"MID EXAM"

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Subject # MOS(2)

Section # "C"

Submitted to #

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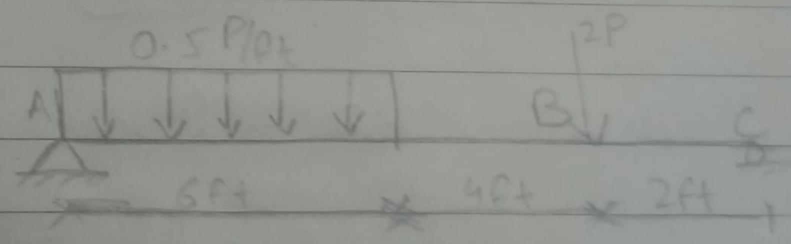
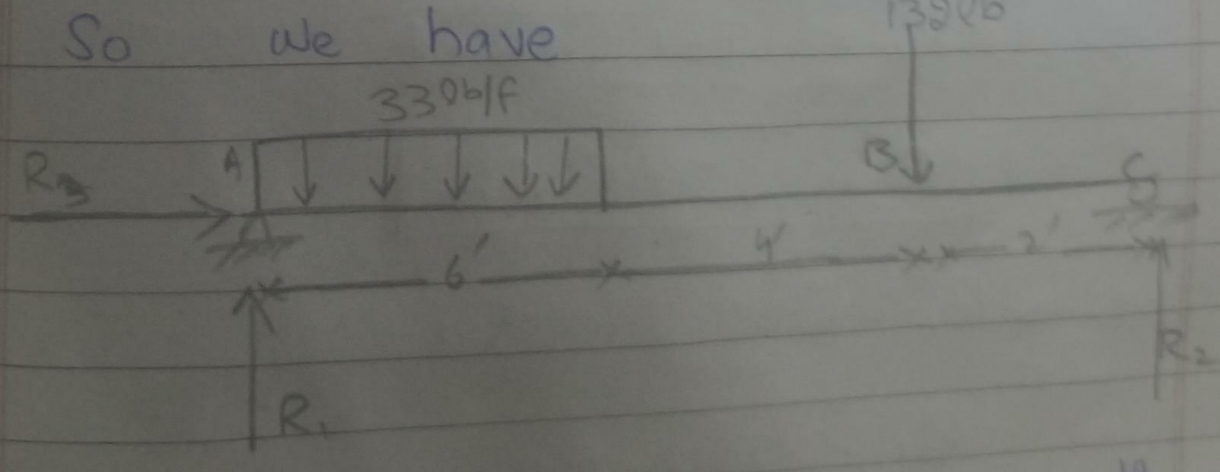
Qu Coustruct the Mohr's Circle diagram and find principal stress and maximum in plane shear stress for the stress state of a point C located at the centre of uniformly distributed load ________ in pounds.

Given Beam:-



Note Put the value of P=66

So we have



To find the unknown reaction at the support apply equilibrium equation

Date:
Day: M T W T F S S

$\Sigma f_x = 0$ i.e $R_3 = 0$

$\Sigma f_y = 0$ (+)↑ ↓(−)

$R_1 + R_2 = (33 \times 6)\,lb + 132\,lb$

$R_1 + R_2 = 198 + 132$

$\Rightarrow 330$

$R_1 + R_2 = 330$ —— (1)

Next $\Sigma M_A = 0$ (+↺ −)

$R_2 \times 12 - 10 \times 132 - (33 \times 6) \times 6/2 = 0$

$12R_2 = 1320 + (198) \times 3$

$= 1320 + 594$

$\Rightarrow 12R_2 = 1914\ lb.ft$

$\boxed{R_2 = 159.5\ lb}$

(1) $\Rightarrow R_1 + R_2 = 330$

$R_1 = 330 - R_2$

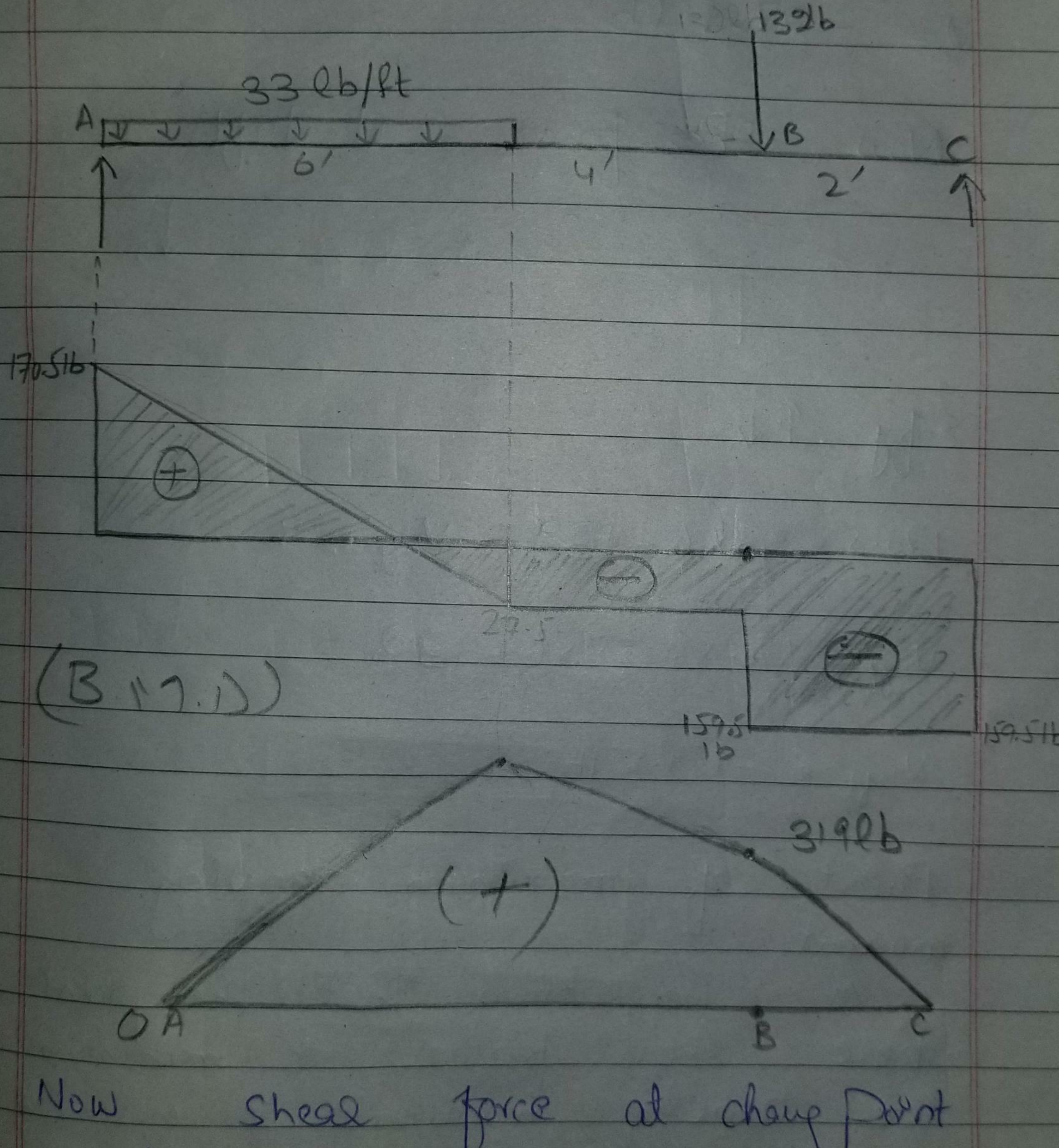
~~$R_1 = R_2 + 330$~~

$R_1 = 330 - 159.5$

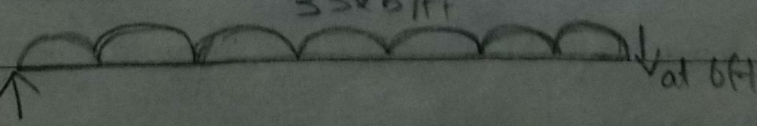
$\boxed{R_1 = 170.5\ lb}$

Now draw shear force and bending moment diagram

we have.



Now shear force at chang point of beam



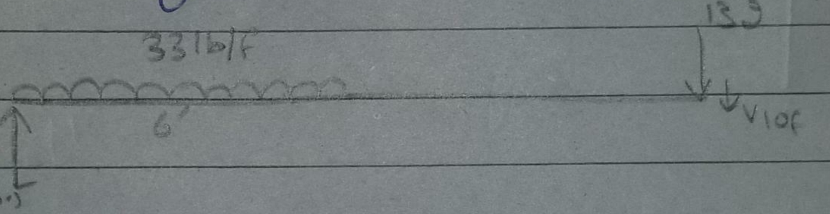
Shear stress at 6ft from left support

$\Sigma F_y = 0$ ↑+ ↓-

$170.5 - 33 \times 6 - V_{left} = 0$

$V_{left} = -27.5$ lb

Now shear force at 10ft



$\Sigma F_y =$ ↑+ ↓-

$170.5 - 33 \times 6 - 132 - V_{10ft} = 0$

$V_{10ft} = 170.5 - 33 \times 6 - 132$

$V_{10ft} = -159.5$ lb

Point of maximum bending moment

As we know that the point where shear forces is minimum the bending moment is maximum So from point of zero sheer corresponding point will have maximum bending movement.

Date:
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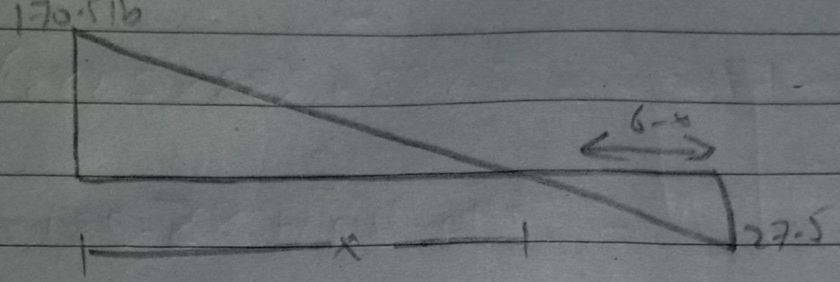
From shear force diagram on page (2) we have



We know that

$$\frac{170.5}{x} = \frac{27.5}{6-x}$$

$$(6-x)170.5 = 27.5x$$

$$511.5 - 170.5x = 27.5x$$

$$511.5 = 27.5x + 170.5x$$

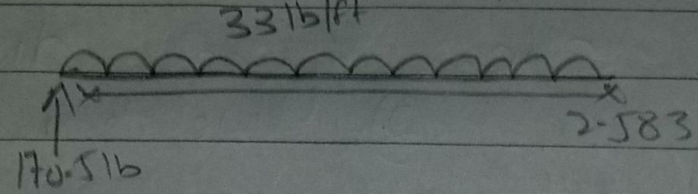
$$511.5 = 198x$$

$$198x = 511.5$$

$$x = \frac{511.5}{198}$$

$$\boxed{x = 2.583 \text{ ft}}$$

Now determine the value of Moment at 2.583



$$M_{2.583} - 170.5 \times 2.583 + (33 \times 2.583) \times \frac{2.583}{2} = 0$$

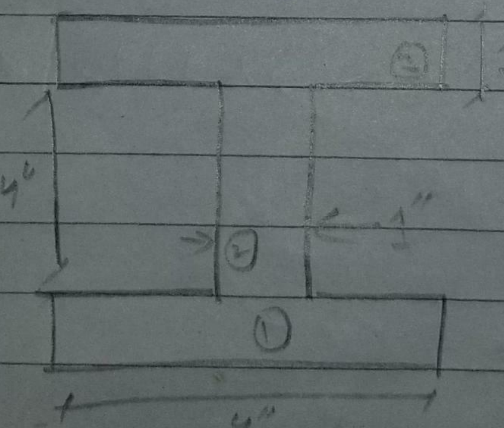
$$\Rightarrow M_{2.583\,ft} - 440.4015 + 85.239 \times 1.291 = 0$$

$$M_{2.583\,ft} = 550.445 \text{ lb-ft}$$

For shear stress we have

$$I = \frac{VQ}{Ib}$$

So first we determine moment of Inertia I for the given section of Beam



As the given figure symetrical along both the axis So

$$\bar{x} = 4/2 = 2\,in, \quad y = 6/2 = 3\,in$$

i.e $(\bar{x}, \bar{y}) = (2, 3)$ (Centre of gravity)

Pg-7

From extrem left and Bottom
Area of point ① = $4 \times 1 = 4 in^2$
Area of point ② = $4 \times 1 = 4 in^2$
Area of point ③ = $4 \times 1 = 4 in^2$

Moment of inertia about x-axis (Centrodiol) of I_{xx}

Determine distance between C-G of the whole section and the corresponding parts.

Let G_1, G_2, G_3 be the centre of gravity of point ① ② and ③ and K_1, K_2, K_3 be the distance between $\bar{y}$ and y_1, y_2, y_3 respectively

So

$K_1 = \bar{y} - y_1 = 3 - 0.5 = 2.5 in$

$K_2 = \bar{y} - y_2 = 3 - 3 = 0 in$

$K_3 = \bar{y} - y_3 = 3 - 0.5 = 2.5 in$

So $I_{xx} = \frac{b_1 h_1^3}{12} + a_1 K_1^2 + \frac{b_2 h_2^3}{12} + a_2 K_2 + \frac{b_3 h^3}{12}$

$+ a_3 K_3$

$I_{xx} = \frac{(4)(1)^3}{12} + 4(2.5)^2 + \frac{(1)(4)^2}{12} + 4_2(0) + \frac{4(1)}{12}$

$+ 4(2.5)^2$

+

$$I_{xx} = \frac{4}{12} + 25 + \frac{64}{12} + \frac{4}{12} + 25$$

$$\Rightarrow \frac{4 + 12(25) + 64 + 4 + 12(25)}{12}$$

$$\boxed{I_{xx} = 56 \text{ in}^4}$$

Now

$$I_{yy} = \frac{(4)^3(1)}{12} + \frac{(1)^3(4)}{12} + \frac{(4)^3(1)}{12}$$

$$= \frac{64}{12} + \frac{4}{12} + \frac{64}{12}$$

$$\bar{I}_{yy} = \frac{64 + 4 + 64}{12}$$

$$\boxed{I_{yy} = 11 \text{ in}^4}$$