

3 types of vectors

- 1)
- 2)
- 3)

Types of vectors:

Components = vectors that act on an object

Resultant = a single vector that is the vector sum of components that are acting

Equilibrant = equal and opposite to a resultant
equal in size and opposite in
direction (180°)

$$E = -R$$



Today, Equilibrants!



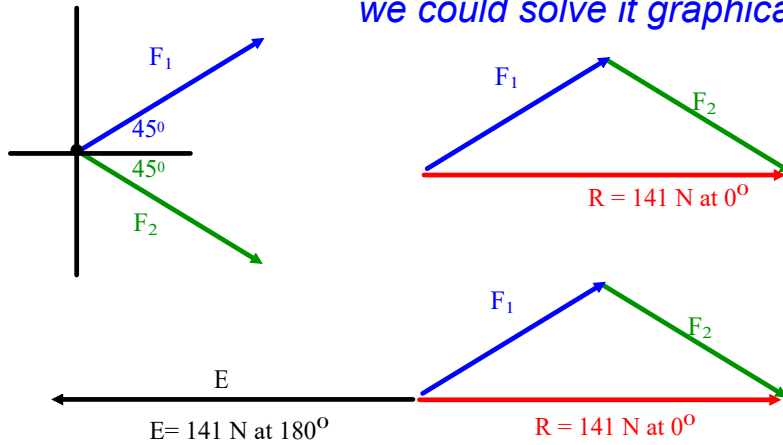
Equilibrant = equal and opposite to a resultant
 equal in size and opposite in
 direction (180°)

$$E = -R$$

Equilibrant = a vector equal and opposite of the *Resultant*
 ...it is a single vector that *equalizes or overcomes* the
 components acting.

we could solve it graphically!

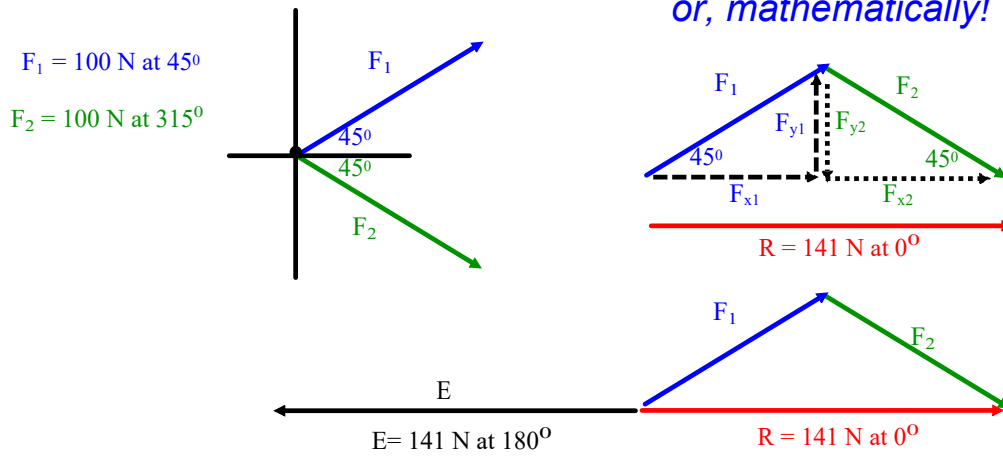
$F_1 = 100 \text{ N at } 45^\circ$
 $F_2 = 100 \text{ N at } 315^\circ$
 $R = ?$
 $E = ?$



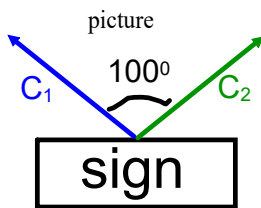
Equilibrant = a vector equal and opposite of the *Resultant*

...it is a single vector that *equalizes or overcomes* the components acting.

or, mathematically!



A 100. N sign is suspended by two ropes 100° apart. What is the tension on each rope?

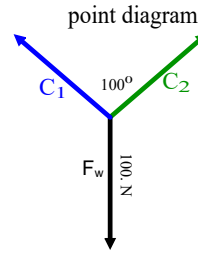
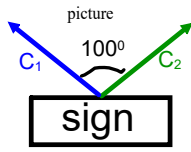


point diagram

What's the point diagram look like?

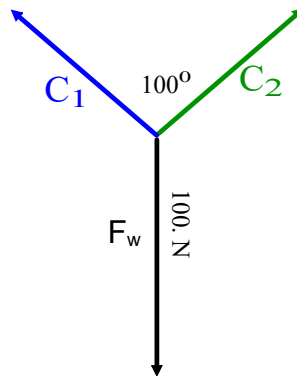
vector diagram

A 100. N sign is suspended by two ropes 100° apart. What is the tension on each rope?

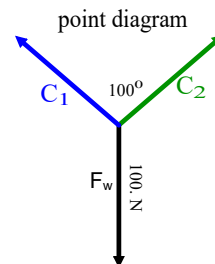
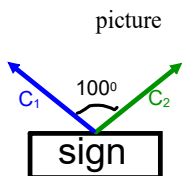


How would we draw the vector diagram?

vector diagram

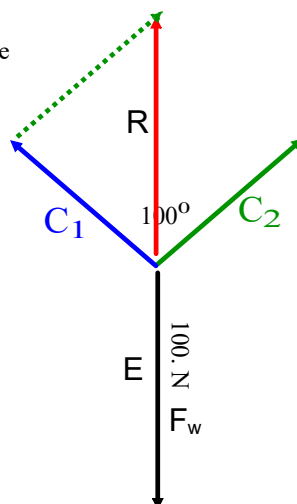


A 100. N sign is suspended by two ropes 100° apart. What is the tension on each rope?

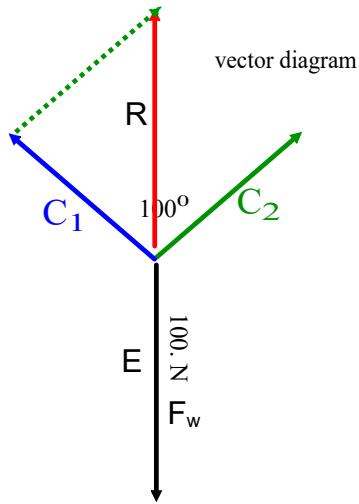


vector diagram

Please note that the weight of the object 100 N is NOT the resultant of C_1 and C_2 . It is the equilibrant. *Why can't it be?*

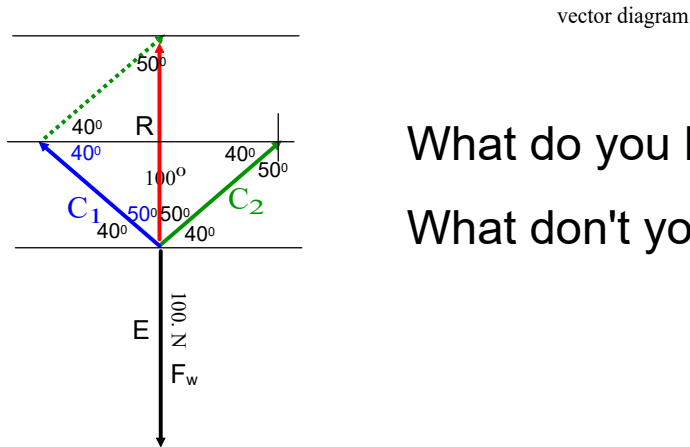


A 100. N sign is suspended by two ropes 100° apart. What is the tension on each rope?



Find all the angles!

We could solve it graphically!



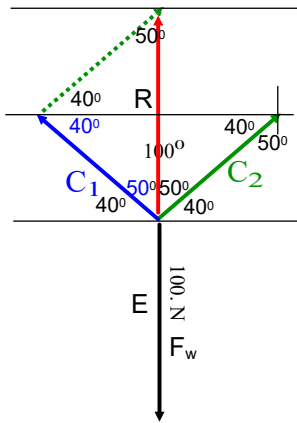
What do you know?

What don't you know?



$a = 78 \text{ N}$

We could solve it graphically!



vector diagram

What do you know?

angles of C_1 and C_2 and magnitude of "R"

What don't you know?

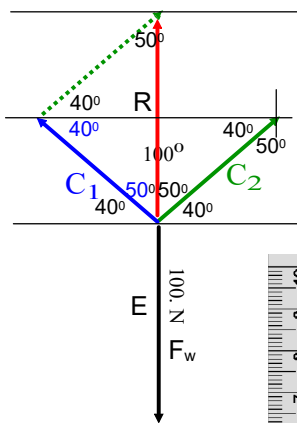
magnitude of C_1 and C_2

- graph what you know!!!!

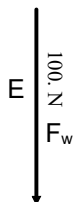
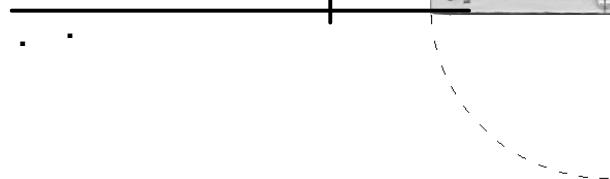
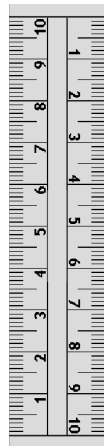


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vector diagram



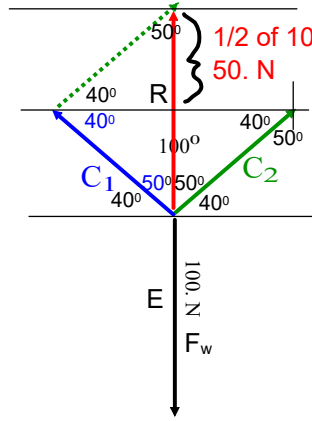
$a = 78 \text{ N}$



or, mathematically

$$\begin{aligned} \sin 40^\circ &= 50 \text{ N}/C_1 \\ C_1 &= 50 \text{ N}/\sin 40^\circ \\ C_1 &= 78 \text{ N} \\ \cos 50^\circ &= 50 \text{ N}/C_1 \\ C_1 &= 50 \text{ N}/\sin 50^\circ \\ C_1 &= 78 \text{ N} \end{aligned}$$

vector diagram



cut diagram in half-
now the resultant
is 1/2 100 N, or 50 N

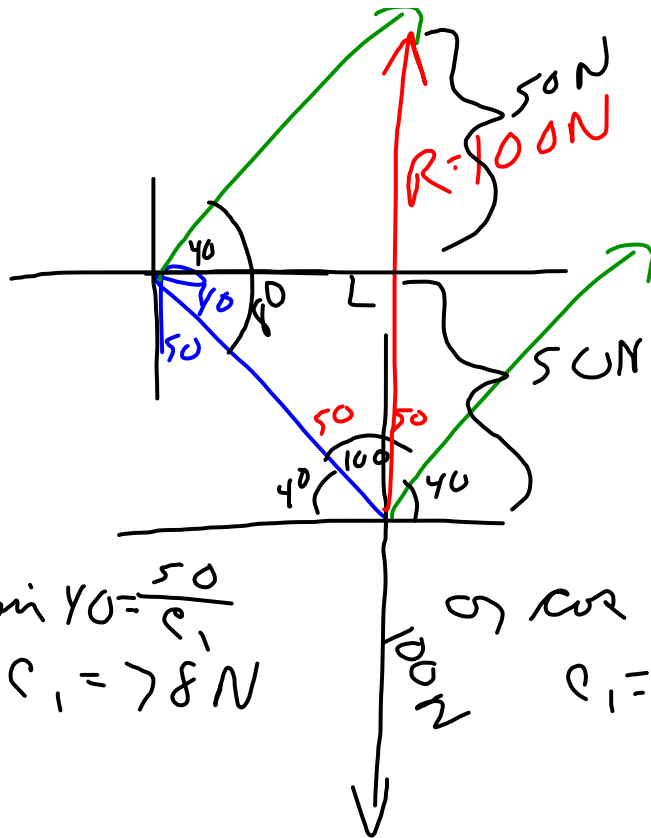
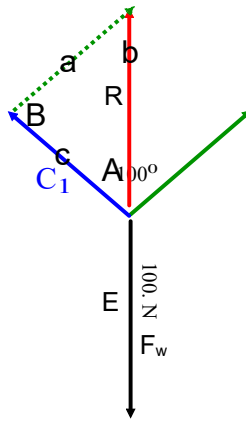
or,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{\sin 50^\circ} = \frac{100 \text{ N}}{\sin 80^\circ}$$

$$a = 78 \text{ N}$$

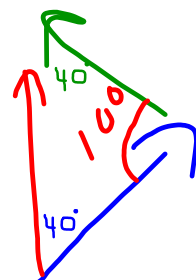
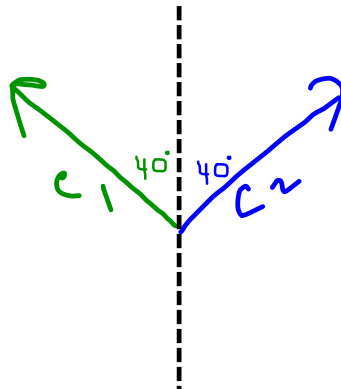
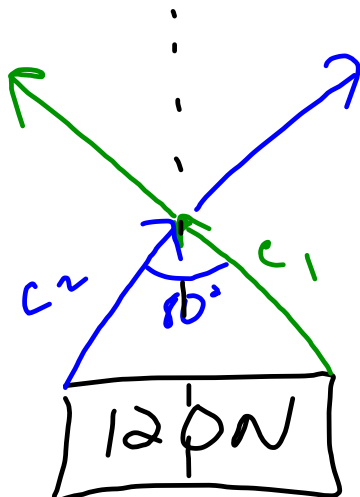
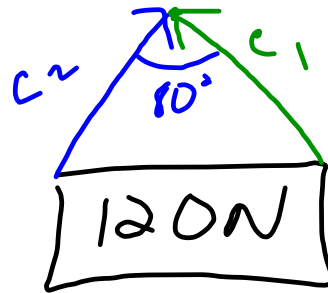
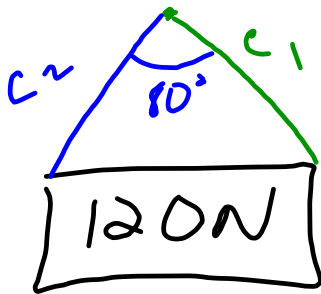
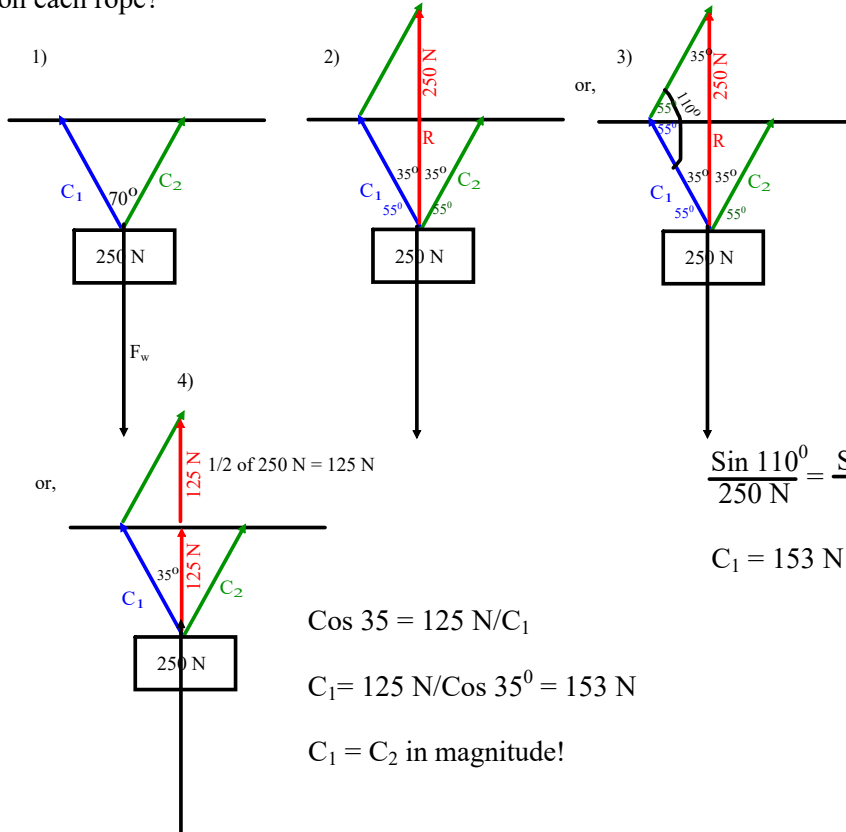


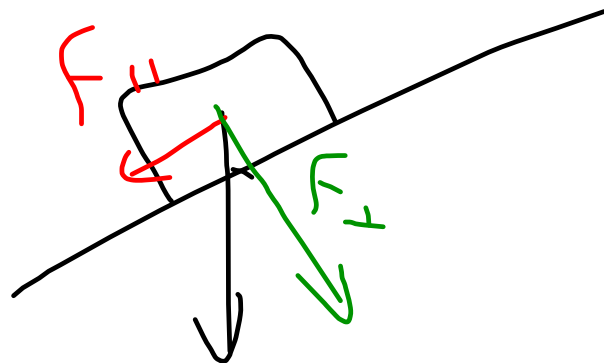
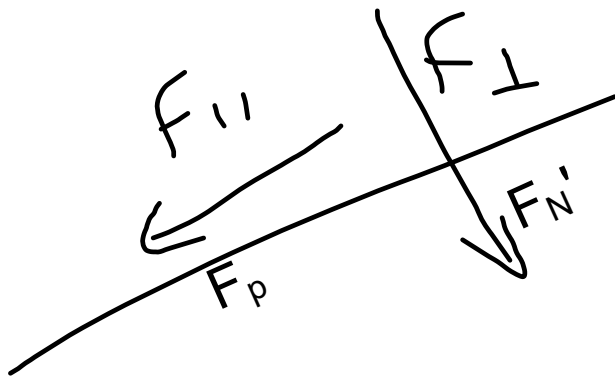
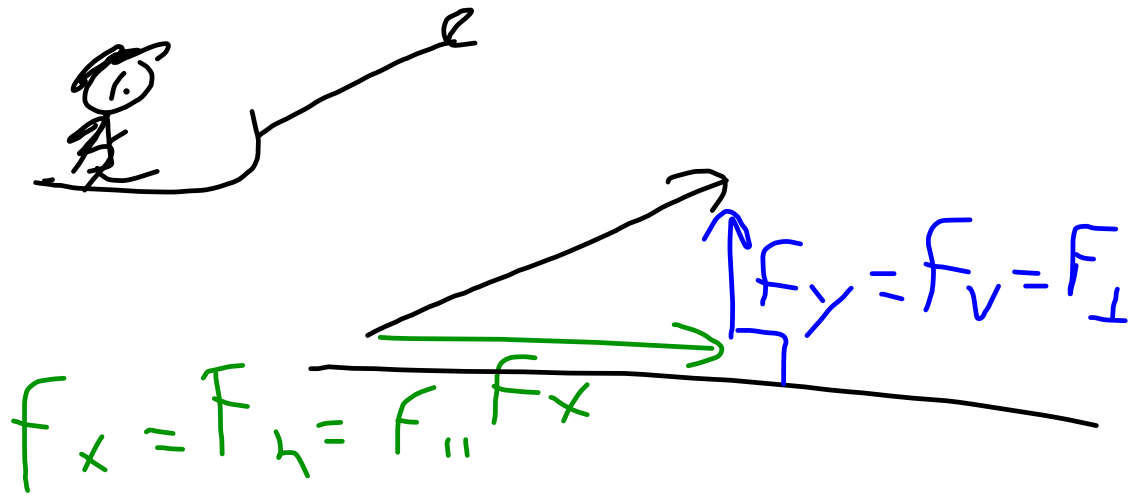
$$\begin{aligned} \sin 40^\circ &= \frac{50}{C_1} \\ C_1 &= 78 \text{ N} \end{aligned}$$

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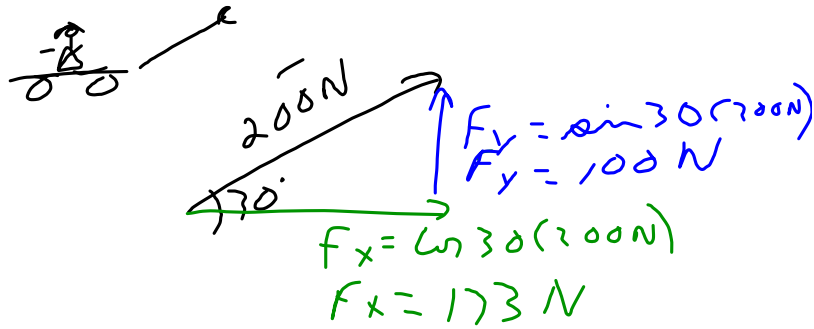
Or, use law of sines to solve for one on the components

A 250. N sign is suspended by two ropes 70° apart. What is the tension on each rope?

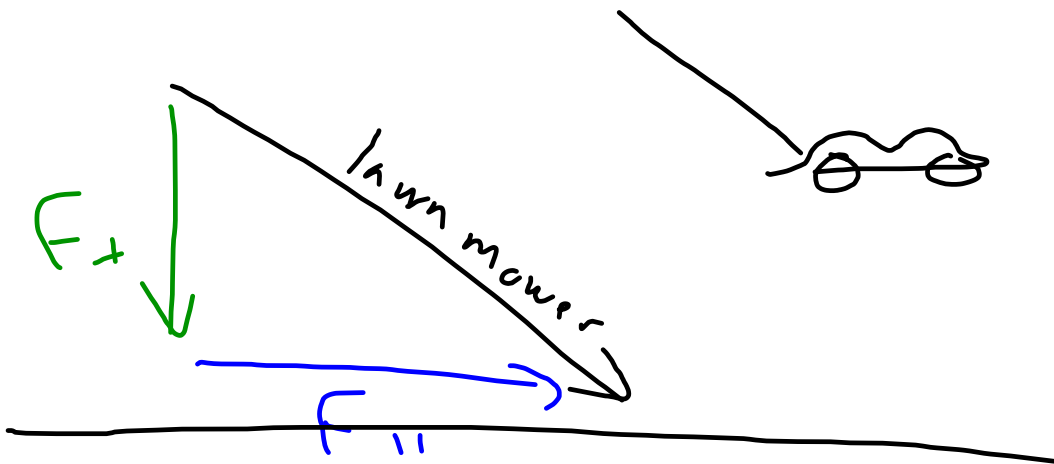
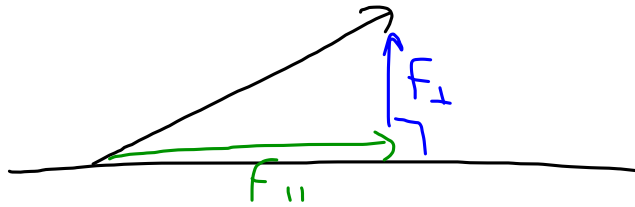




Little Jimmy pulls his sister on a wagon ride applying a force of 200. N on the handle. The handle makes an angle of 30° with the road. What are the vertical and horizontal components of his force?



$F_y = F_{\text{vert}} (F_v) = F_{\perp}$ *surface*
 $F_x = F_{\text{horiz}} (F_h) = F_{\parallel}$



Note that F_{\perp} is acting downward

