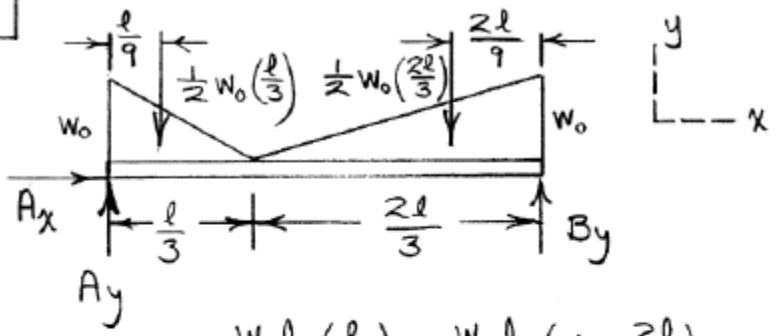
E36 Spring 2005
Homework 9 Solutions
5/98,108,114,124,134

5/98



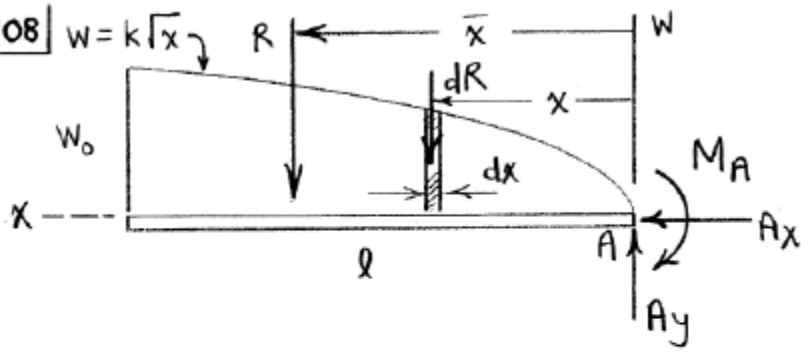
$\curvearrowright + \Sigma M_A = 0 : -\frac{w_0 l}{6}\left(\frac{l}{9}\right) - \frac{w_0 l}{3}\left(l - \frac{2l}{9}\right) + B_y l = 0$, $\underline{B_y = \frac{5}{18} w_0 l}$

$\Sigma F_y = 0 : \quad A_y + \frac{5}{18} w_0 l - \frac{w_0 l}{6} - \frac{w_0 l}{3} = 0$

$\underline{A_y = \frac{2}{9} w_0 l}$

$\Sigma F_x = 0 \Rightarrow \underline{A_x = 0}$

5/108 $w = k\sqrt{x}$



$w = k\sqrt{x}$ @ left end : $w_0 = k\sqrt{\ell}$, $k = \frac{w_0}{\sqrt{\ell}}$

So $w = \frac{w_0}{\sqrt{\ell}}\sqrt{x}$

$$R = \int dR = \int w\,dx = \int_0^\ell \frac{w_0}{\sqrt{\ell}}\sqrt{x}\,dx = \frac{2}{3}w_0\ell$$

$$\bar{x} = \frac{\int x\,w\,dx}{\int w\,dx} = \frac{\int_0^\ell x\,\frac{w}{\sqrt{\ell}}\sqrt{x}\,dx}{\frac{2}{3}w_0\ell} = \frac{3}{5}\ell$$

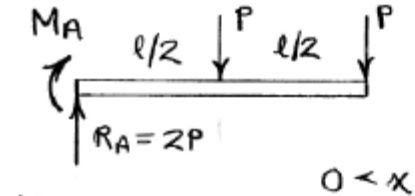
$+\uparrow \Sigma F = 0$: $A_y - \frac{2}{3}w_0\ell = 0$, $\underline{A_y = \frac{2}{3}w_0\ell}$

$\curvearrowleft + \Sigma M_A = 0$: $\frac{2}{3}w_0\ell\left(\frac{3}{5}\ell\right) - M_A = 0$

$\underline{M_A = \frac{2}{5}w_0\ell^2 \quad CW}$

$\rightarrow + \Sigma F = 0 \Rightarrow$ $\underline{A_x = 0}$

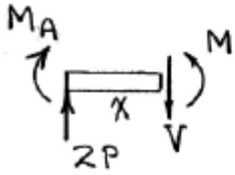
5/114



$\circlearrowleft + \Sigma M_A = 0: \quad M_A + P\frac{l}{2} + Pl = 0$

$M_A = -\frac{3}{2}Pl$

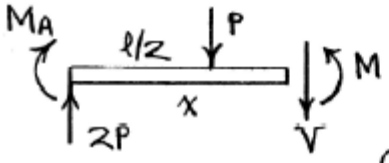
$0 < x < l/2:$



$+\uparrow \Sigma F = 0 \Rightarrow V = 2P$

$\circlearrowleft + \Sigma M_A = 0: \quad \frac{3}{2}Pl + M - 2Px = 0$

$M = 2Px - \frac{3}{2}Pl$

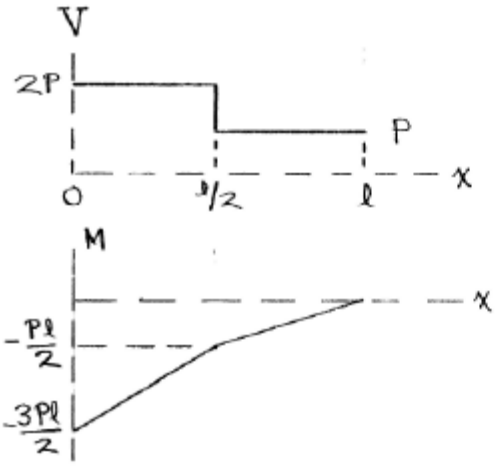


$\frac{l}{2} < x < l:$

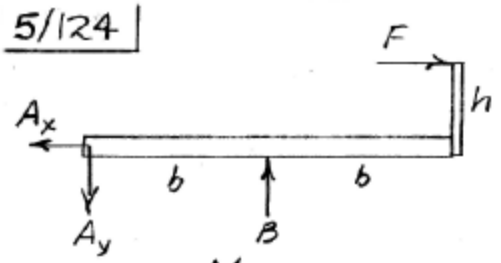
$+\uparrow \Sigma F = 0: \quad 2P - P - V = 0, \quad V = P$

$\circlearrowleft + \Sigma M_A = 0: \quad \frac{3}{2}Pl - P\frac{l}{2} - Px + M = 0$

$M = -P(l - x)$



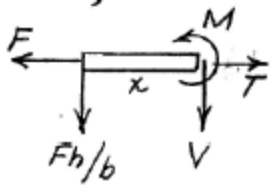
5/124



$\Sigma M_A = 0;\ Fh - Bb = 0$

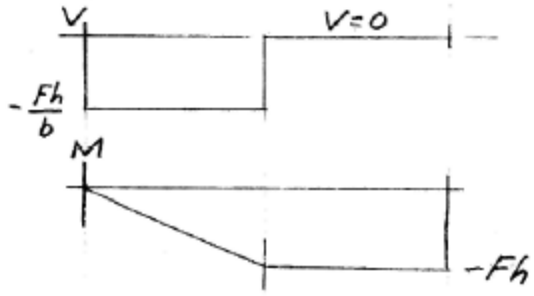
$B = Fh/b$

$\Sigma F_y = 0;\ A_y = B = Fh/b$

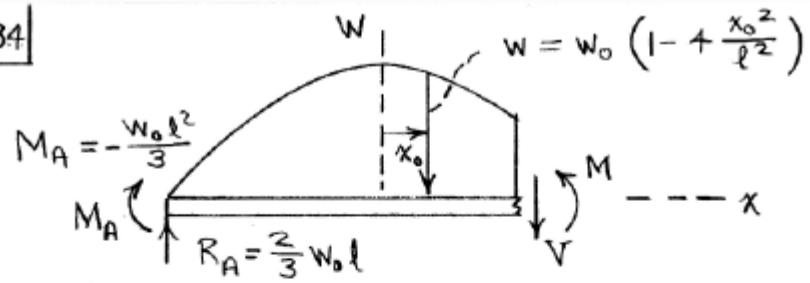


$\Sigma F_y = 0;\ V = -Fh/b$

$\Sigma M = 0;\ M + \frac{Fh}{b}x = 0,\ M = -\frac{Fh}{b}x$



5/134



(R_A and M_A from Prob. 5/104)

$+\uparrow \Sigma F = 0:\ \frac{2}{3}w_0 l - \int_{-l/2}^{x} w_0\left(1 - 4\frac{x_0^2}{l^2}\right)dx_0 - V = 0$

$$V = w_0\left(\frac{l}{3} - x + \frac{4x^3}{3l^2}\right)$$

$\zeta + \Sigma M = 0:\ M + \int_{-l/2}^{x} w_0\left(1 - 4\frac{x_0^2}{l^2}\right)(x - x_0)\,dx_0$

$+ \frac{w_0 l^2}{3} - \frac{2}{3}w_0 l\left(\frac{l}{2} + x\right) = 0,\ M = w_0\left(-\frac{l^2}{16} + \frac{xl}{3} - \frac{x^2}{2} + \frac{x^4}{3l^2}\right)$