#1

Examples
Vector Addition of Forces

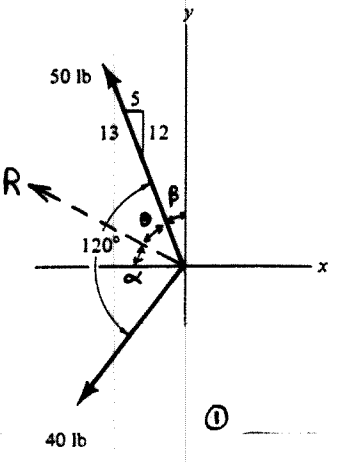
Example 1 :

Given:
The forces shown in figure

Req.d. :
The magnitude & direction of resultant

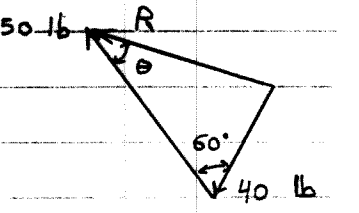
Soln.:
Using the cosine law in Fig. ②

$R^2 = (50)^2 + (40)^2 - 2(50)(40)\cos 60^\circ$



①

Units ? ⇒ $\boxed{R = 45.8 \text{ lb}}$



②

$\frac{40}{\sin\theta} = \frac{45.83}{\sin 60^\circ} \Rightarrow \theta = 49.11^\circ$

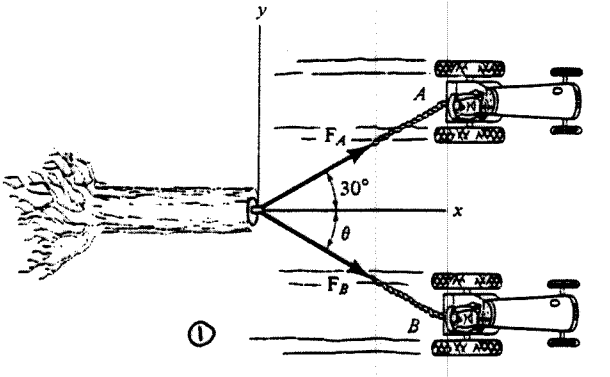
$\alpha = 90^\circ - 49.11 - \underbrace{(\tan^{-1}\frac{5}{12})}_{\beta} \Rightarrow \boxed{\alpha = 18.3^\circ}$

Example 2 :

Given :
The figure shown
$\theta = 15^\circ$, $R = 10$ kN along x

Req.d. :
F_A and F_B

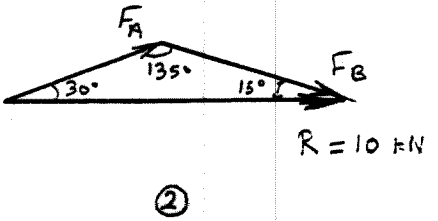
Soln. : ("Guess" the answers!)



①

From Fig. ②,

$\frac{10}{\sin 135^\circ} = \frac{F_A}{\sin 15^\circ} = \frac{F_B}{\sin 30^\circ}$



②

⇒ $\boxed{F_A = 3.66 \text{ kN}}$

$\boxed{F_B = 7.07 \text{ kN}}$

Are the answers "reasonable" ? Why ?!

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*very important note : Do NOT depend only on the handouts given to you ; you MUST read the textbook

#1

Example 3:

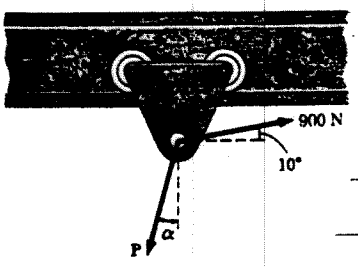
Given:

The figure shown

R = 2700 N vertical downward

Reqd.:

The force $\vec{P}$



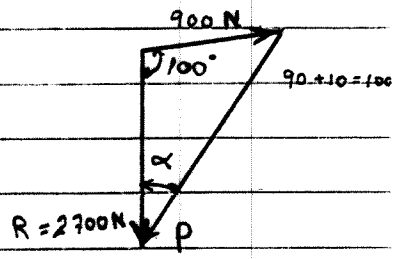
①

Soln.:

Using the sine and cosine laws in Fig. ②,

$P^2 = (900)^2 + (2700)^2 - 2(900)(2700)\cos 100°$

$\Rightarrow$ **P = 2990 N**



②

$\frac{\sin\alpha}{900} = \frac{\sin 100}{2990} \Rightarrow$ **α = 17.2°**

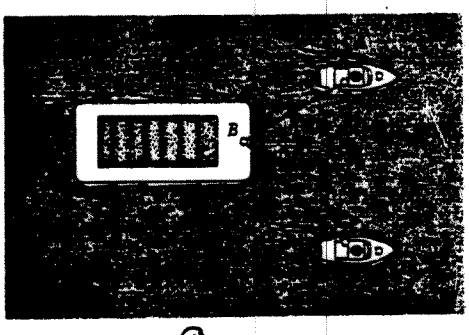
Example 4:

Given:

The figure shown

Tension in AB = 4500 lb

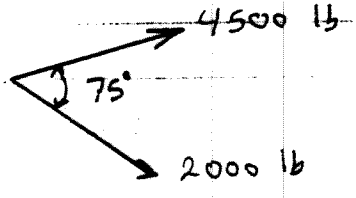
Tension in BC = 2000 lb



④

Reqd.:

The magnitude and direction of the resultant force



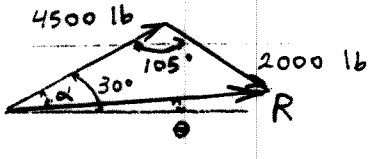
Soln.:

From Fig. ②,

$R^2 = (4500)^2 + (2000)^2 - 2(4500)(2000)\cos 105°$

Review significant Figures!

$\Rightarrow$ **R = 5377 lb ≈ 5380 lb**



$\frac{\sin 105}{5377} = \frac{\sin\alpha}{2000} \Rightarrow \alpha = 21.06° \Rightarrow \theta = 30 - 21.06°$

②

θ = 8.94° above horizontal