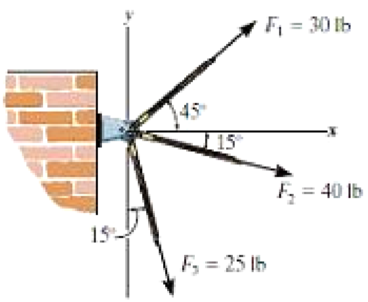
***2–32.** Determine the magnitude of the resultant force acting on the pin and its direction measured clockwise from the positive *x* axis.



Rectangular Components: By referring to Fig. *a*, the *x* and *y* components of $\mathbf{F}_1$, $\mathbf{F}_2$, and $\mathbf{F}_3$ can be written as

$$(F_1)_x = 30\cos 45° = 21.21\text{ lb} \qquad (F_1)_y = 30\sin 45° = 21.21\text{ lb}$$
$$(F_2)_x = 40\cos 15° = 38.64\text{ lb} \qquad (F_2)_y = 40\sin 15° = 10.35\text{ lb}$$
$$(F_3)_x = 25\sin 15° = 6.47\text{ lb} \qquad (F_3)_y = 25\cos 15° = 24.15\text{ lb}$$

Resultant Force: Summing the force components algebraically along the *x* and *y* axes,

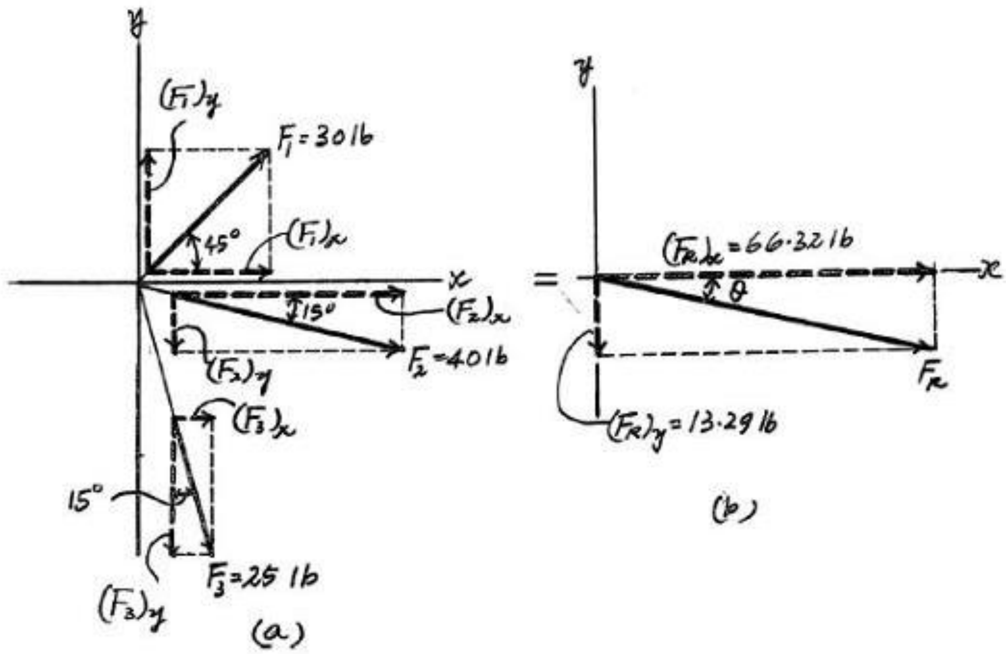
$$\overset{+}{\rightarrow}\Sigma(F_R)_x = \Sigma F_x; \quad (F_R)_x = 21.21 + 38.64 + 6.47 = 66.32\text{ lb} \rightarrow$$
$$+\uparrow \Sigma(F_R)_y = \Sigma F_y; \quad (F_R)_y = 21.21 - 10.35 - 24.15 = -13.29\text{ lb} = 13.29\text{ lb} \downarrow$$

The magnitude of the resultant force $\mathbf{F}_R$ is

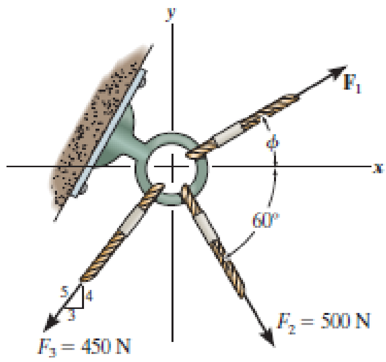
$$F_R = \sqrt{(F_R)_x^2 + (F_R)_y^2} = \sqrt{66.32^2 + 13.29^2} = 67.6\text{ lb} \qquad \textbf{Ans.}$$

The direction angle θ of $\mathbf{F}_R$, measured clockwise from the positive *x* axis, is

$$\theta = \tan^{-1}\left[\frac{(F_R)_y}{(F_R)_x}\right] = \tan^{-1}\left(\frac{13.29}{66.32}\right) = 11.3° \qquad \textbf{Ans.}$$



•2–33. If F1 = 600 N and ϕ = 30° , determine the magnitude of the resultant force acting on the eyebolt and its direction measured clockwise from the positive *x* axis.



Rectangular Components: By referring to Fig. *a* , the *x* and *y* components of each force can be written as

$(F_1)_x = 600\cos 30° = 519.62\text{ N} \quad (F_1)_y = 600\sin 30° = 300\text{ N}$

$(F_2)_x = 500\cos 60° = 250\text{ N} \quad (F_2)_y = 500\sin 60° = 433.0\text{ N}$

$(F_3)_x = 450\left(\frac{3}{5}\right) = 270\text{ N} \qquad (F_3)_y = 450\left(\frac{4}{5}\right) = 360\text{ N}$

Resultant Force: Summing the force components algebraically along the *x* and *y* axes,

$\overset{+}{\rightarrow}\Sigma(F_R)_x = \Sigma F_x; \quad (F_R)_x = 519.62 + 250 - 270 = 499.62\text{ N} \rightarrow$

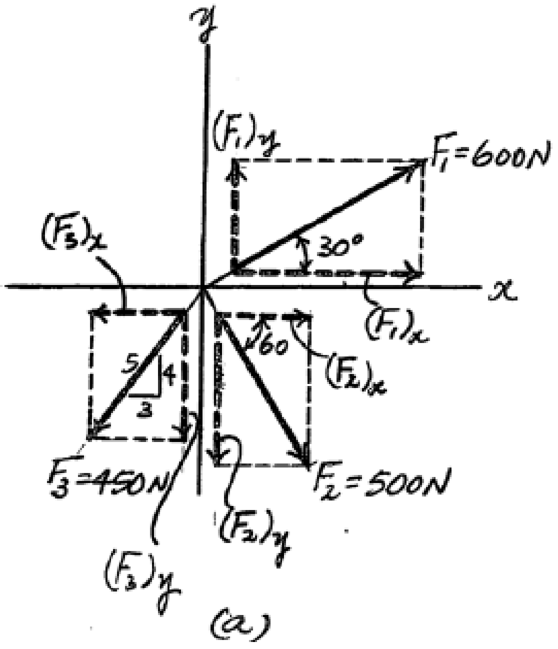
$+\uparrow\Sigma(F_R)_y = \Sigma F_y; \quad (F_R)_y = 300 - 433.01 - 360 = -493.01\text{N} = 493.01\text{ N} \downarrow$

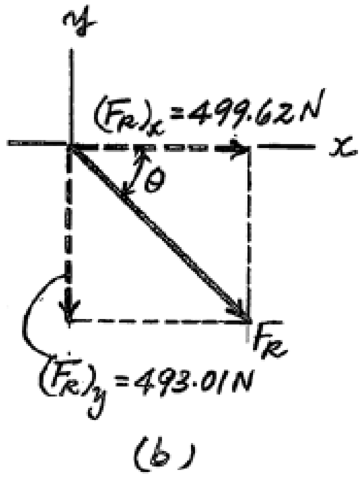
The magnitude of the resultant force $\mathbf{F}_R$ is

$$F_R = \sqrt{(F_R)_x^{\,2} + (F_R)_y^{\,2}} = \sqrt{499.62^2 + 493.01^2} = 701.91\text{ N} = 702\text{ N} \qquad \textbf{Ans.}$$

The direction angle θ of $\mathbf{F}_R$, Fig. *b*, measured clockwise from the *x* axis, is

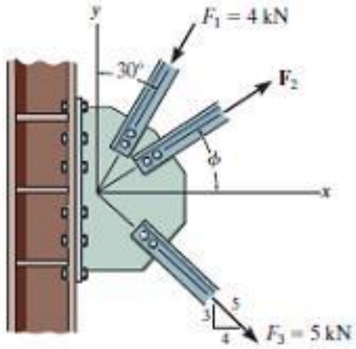
$$\theta = \tan^{-1}\left[\frac{(F_R)_y}{(F_R)_x}\right] = \tan^{-1}\left(\frac{493.01}{499.62}\right) = 44.6°$$





***2–36.** If ϕ= 30° and F_2 = 3 kN ,determine the magnitude of the resultant force acting on the plate and its direction θ measured clockwise from the positive *x* axis .

*2–36. If $\phi = 30°$ and $F_2 = 3$ kN, determine the magnitude of the resultant force acting on the plate and its direction θ measured clockwise from the positive *x* axis.



Rectangular Components: By referring to Fig. *a*, the *x* and *y* components of $\mathbf{F}_1$, $\mathbf{F}_2$, and $\mathbf{F}_3$ can be written as

$(F_1)_x = 4\sin 30° = 2\text{ kN}$ $(F_1)_y = 4\cos 30° = 3.464\text{ kN}$

$(F_2)_x = 3\cos 30° = 2.598\text{ kN}$ $(F_2)_y = 3\sin 30° = 1.50\text{ kN}$

$(F_3)_x = 5\left(\frac{4}{5}\right) = 4\text{ kN}$ $(F_3)_y = 5\left(\frac{3}{5}\right) = 3\text{ kN}$

Resultant Force: Summing the force components algebraically along the *x* and *y* axes,

$$\overset{+}{\rightarrow}\Sigma(F_R)_x = \Sigma F_x; \quad (F_R)_x = -2 + 2.598 + 4 = 4.598\text{ kN} \rightarrow$$

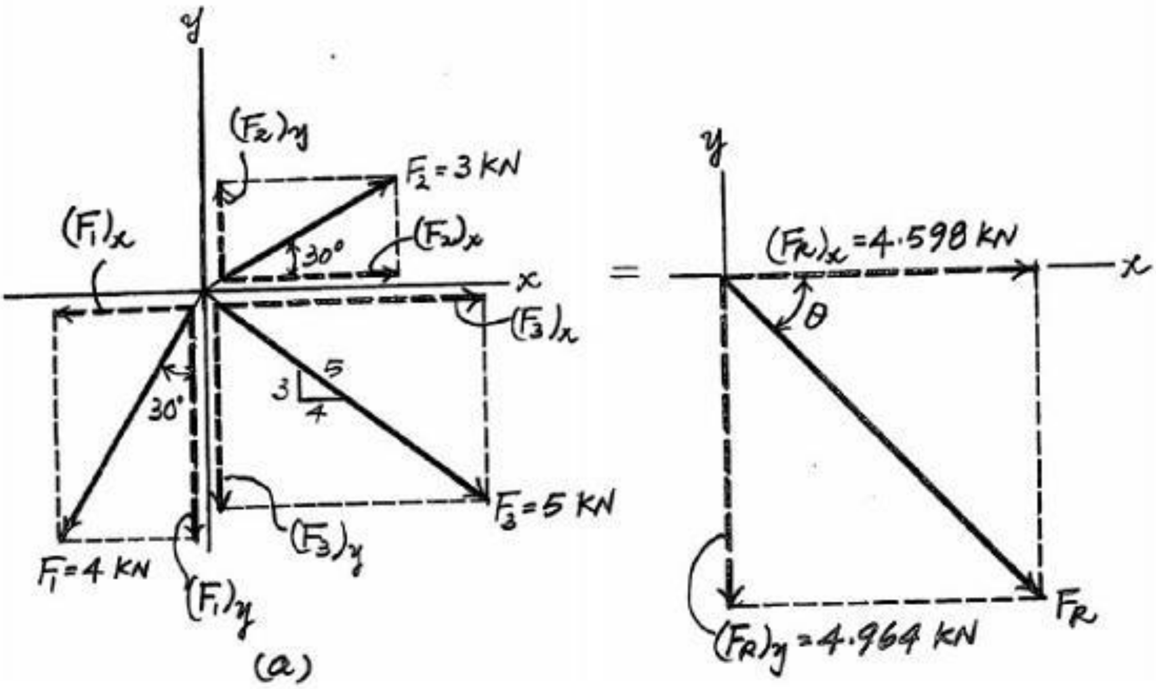
$$+\uparrow\Sigma(F_R)_y = \Sigma F_y; \quad (F_R)_y = -3.464 + 1.50 - 3 = -4.964\text{ kN} = 4.964\text{ kN} \downarrow$$

The magnitude of the resultant force $\mathbf{F}_R$ is

$$F_R = \sqrt{(F_R)_x^2 + (F_R)_y^2} = \sqrt{4.598^2 + 4.964^2} = 6.77\text{ kN} \qquad \textbf{Ans.}$$

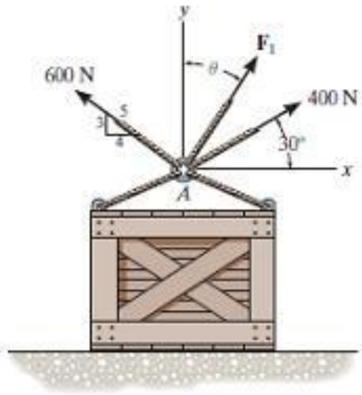
The direction angle θ of $\mathbf{F}_R$, Fig. *b*, measured clockwise from the positive *x* axis, is

$$\theta = \tan^{-1}\left[\frac{(F_R)_y}{(F_R)_x}\right] = \tan^{-1}\left(\frac{4.964}{4.598}\right) = 47.2° \qquad \textbf{Ans.}$$



2–39. Determine the magnitude of $\mathbf{F}_1$ and its direction θ so that the resultant force is directed vertically upward and has a magnitude of 800 N.

2–39. Determine the magnitude of $\mathbf{F}_1$ and its direction θ so that the resultant force is directed vertically upward and has a magnitude of 800 N.



Scalar Notation : Suming the force components algebraically, we have

$$\xrightarrow{+} F_{R_x} = \Sigma F_x; \quad F_{R_x} = 0 = F_1 \sin\theta + 400\cos 30° - 600\left(\frac{4}{5}\right)$$

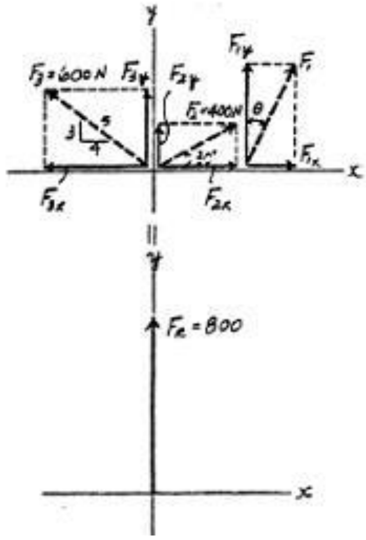
$$F_1 \sin\theta = 133.6 \qquad [1]$$

$$+\uparrow F_{R_y} = \Sigma F_y; \quad F_{R_y} = 800 = F_1 \cos\theta + 400\sin 30° + 600\left(\frac{3}{5}\right)$$

$$F_1 \cos\theta = 240 \qquad [2]$$

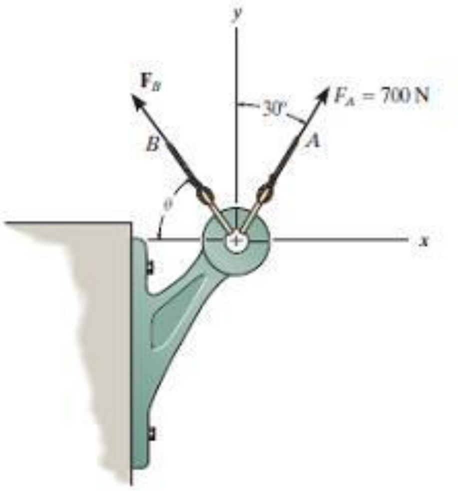
Solving Eq. [1] and [2] yields

$\theta = 29.1°$ $\quad F_1 = 275$ N $\quad$ **Ans**



2–42. Determine the magnitude and angle measured counterclockwise from the positive *y* axis of the resultant force acting on the bracket if $F_B = 600$ N and $\theta = 20°$.

2–42. Determine the magnitude and angle measured counterclockwise from the positive y axis of the resultant force acting on the bracket if $F_B = 600$ N and $\theta = 20°$.



Scalar Notation : Suming the force components algebraically, we have

$$\xrightarrow{+} F_{R_x} = \Sigma F_x: \quad F_{R_x} = 700\sin 30° - 600\cos 20° = -213.8 \text{ N} = 213.8 \text{ N} \leftarrow$$

$$+\uparrow F_{R_y} = \Sigma F_y: \quad F_{R_y} = 700\cos 30° + 600\sin 20° = 811.4 \text{ N} \uparrow$$

The magnitude of the resultant force $\mathbf{F}_R$ is

$$F_R = \sqrt{F_{R_x}^2 + F_{R_y}^2} = \sqrt{213.8^2 + 811.4^2} = 839 \text{ N} \qquad \textbf{Ans}$$

The directional angle θ measured counterclockwise from positive y axis is

$$\phi = \tan^{-1}\frac{F_{R_x}}{F_{R_y}} = \tan^{-1}\left(\frac{213.8}{811.4}\right) = 14.8° \qquad \textbf{Ans}$$