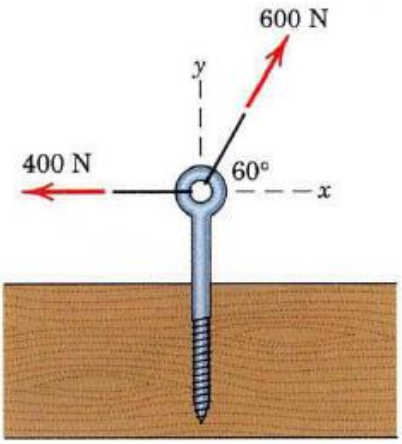
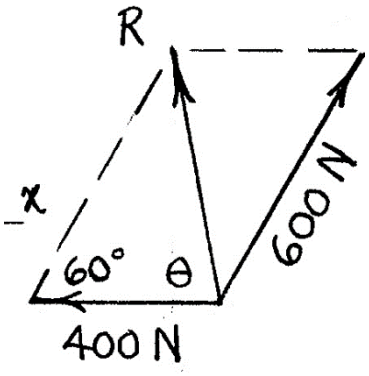
Problem 4

Determine the resultant R of the two forces shown by summing scalar components.



Solution



$$R_x = \Sigma F_x = 600\cos 60^\circ - 400 = -100 \text{ N}$$
$$R_y = \Sigma F_y = 600\sin 60^\circ + 0 = 520 \text{ N}$$

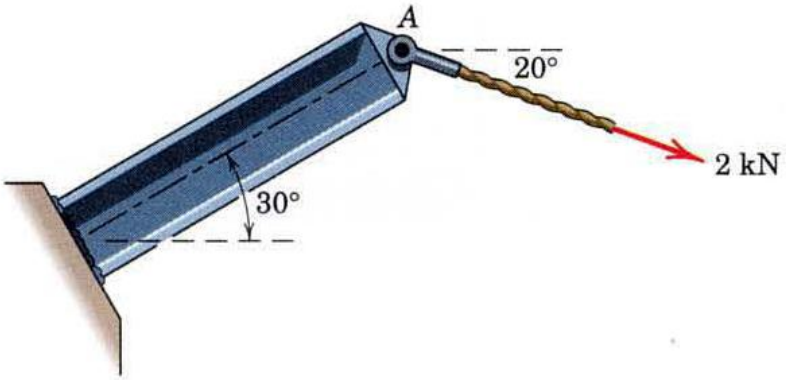
Law of cosines:

$$R^2 = 600^2 + 400^2 - 2(600)(400)\cos 60^\circ$$

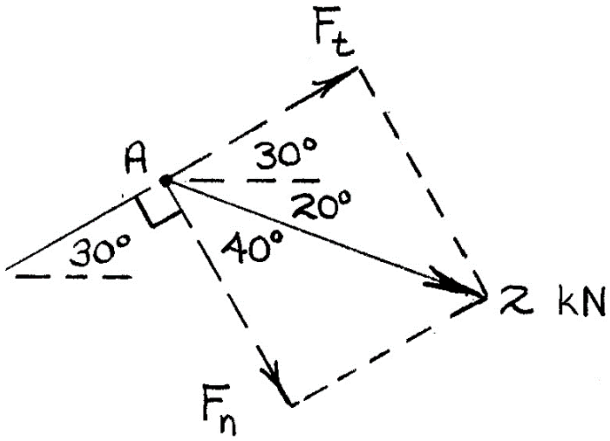
$$R = 529 \text{ N}$$

Problem 5

To satisfy design limitations it is necessary to deter mine the effect of the 2-kN tension in the cable on the shear, tension, and bending of the fixed I-beam. For this purpose replace this force by its equivalent of two forces at *A*, F_t parallel and F_n perpendicular to the beam. Determine F_t and F_n .



Solution

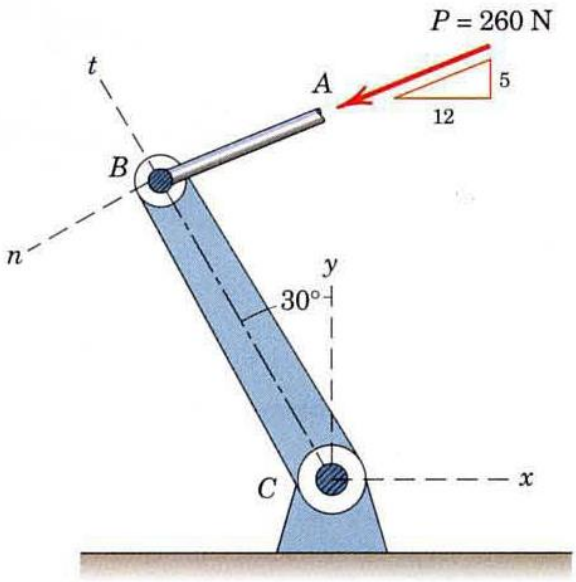


$F_t = 2 \cos 50° = \underline{1.286 \text{ kN}}$

$F_n = 2 \sin 50° = \underline{1.532 \text{ kN}}$

Problem 6

In the design of a control mechanism, it is determined that rod AB transmits a 260-N force P to the crank BC. Determine the *x* and *y* scalar components of P.



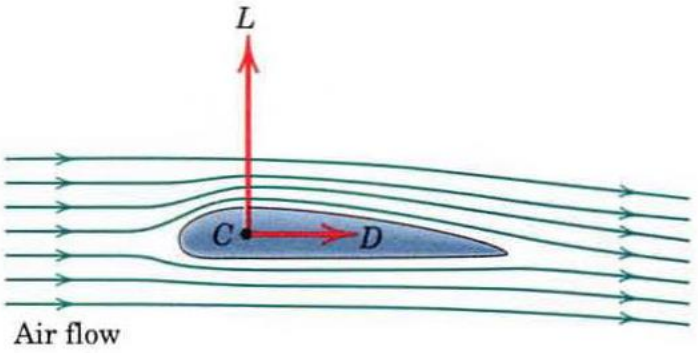
Solution

$$P_x = -260\left(\frac{12}{13}\right) = -240 \quad N$$

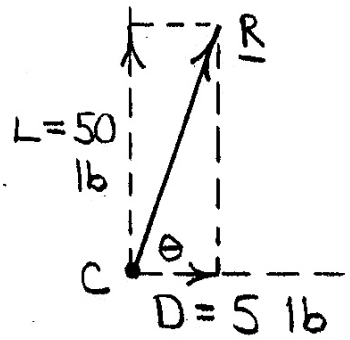
$$P_y = -260\left(\frac{5}{13}\right) = -100 \quad N$$

Problem 7

The ratio of the lift force *L* to the drag force D for the simple airfoil is L/D = 10. If the lift force on a short sect ion of the airfoil is 50 lb, compute the magnitude of the resultant force R and the angle **θ** which it makes with the horizontal.



Solution



$$\frac{L}{D} = \frac{50}{D} = 10 \; ; \quad D = 5 \text{ lb}$$

$$R = \sqrt{L^2 + D^2} = \sqrt{50^2 + 5^2}$$

$$= \underline{50.2 \text{ lb}}$$

$$\theta = \tan^{-1}\left(\frac{L}{D}\right) = \tan^{-1}\left(\frac{50}{5}\right)$$

$$= \underline{84.3^\circ}$$