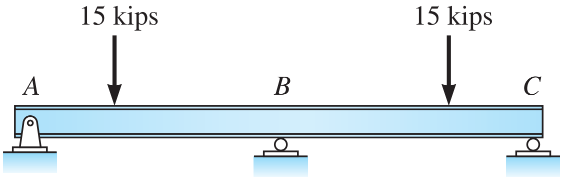
P9.6. Compute the reactions and draw the shear and moment curves for the beam in Figure P9.6. *EI* is constant.



P9.6

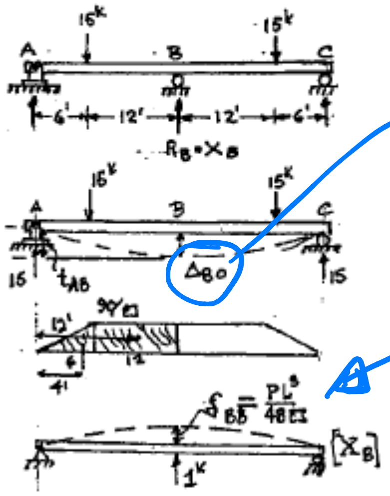
~~Using Moment-Area determine Δ_{BO}~~

$$\cancel{\Delta_{BO} = t_{AB} = 12\left(\frac{90}{EI}\right)(12) + \frac{1}{2}6\left(\frac{90}{EI}\right)4}$$

$$\Delta_{BO} = \frac{-14{,}040}{EI}$$

$$\delta_{BB} = \frac{PL^3}{48EI} \qquad \text{See Figure 9.3}$$

$$\delta_{BB} = \frac{1^k(36)^3}{48EI} = \boxed{\frac{972}{EI}}$$



<u>Compatibility Equation</u>

$$\Delta_B = 0$$

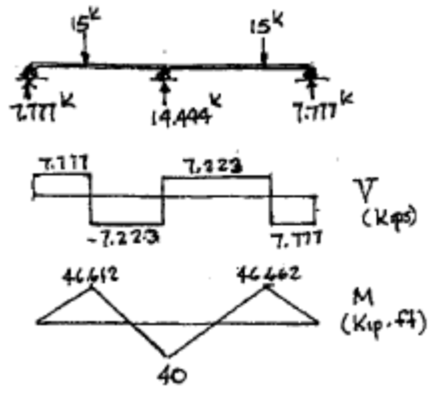
$$\Delta_{BO} + \delta_{BB} X_B = 0$$

$$-\frac{14{,}040}{EI} + \frac{972}{EI} X_B = 0$$

$$\boxed{X_B = 14.444}$$

SEE FOLLOWING FOR VIRTUAL WORK

CAN FIND FROM TABULATED SOLUTIONS OR USE VIRTUAL WORK SEE FOLLOWING



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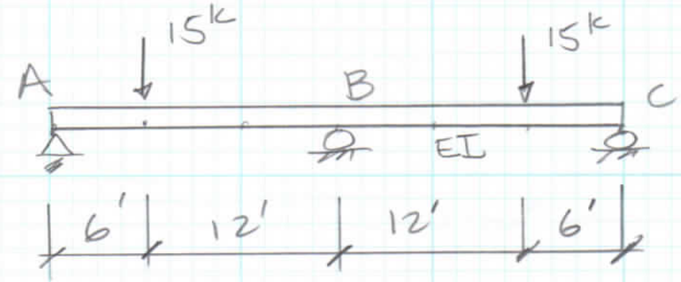
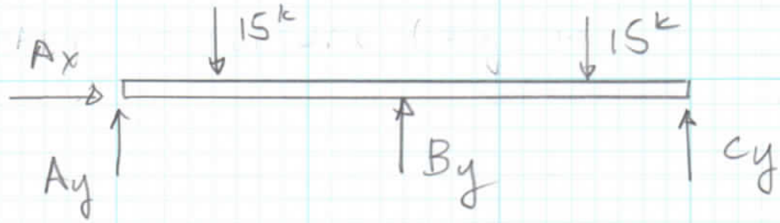
P 9.6





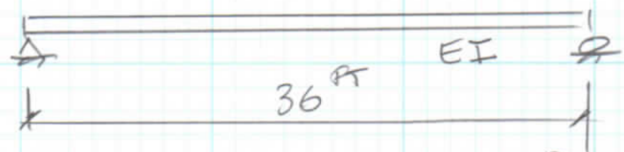
$X = 4$

$3n = 3(1) = 3$

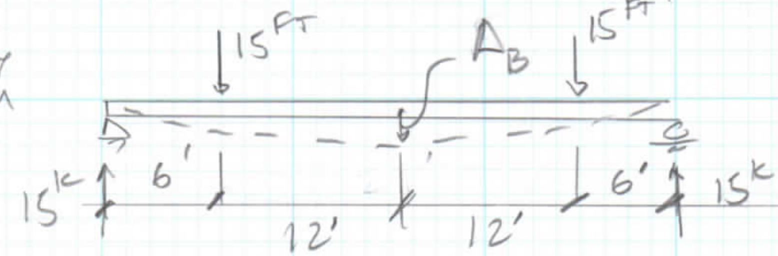
INDET TO 1°

CHOOSE B_y AS REDUNDANT

PRIMARY STRUCTURE



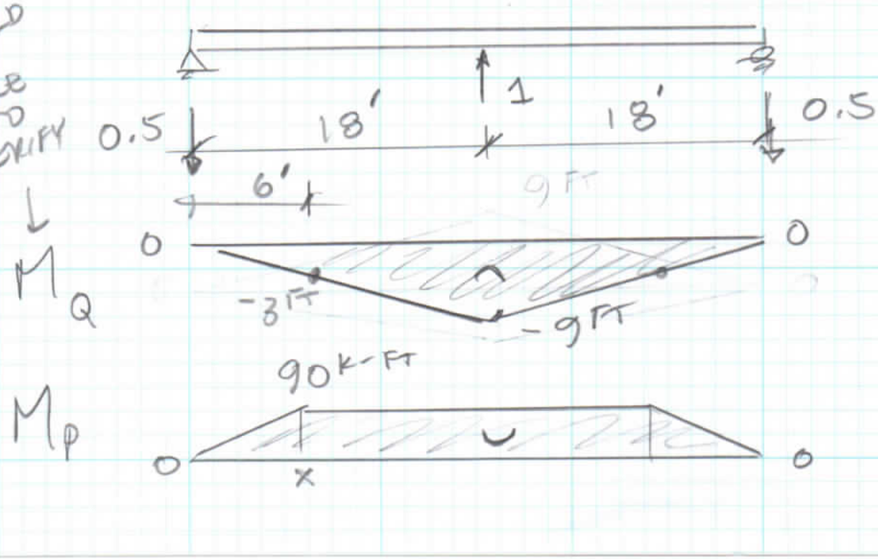
PRIMARY PROBLEM



USE VIRTUAL WORK TO FIND δ_B

VIRTUAL SYSTEM TO MEASURE δ_B

YOU SHOULD BE ABLE TO VERIFY



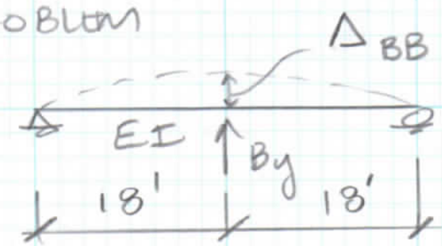
$$1\cdot\Delta_B = \frac{1}{EI}\left[\int^{L_{AX}} M_P M_Q\,dx + \int^{X_B} M_P M_Q\,dx\right] * 2$$

SYMMETRY

$$\Delta_B = \frac{1}{EI}\left[\frac{1}{3}\underset{M_1}{(-3^{FT})}\underset{M_3}{(90^{k\text{-}FT})}\underset{L}{(6^{FT})} + \frac{1}{2}\underset{M_1}{(-3^{F}}\underset{M_2}{-9^{FT})}\underset{M_3}{(90^{k\text{-}FT})}\underset{L}{(12^{FT})}\right] * 2$$

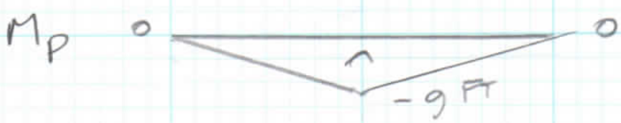
$$\Delta_B = \frac{1}{EI}(-540 - 6480) * 2 = \frac{-14040^{k\text{-}FT^3}}{EI}$$

REDUNDANT PROBLEM

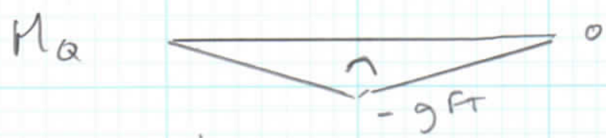


$$\Delta_{BB} = B_y\,\delta_{BB}$$

VW TO FIND δ_{BB}



NOTE M_Q IS SAME AS M_P



$$1\cdot\delta_{BB} = \frac{1}{EI}\left[\int_0^{L_{AB}} M_P M_Q\,dx\right] * 2$$

SYMMETRY

$$\delta_{BB} = \frac{1}{EI}\left(\frac{1}{3}\right)\underset{M_1}{(-9^{FT})}\underset{M_3}{(-9^{FT})}\underset{L}{(18^{FT})} * 2$$

$$\delta_{BB} = \frac{972^{FT^3}}{EI}$$

COMPATIBILITY AT POINT B

$$\Delta_B + B_y \delta_{BB} = 0$$

$$\frac{-14040^{k\text{-}FT^3}}{\cancel{EI}} + B_y\left(\frac{972^{FT^3}}{\cancel{EI}}\right) = 0$$

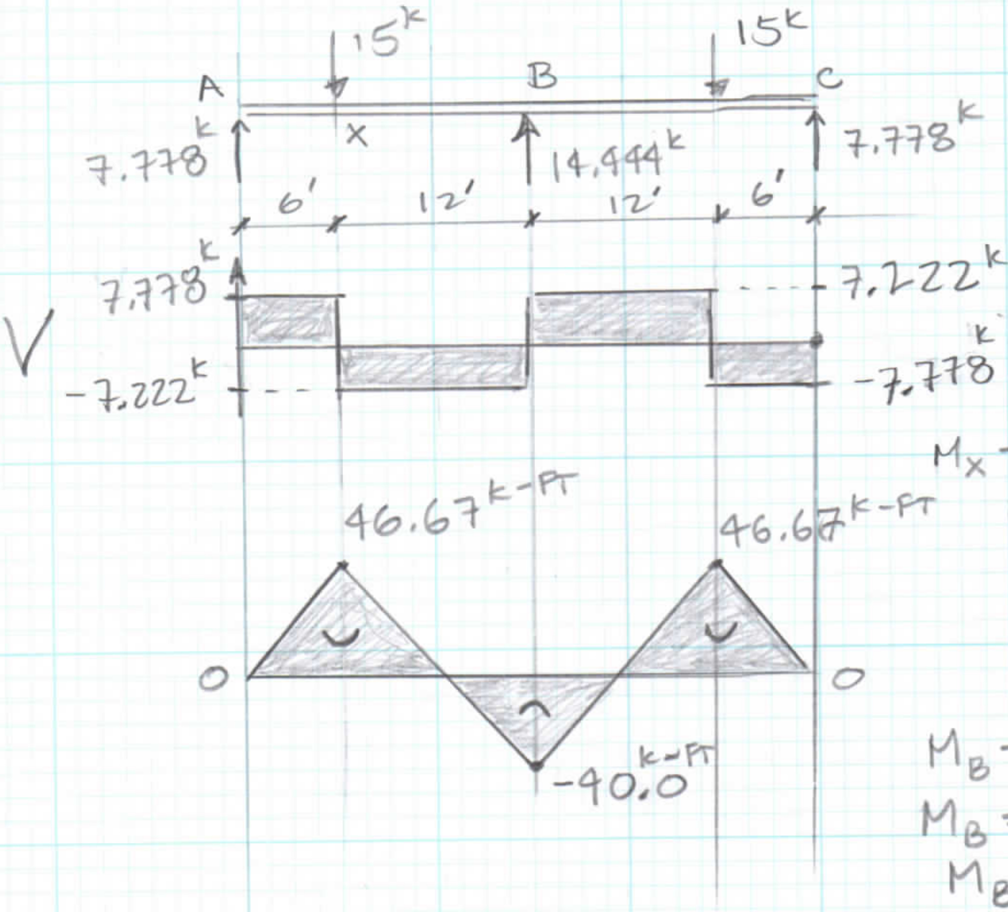
$$\underline{\underline{B_y = 14.444^k}} \uparrow$$

$$\Sigma M_A = 0: \quad -15^k(6') + \overset{14.444}{\cancel{B_y}}(18') - 15^k(30') + C_y(36') = 0$$

$$\underline{C_y = 7.777^k}$$

$$\Sigma F_y = 0: \quad A_y + \overset{14.444}{\cancel{B_y}} + \overset{7.777}{\cancel{C_y}} - 15^k - 15^k = 0$$

$$\underline{A_y = 7.777^k}$$



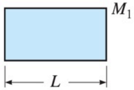
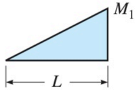
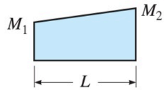
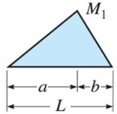
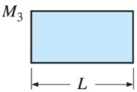
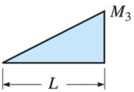
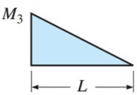
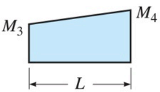
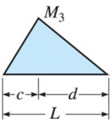
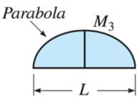
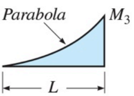
$$M_x - \overset{0}{\cancel{M_A}} = 7.778^k(6')$$

$$\underline{\underline{M_x = 46.67^{k\text{-}FT}}}$$

$$M_B - M_x = -7.222^k(12^{FT})$$

$$M_B = 46.67 - 86.67^{k\text{-}FT}$$

$$M_B = -\underline{\underline{40.0}}^{k\text{-}FT}$$

M_Q / M_P				
	M_1M_3L	$\frac{1}{2}M_1M_3L$	Δ_B x_B $\boxed{\frac{1}{2}(M_1 + M_2)M_3L}$	$\frac{1}{2}M_1M_3L$
	$\frac{1}{2}M_1M_3L$	Δ_{BAX} $\boxed{\frac{1}{3}M_1M_3L}$ δ_{BBAB}	$\frac{1}{6}(M_1 + 2M_2)M_3L$	$\frac{1}{6}M_1M_3(L + a)$
	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3L$	$\frac{1}{6}(2M_1 + M_2)M_3L$	$\frac{1}{6}M_1M_3(L + b)$
	$\frac{1}{2}M_1(M_3 + M_4)L$	$\frac{1}{6}M_1(M_3 + 2M_4)L$	$\frac{1}{6}M_1(2M_3 + M_4)L + \frac{1}{6}M_2(M_3 + 2M_4)L$	$\frac{1}{6}M_1M_3(L + b) + \frac{1}{6}M_1M_4(L + a)$
	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3(L + c)$	$\frac{1}{6}M_1M_3(L + d) + \frac{1}{6}M_2M_3(L + c)$	for $c \leq a$: $\left(\frac{1}{3} - \frac{(a - c)^2}{6ad}\right)M_1M_3L$
	$\frac{2}{3}M_1M_3L$	$\frac{1}{3}M_1M_3L$	$\frac{1}{3}(M_1 + M_2)M_3L$	$\frac{1}{3}M_1M_3\left(L + \frac{ab}{L}\right)$
	$\frac{1}{3}M_1M_3L$	$\frac{1}{4}M_1M_3L$	$\frac{1}{12}(M_1 + 3M_2)M_3L$	$\frac{1}{12}M_1M_3\left(3a + \frac{a^2}{L}\right)$