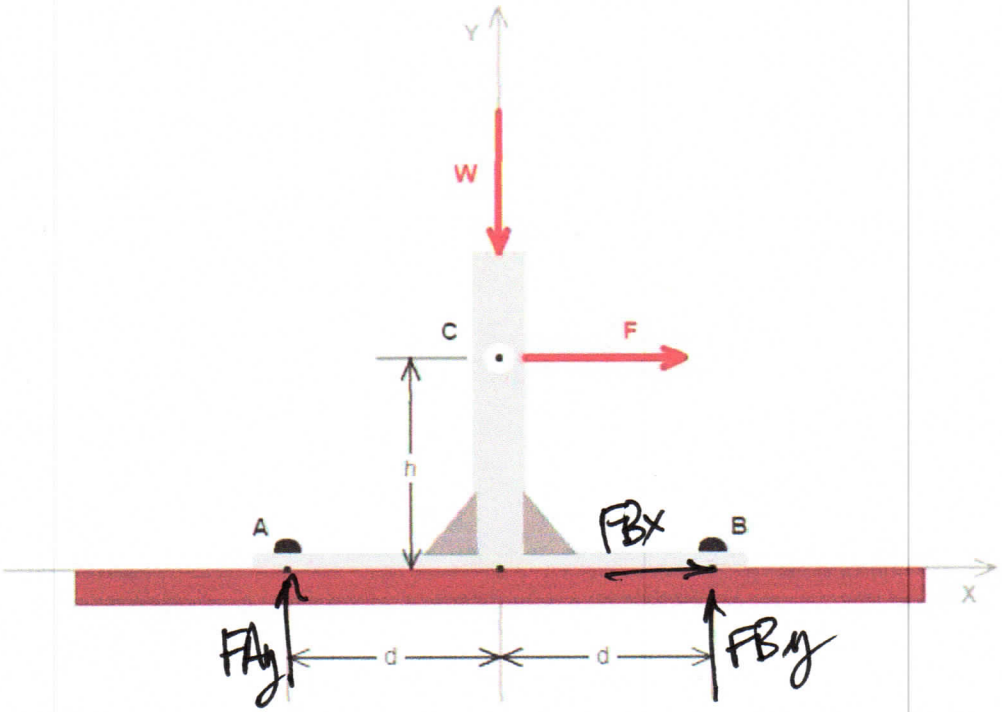
SOLUTION

ip4STATICS Worksheet for U04_P15

A mooring post for ships is attached to a dock by two bolts, at A and B respectively. The hawser pulls horizontally with force F. The post also supports the weight of a crane (crane not shown). Assume the x component of FA is zero; assume no local moments at A and B.

Instance variables: force W and F in tons, lengths d and h in ft.



(1) What is the reaction force FA on the post in equilibrium? ('mag,deg')

(2) What is the reaction force FB on the post in equilibrium? ('mag,deg')

$\Sigma F_x = 0$: $F_{Bx} + F = 0$; $F_{Bx} = -F$.

$\Sigma F_y = 0$: $F_{Ay} + F_{By} = W$.

$\Sigma M_B = 0$: $(2d)F_{Ay} + (h)F = (d)W$

$\therefore F_{Ay} = \frac{W}{2} - \left(\frac{h}{2d}\right)F$

(1) $|F_A| = \sqrt{F_{Ay}^2} = F_{Ay}$

$\angle F_A = 90°$

(2) $F_{By} = W - F_{Ay} = W - \frac{W}{2} + \left(\frac{h}{2d}\right)F$

$$F_{By} = \frac{W}{2} + \left(\frac{h}{2d}\right)F .$$

$$|F_B| = \sqrt{F_{Bx}^2 + F_{By}^2} \text{ . (See } F_{Bx} \text{ above.)}$$

$$\angle F_B = \tan^{-1}(F_{By}/F_{Bx}) .$$