

Worksheet #3: Vector Word Problems

$$\textcircled{1} F_1 = 40 \langle \cos 30^\circ, \sin 30^\circ \rangle$$

$$+ F_2 = 60 \langle \cos 45^\circ, \sin 45^\circ \rangle$$

$$F_1 + F_2 = \langle 77.1, -22.4 \rangle$$

$$\|F_1 + F_2\| = \sqrt{(77.1)^2 + (-22.4)^2} = \boxed{80.34 \text{ N}}$$

Direction:



$$\tan^{-1}\left(\frac{-22.4}{77.1}\right) = \boxed{-16.2^\circ}$$

* Could also use Law of Cosines

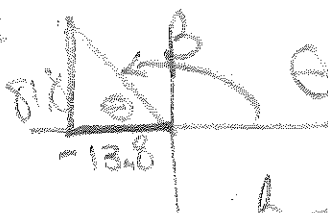
$$\textcircled{2} F_1 = 30 \langle \cos 45^\circ, \sin 45^\circ \rangle$$

$$+ F_2 = 70 \langle \cos 120^\circ, \sin 120^\circ \rangle$$

$$F_1 + F_2 = \langle -13.8, 81.8 \rangle$$

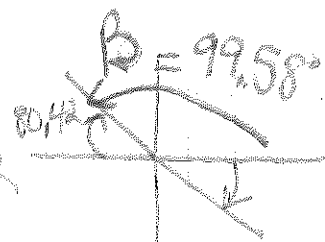
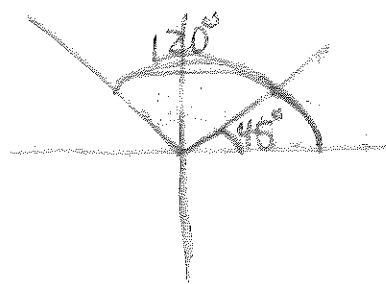
$$\|F_1 + F_2\| = \sqrt{(-13.8)^2 + (81.8)^2} = \boxed{82.96 \text{ N}}$$

Direction:



$$\theta = \tan^{-1}\left(\frac{81.8}{-13.8}\right) = -80.42^\circ$$

$$\beta = 90^\circ + 9.58^\circ = \boxed{99.58^\circ}$$



$$\textcircled{3} \|F_1\| \cos 55^\circ + \|F_2\| \cos 40^\circ = 0$$

$$\|F_1\| \sin 55^\circ + \|F_2\| \sin 40^\circ = 1000$$

$$\begin{bmatrix} -9063 & 76604 \\ 42262 & 6428 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 1000 \end{bmatrix}$$

$$\begin{aligned} x = \|F_1\| &= 845.2 \text{ lb} \\ y = \|F_2\| &= 1000 \text{ lb} \end{aligned}$$

$$\textcircled{4} \quad \|F_1\| \cos 145^\circ + \|F_2\| \cos 50^\circ = 0$$

$$\|F_1\| \sin 145^\circ + \|F_2\| \sin 50^\circ = 800$$

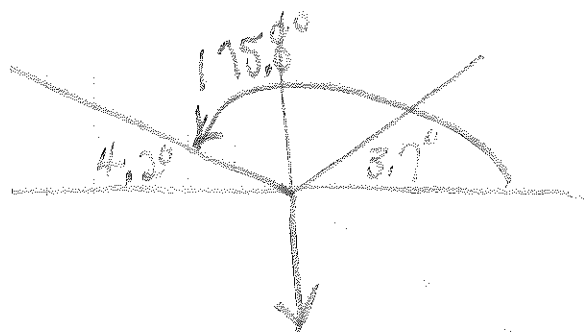
$$\begin{bmatrix} -0.8192 & 0.6428 \\ 0.5736 & 0.7660 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 800 \end{bmatrix}$$

$$x = \|F_1\| = 576.2 \text{ lb}$$

$$y = \|F_2\| = 657.8 \text{ lb}$$

$$\textcircled{5} \quad \|F_1\| \cos 175.8^\circ + \|F_2\| \cos 3.7^\circ = 0$$

$$\|F_1\| \sin 175.8^\circ + \|F_2\| \sin 3.7^\circ = 150$$



$$\begin{bmatrix} -0.9973 & 0.9979 \\ 0.2664 & 0.0645 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 150 \end{bmatrix}$$

$$x = \|F_1\| = 1087.1 \text{ lb}$$

$$y = \|F_2\| = 1088.4 \text{ lb}$$