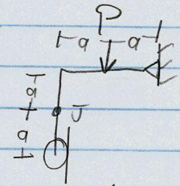
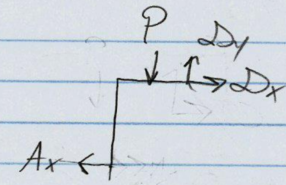
7.21

a)

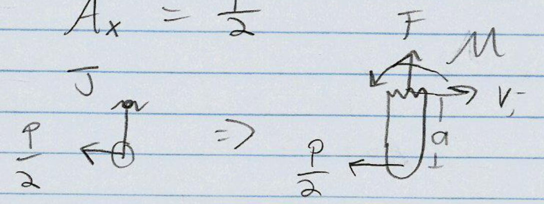


FBD



$$\Sigma M_D \circlearrowleft^{+} = 0 = aP - 2a\,A_x$$

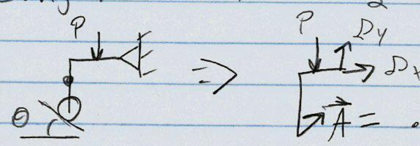
$$A_x = \frac{P}{2}$$



$$\boxed{\begin{aligned} F &= 0 \\ V &= \frac{P}{2} \\ M &= \frac{Pa}{2} \end{aligned}}$$

$$\Sigma F_x = 0 = V - \frac{P}{2}$$
$$\Sigma F_y = 0 = F$$
$$\Sigma M_J \circlearrowleft^{+} = 0 = M - \frac{P}{2} \cdot a$$

b)

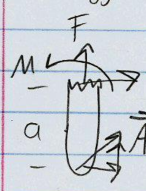


$$\vec{A} = .6A\vec{i} + .8A\vec{j}$$

$$\theta = \arctan\frac{3}{4} = 36.9^\circ \qquad A_x = \sin\theta A \qquad A_y = \cos\theta A$$

$$\Sigma M_D \circlearrowleft^{+} = 0 = Pa + 2a(.6A) - 2a(.8A)$$

$$A = 2.5P$$

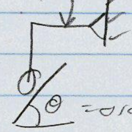
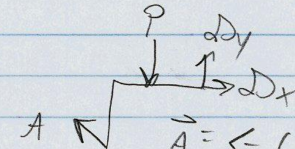


$$\vec{A} = \langle 1.5P, 2P, 0 \rangle$$

$$\boxed{\begin{aligned} F &= -2P \\ V &= -1.5P \\ M &= -1.5Pa \end{aligned}}$$

$$\Sigma F_x = 0 = V + 1.5P$$
$$\Sigma F_y = 0 = F + 2P$$
$$\Sigma M_J \circlearrowleft^{+} = 0 = M + 1.5Pa$$

7.21

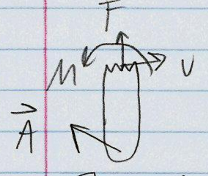
c)  $\Rightarrow$ FBD 

$\theta = \arctan\frac{3}{4} = 36.9$

$\vec{A} = \langle -.6A, .8A, 0\rangle$

$\Sigma M_D \circlearrowleft^{+} = 0 = Pa - 2a(.6A) - 2a(.8A)$

$A = \dfrac{P}{2.8}$



$\Sigma F_x = 0 = V - \frac{.6}{2.8}A$

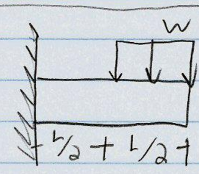
$\Sigma F_y = 0 = F + \frac{.8}{2.8}A$

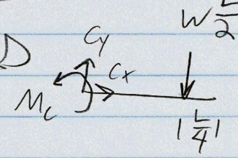
$\Sigma M_J \circlearrowleft^{+} = 0 = -\dfrac{.6}{2.8}Aa + M$

$F = \frac{-2}{7}A$

$V = \frac{3}{14}A$

$M = \dfrac{3a}{14}A$

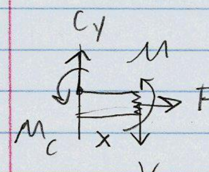
7.32 

$\Rightarrow$ FBD 

$\Sigma F_x = 0 = C_x$ $\quad \therefore C_x = 0$

$\Sigma F_y = 0 = C_y - w\frac{L}{2}$ $\quad \therefore C_y = \frac{wL}{2}$

$\Sigma M_C \circlearrowleft^{+} = 0 = M_c - \left(\dfrac{3}{4}L\right)\left(\dfrac{wL}{2}\right)$ $\quad \therefore M_c = \dfrac{3}{8}L^2 w$



$F = 0$

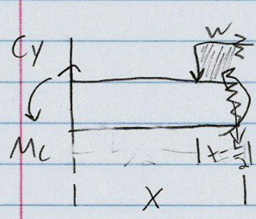
$V = C_y = \frac{wL}{2}$

$\Sigma M_{cut} \circlearrowleft^{+} = 0 = M + M_c - C_y x$

$M(x) = C_y x - M_c$

$= \dfrac{wL}{2}x - \dfrac{3}{8}L^2 w$

$M(x) = \frac{wL}{2}\left(x - \frac{3}{4}L\right)$



$\Sigma F_y = 0 = C_y - V - w\left(x - \frac{L}{2}\right)$

$V = C_y - w\left(x - L/2\right)$

$\Sigma M_{cut} \circlearrowleft^{+} = 0 = M(x) = -xC_y + \left(\frac{x}{2} - \frac{L}{4}\right)w\left(x - \frac{L}{2}\right) + M_c$

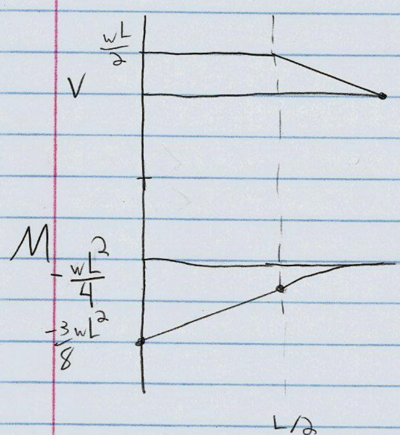
$x^2 - Lx + \frac{L^2}{4}$ 7.32 (cont.)

$w\frac{1}{2}\left(x-\frac{L}{2}\right)\left(x-\frac{L}{2}\right)$

$M(x) = -\frac{wL}{2}x + \frac{w}{2 \cdot 2}\left(x^2 - Lx + \frac{L^2}{4}\right) + \frac{3}{8}L^2 w$

$= \frac{w}{2}\left[-Lx + x^2 - Lx + \frac{L^2}{4} + \frac{3}{4}L^2\right]$

$M(x) = \frac{w}{2}\left(x^2 - 2Lx + L^2\right)$



$V_1 = \frac{wL}{2}$

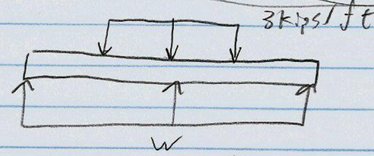
$M_1 = \frac{wL}{2}\left(x - \frac{3}{4}L\right)$

$V_2 = \frac{wL}{2} - w\left(x - \frac{L}{2}\right)$

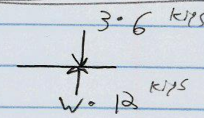
$M_2 = \frac{w}{2}\left(x^2 - 2Lx + L^2\right)$

$\boxed{V_{max} = \frac{wL}{2} \qquad M_{max} = -\frac{3}{8}wL^2}$

7.46

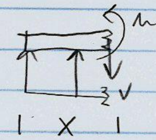


$\Rightarrow$



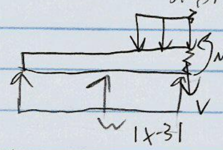
$\Sigma F_y = 0 = 12w - 18$

$w = 1.5 \frac{kips}{ft}$



$\Sigma F_y = 0 = wx - V, \quad V = 1.5x$

$\Sigma M_{cut} = 0 = M - \frac{x}{2}wx \;; \quad M = \frac{x^2 w}{2}$



$\Sigma F_y = 0 = wx - 3(x-3) - V$

$V = 1.5x - 3(x-3)$

$\Sigma M_{cut} = 0 = -\frac{wx^2}{2} + 3(x-3)\left(\frac{x-3}{2}\right) + M$

$w = 1.5$

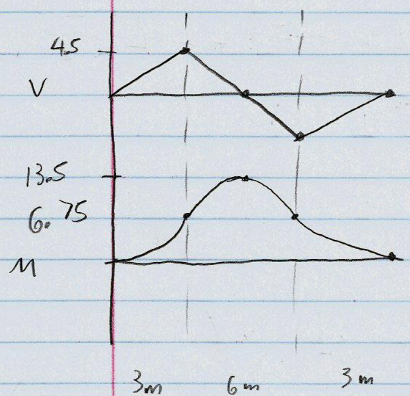
$V_1 = 1.5x \qquad V_2 = 1.5x - 3(x-3) = 1.5x - 3x + 9 = -1.5x + 9$

$M_1 = \frac{wx^2}{2} = .75x^2 \quad M_2 = \frac{wx^2}{2} - \frac{3}{2}(x-3)^2 = .75x^2 - 1.5x^2 + 9x - 13.5$

$x^2 - 6x + 9$

$V_1 = 1.5x \qquad V_2 = -1.5x + 9$

$M_1 = .75x^2 \qquad M_2 = -.75x^2 + 9x - 13.5$



kips

kips-ft

By inspection $9 < x < 12$ is symetric to $0 < x < 3$

$$\boxed{\begin{array}{l} V_{max} = 4.5 \text{ kips} \\ M_{max} = 13.5 \text{ kips-ft} \end{array}}$$