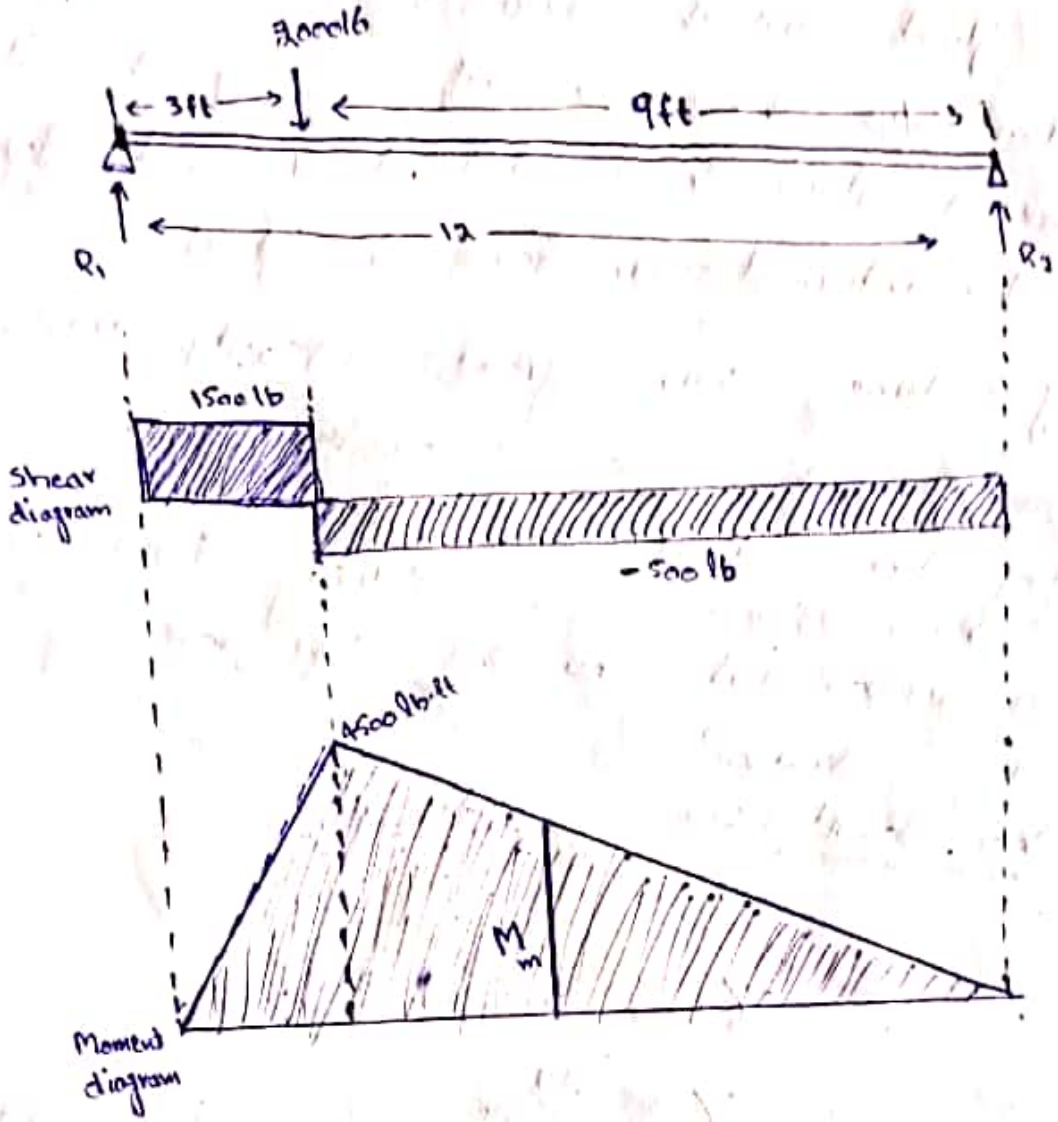
Q No #1 :->



$$\Sigma M R_2 = 0$$

$$12 R_1 = 9(2000)$$

$$R_1 = 1500 \text{ lb}$$

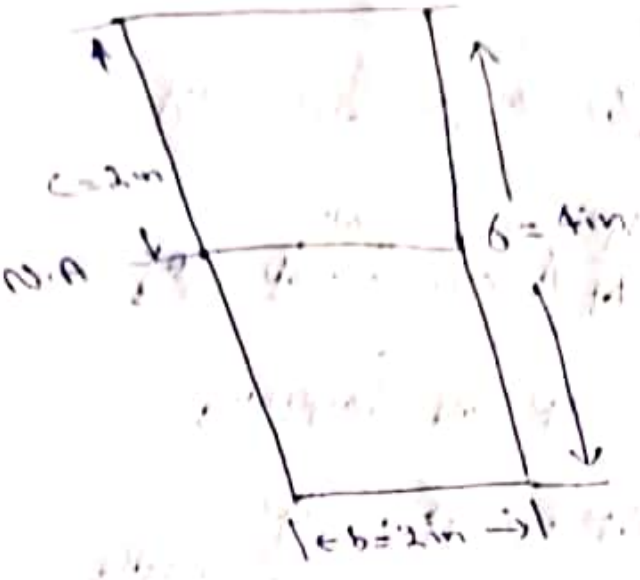
$$\Sigma M R_1 = 0$$

$$12 R_2 = 3(2000)$$

$$R_2 = 500 \text{ lb}$$

Maximum fiber stress.

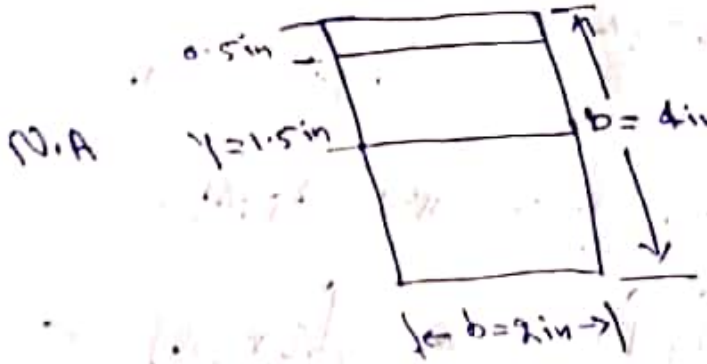
Maximum fiber Stress (2)



$$(fb)_{max} = \frac{Mc}{I} = \frac{4500(12)(2)}{\frac{2(4)^3}{12}}$$

$$\boxed{(Fb)_{max} = 10,125 \text{ psi}} \quad \text{Ans}$$

Stress in a fiber located 0.5 in from the top of the beam as laid span.



$$\frac{M_m}{6} = \frac{4500}{9}$$

$$M_m = 3000 \text{ lb.ft}$$

$$fb = My/I$$

$(P-I-O) \Rightarrow$

$$fb = \frac{M_1}{I}$$

$$F_b = \frac{3000\,(12)(1.5)}{3}$$

$$\frac{2(4)}{12}$$

$$fb = 5,062.5 \text{ psi}$$

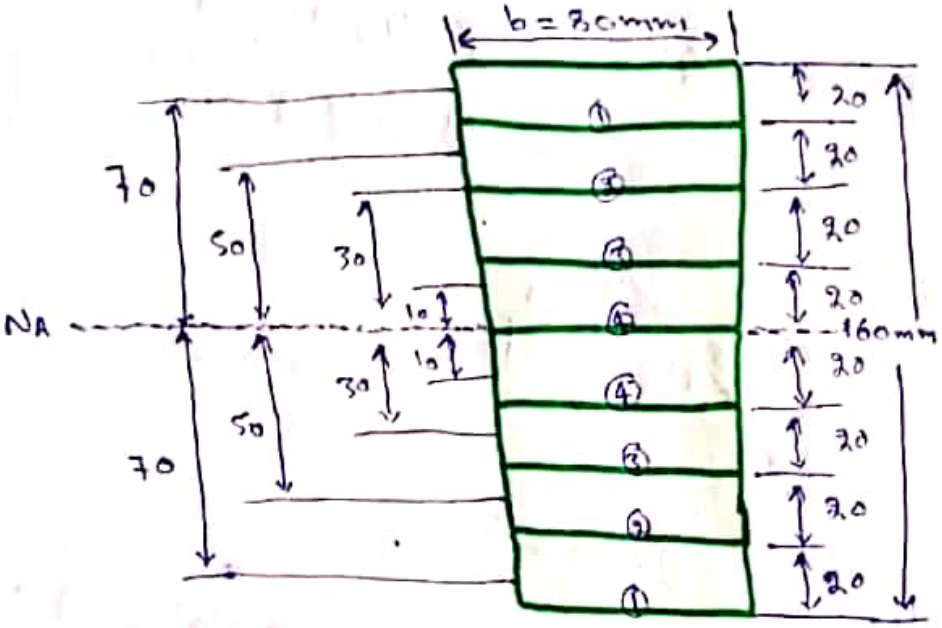
Q No #2 :→

$$I = \frac{bd^3}{12} = \frac{80(160^3)}{12}$$

$$I = 27.31$$

$$f_v = \frac{VQ}{Ib} = \frac{40(1000)Q}{(27.31 \times 10^6)(80)}$$

$$f_v = (18.31 \times 10^{-6})Q$$



⇒ 1 layer (20 mm from top and bottom layers).

$$Q_1 = 80(20)(70)$$

$$Q_1 = 112000\ mm^3$$

$$f_{v1} = (18.31 \times 10^{-6})(112000)$$

$$\boxed{f_{v1} = 2.0508\ MPa}$$ Ans

⇒ 2 layer (40mm from top and bottom layers).

$$Q_2 = Q_1 + 80(20)(50)$$

$$Q_2 = 112000 + 80000$$

(PT-0) ⇒

$Q_2 = 112000 + 80000$ (2)

$Q_2 \Rightarrow 192000\ mm^2$

$f_{v2} = (18.31 \times 10^{-6})(192000)$

$\boxed{f_{v2} = 3.5156\ MPa}$ Ans

$\Rightarrow$ 3 layers (60 from top and bottom layer)

$Q_3 = Q_2 + 80(20)(30)$

$Q_3 = 192000 + 48000$

$Q_3 = 240000\ mm^3$

$f_{v3} = (18.31 \times 10^{-6})(240000)$

$\boxed{f_{v3} = 4.3945\ MPa}$ Ans

4 layers :- (The Neutral Axis NA)

$Q_4 = Q_3 + 80(20)(10)$

$Q_4 = 240000 + 16000$

$Q_4 = 256000\ mm^3$

$f_{v4} = (f_v)_{max} = (18.31 \times 10^{-6})(256000)$

For rectangular section

$$(f_v)_{max} = \frac{3V}{2bd} = \frac{3(40)(1000)}{2(80)(160)}$$

$$(f_v)_{max} = 4.6875 \text{ MPa}$$