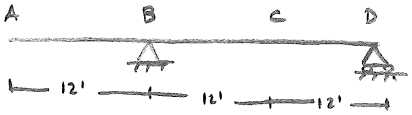
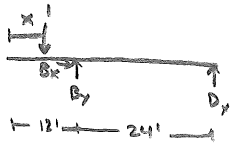
Homework 4: Problem 1

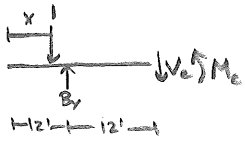


a)



$\circlearrowleft \Sigma M_B = 0$: $D_y(24) + 1(12 - x) = 0 \Rightarrow \boxed{D_y = -\frac{1}{2} + \frac{x}{24}}$

$+\uparrow \Sigma F_y = 0$: $B_y + D_y - 1 = 0 \Rightarrow \boxed{B_y = \frac{3}{2} - \frac{x}{24}}$



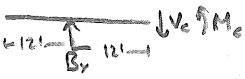
$0 \le x < 24$

$+\uparrow \Sigma F_y = 0$: $B_y - 1 - V_c = 0 \Rightarrow$

$\circlearrowleft \Sigma M_c = 0$: $M_c - B_y(12) + 1(24 - x) = 0 \Rightarrow$

$\boxed{V_c = \frac{1}{2} - \frac{x}{24}}$

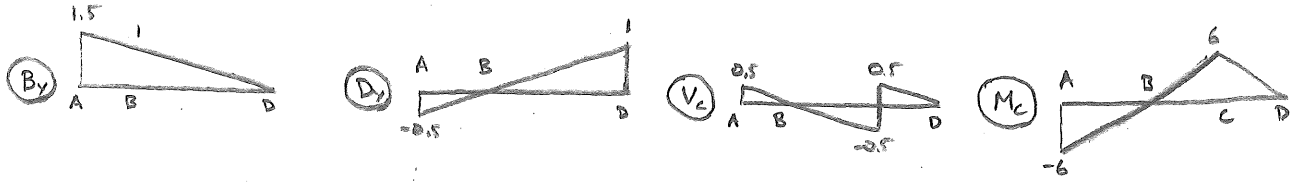
$\boxed{M_c = -6 + \frac{x}{2}}$ $\quad 0 \le x \le 24$



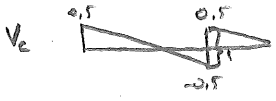
$24 \le x < 36$

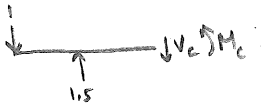
$+\uparrow \Sigma F_y = 0$: $B_y - V_c = 0 \Rightarrow \boxed{V_c = \frac{3}{2} - \frac{x}{24}}$

$\circlearrowleft \Sigma M_c = 0$: $M_c - B_y(12) = 0 \Rightarrow \boxed{M_c = 18 - \frac{x}{2}}$ $\quad 24 \le x < 36$



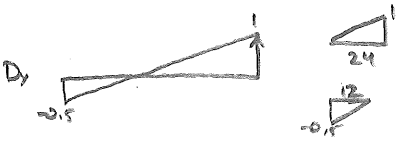
b)

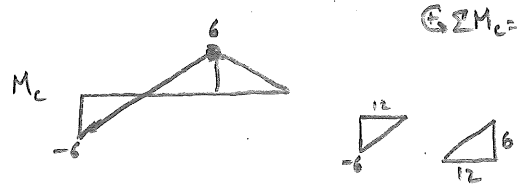




$+\uparrow \Sigma F_y = 0$: $V_c = 0.5$

$\circlearrowleft \Sigma M_c = 0$: $M_c = -6$





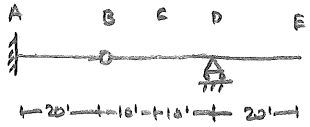
c) $B_y = 2(1.5) + 0.8\left[\frac{1}{2}(36)(1.5)\right] = 24.6$ k

$D_y = 2(-0.5) + 0.8\left[\frac{1}{2}(12)(-0.5) + \frac{1}{2}(24)(1)\right] = 6.2$ k

$V_c = 2(0.5) + 0.8\left[\frac{1}{2}(12)(0.5) + \frac{1}{2}(12)(0.5) + \frac{1}{2}(12)(0.5)\right] = 3.4$ k

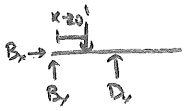
$M_c = 2(-6) + 0.8\left[\frac{1}{2}(12)(-6) + \frac{1}{2}(24)(6)\right] = 16.8$ k-ft

Homework 4: Problem 2

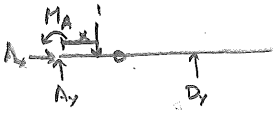


a)

$\circlearrowleft \Sigma M_B = 0$: $\boxed{D_y = 0 \quad 0 \le x < 20}$



$\circlearrowleft \Sigma M_B = 0$: $D_y(20) - 1(x-20) = 0 \Rightarrow \boxed{D_y = \frac{x}{20} - 1 \quad 20 \le x < 60}$

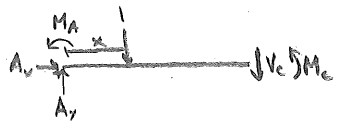


$+\uparrow \Sigma F_y = 0$: $A_y - 1 + D_y = 0 \Rightarrow A_y = 1 - D_y \Rightarrow \boxed{A_y = \begin{cases} 1 & 0 \le x < 20 \\ 2 - \frac{x}{20} & 20 \le x < 60 \end{cases}}$

$\circlearrowleft \Sigma M_A = 0$: $M_A - 1(x) + D_y(40) = 0$

$\Rightarrow M_A = x - D_y(40) \Rightarrow \boxed{M_A = \begin{cases} x & 0 \le x < 20 \\ -x + 40 & 20 \le x < 60 \end{cases}}$

$0 \le x < 30$



$+\uparrow \Sigma F_y = 0$: $A_y - 1 - V_c = 0 \Rightarrow V_c = A_y - 1$

$+\circlearrowleft \Sigma M_c = 0$: $M_c + M_A - A_y(30) + 1(30 - x) = 0$

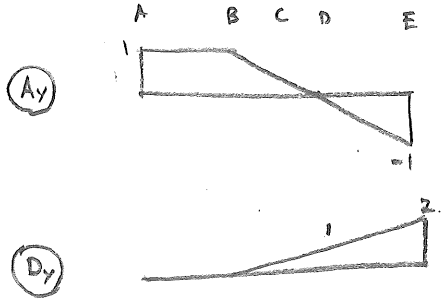
$\Rightarrow M_c = -M_A + A_y(30) + (x - 30)$

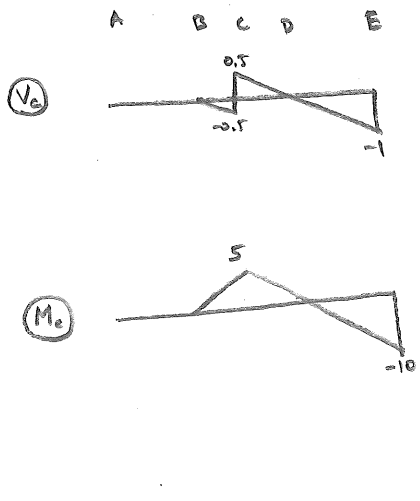
$30 \le x < 60$

$+\uparrow \Sigma F_y = 0$: $A_y - V_c = 0 \Rightarrow V_c = A_y$

$\circlearrowleft \Sigma M_c = 0$: $M_c + M_A - A_y(30) = 0 \Rightarrow M_c = -M_A + A_y(30)$

$$\boxed{V_c = \begin{cases} 0 & \\ 1 - \frac{x}{20} & \\ 2 - \frac{x}{20} & \end{cases} \qquad M_c = \begin{cases} 0 & 0 \le x < 20 \\ -10 + \frac{x}{2} & 20 \le x < 30 \\ 20 - \frac{x}{2} & 30 \le x < 60 \end{cases}}$$



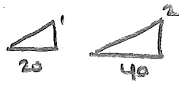


Homework 4: Problem 2 (Continued)

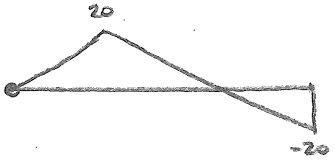
b)

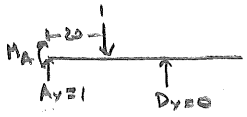
A_y

D_y



M_A

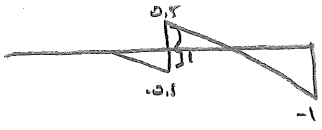


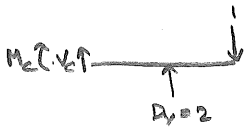


$\circlearrowleft \Sigma M_A = 0$: $1(20) - M_A = 0$

$\Rightarrow M_A = 20$ at $x = 20$

V_c





$+\uparrow \Sigma F_y = 0$: $V_c + 2 - 1 = 0 \Rightarrow V_c = -1$

M_c

$\circlearrowleft \Sigma M_c = 0$: $-M_c + 2(10) - 1(30) = 0 \Rightarrow M_c = -10$

c)

$A_y = 5(-1) + 0.5\left[(1)(20) + \frac{1}{2}(20)(1)\right] = 10$ k

$D_y = 5(2) + 0.5\left[\frac{1}{2}(20)(1)\right] = 15$ k

$M_A = 5(-20) + 0.5\left[\frac{1}{2}(40)(20)\right] = 100$ k-ft

$V_c = 5(-1) + 0.5\left[\frac{1}{2}(10)(-0.5) + \frac{1}{2}(10)(0.5)\right] = -5$ k

$M_c = 5(-10) + 0.5\left[\frac{1}{2}(20)(5)\right] = -25$ k-ft