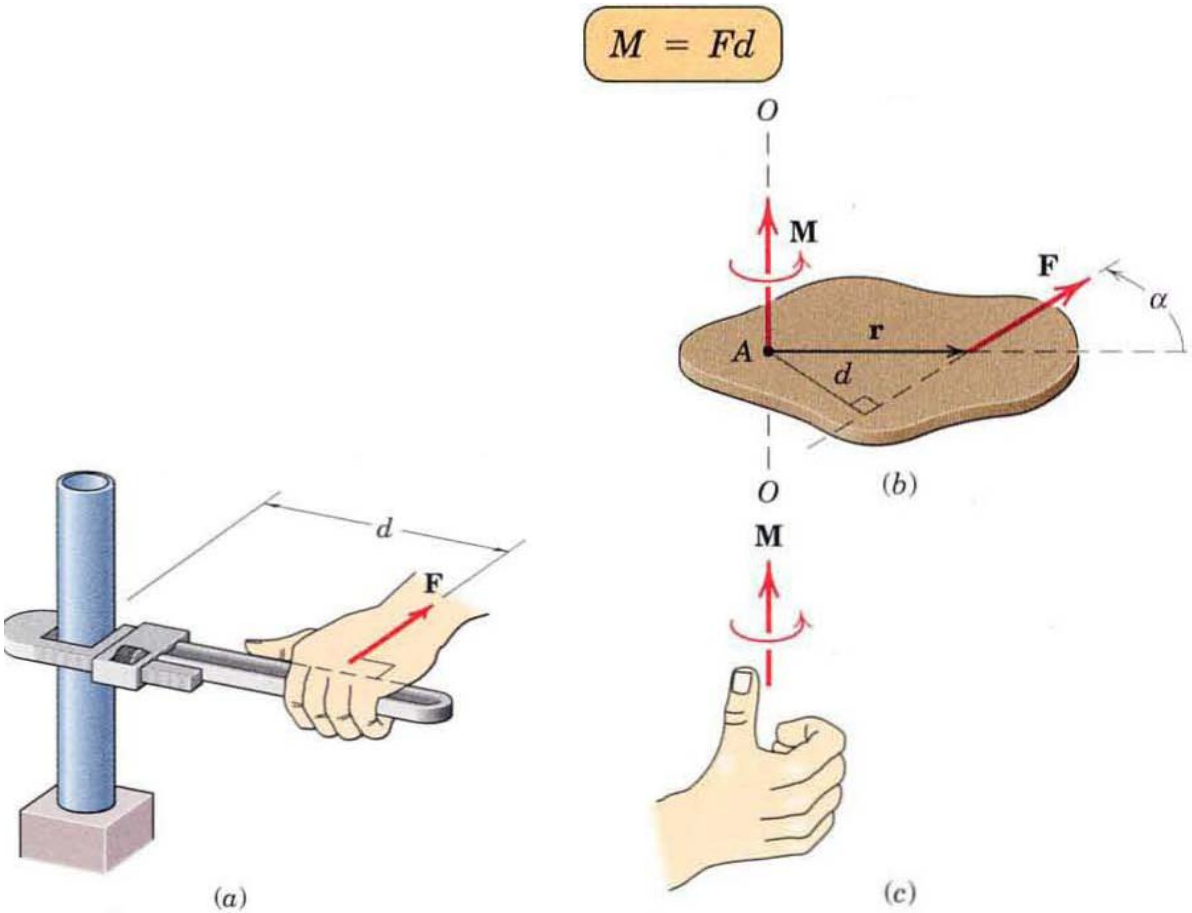
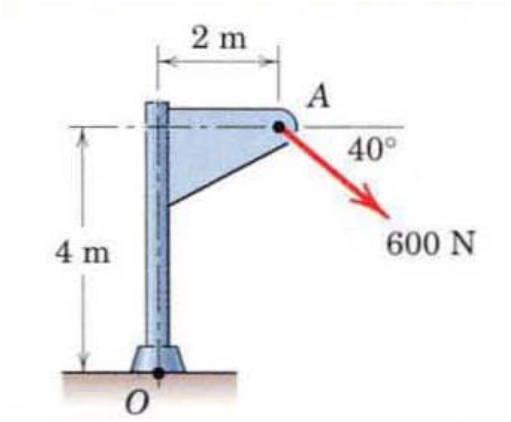
## Moment

As a familiar example of the concept of moment, consider the pipe wrench of Fig. a. One effect of the force applied perpendicular to the handle of the wrench is the tendency to rotate the pipe about its vertical axis. The magnitude of this tendency depends on both the magnitude *F* of the force and the effective length *d* of the wrench handle. Figure *b* shows a two-dimensional body acted on by a force F in its plane. The magnitude of the moment or tendency of the force to rotate the body about the axis O-O perpendicular to the plane of the body is proportional both to the magnitude of the force and to the *moment arm* d, which is the perpendicular distance from the axis to the line of act ion of the force

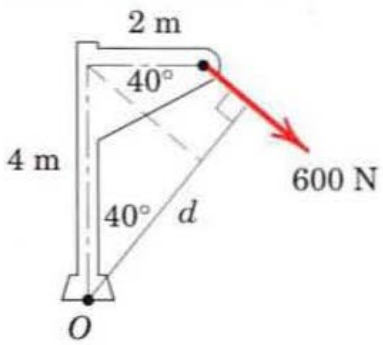


**Problem1**

Calculate the magnitude of the moment about the base point 0 of the 600-N




Solution 1

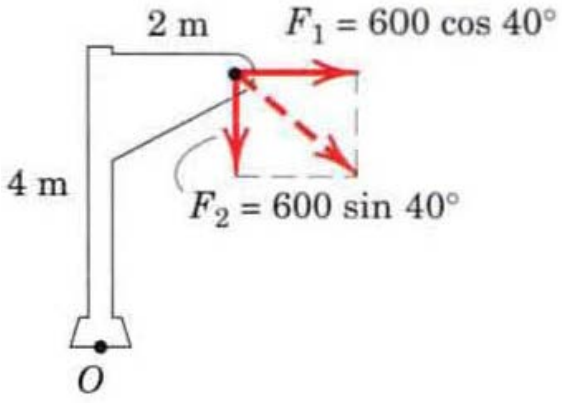



$d = 4 \cos 40 + 2 \sin 40 = 4.35$ m

M = Fd the moment is clockwise and has the magnitude

$M_o = 600(4.35) = 2610$ N· m

Solution 2




Replace the force by its rectangular components at $A$

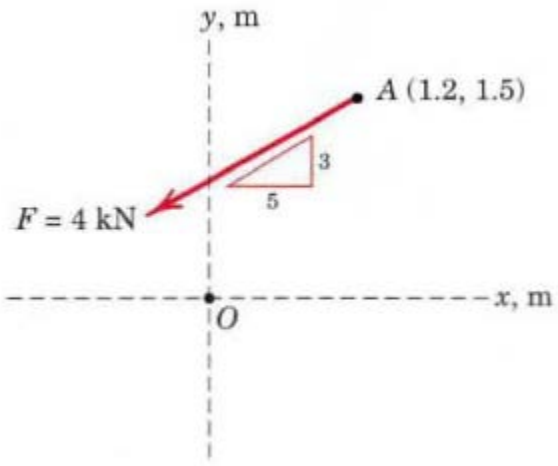
$F_1 = 600 \cos 40 = 460$ N

$F_2 = 600 \sin 40 = 386$ N

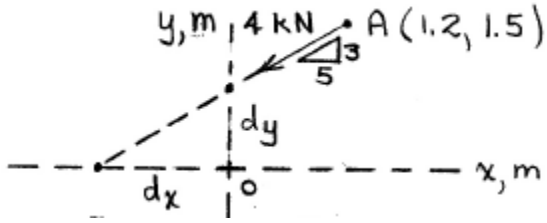
$M_o = 460(4) + 386(2) = 2610$ N·m

## Problem 2

The 4-kN force F is applied at point *A*. Compute the moment of F about point 0, expressing it both as a scalar and as a vector quantity. Determine the coordinates of the points on the *x* – and y-axes a bout which the moment of F is zero.




Solution




$+\circlearrowleft M_O = 4\left[\frac{5}{\sqrt{34}}(1.5) - \frac{3}{\sqrt{34}}(1.2)\right] = \underline{2.68\ \text{kN·m}}$

As a vector, $\underline{\mathbf{M}_O = 2.68\mathbf{k}\ \text{kN·m}}$

$\frac{1.5}{d_x + 1.2} = \frac{3}{5}$, $d_x = 1.3\ \text{m}$

$\frac{d_y}{1.3} = \frac{3}{5}$, $d_y = 0.78\ \text{m}$

Coordinates of intercepts (in m): $\underline{(-1.3, 0),\ (0, 0.78)}$