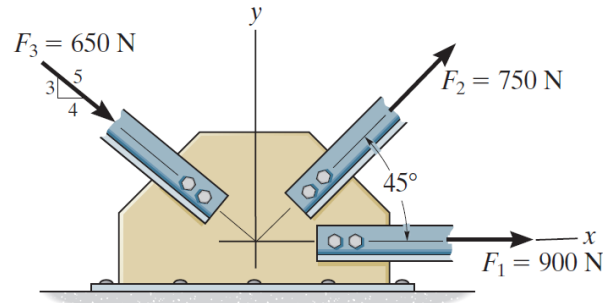


Problem 2-37

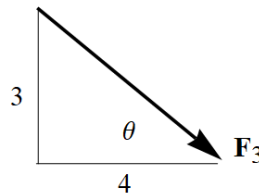
Determine the magnitude of the resultant force acting on the plate and its direction, measured counterclockwise from the positive x axis.



Probs. 2–36/37

Solution

Begin by finding the angle θ that \mathbf{F}_3 makes with the x -axis.



$$\tan \theta = \frac{3}{4} \quad \rightarrow \quad \theta = \tan^{-1} \left(\frac{3}{4} \right) \approx 36.9^\circ$$

Write each of the forces in component form.

$$\mathbf{F}_1 = 900 \langle 1, 0 \rangle \text{ N}$$

$$\mathbf{F}_2 = 750 \langle \cos 45^\circ, \sin 45^\circ \rangle \text{ N}$$

$$\mathbf{F}_3 = 650 \langle \cos \theta, -\sin \theta \rangle \text{ N} = 650 \left\langle \frac{4}{5}, -\frac{3}{5} \right\rangle \text{ N} = \langle 520, -390 \rangle \text{ N}$$

Add them together to get the resultant force.

$$\begin{aligned} \mathbf{F}_R &= \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 \\ &= \langle 900 + 750 \cos 45^\circ + 520, 750 \sin 45^\circ - 390 \rangle \text{ N} \\ &= \langle 1420 + 750 \cos 45^\circ, 750 \sin 45^\circ - 390 \rangle \text{ N} \\ &\approx \langle 1950, 140 \rangle \text{ N} \end{aligned}$$

Its magnitude is

$$|\mathbf{F}_R| = \sqrt{(1420 + 750 \cos 45^\circ)^2 + (750 \sin 45^\circ - 390)^2} \approx 1.96 \times 10^3 \text{ N,}$$

and the direction it points in counterclockwise from the positive x -axis is

$$\tan \phi = \frac{750 \sin 45^\circ - 390}{1420 + 750 \cos 45^\circ} \rightarrow \phi \approx 4.12^\circ.$$