May the Force be with you....

or possibly against you, depending on what you are trying to accomplish.

Learning Goal: I will be able to break forces (Vectors) into their component form and solve simple two dimensional problems.

Feb 10-9:16 PM

Dynamics is the study of the causes of motion.

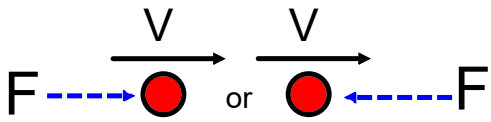
In its most basic sense, a **FORCE** can be considered a PUSH or PULL that acts on an object.

Sometimes we can see how the forces is applied, ie a rope tied to wagon, but most times we cannot actually SEE the force, yet we can feel it.

We use vector diagrams to represent forces that act on objects.

When an unbalanced force is applied to an object it can have one of the following effects:

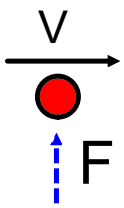
(i) there is a change in the object's velocity

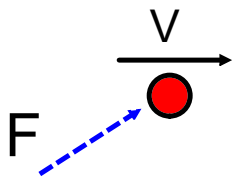


(ii) there is a change in the objects direction

OR

(iii) there is a change in both velocity and direction.





Oct 10-1:25 PM

Applied Force (F_a)
- a force that results when one object makes contact with another and pushes or pulls on it

Tension Force (F_T)
- a pulling force from a rope or string on an object that always points toward the rope or string

Normal Force (F_N)
- a perpendicular force exerted by a surface on an object in contact with the surface; the normal force always points away from the surface

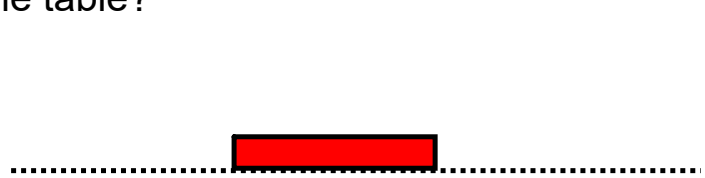
Friction Force (F_f) or (F_s)
- opposes the sliding of two surfaces across one another; friction acts opposite to the motion or attempted motion

Free-Body Diagram (FBD)
-a simple drawing of an object showing all the forces that are acting on it

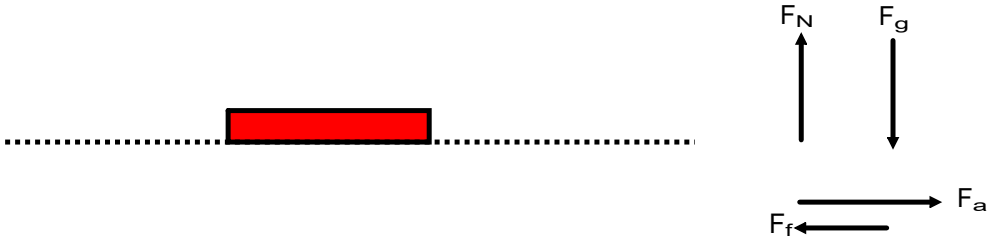
Oct 10-1:12 PM

Force Diagrams or Free Body Diagrams

Draw the Free Body Diagram for the forces acting on this book at rest on the table?

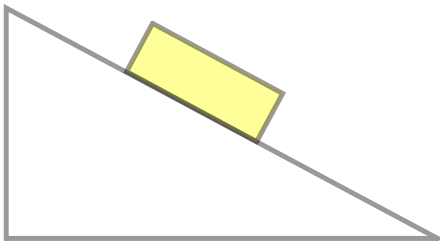


Draw the Free Body Diagram for the forces acting on the book as I push it across the table?

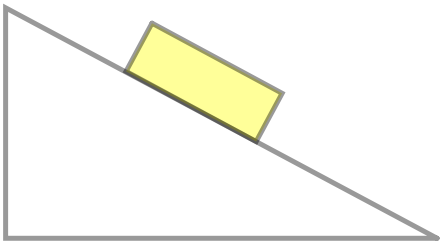


Oct 10-1:16 PM

What would the free body diagram look like for a book RESTING on a ramp?

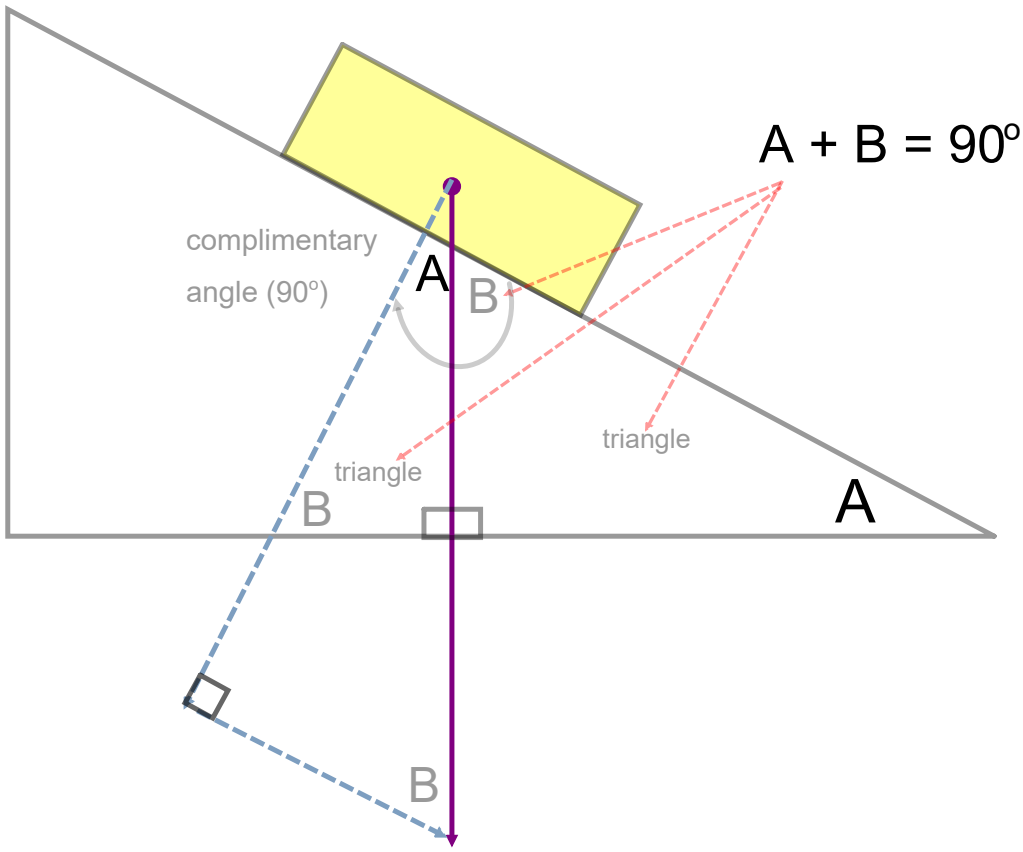


If the book is sliding (moving) down the ramp, there must be an unbalanced force in the system. Where might that unbalanced force come from?



Oct 10-2:28 PM

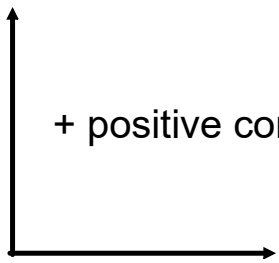
The Geometry of a Ramp Problem



Feb 10-9:27 PM

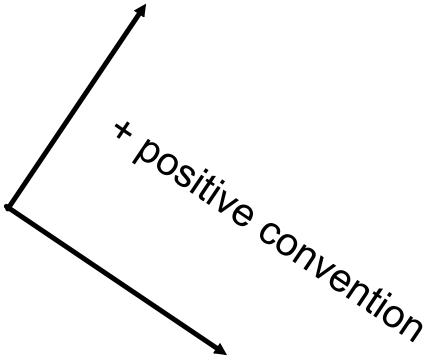
The NET Force (F_{Net}) is the sum of all the forces acting on an object.

To sum the net forces on an object, we will continue to use the same positive direction convention previously discussed, also, we will continue to break up vectors into their respective x and y components.



+ positive convention

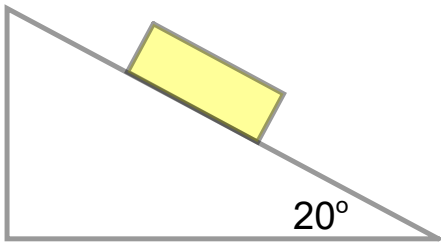
OR



Oct 10-2:23 PM

Find the NET Force acting on the 5 kg book **resting** on the ramp?

1. Draw FBD



2. Determine the force of gravity.

3. Determine the Normal Force.

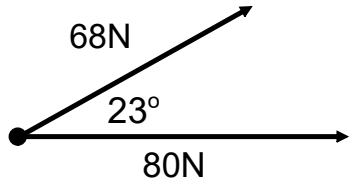
4. Determine the Frictional Force.

5. If the book begins to accelerate down the ramp at 0.25m/s^2 , what is the new frictional force?

Oct 10-2:33 PM

Example 1: (Parallelogram method)

Two forces of 80N and 68N are applied to an object at the same time. The angle between the forces is 23^0. Find the resultant force.



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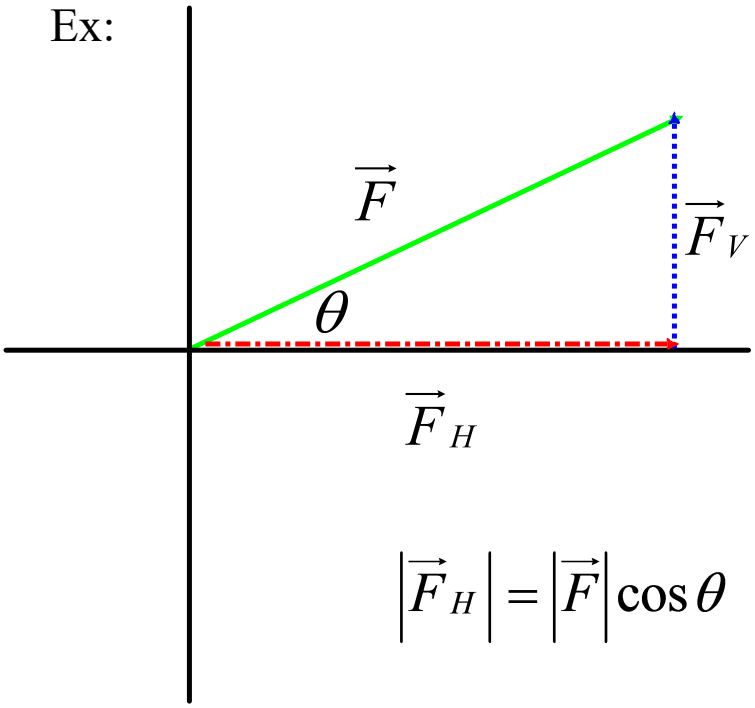
Resolving a vector into its components

In many cases a vector can be described as itshorizontal component and its vertical component.

Ex:



$$\left|\vec{F}_V\right| = \left|\vec{F}\right| \sin\theta$$

$$\left|\vec{F}_H\right| = \left|\vec{F}\right| \cos\theta$$

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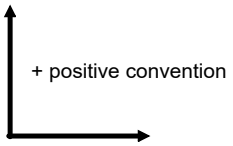
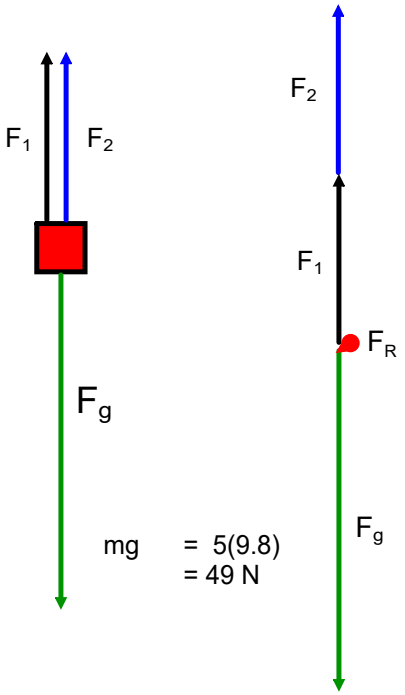
Forces in Equilibrium:

If two or more forces are in equilibrium, the resultant force will always be 0



Example: A 5kg weight suspended from two strings.



$F_1 + F_2 + F_g = 0$

What are the magnitudes of F_1 and F_2?

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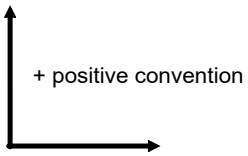
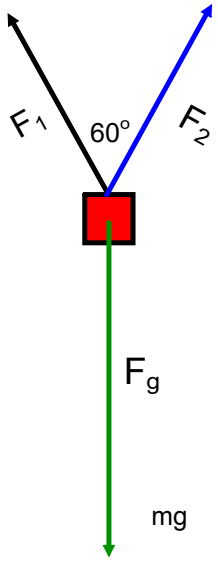
Forces in Equilibrium:

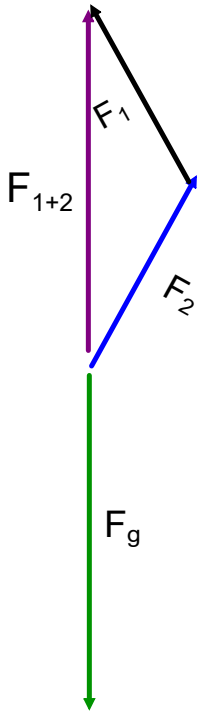


If two or more forces are in equilibrium, the resultant force will always be 0

Example: A 5kg weight suspended from two strings with an angle of 60 ° between the two forces.



mg = 5(9.8)
= 49 N



F_1 and F_2 create a resultant vector that balances the F_g

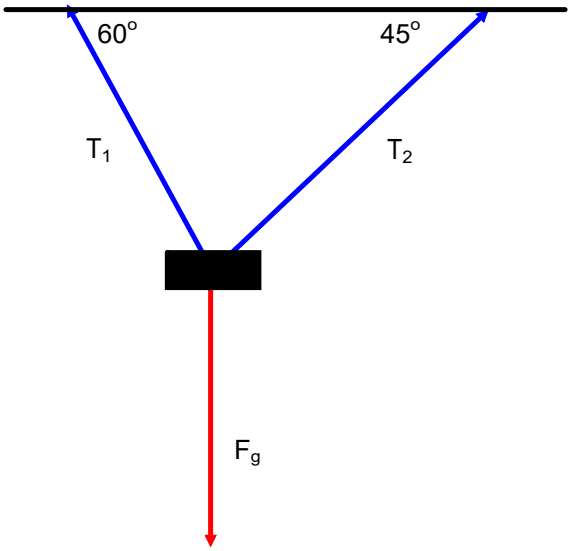
$$F_1 + F_2 = F_g$$
$$F_{1+2} = F_g$$
$$F_{1+2} - F_g = 0$$

What are the magnitudes of F_1 and F_2?

What do you notice is different from the first example?

Feb 17-2:49 PM

Example:
A mass of 20 kg is suspended from a ceiling by twdengths of rope that make angles of 60º and 45º with the ceiling. Determine the tension in each ofthe ropes.



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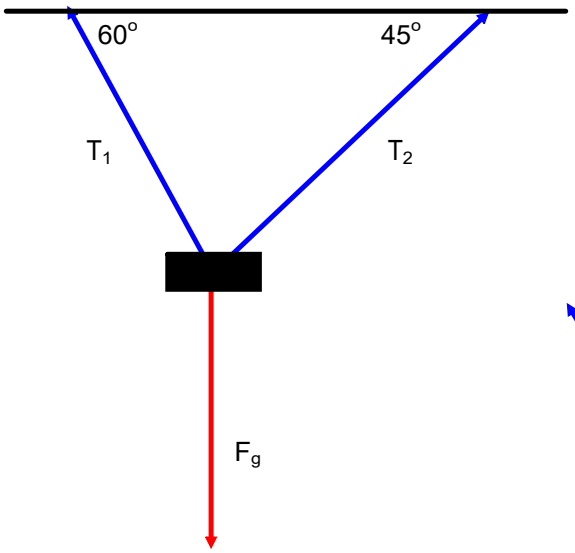
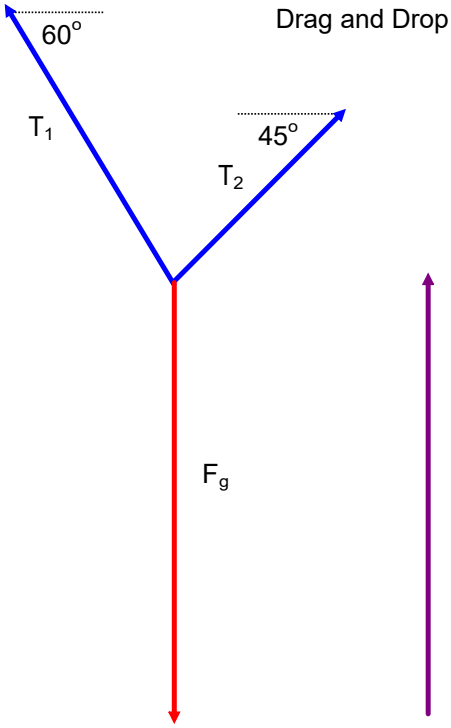
Method One - Parallelogram/Triangle Approach

Note the length of the rope can be a deception as to the magnitude of the Force Vector.

The length of the rope is fixed, but the magnitude of the force vectors can extend outside the parameters of the problem.



Drag and Drop



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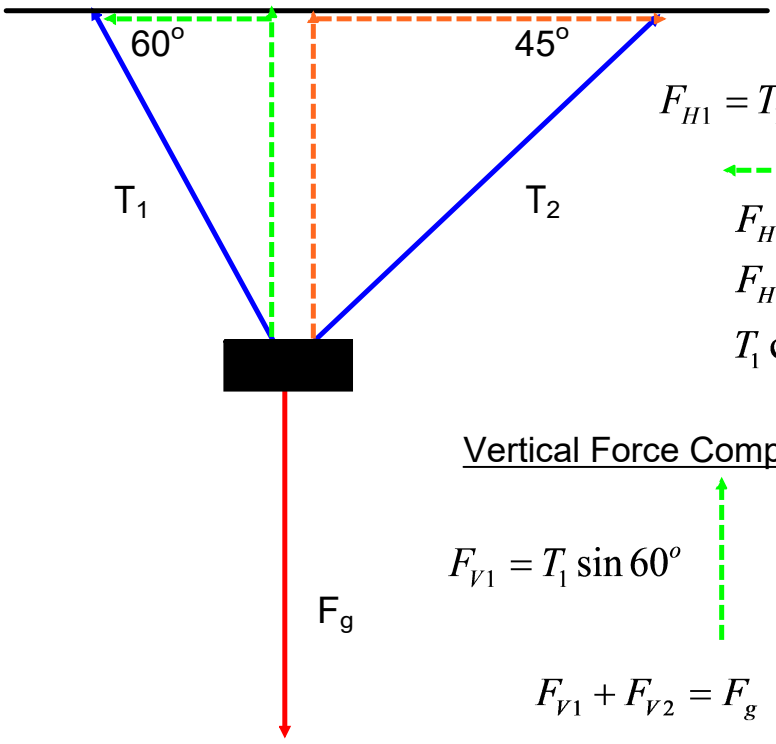
Method Two - Component Approach

+ positive convention



Horizontal Force Components

$$F_{H1} = T_1 \cos 60^o \qquad F_{H2} = T_2 \cos 45^o$$

$$F_{H1} = F_{H2}$$
$$F_{H1} - F_{H2} = 0$$
$$T_1 \cos 60^o - T_2 \cos 45^o = 0$$

Vertical Force Components

$$F_{V1} = T_1 \sin 60^o \qquad F_{V2} = T_2 \sin 45^o \qquad F_g = mg$$

$$F_{V1} + F_{V2} = F_g$$
$$F_{V1} + F_{V2} = mg$$
$$T_1 \sin 60^o + T_2 \sin 45^o = mg$$

Solve the Linear System

$$T_1 \cos 60^o - T_2 \cos 45^o = 0$$
$$T_1 \sin 60^o - T_2 \sin 45^o = mg$$

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Homework

Read pg 70 - 76

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