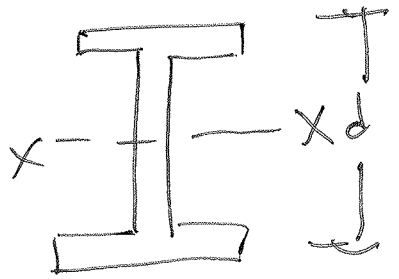
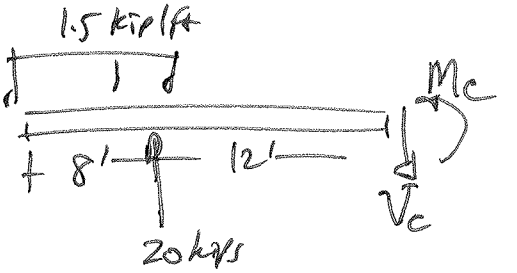
6.3-25

W 24 x 94 : From APPR D-1

$I_x = 2700$ in^4

$d = 24.31$ in





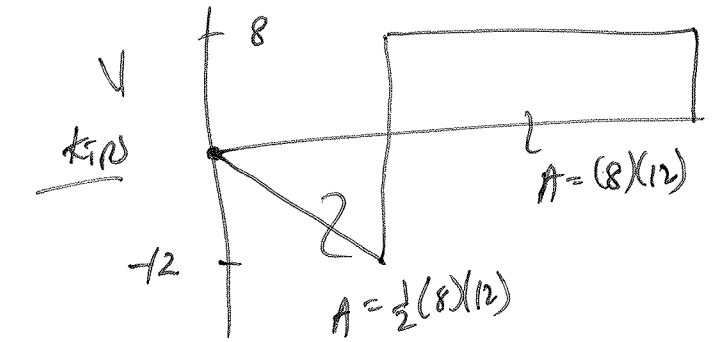
(a) Sketch V & M diagram:

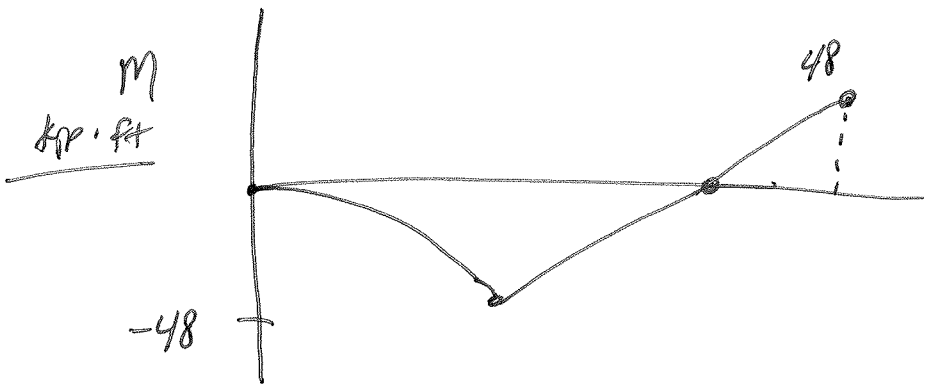
$\Sigma F_y \uparrow \quad -(1.5)(8) + 20 - V_c = 0$

$V_c = 8$ kips

$\circlearrowleft \Sigma M_c \quad M_c + (1.5)(8)(16) - 20(12) = 0$ $\quad M_c = 48$ kip·ft

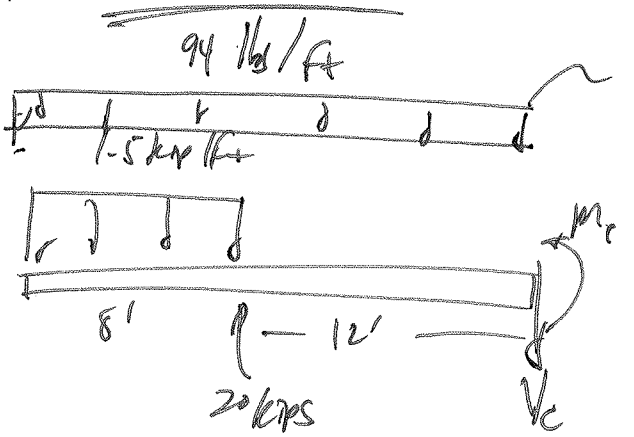
V & M neglecting weight:





V & M with weight

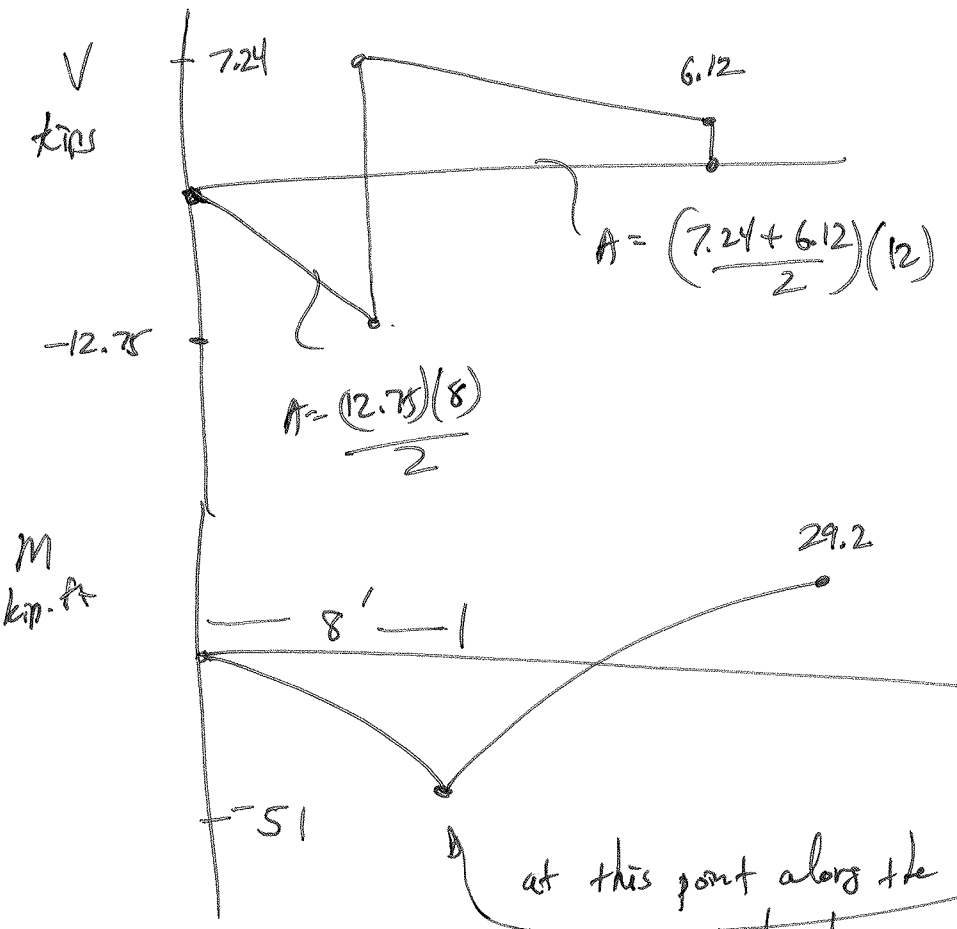
(b)



$\circlearrowleft \sum M_c$ $\quad M_c + (1.5)(8)(16) - 20(12) + (0.094)(20)(10) = 0$

$M_c = 29.2$ kip·ft

$\sum F_y \uparrow$ $\quad -(1.5)(8) + 20 - V_c - (0.094)(20) = 0$ $\quad V_c = 6.12$ kips

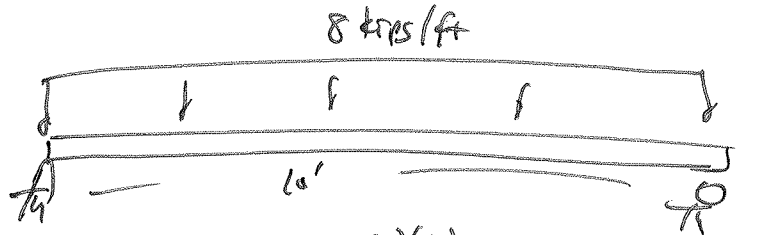


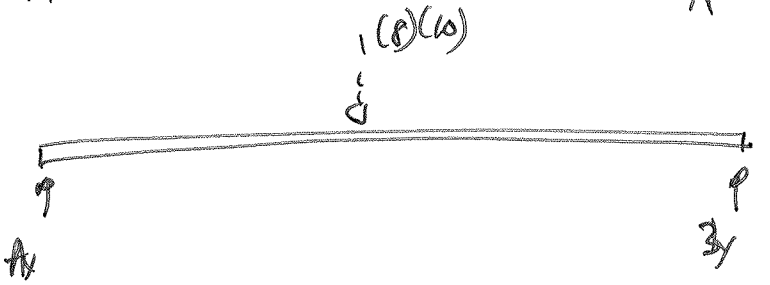
$$|\sigma_{max}| = \frac{|M_{max}|\,|y_{max}|}{I}$$

$$= \frac{(51 \times 10^3)(12)\,\frac{24.3}{2}}{2700}$$

$$= 2.76 \text{ ksi}$$

6.4-1



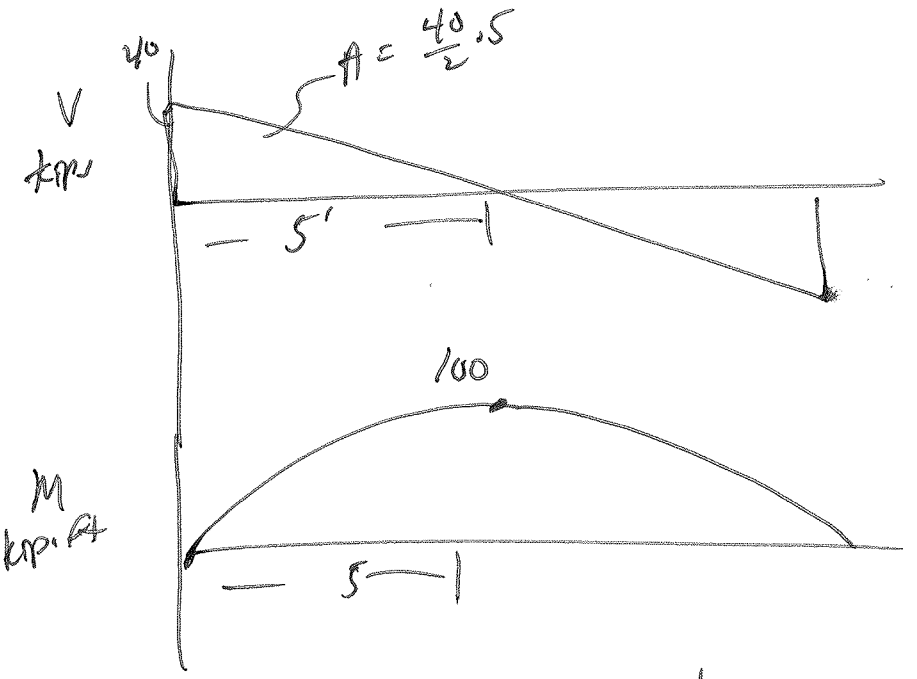


ΣF_y ↑ :

$A_y + B_y - 80 = 0$

$\circlearrowleft \Sigma M_A$ $\quad B_y(10) - (8)(10)(5) = 0$

$A_y = B_y = 40$ kips



$$S_{design} = \frac{M_{max}}{\sigma_{max}}$$

$$= \frac{(100)(12^3)(12)}{20 \times 10^3}$$

$$S_{design} = 60\ in^3$$

Any beam from D.1 that has $S_x \geq 60\ in^3$ will work.

The lightest is W16×40.