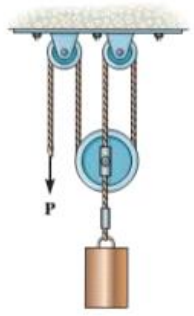
Homework 8

Monday, October 26, 2020 8:55 PM

"I pledge my honor I have abided by the Stevens Honor system."

- Alex Jaskiewicz

F5–13. Determine the force P needed to hold the 60-lb weight in equilibrium.

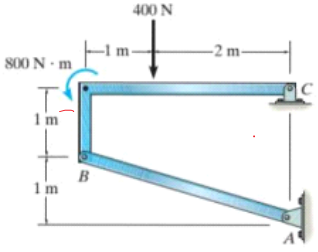


$$F_y = 0$$

$$3P - 60 = 0$$

$$P = 20 \text{ lbs.}$$

F5–16. Determine the horizontal and vertical components of reaction at pin C.



$$M_c = 0$$

$$400(2) + 800 - F_{BA}\cos(\theta) - F_{BA}\sin(\theta)(3) = 0$$

$$F_{BA}\left(\frac{6}{\sqrt{10}}\right) = 1600$$

$$F_{BA} = 843.27 \text{ N.}$$

$$F_x = 0$$

$$C_x - F_{BA}\cos(\theta) = 0$$

$$C_x - 843.27\left(\frac{3}{\sqrt{10}}\right) = 0$$

$$C_x = 800 \text{ N.}$$

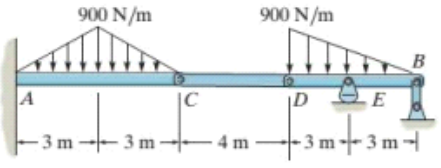
$$F_y = 0$$

$$C_y + F_{BA}\sin(\theta) - 400 = 0$$

$$C_y + 843.27\left(\frac{1}{\sqrt{10}}\right) - 400 = 0$$

$$C_y = 132.5 \text{ N.}$$

5–38. Determine the reactions at the supports at A, E, and B of the compound beam.



$$F_x = 0$$

$$D_y = 0$$

$$M_B = 0$$

$M_B = 0$

$.5\left(900(6)\left(\frac{1}{3}(6)\right)\right) - D_y(6) - N_E(3) = 0$

$2D_y + N_E = 3600$

$F_y = 0$

$D_y - .5(900)(6) + N_E + N_B = 0$

$D_y + N_E + N_B = 2700$

$F_x = 0$

$D_x - C_x = 0$

$C_x = 0$

$M_D = 0$

$-C_y(4) = 0$

$C_y = 0$

$F_y = 0$

$C_y - D_y = 0$

$D_y = 0$

$2D_y + N_E = 3600$

$N_E = 3600\ N.$

$D_y + N_E + N_B - 2700 = 0$

$N_B = -900\ N.$

At A:

$F_x = 0$

$A_x + C_x = 0$

$A_x = 0$

$F_y = 0$

$A_y - \left(\frac{1}{2}(900)(3)\right) - \left(\frac{1}{2}(900)(3)\right) = 0$

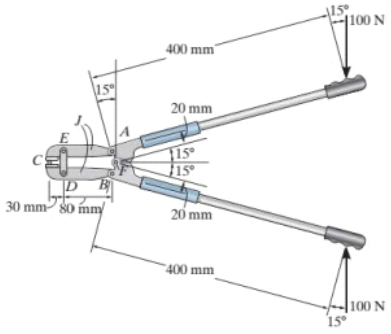
$A_y = 2700\ N.$

$M_A = 0$

$M_A = \frac{1}{2}(900)(3)(2) - \frac{1}{2}(900)(3)(4) = 0$

$M_k = 8100\ N \cdot m$

5–46. Determine the force that the jaws J of the metal cutters exert on the smooth cable C if 100-N forces are applied to the handles. The jaws are pinned at E and A, and D and B. There is also a pin at F.



$M_F = 0$

$100\sin(15)(20) - 100\cos(15)(400) - A_x\cos(15)(20) + A_y\sin(15)(20) = 0$

$517.64 - 38637 - 19.32A_x + 5.18A_y = 0$

$5.18A_y - 19.32A_x = 38119.36$

$F_x = 0$

$A_x = 0$; $5.18 A_y = 38119.36$

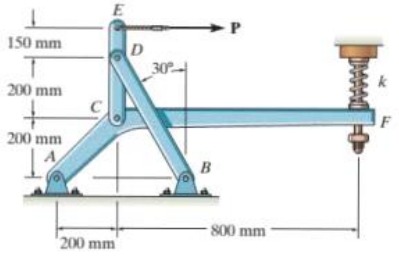
$A_y = 7364.64 N.$

$M_E = 0$

$A_y (80) - F_c (30) = 0$

$F_c = 19639 N.$

***5–52.** Determine force **P** on the cable if the spring is compressed 25 mm when the mechanism is in the position shown. The spring has a stiffness of $k = 6$ kN/m.



$F_s = kx$

$F_s = 600 (.025)$

$F_s = 150 N.$

$M_A = 0$

$C_y (.2) + C_x (.1) - F_s = 0$

$C_y (.2) + C_x (.2) - 150 = 0$

$M_C = 0$

$F_{BD} \sin(30) (.2) - P (.35) = 0$

$F_{BD} = 3.5P$

$$F_x = 0$$

$$C_x + P - F_{BD}\sin(30) = 0$$

$$F_{BD} = 3.5P$$

$$C_x + P - (3.5P)\sin(30) = 0$$

$$C_x = .75P$$

$$F_y = 0$$

$$F_{BD}\cos(30) - C_y = 0$$

$$C_y = (3.5P)\cos(30)$$

$$C_y = 3.031P$$

$$C_x = .75P$$

$$C_x(.2) + C_y(.2) - 150 = 0$$

$$C_x + C_y = 750$$

$$.75P + 3.031P = 750$$

$$P = 198.36N.$$