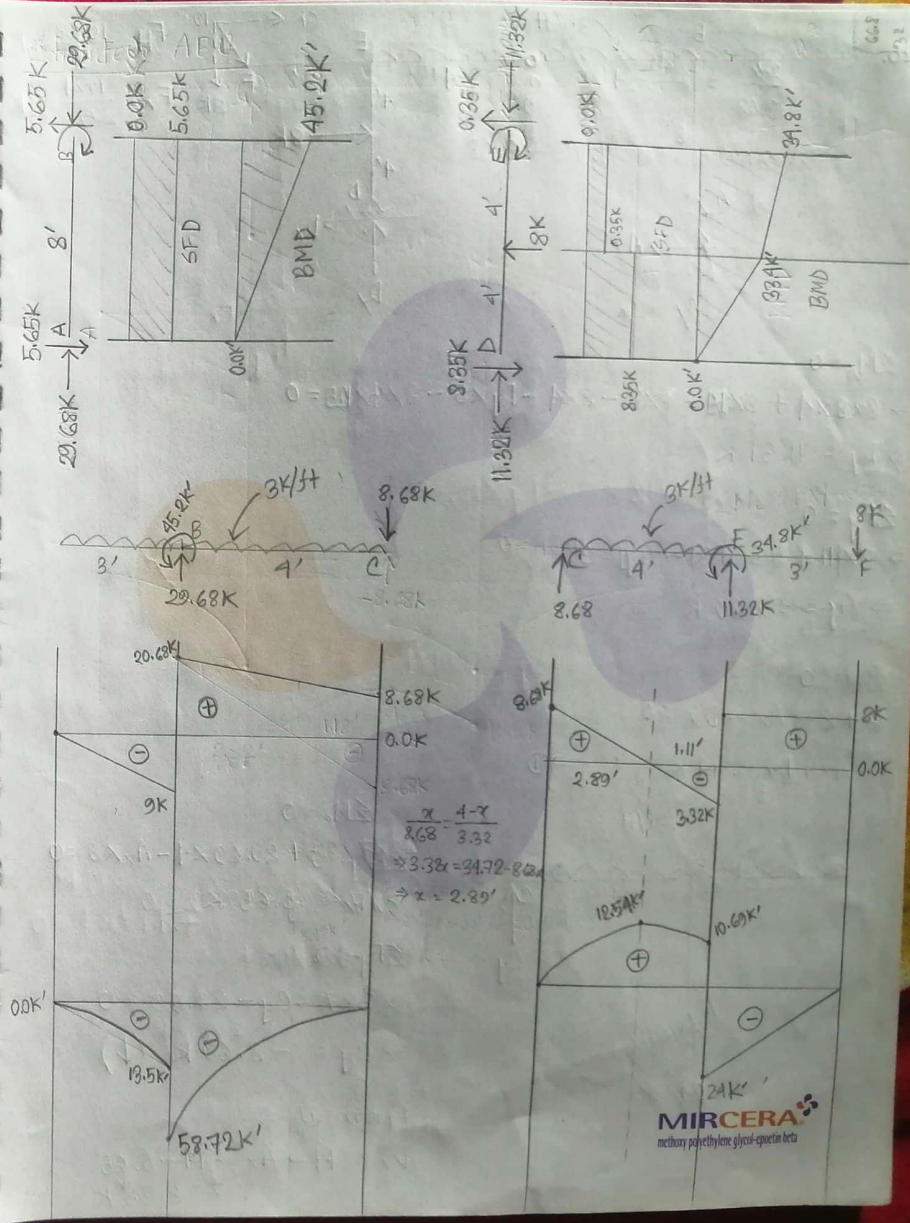
$$3 \times 4 + 8 - D_y - C_y = 0$$

$$D_y = 12 + 8 - 8.68 = 11.32K$$

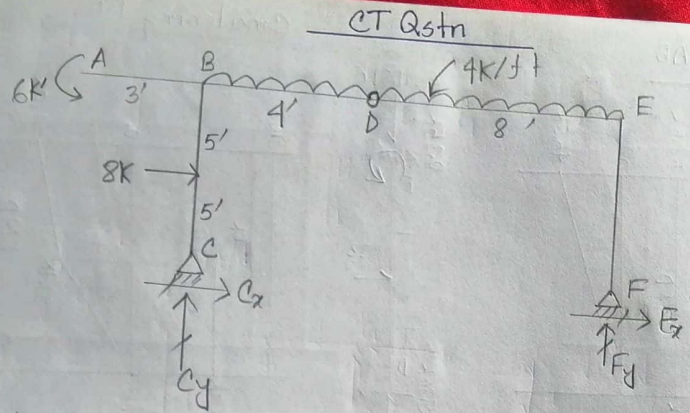
$$\sum F_H = 0$$

$$\Rightarrow 6 - C_x - D_x + 8 = 0$$

$$\Rightarrow D_x = 6 - 5.65 + 8 = 8.35K$$



MIRCERA
methoxy polyethylene glycol-spectin beta



$$\sum M_C = 0$$

$$\Rightarrow -6 + 8 \times 5 + 4 \times 12 \times 6 - F_y \times 12 = 0$$

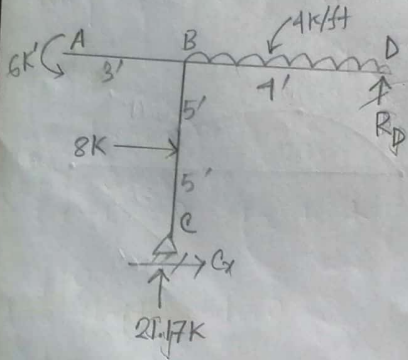
$$\Rightarrow F_y = 26.83 \text{ K}$$

$$\sum F_y = 0$$

$$\Rightarrow 4 \times 12 - C_y - 26.83 = 0 \Rightarrow C_y = 21.17 \text{ K}$$

$$\sum F_x = 0$$

$$\Rightarrow 8 + C_x + F_x = 0 \Rightarrow C_x + F_x = -8 \quad \text{--- (1)}$$



$$\sum M_D = 0$$

$$-6 - 4 \times 4 \times 2 - 8 \times 5 - C_x \times 10 + 21.17 \times 4 = 0$$

$$\Rightarrow C_x = -0.67 \text{ K} \quad (\leftarrow)$$

$$\text{From (1)} \Rightarrow F_x = -8 + 0.67$$

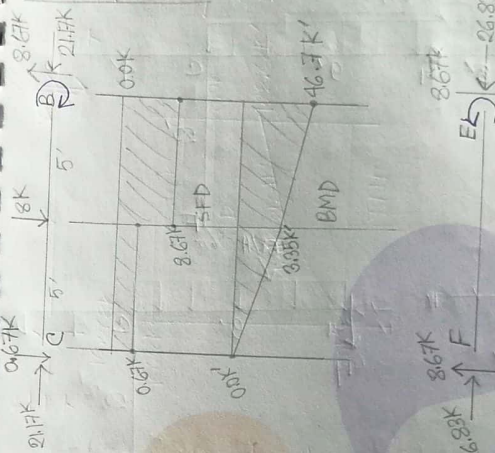
$$= -8.67 \text{ K} \quad (\leftarrow)$$

$$\sum F_y = 0$$

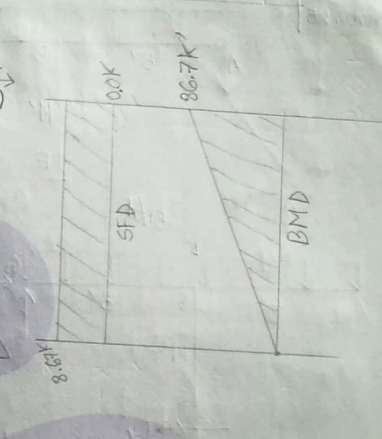
$$4 \times 4 - 21.17 - R_D = 0$$

$$\Rightarrow R_D = -5.17 \text{ K} \quad (\downarrow)$$

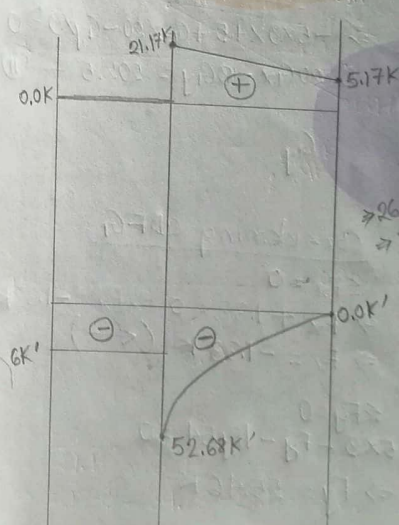
Consider BC



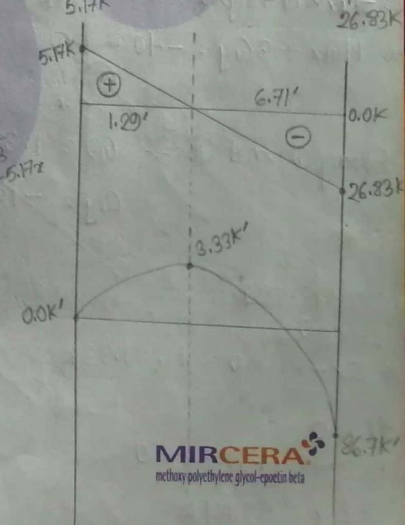
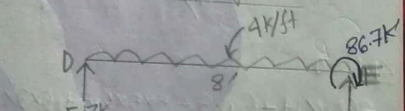
Consider EF



Considering ABD



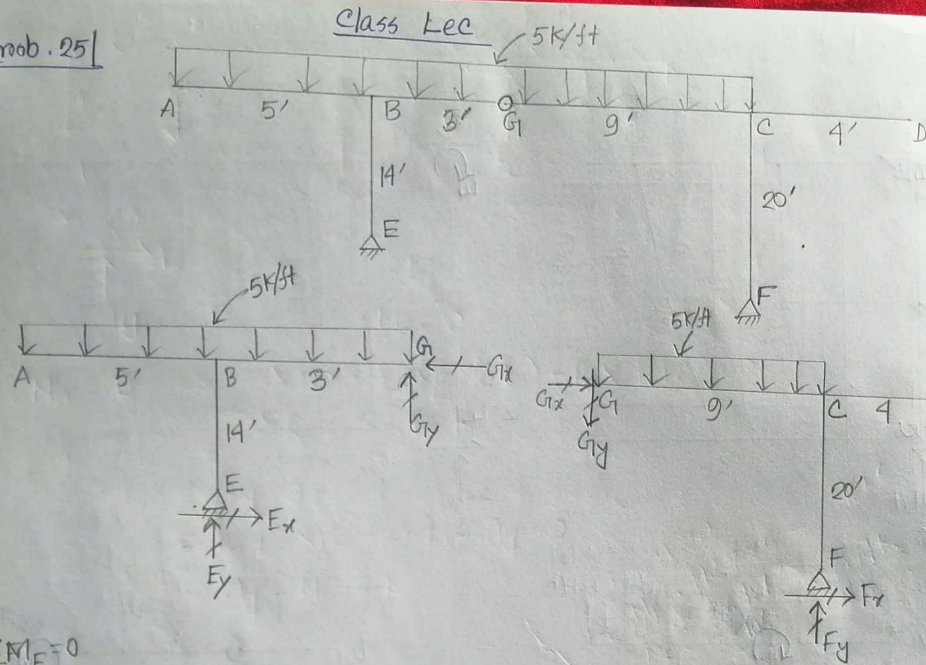
Considering DE



MIRCERA
methoxy polyethylene glycol-co-polyvinyl alcohol

Prob. 25

Class Lec



$$\sum M_E = 0$$

$$\Rightarrow -G_x \times 14 + G_y \times 3 - 5 \times 5 \times 2.5 + 5 \times 3 \times 1.5 = 0$$

$$\Rightarrow 14G_x + 3G_y = -40 \quad \text{--- (I)}$$

Solving (I) and (II) $\Rightarrow G_x = 1.33 \text{ K}$

$$G_y = -19.54 \text{ K}$$

$$\sum M_F = 0$$

$$\Rightarrow -5 \times 9 \times 4.5 + G_x \times 20 - G_y \times 9 = 0$$

$$\Rightarrow 20G_x - 9G_y = 202.5 \quad \text{--- (II)}$$

Considering CDFG

$$\sum F_x = 0$$

$$\Rightarrow F_x + 1.33 = 0 \Rightarrow F_x = -1.33 \text{ K}$$

$$\Rightarrow F_x = -1.33 \text{ K} (\leftarrow)$$

$$\sum F_y = 0$$

$$5 \times 9 - F_y - 19.54 = 0$$

$$\Rightarrow F_y = 25.46 \text{ K}$$

Considering ABGE

$$\sum F_x = 0$$

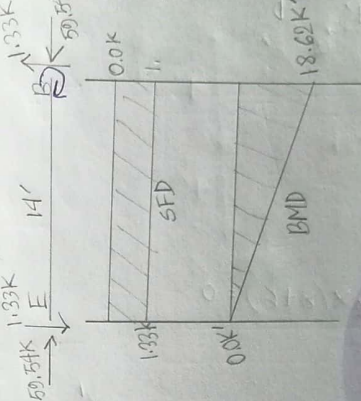
$$\Rightarrow E_x - 1.33 = 0 \Rightarrow E_x = 1.33 \text{ K}$$

$$\sum F_y = 0$$

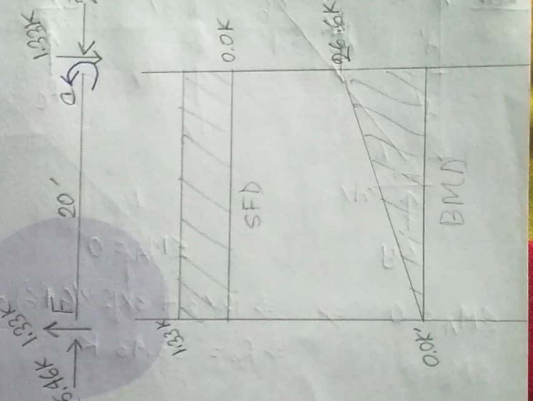
$$5 \times 8 - E_y + 19.54 = 0$$

$$\Rightarrow E_y = 59.54 \text{ K}$$

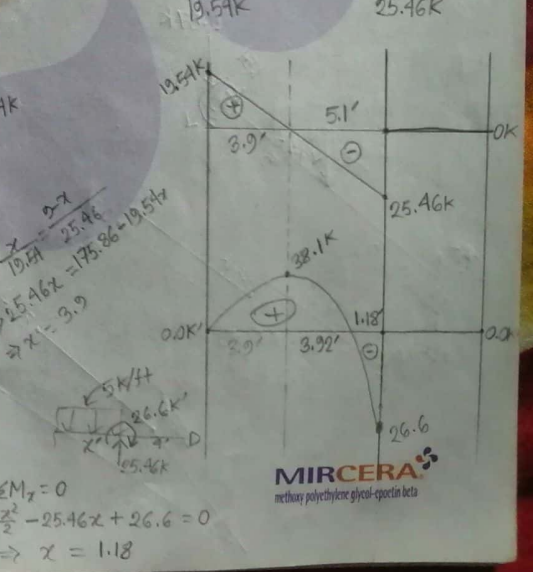
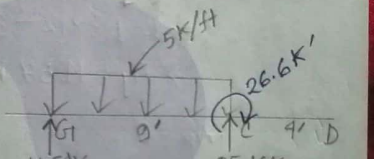
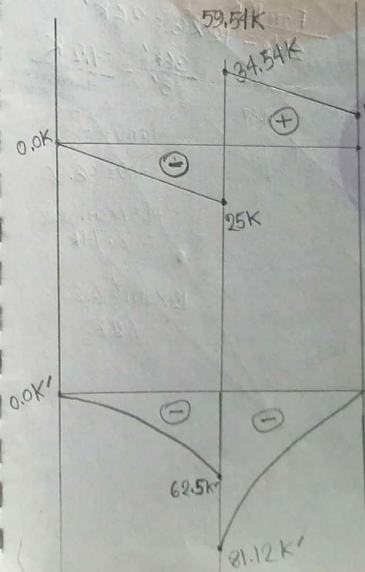
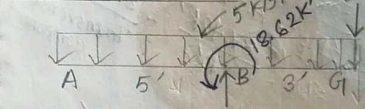
Considering BE



Considering CF



Considering ABG



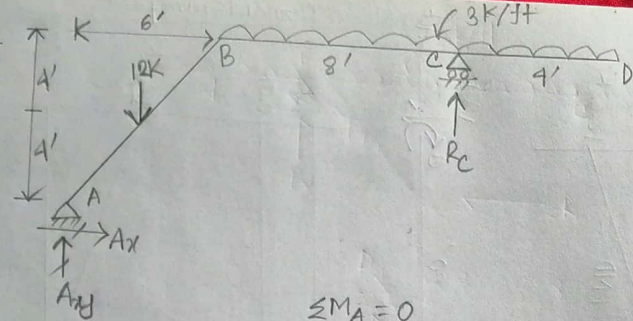
$$\sum M_D = 0$$

$$5 \times 8^2 - 25.46 \times 8 + 26.6 = 0$$

$$\Rightarrow x = 1.18$$

MIRCERA
methoxy polyethylene glycol-epoxidin beta

26.



$$\sum M_A = 0$$

$$\sum N_A = 0 \Rightarrow 12 \times 3 + 3 \times 12 \times (6+6) - R_C \times (8+6) = 0$$

$$\Rightarrow R_C = 33.43 \text{ K}$$

$$\sum F_y = 0$$

$$\Rightarrow 12 + 3 \times 12 - 33.43 - A_y = 0$$

$$\Rightarrow A_y = 14.57 \text{ K}$$

$$A_x = 0$$

From 14.57 K

$$\sum M_B = 14.57 \times 6 = 87.42 \text{ K'}$$

Transverse component

$$\frac{87.42}{10} = 8.74 \text{ K}$$

From 12 K

$$\sum M_B = 12 \times 3 = 36 \text{ K'}$$

$$\frac{36}{5} = 7.2 \text{ K}$$

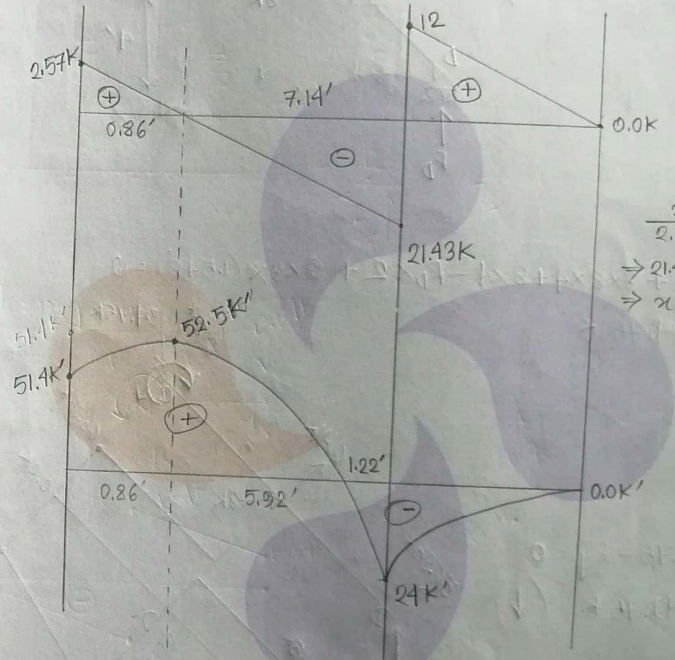
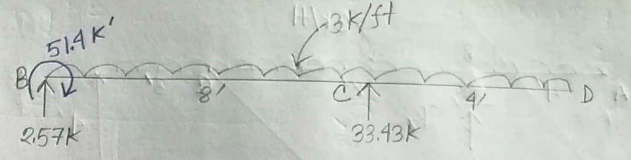
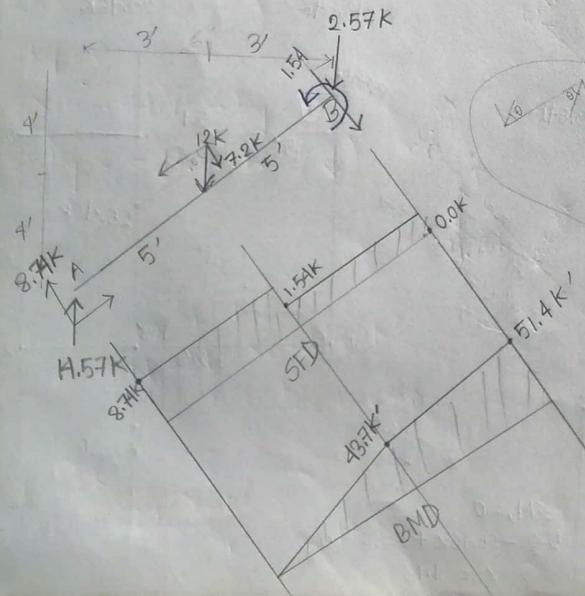
transverse component

$$\tan \theta = \frac{8}{6}$$

$$\Rightarrow \theta = 36.86^\circ$$

$$14.57 \times \sin(36.86) = 8.74 \text{ K}$$

$$12 \times \sin(36.86) = 7.2 \text{ K}$$



$$\frac{x}{2.57} = \frac{8-x}{21.43}$$

$$\Rightarrow 21.43x = 20.56 - 2.57x$$

$$\Rightarrow x = 0.86'$$

$\sum M_x = 0$

$$3x \cdot \frac{x}{2} - 33.43x + 3 \times 4 \times (2+x)$$

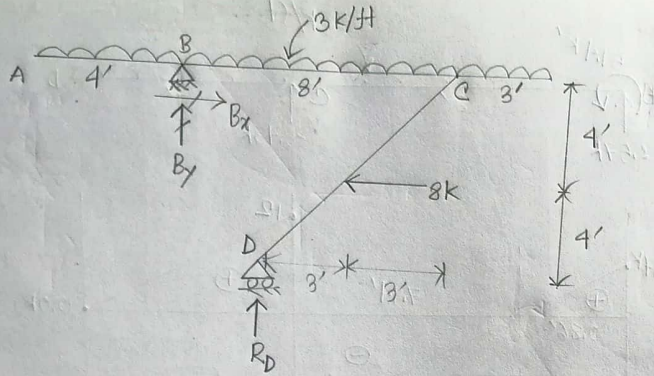
$$\Rightarrow 1.5x^2 - 33.43x + 24 + 12x$$

$$\Rightarrow 1.5x^2 - 21.43x + 24 = 0$$

$$\Rightarrow x = 1.22'$$



27.



$$\sum M_B = 0$$

$$\Rightarrow -3 \times 4 \times 2 + 3 \times 8 \times 4 + 8 \times 4 - R_D \times 2 + 3 \times 3 \times (1.5 + 8) = 0$$

$$\Rightarrow R_D = 24.75 \text{ K}$$

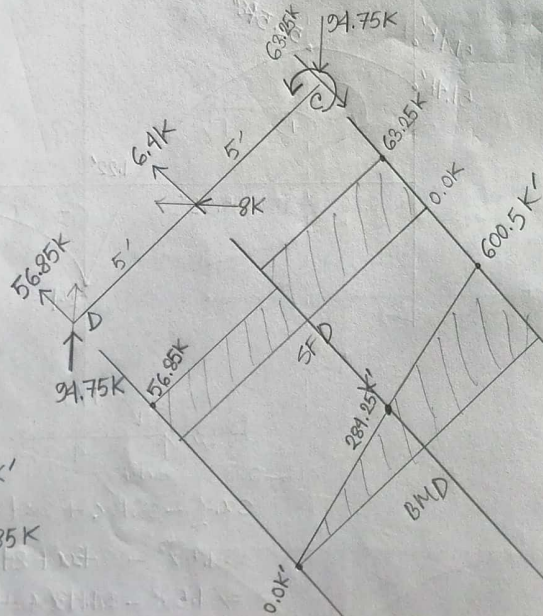
$$\sum F_x = 0$$

$$B_x = 8 \text{ K}$$

$$\sum F_y = 0$$

$$3 \times 15 - 24.75 - B_y = 0$$

$$\Rightarrow B_y = -49.75 \text{ K} \quad (\downarrow)$$



For 24.75 K

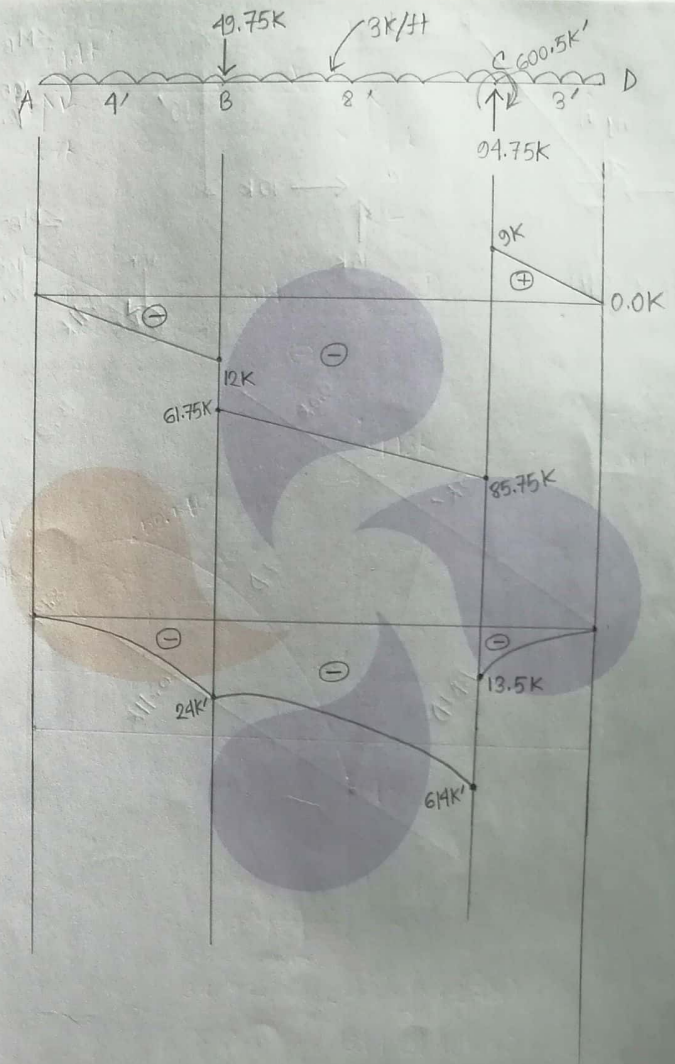
$$\sum M_c = 24.75 \times 6 = 568.5 \text{ K'}$$

$$\frac{568.5 \text{ K'}}{10'} = 56.85 \text{ K}$$

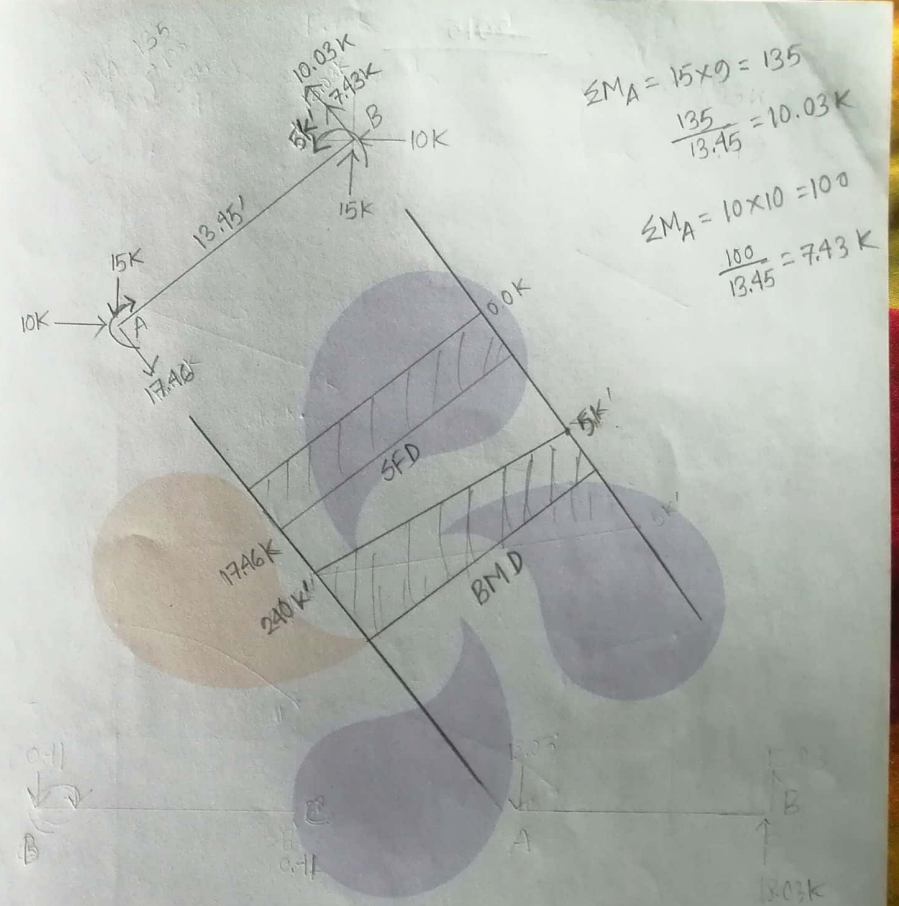
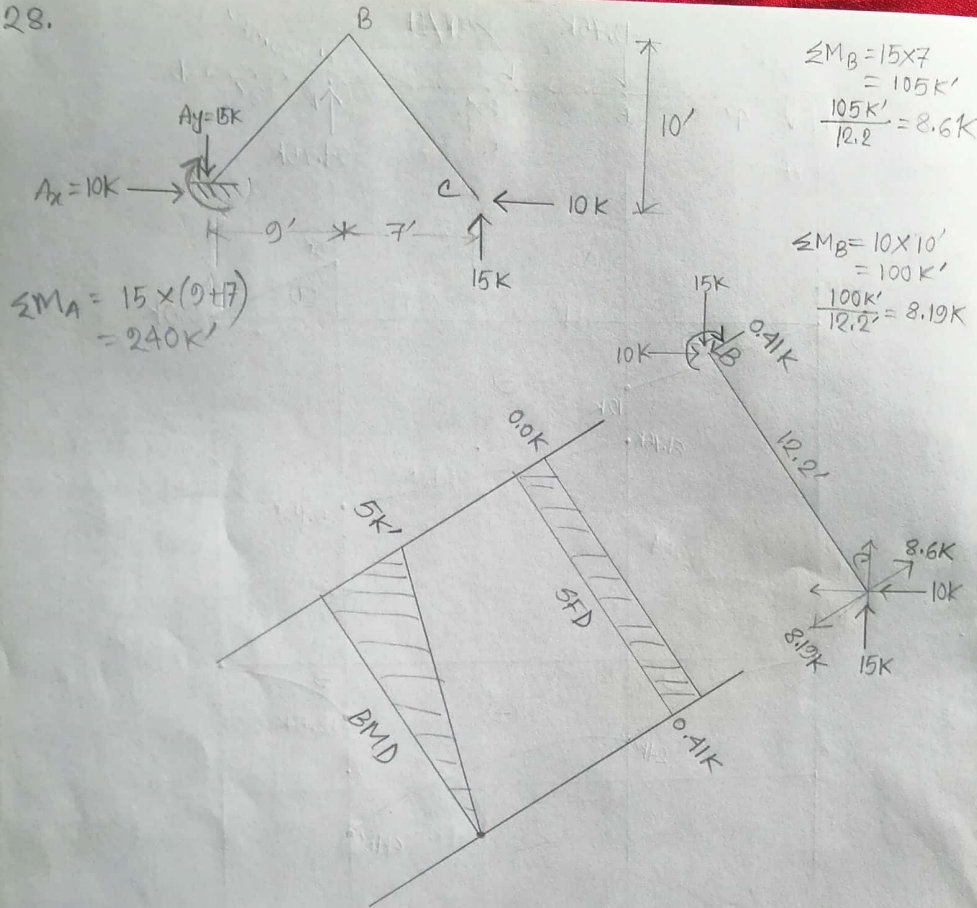
For 8 K

$$\sum M_c = 8 \times 4 = 32 \text{ K'}$$

$$\frac{32 \text{ K'}}{5'} = 6.4 \text{ K}$$

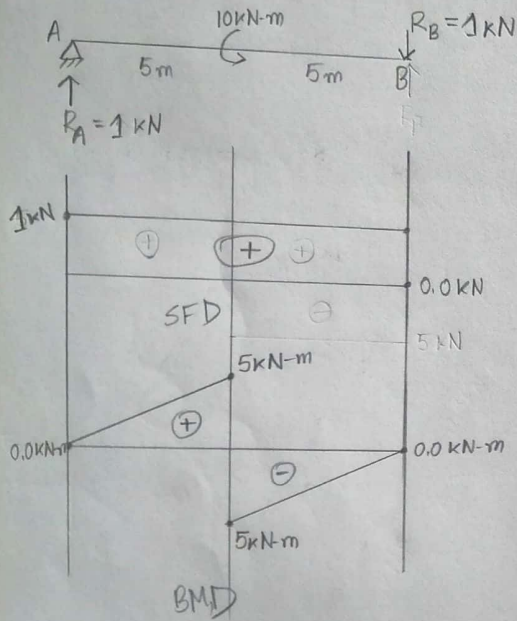
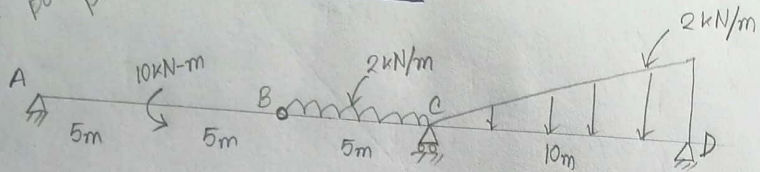


28.



Q.1. inflection point problem

2015



$$\sum M_A = 0$$

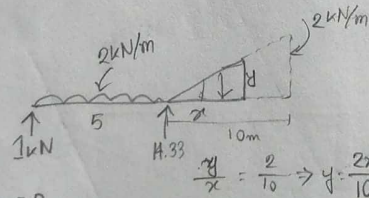
$$\Rightarrow R_B \times 10 - 10 = 0$$

$$\Rightarrow R_B = 1 \text{ kN}$$

$$\sum F_y = 0$$

$$R_A = 1 \text{ kN}$$

Inflection



$$\sum M_x = 0$$

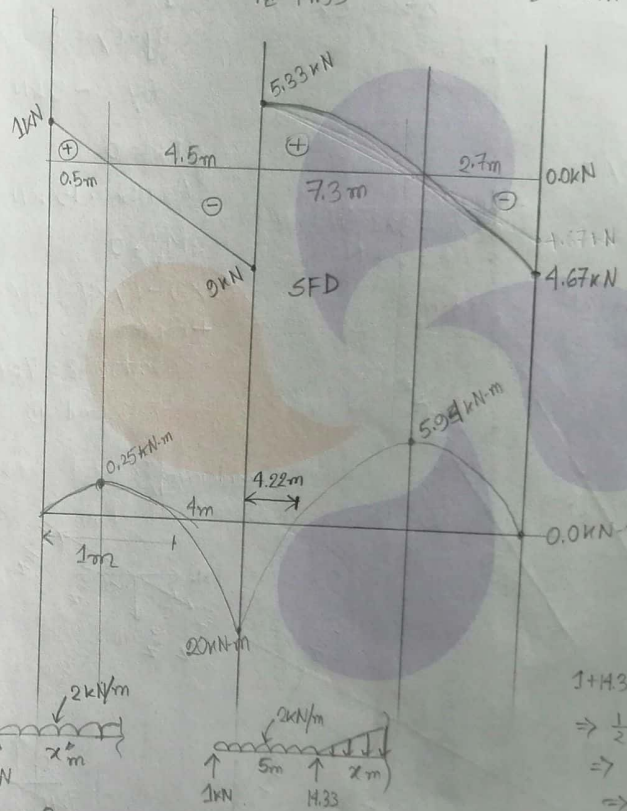
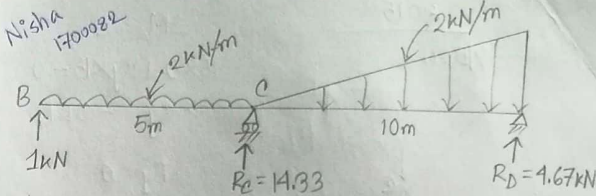
$$1 \times (5+x) - 2 \times 5 \times (2.5+x) + 14.33x - \frac{1}{2} \times x \cdot \frac{2x}{10} \cdot \frac{x}{3} = 0$$

$$\Rightarrow 5+x - 25 - 10x + 14.33x - \frac{1}{2} \times \frac{2x}{10} \cdot \frac{x}{3} = 0$$

$$\Rightarrow -\frac{x^3}{30} + 5.33x - 20 = 0$$

$$\Rightarrow x = 4.22$$

Nisha 1700022



$$\sum M_C = 0$$

$$\Rightarrow \frac{1}{2} \times 2 \times 10 \times \frac{2 \times 10}{3} - R_B \times 10 - 2 \times 5 \times 2.5 + 1 \times 5 = 0$$

$$\Rightarrow R_B = 4.67 \text{ kN}$$

$$\sum F_y = 0$$

$$\Rightarrow \frac{1}{2} \times 2 \times 10 + 2 \times 5 - 4.67 - 1 - R_C = 0$$

$$\Rightarrow R_C = 14.33 \text{ kN}$$

$$\frac{x}{1} = \frac{5-x}{9}$$

$$\Rightarrow 9x = 5-x$$

$$\Rightarrow x = 0.5$$

$$\sum F_y = 0$$

$$1 + 14.33 - 2 \times 5 - \frac{1}{2} \times x \cdot y = 0$$

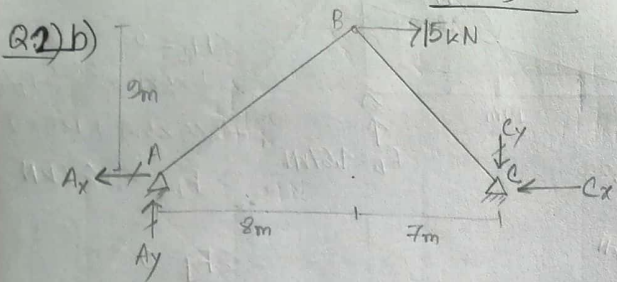
$$\Rightarrow \frac{1}{2} \times x \cdot \frac{x}{5} = 5.33$$

$$\Rightarrow x^2 = 53.3$$

$$\Rightarrow x = 7.3 \text{ m}$$

Q2) b)

2015



$$\sum M_A = 0$$

$$15 \times 9 + C_y \times 15 = 0$$

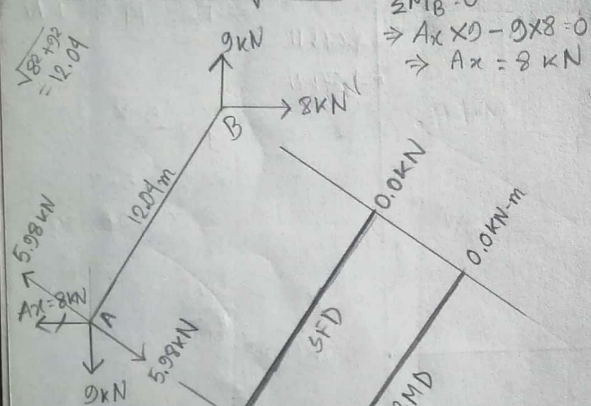
$$\Rightarrow C_y = -9 \text{ kN}$$

$$\sum F_y = 0$$

$$\Rightarrow A_y - C_y = 0$$

$$\Rightarrow A_y = 9 \text{ kN}$$

considering AB



$$\sum M_B = 0$$

$$\Rightarrow A_x \times 9 - 9 \times 8 = 0$$

$$\Rightarrow A_x = 8 \text{ kN}$$

$$\sum F_x = 0$$

$$A_x + C_x = 15 \text{ kN} \text{ --- (1)}$$

$$\sum M_C = 0$$

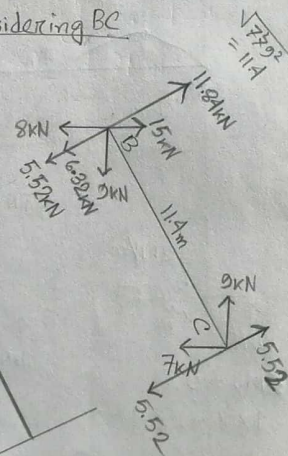
$$15 \times 7 - C_y \times 7 = 0$$

$$\Rightarrow C_y = 15 \text{ kN}$$

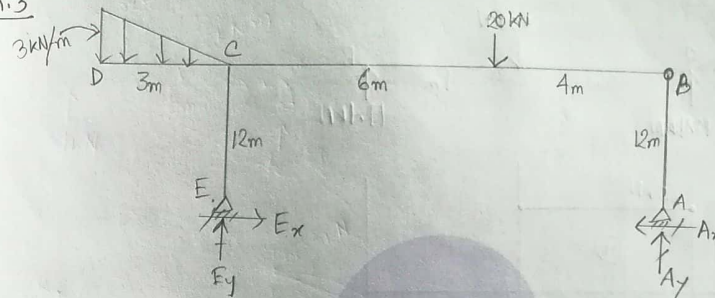
$$+ \text{From (1)}$$

$$C_x = 15 - 8 = 7 \text{ kN}$$

Considering BC



Q.3



$$\sum M_A = 0$$

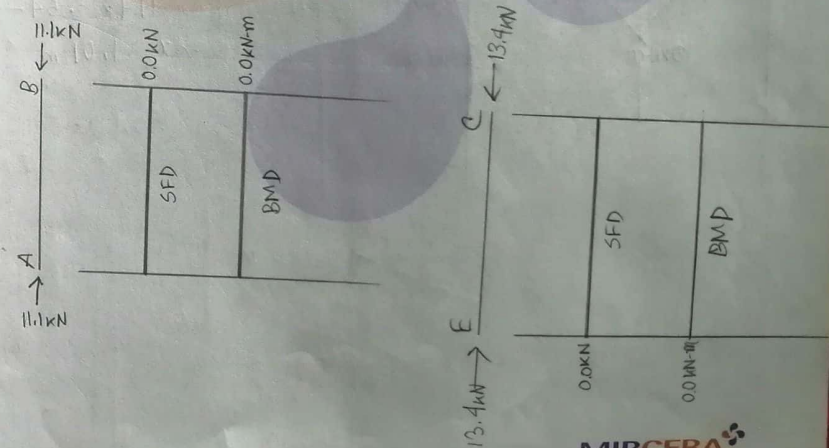
$$\Rightarrow -20 \times 4 + E_y \times 10 - \frac{1}{2} \times 3 \times 3 \left(\frac{2 \times 3}{3} + 10 \right) = 0$$

$$\Rightarrow E_y = 13.4 \text{ kN}$$

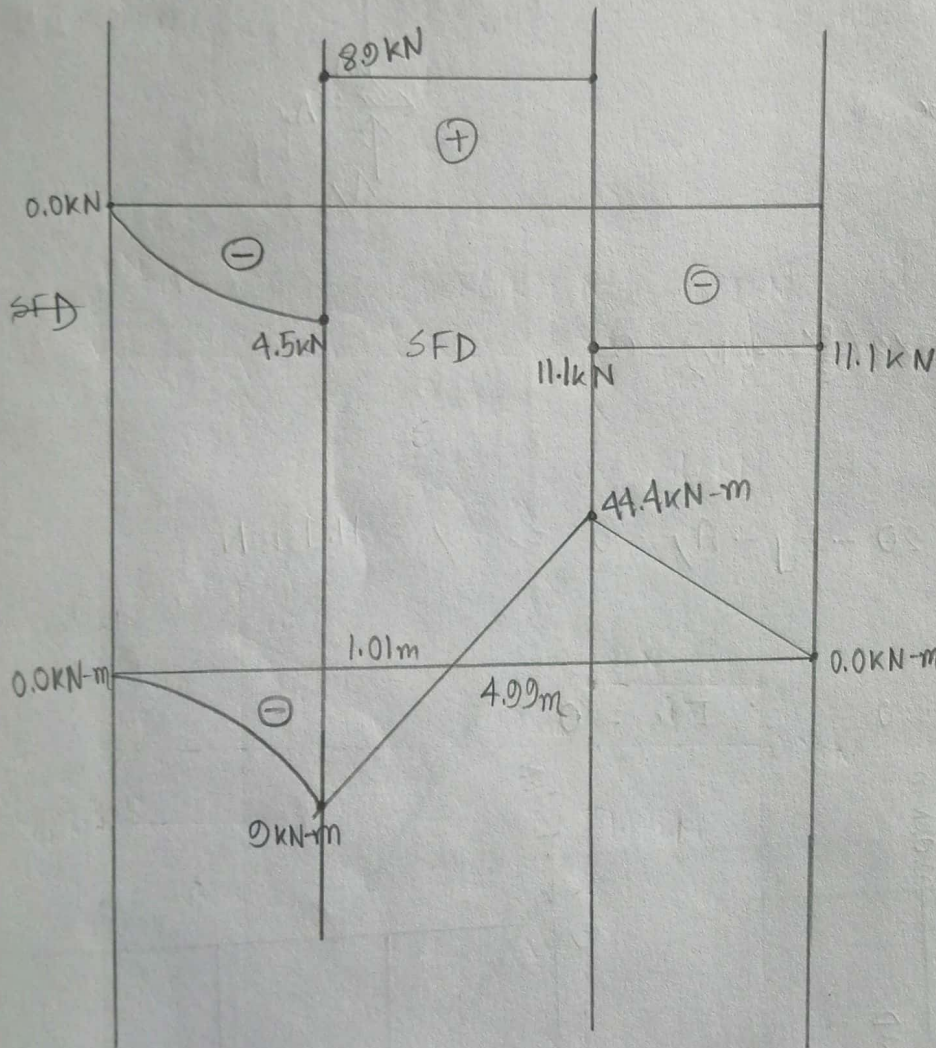
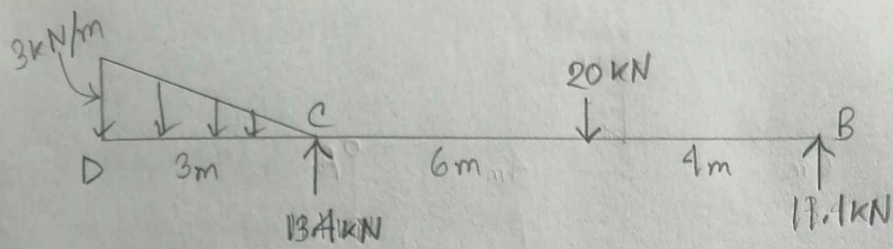
$$\sum F_y = 0 \Rightarrow \frac{1}{2} \times 3 \times 3 + 20 - E_y - A_y = 0 \Rightarrow A_y = 11.1 \text{ kN}$$

$$\sum M_B = 0$$

$$\Rightarrow A_x \times 12 = 0 \Rightarrow A_x = 0 \therefore E_x = 0$$



MIRCERA
methoxy polyethylene glycol-epoxyin beta



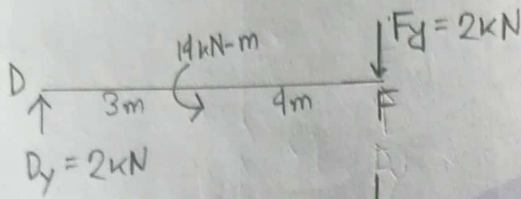
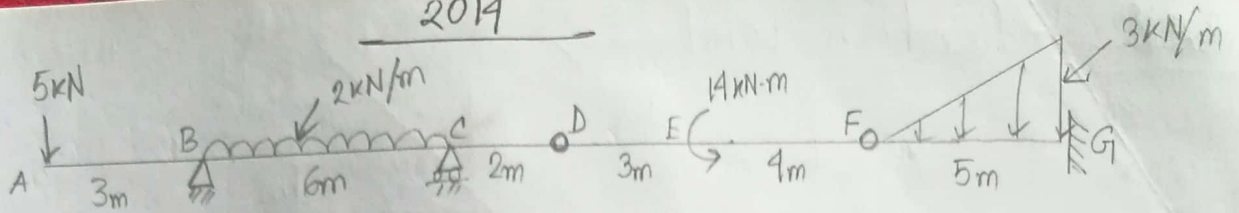
$$\frac{x}{9} = \frac{6-x}{44.4}$$

$$\Rightarrow 44.4x = 54 - 9x$$

$$\Rightarrow x = 1.01 \text{ m}$$

2014

Q.1)



$$\sum M_D = 0$$

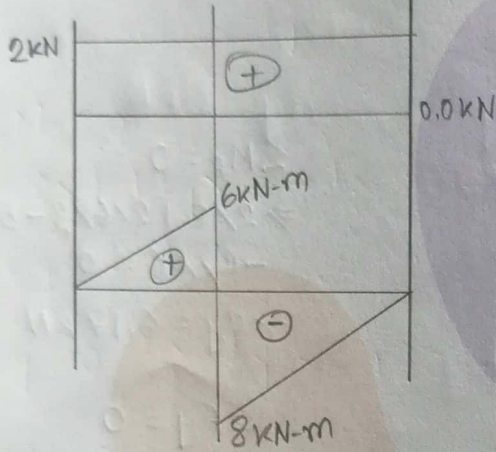
$$-14 + F_y \times 7 = 0$$

$$\Rightarrow F_y = 2 \text{ kN}$$

$$\sum F_y = 0$$

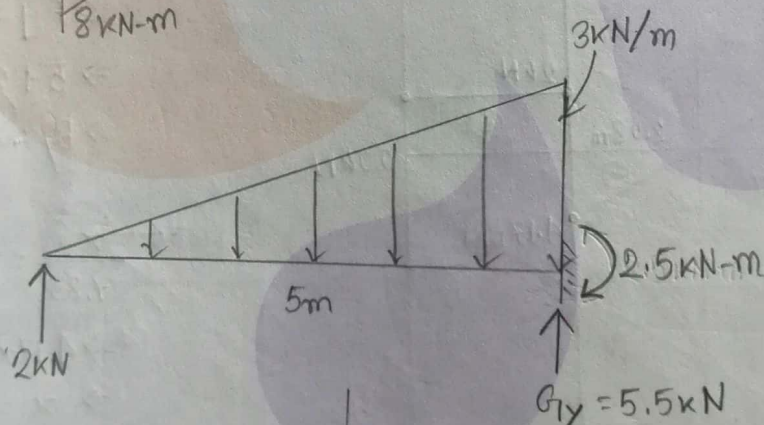
$$D_y - F_y = 0$$

$$\Rightarrow D_y = 2 \text{ kN}$$



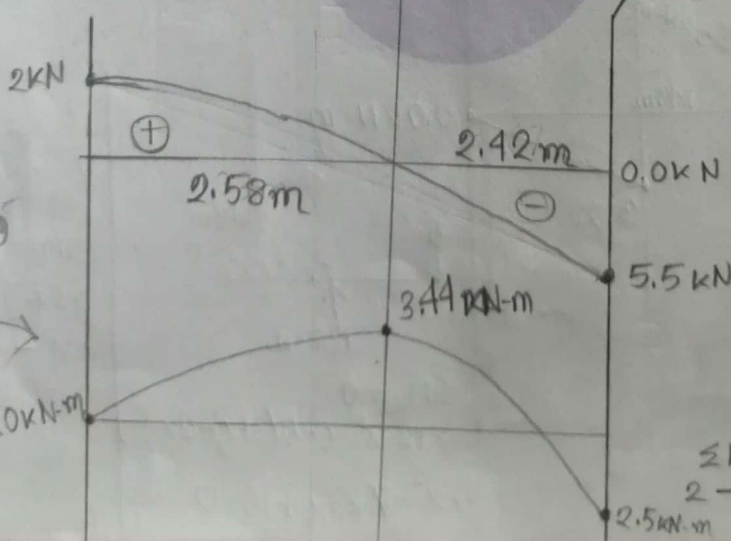
12.5 meter
center resist
4.475 20

$$5 \times 2 = 10$$

$$\frac{1}{2} \times 3 \times 5 \times \frac{1.5}{3} = 12.5$$


$$\sum M_G = 2 \times 5 - \frac{1}{2} \times 3 \times 5 \times \frac{1 \times 5}{3} = 0$$

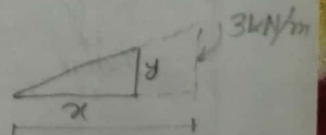
$$= -2.5 \text{ kN-m}$$



$$\sum F_y = 0$$

$$\frac{1}{2} \times 3 \times 5 - 2 - G_y = 0$$

$$\Rightarrow G_y = 5.5 \text{ kN}$$



$$\frac{x}{y} = \frac{5}{3} \Rightarrow y = \frac{3x}{5}$$

MIRCERA
methoxy polyethylene glycol-croctin beta

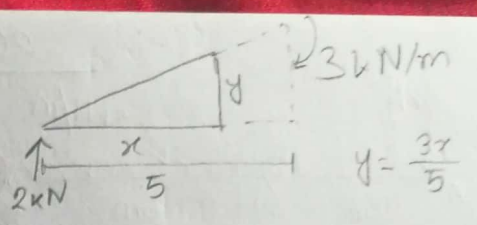
$$\sum F_y = 0$$

$$2 - \frac{1}{2} \times x \times y \Rightarrow \frac{1}{2} \times x \times \frac{3x}{5} = 2$$

$$\Rightarrow x = 2.58 \text{ m}$$

ATA BAKAT
PROOB

IP Inflection point \rightarrow



$$\sum M_x = 0$$

$$2x - \frac{1}{2} \times y \cdot \frac{x}{3} = 0$$

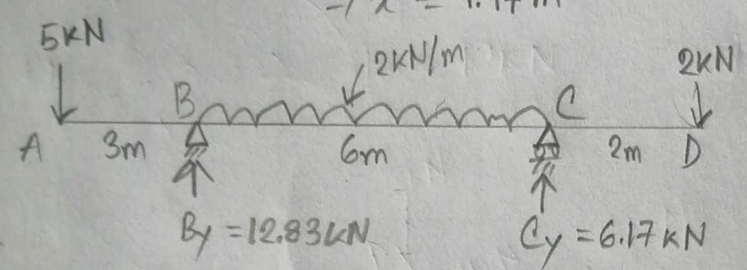
$$\Rightarrow 2x - \frac{1}{2} \times \frac{3x}{5} \cdot \frac{x}{3} = 0$$

$$\Rightarrow 2x - \frac{x^2}{10} = 0$$

$$\Rightarrow 2x = \frac{x^2}{10}$$

$$\Rightarrow 2 = \frac{x^2}{10} \Rightarrow x^2 = 20$$

$$\Rightarrow x = 4.47 \text{ m}$$



$$\sum M_B = 0$$

$$\Rightarrow 2 \times 8 + 2 \times 6 \times 3 - 5 \times 3 - C_y \times 6 = 0$$

$$\Rightarrow C_y = 6.17 \text{ kN}$$

$$\sum F_y = 0$$

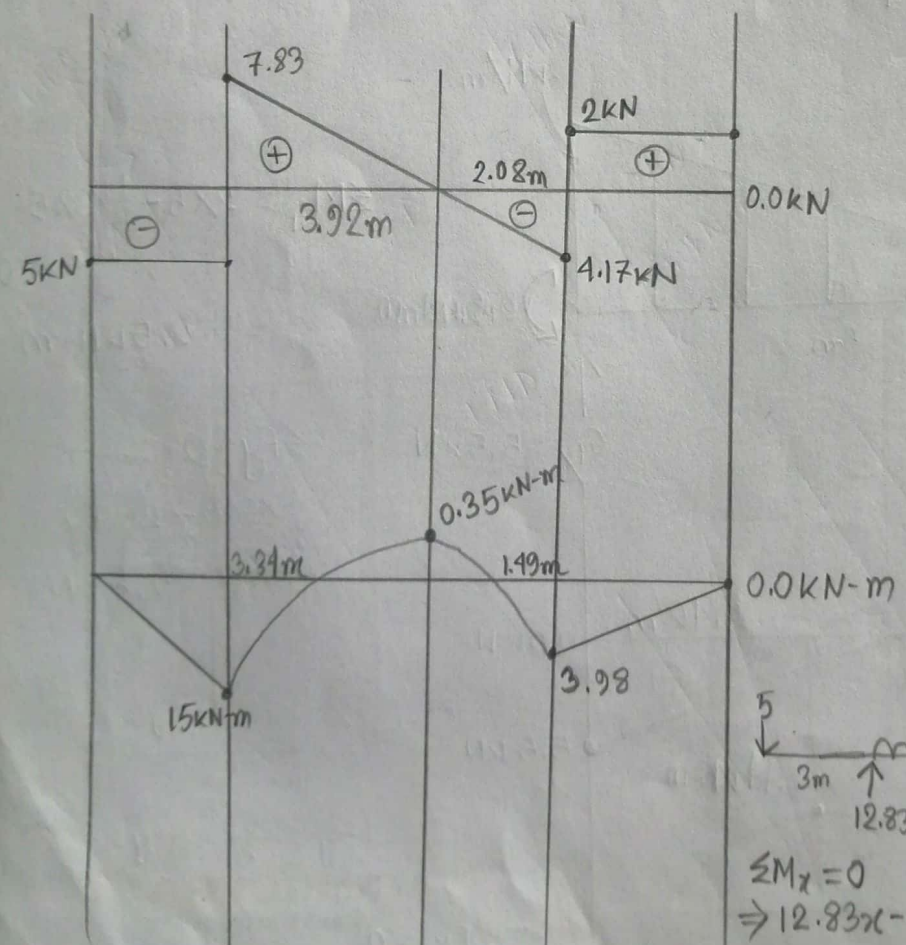
$$\Rightarrow 5 + 2 \times 6 + 2 - 6.17 - B_y = 0$$

$$\Rightarrow B_y = 12.83 \text{ kN}$$

$$\frac{x}{7.83} = \frac{6-x}{4.17}$$

$$\Rightarrow 4.17x = 46.98 - 7.83x$$

$$\Rightarrow x = 3.92 \text{ m}$$



$$\sum M_x = 0$$

$$\Rightarrow 12.83x - 5(3+x) - 2x \cdot \frac{x}{2} = 0$$

$$\Rightarrow x^2 - 7.83x + 15 = 0$$

$$\Rightarrow x = 3.34 \text{ m}$$

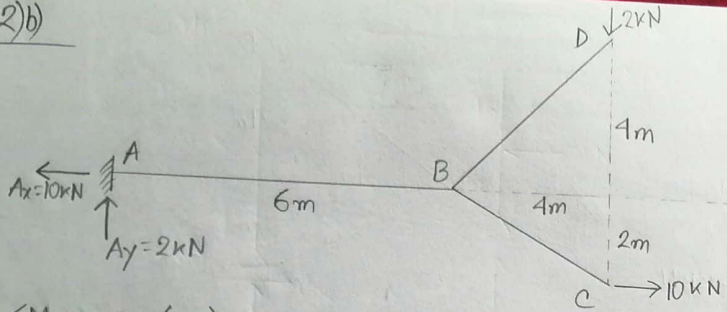
$$\sum M_x = 0$$

$$\Rightarrow 2x \cdot \frac{x}{2} - 6.17x + 2(2+x) = 0$$

$$\Rightarrow x^2 - 4.17x + 4 = 0$$

$$\Rightarrow x = 1.99$$

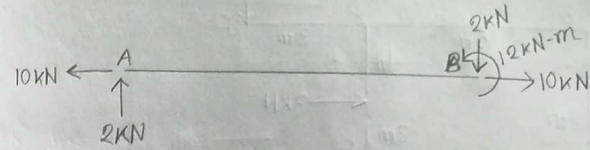
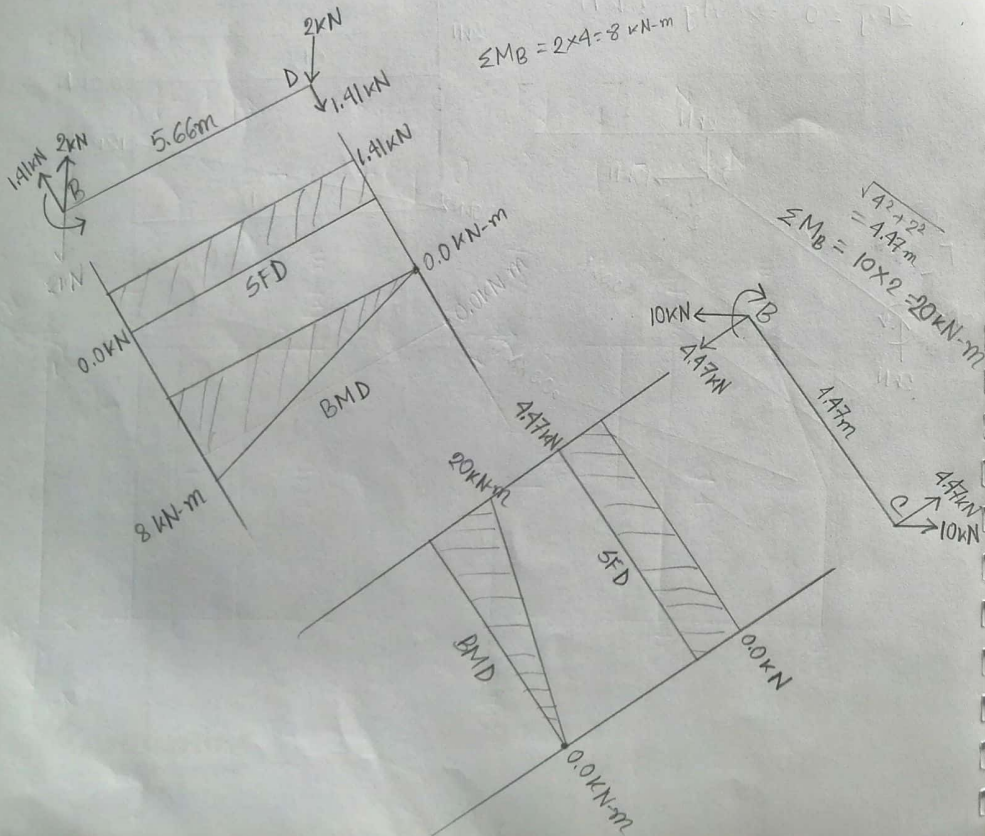
Q.2)b)



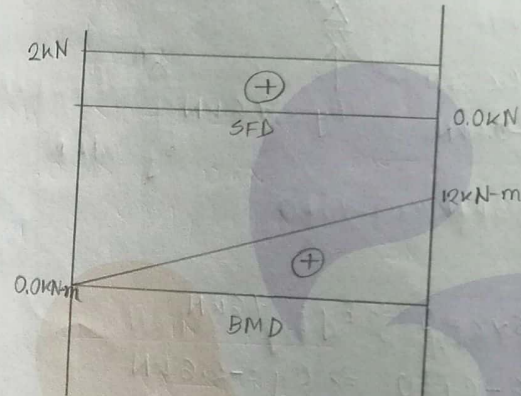
$$\sum M_A = 2 \times (6+4) - 10 \times 2 = 0$$

$$\sum F_x = 0 \Rightarrow Ax = 10 \text{ kN}, \quad \sum F_y = 0 \Rightarrow Ay = 2 \text{ kN}$$

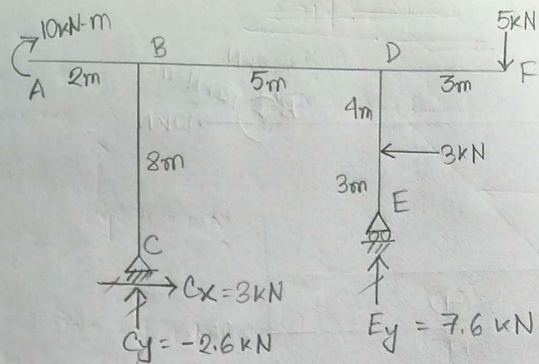
$$\sum M_B = 2 \times 4 = 8 \text{ kN-m}$$



$$+8 - 20 = -12$$



Q.3]

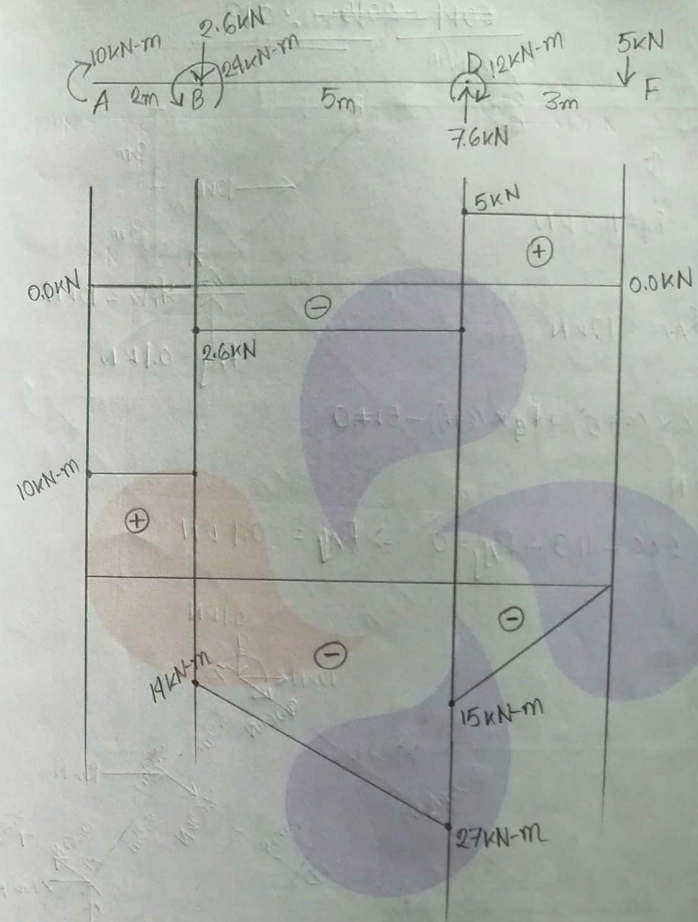
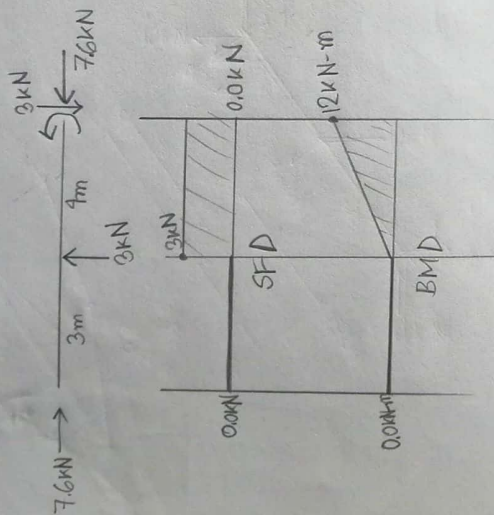
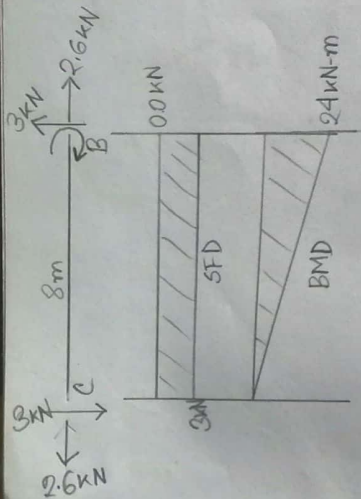


$$\sum F_x = 0 \Rightarrow C_x = 3 \text{ kN}$$

$$\sum M_c = 0$$

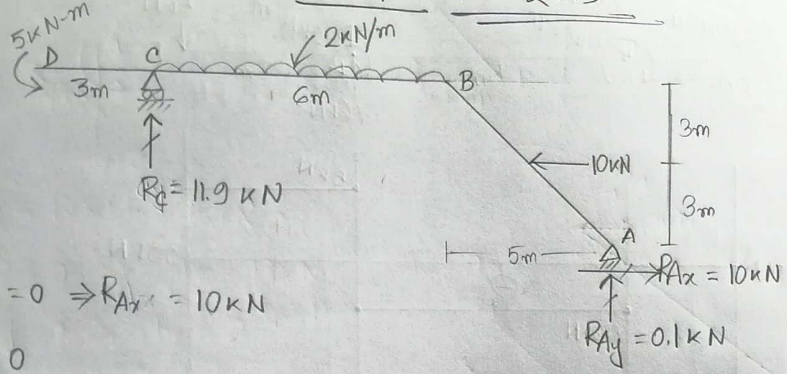
$$\Rightarrow 0 - 3 \times 4 - E_y \times 5 + 5 \times 8 = 0 \Rightarrow E_y = 7.6 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow 5 - 7.6 - C_y = 0 \Rightarrow C_y = -2.6 \text{ kN}$$



~~2014-2015~~ 2013

Q.3)



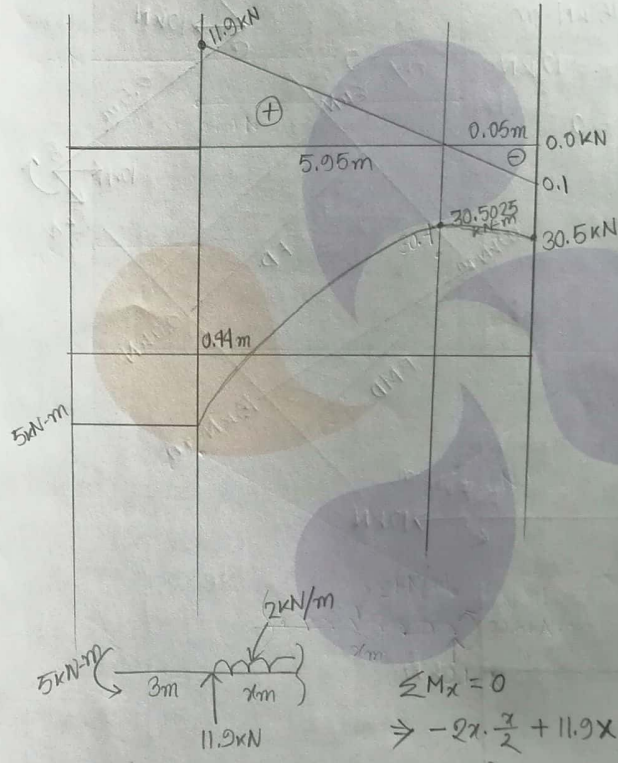
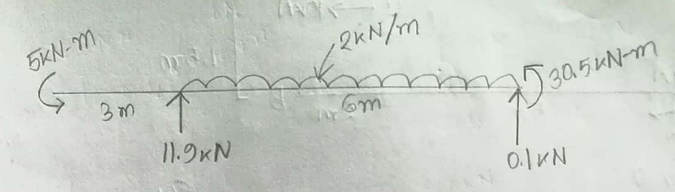
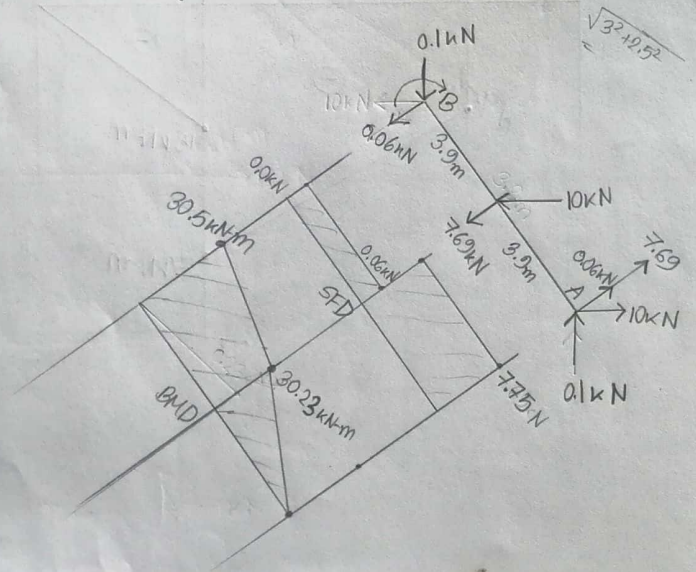
$$\sum F_x = 0 \Rightarrow R_{Ax} = 10 \text{ kN}$$

$$\sum M_A = 0$$

$$\Rightarrow -10 \times 3 - 2 \times 6 \times (3+5) + R_D \times (6+5) - 5 = 0$$

$$\Rightarrow R_D = 11.9 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow 2 \times 6 - 11.9 - R_{Ay} = 0 \Rightarrow R_{Ay} = 0.1 \text{ kN}$$



$$\frac{x}{11.9} = \frac{6-x}{0.1}$$

$$\Rightarrow 0.1x = 71.4 - 11.9x$$

$$\Rightarrow x = 5.95 \text{ m}$$

$$\sum M_x = 0$$

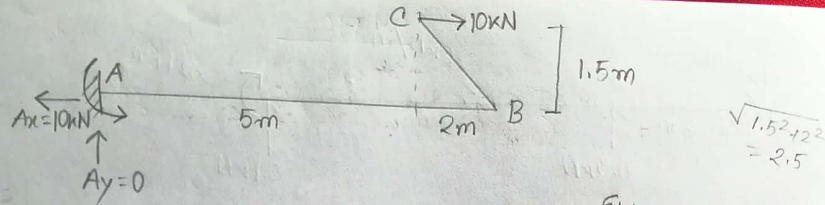
$$\Rightarrow -2x \cdot \frac{x}{2} + 11.9x - 5 = 0$$

$$\Rightarrow x^2 - 11.9x + 5 = 0$$

$$\Rightarrow x = 0.44 \text{ m}$$

MIRCERA
methoxy polyethylene glycol-epoxin beta

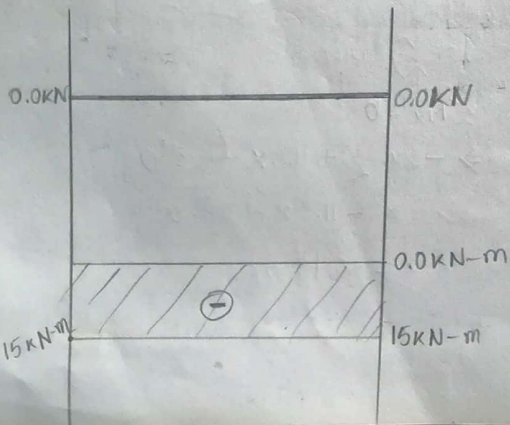
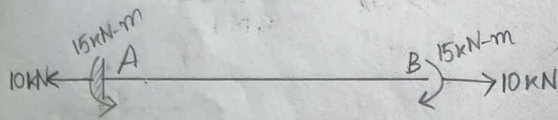
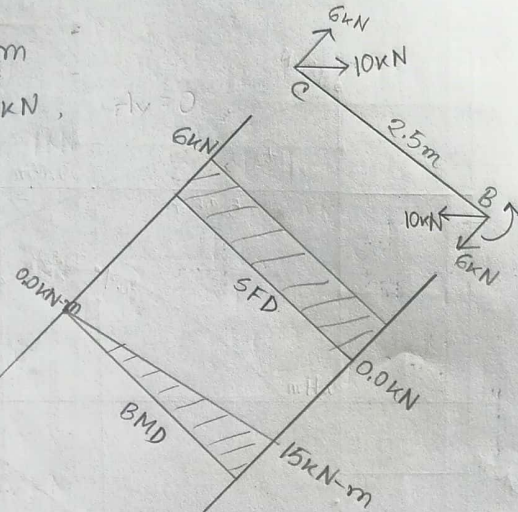
Q.4) b)



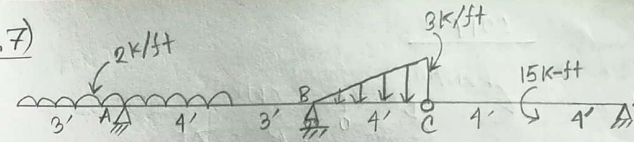
$$\sum M_A = 10 \times 1.5 = 15 \text{ kN-m}$$

$$\sum F_x = 0 \Rightarrow Ax = 10 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow Ay = 0$$



Q.7)



Considering CD

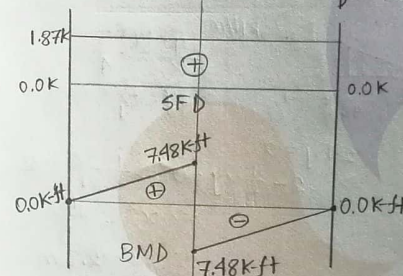
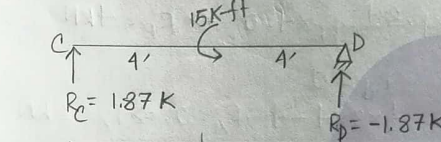
$$\sum M_C = 0$$

$$\sum F_y = 0$$

$$-15 - R_D \times 8 = 0$$

$$R_D = 1.87 \text{ k}$$

$$R_D = -1.87 \text{ k}$$



$$\sum M_A = 0$$

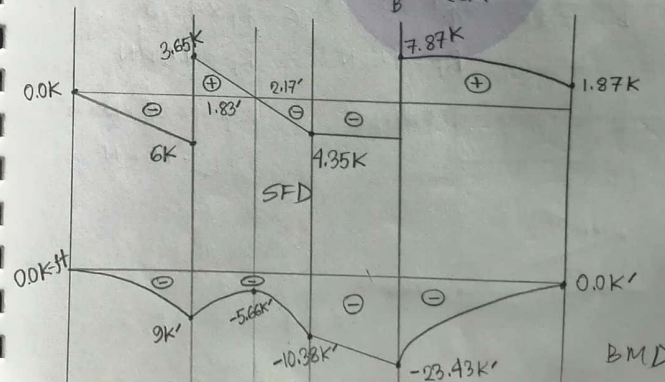
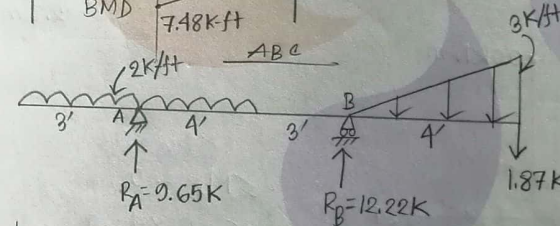
$$2 \times 4 \times 2 - 2 \times 3 \times 1.5 - R_B \times 7 + \frac{1}{2} \times 3 \times 4 \times \left(\frac{2 \times 4}{3} + 7 \right) + 1.87 \times 1 = 0$$

$$\Rightarrow R_B = 12.22 \text{ k}$$

$$\sum F_y = 0$$

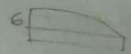
$$2 \times 7 + \frac{1}{2} \times 3 \times 4 + 1.87 - 12.22 - R_A = 0$$

$$\Rightarrow R_A = 9.65 \text{ k}$$



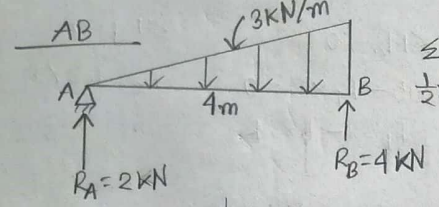
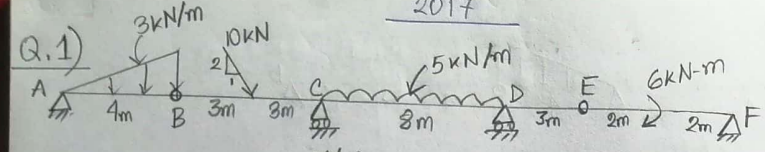
$$\frac{2}{3.65} = \frac{4-x}{4.35}$$

$$x = 1.83'$$



MIRCERA
methoxy polyethylene glycol-epoxin beta

2017

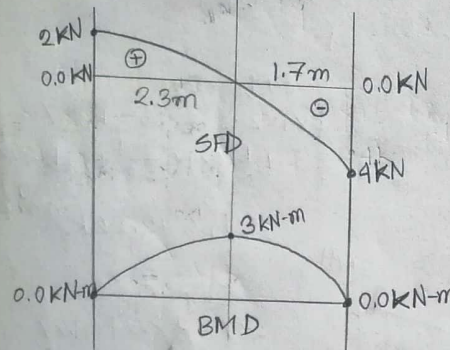


$$\sum M_A = 0$$

$$\frac{1}{2} \times 3 \times 4 \times \frac{2 \times 4}{3} - R_B \times 4 = 0 \Rightarrow R_B = 4\text{ kN}$$

$$\sum F_y = 0$$

$$\frac{1}{2} \times 3 \times 4 - 4 - R_A = 0 \Rightarrow R_A = 2\text{ kN}$$



Small diagram showing a triangular load on a segment of length 4m. The zero-crossing of the shear force is found at $x = 2.3\text{ m}$.

$$\frac{y}{x} = \frac{3}{4}$$

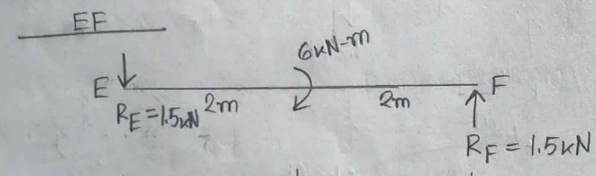
$$\Rightarrow y = \frac{3x}{4}$$

$$\sum F_y = 0$$

$$\Rightarrow 2 - \frac{1}{2} \times x \times y = 0 \Rightarrow \frac{1}{2} \times \frac{3x^2}{4} = 2$$

$$\Rightarrow x^2 = \frac{16}{3}$$

$$\Rightarrow x = 2.3\text{ m}$$



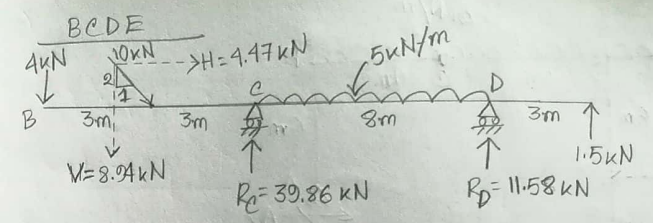
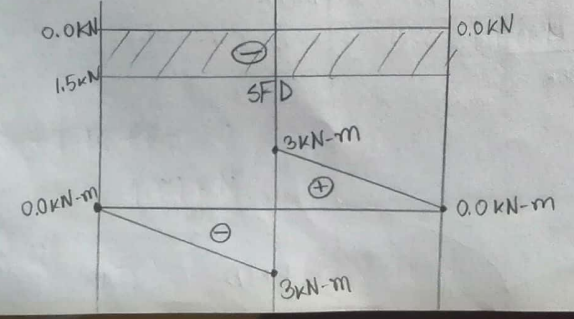
$$\sum M_E = 0$$

$$6 - R_F \times 4 = 0$$

$$R_F = 1.5\text{ kN}$$

$$\sum F_y = 0$$

$$R_E = 1.5\text{ kN}$$

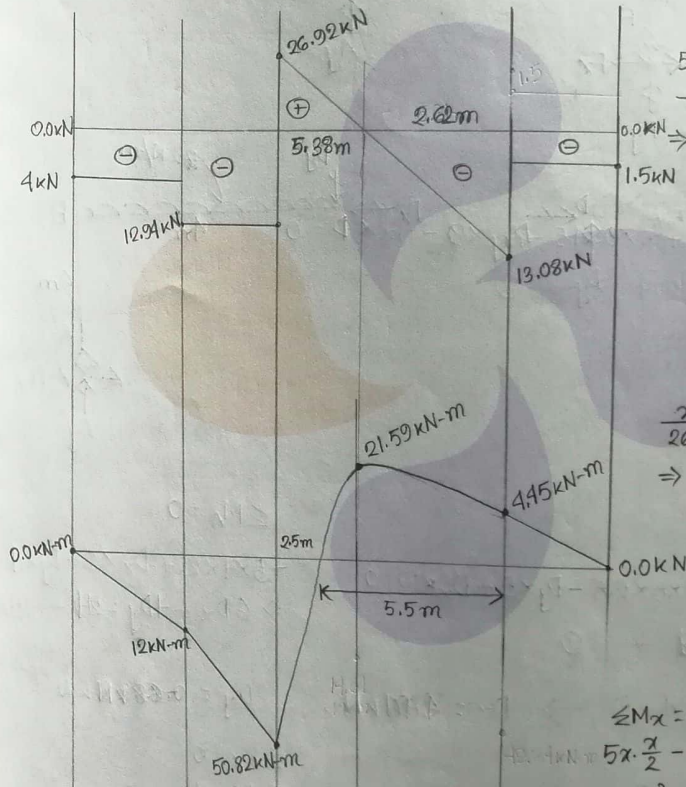


$$V = \frac{10}{\sqrt{5}} \times 2$$

$$= 8.94\text{ kN}$$

$$H = \frac{10}{\sqrt{5}} \times 1$$

$$= 4.47\text{ kN}$$



$$\sum M_C = 0$$

$$5 \times 8 \times 4 - R_D \times 8 - 1.5 \times 11$$

$$- 4 \times 6 - 8.94 \times 3 = 0$$

$$\Rightarrow R_D = 11.58\text{ kN}$$

$$\sum F_y = 0$$

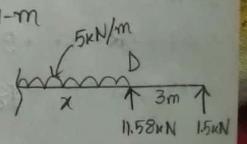
$$4 + 8.94 + 5 \times 8 - 1.5$$

$$- 11.58 - R_C = 0$$

$$\Rightarrow R_C = 39.86\text{ kN}$$

$$\frac{x}{26.92} = \frac{8-x}{13.08}$$

$$\Rightarrow x = 5.38\text{ m}$$



$$\sum M_x = 0$$

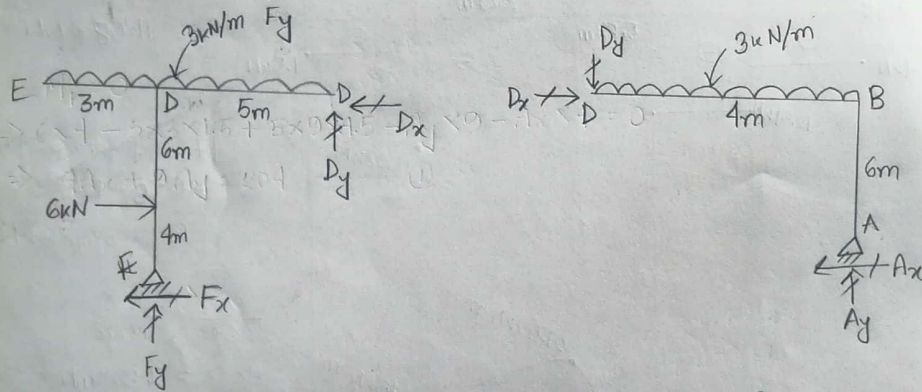
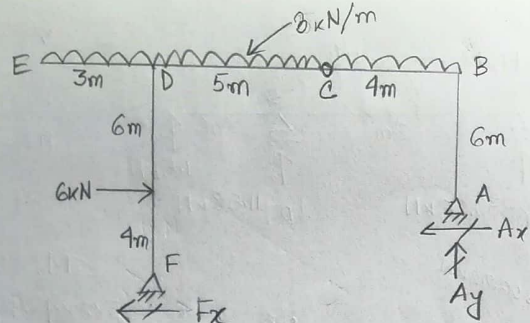
$$5 \times \frac{x}{2} - 11.58x - 1.5(3+x) = 0$$

$$\Rightarrow 2.5x^2 - 13.08x - 4.5 = 0$$

$$\Rightarrow x = 5.5\text{ m}$$

MIRCERA
methoxy polyethylene glycol-epoetin beta

Q.3)



$$\sum M_F = 0$$

$$6 \times 4 - 3 \times 3 \times 1.5 + 3 \times 5 \times 2.5 - D_y \times 5 - D_x \times 10 = 0$$

$$\Rightarrow 10D_x + 5D_y = 48 \quad \text{--- (1)}$$

Solving (1) and (2) $\Rightarrow D_x = 4.46 \text{ kN}, D_y = 0.68 \text{ kN}$

$$\sum F_x = 0$$

$$6 - 4.46 + F_x = 0$$

$$\Rightarrow F_x = 1.54 \text{ kN}$$

$$\sum F_y = 0$$

$$\Rightarrow 3 \times 8 - F_y + 0.68 = 0 \Rightarrow F_y = 23.32 \text{ kN}$$

$$\sum M_A = 0$$

$$-3 \times 4 \times 2 + D_x \times 6 - D_y \times 4 = 0$$

$$\Rightarrow 6D_x - 4D_y = 24 \quad \text{--- (2)}$$

$$\sum F_x = 0$$

$$4.46 - A_x = 0$$

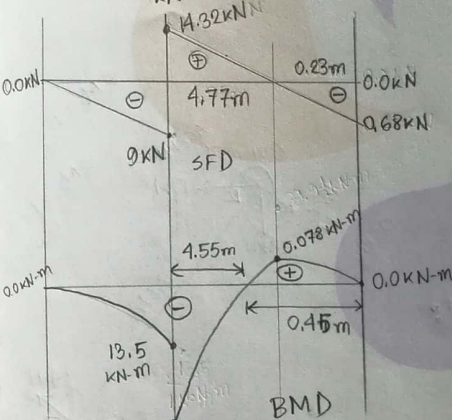
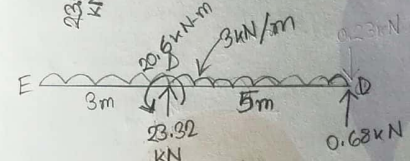
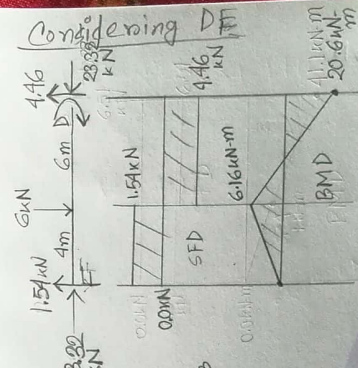
$$A_x = 4.46 \text{ kN}$$

$$\sum F_y = 0$$

$$3 \times 4 + 0.68 - A_y = 0$$

$$A_y = 12.68 \text{ kN}$$

Considering DE



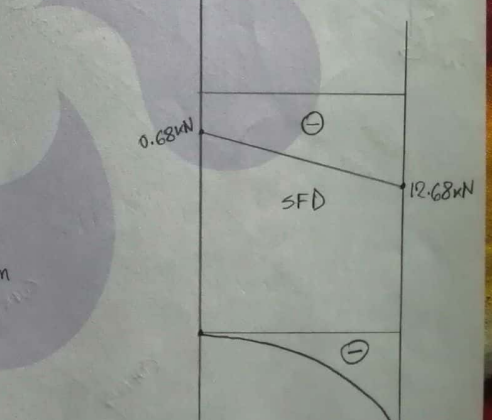
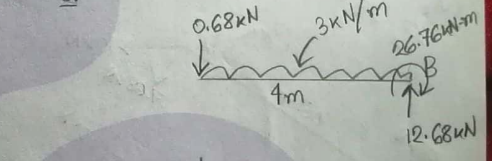
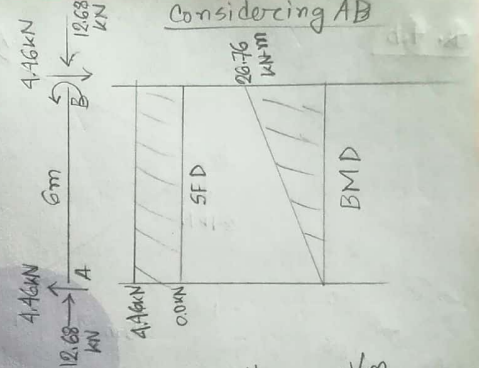
$$\frac{x}{14.32} = \frac{5-x}{0.68} \Rightarrow x = 4.77 \text{ m}$$

$$\sum M_x = 0$$

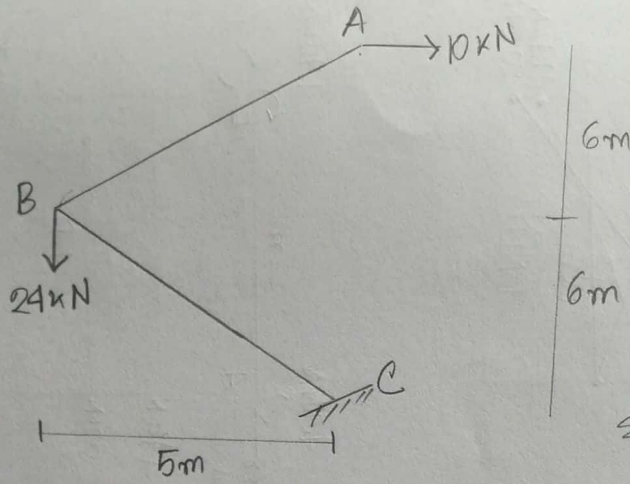
$$\Rightarrow 3 \times \frac{x}{2} - 0.68x = 0$$

$$\Rightarrow x = 0.45 \text{ m}$$

Considering AB



Q. 4)b)

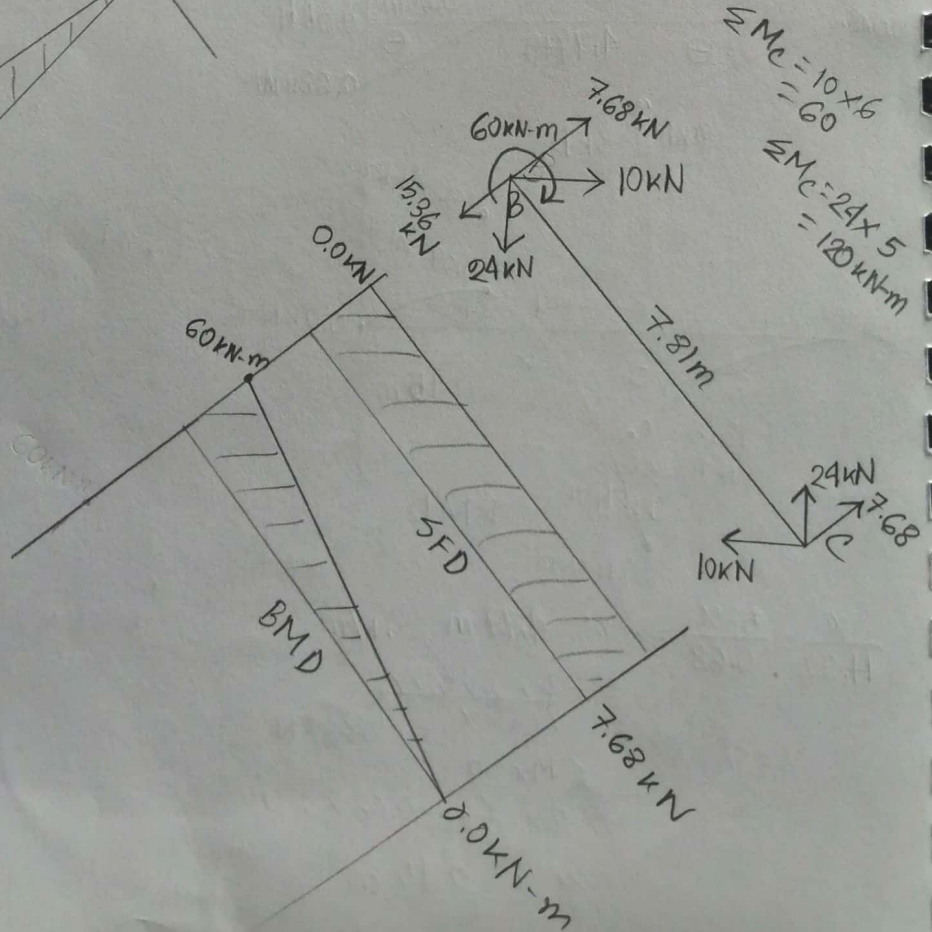
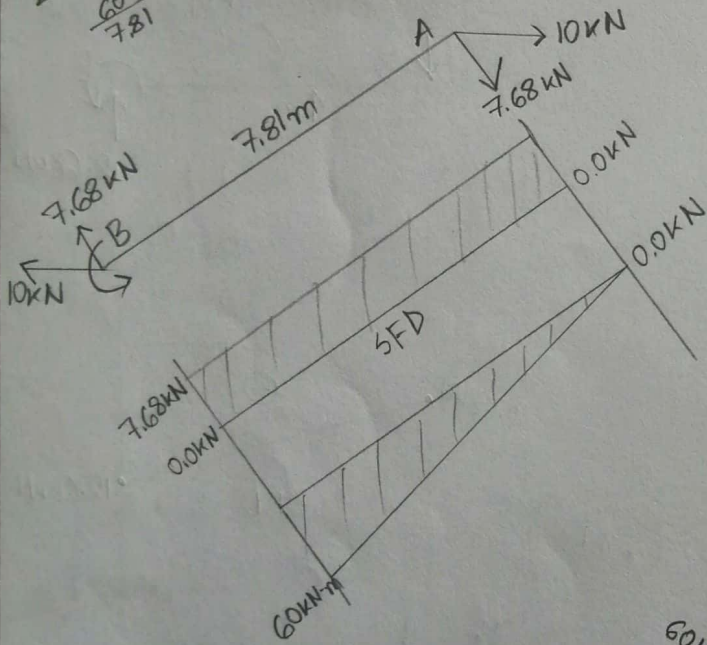


$$\sum M_C = 10 \times 12 - 24 \times 5$$

$$\sqrt{6^2 + 5^2} = 7.81$$

$$\sum M_B = 10 \times 6 = 60$$

$$\frac{60}{7.81} = 7.68$$



$$\sum M_C = 10 \times 6 = 60$$

$$\sum M_C = 24 \times 5 = 120 \text{ kN-m}$$