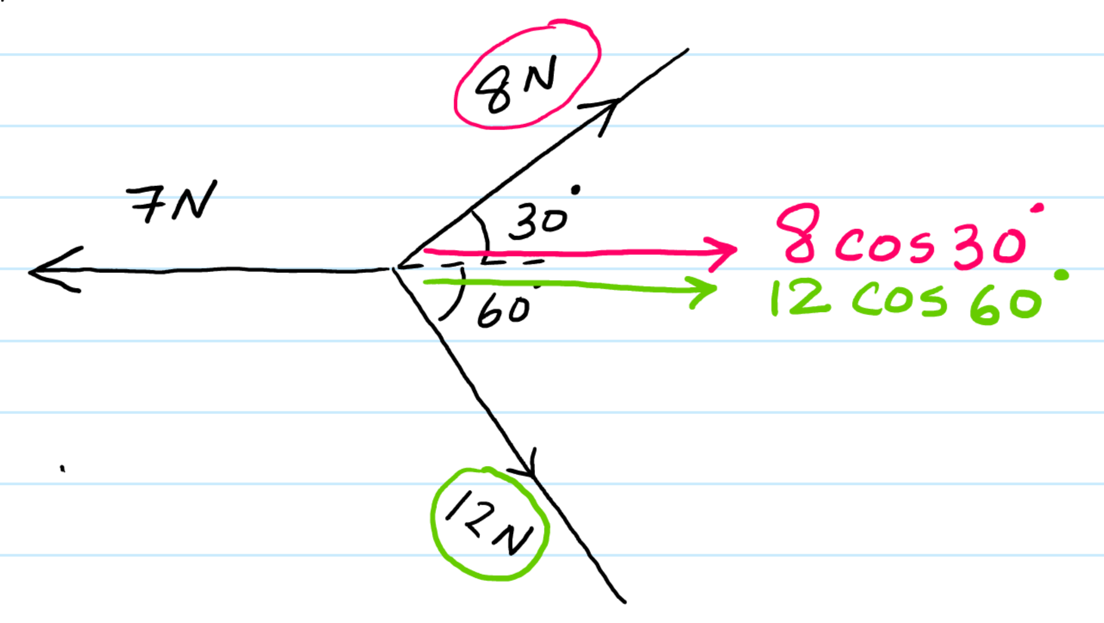
Vector continued

15 September 2020 08:44

"Continuation of Resolution of Vectors"

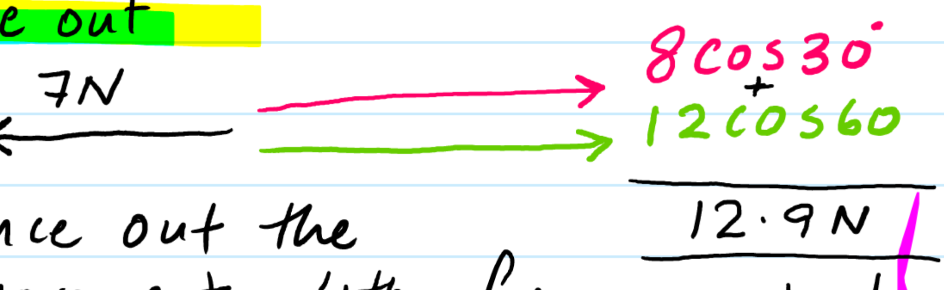
Q.1 The diagram below shows 3 forces.



Calculate the magnitude & direction of the fourth force which if applied, would ensure that the object is only able to move in the VERTICAL PLANE.

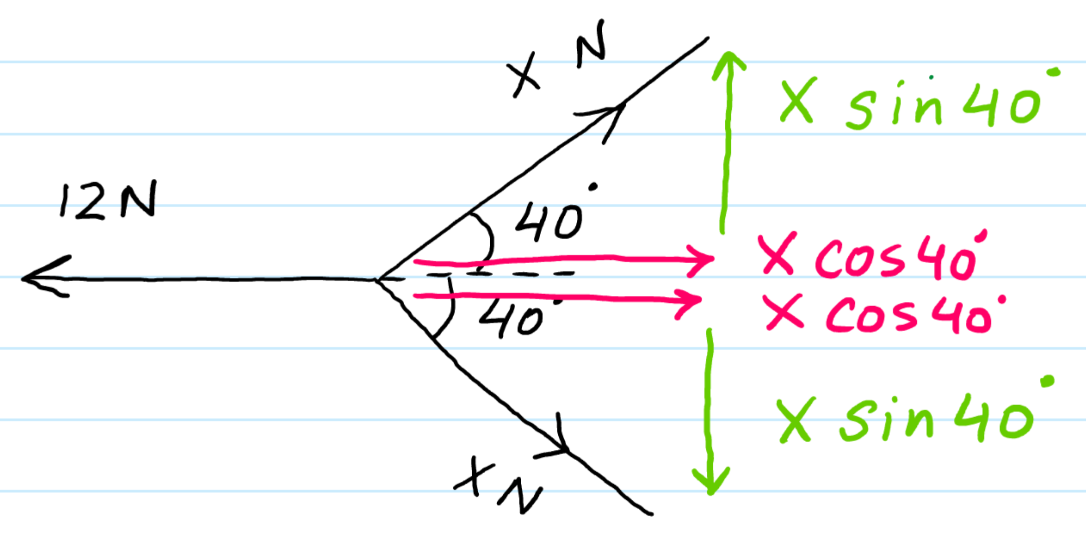
Answer:

The question implies that there should be NO horizontal movement or we can say that the horizontal forces must balance out



So to balance out the horizontal movement, 4th force must be of 12.9 − 7 = 5.9N (acting to the left).

Q.2 The diagram shows 3 forces acting on an object.



Given that this object is in Equilibrium. Find the value of X?

Equilibrium :- forces should balance (both in the horizontal & in the vertical plane)

Lets consider horizontal forces for EQ. the forces on the RIGHT must balance out with the forces on the LEFT. hence

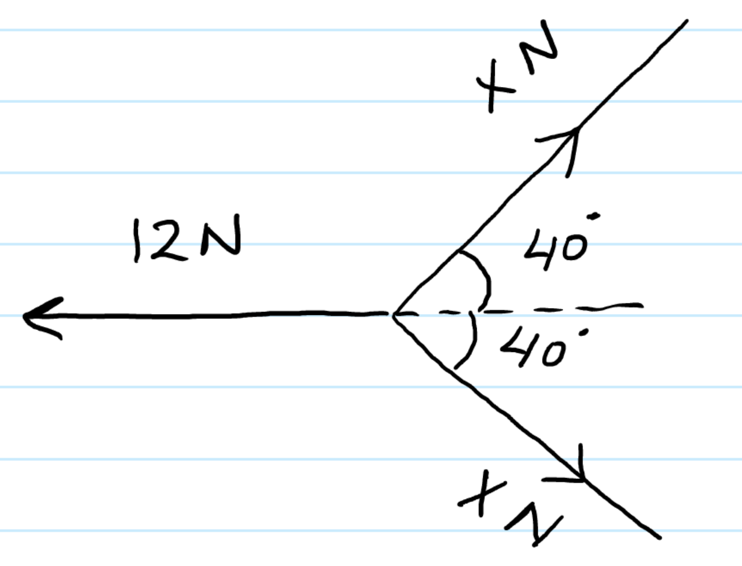
$X \cos 40° + X \cos 40° = 12 N$

$2X \cos 40° = 12$

$X = 7.8 N$

Note :- The same answer of X, can also be obtained using an alternate method. This method is called Constructing a VECTOR TRIANGLE FOR EQUILIBRIUM.

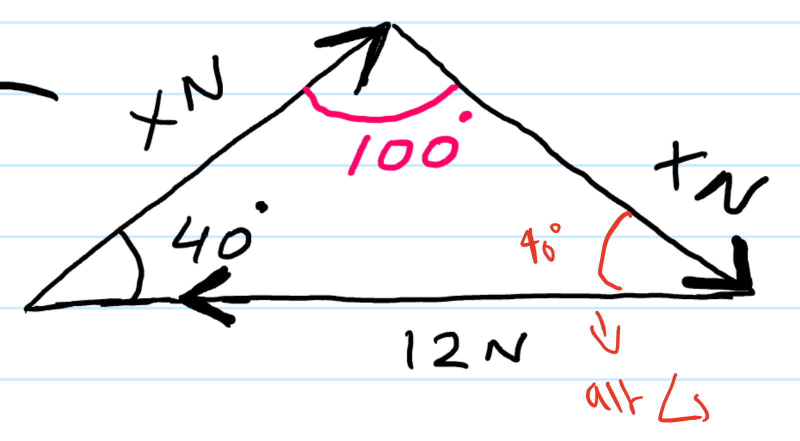
* How do we construct Vector triangle for Equilibrium to find X?



original given diagram

Step # 1 :- Out of 3 forces, ignore any one force (eg 12N) & join the other two forces using head to tail Rule.

Vector Δ for Equilibrium



find X?

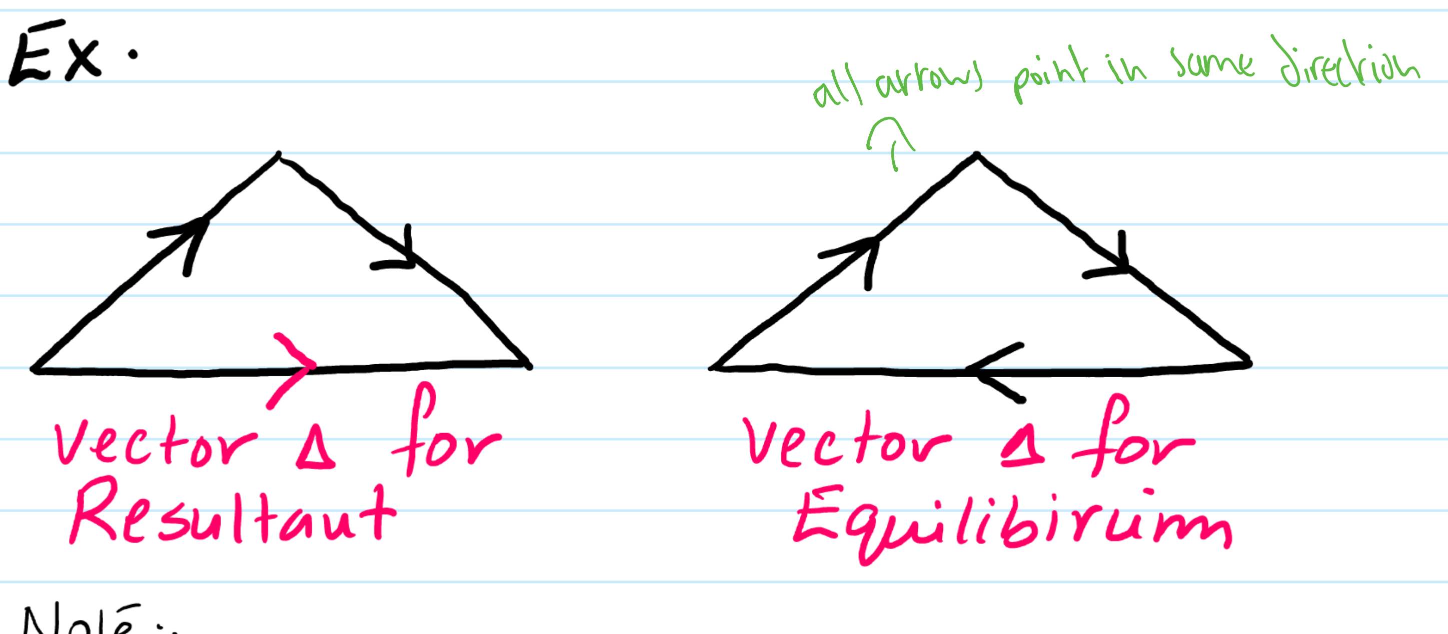
Step # 2 :- Now shift the previously ignored force in a manner so as to complete a triangle.

Use Sine Rule

$$\frac{X}{\sin 40°} = \frac{12}{\sin 100}$$

$X = 7.8N$

Ex.



Note:

Q:- How is vector Δ for Equilibrium different from vector Δ which we constructed previously to obtain Resultant.

In case of Resultant, the head of the Resultant use to point toward the head to the vector but In case of Equilibrium, all arrows point in the same sense.

Limitation of second method is

Since triangle has 3 sides ∴ Vector Δ for Eq. can only be constructed if there are 3 forces given in the Question (not more than 3) whereas first method can be used for more than 3 forces as well