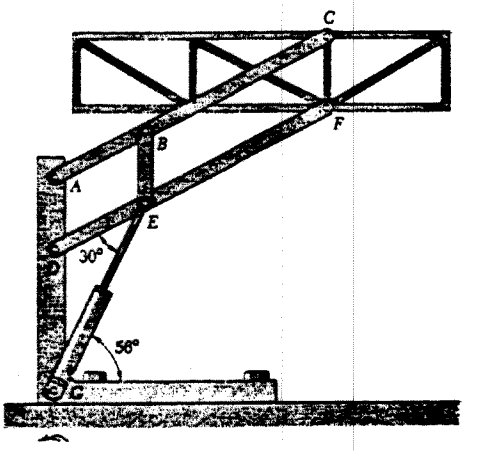
Examples

#2

Addition of a System of Coplanar Forces

(Cartesian Vectors in 2-D)

Example 1:



Given:

The figure shown

The hydraulic cylinder GE exerts on member DF a force $\vec{P}$ along line GE

P has a 600 N component perpendicular to DF

Reqd.:

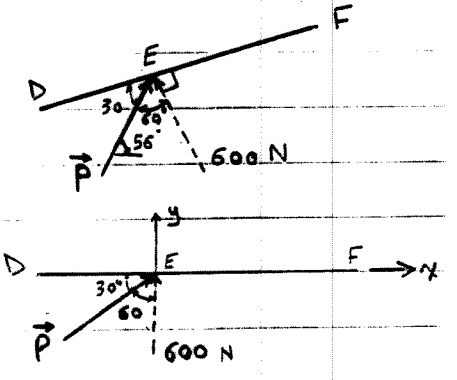
The force $\vec{P}$ and its component parallel to DF

Soln.:

$600 = P \cos 60^\circ \Rightarrow$ **$P = 1200$ N**

$P_{DF} = P_x = 1200 \cos 30^\circ$

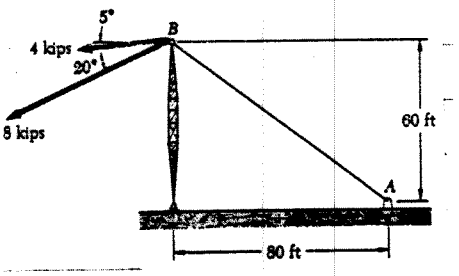
$\Rightarrow$ **$P_x = 1040$ N**



Do you think the answers are correct?

Show!

Example 2:



Given:

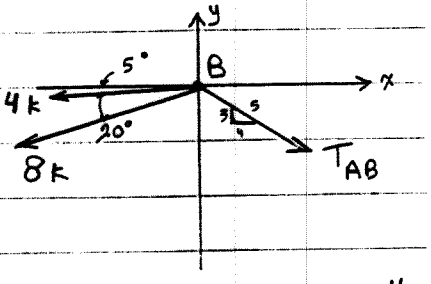
The figure shown

Reqd.:

The tension in AB so that the resultant of the three forces is vertical

Soln.:

Since the resultant is vertical, then $\Sigma F_x = 0$



$\Rightarrow -4 \cos 5^\circ - 8 \cos 25^\circ + T\left(\frac{4}{5}\right) = 0$

k = kip = 1000 lb.

$\Rightarrow$ **$T = 14.04$ k**

Is it the right answer? Prove!

#2

Example 3:

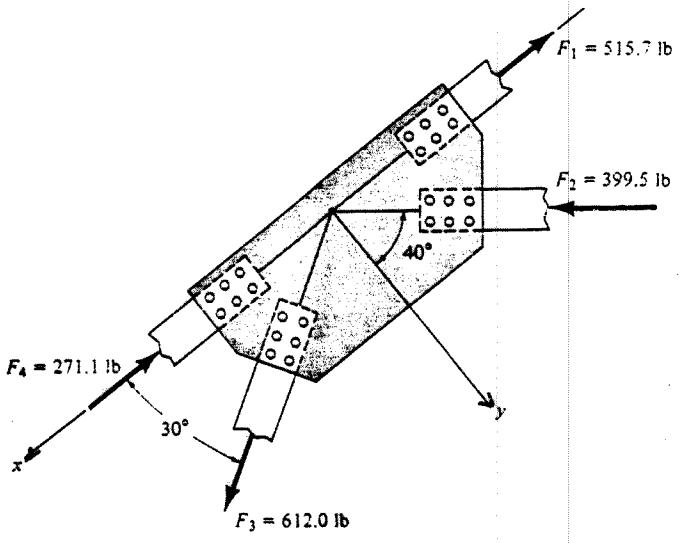
Given:

The gusset plate of a bridge truss shown

Req.d.:

The x and y components of each force

Show that the resultant force is zero.



Soln.:

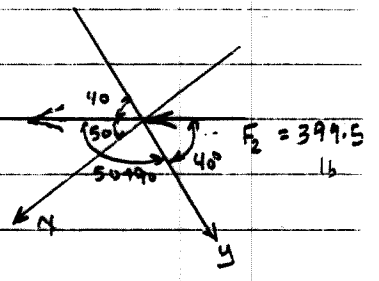
$F_{1x} = -515.7$ lb

$F_{1y} = 0$

$F_{2x} = +399.5 \sin 40° = +257$ lb

$F_{2y} = -399.5 \cos 40° = -306$ lb

or $F_{2y} = +399.5 \cos(50°+90°) = -306$ lb ⇒



$F_{3x} = 612.0 \cos 30° = 530$ lb

$F_{3y} = 612.0 \sin 30° = 306$ lb

$F_{4x} = -271.1$ lb

$F_{4y} = 0$

$\Sigma F_x = -516 + 257 + 530 - 271 = 0 = R_x$

$\Sigma F_y = -306 + 306 = 0 = R_y$

$R = \sqrt{R_x^2 + R_y^2} \Rightarrow \boxed{R = 0}$ ok

Using Cartesian vectors, the forces can be written as

$\vec{F}_1 = -515.7\,\vec{i} + 0\,\vec{j}$

$\vec{F}_2 = 257\,\vec{i} - 306\,\vec{j}$

$\vec{F}_3 = 530\,\vec{i} + 306\,\vec{j}$

$\vec{F}_4 = -271.1\,\vec{i} + 0\,\vec{j}$