PHYSICS 12

NEWTON'S FIRST LAW

Newton's First Law = The Law of Inertia

❖ An object remains moving at constant velocity (or it says at rest) unless acted upon by an unbalanced force.

Note: Constant velocity means no change in speed and/or no change in direction

Unbalanced Force = the net force is NOT zero

Net Force = vector sum of all forces acting on an object

INERTIA = Natural tendency of all objects to resist change in their state of motion or rest. Inertia is directly proportional to the mass of the object.

➢ The higher the mass, the greater the inertia

EQUILIBRIUM = a state during which all forces acting on an object are balanced.

Give an example of an object that experiences acceleration due to changes in direction and speed.

→ a car slows down going into a curve

Give an example of an object that experiences acceleration due to changes in speed only.

→ speeding up on a straight stretch of a road

Give an example of an object that experiences acceleration due to changes in direction only.
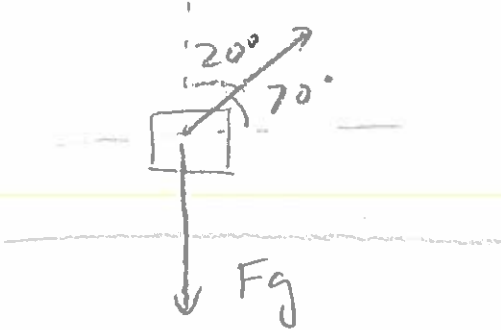
→ taking a ride on a merry-go-round when it is done speeding up and before it starts slowing down
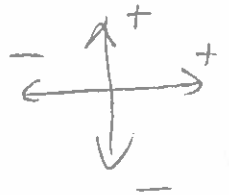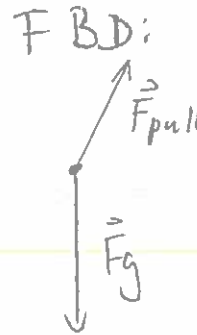
Give an example of an object that is in equilibrium.

→ anything that moves at constant speed along a straight line.
→ anything that is at rest.

Give an example of an object that has greater inertia than you.

→ an aeroplane
→ Earth

$$\|\vec{F}_{pull_2}\| = \sqrt{4477.0353}$$
$$\doteq 67 N$$
$$\theta = \tan^{-1}\left(\frac{42.9539}{51.3030}\right)$$
$$\theta \doteq 40°$$
$$\therefore \vec{F}_{pull_2} = 67N \angle 40°D.$$

1. What force do you have to exert on a 10.0 – kg object that is being pulled with force of 150.0N [Up20°Right] and is 1.0m above the ground in order to keep the object in equilibrium?

Include a Free-Body Diagram.

no FN

FBD:
$$\vec{F}_{net} = [0,0]$$

$$\vec{F}_g = mg$$
$$= (10.0)(9.8)$$
$$= [0, -98.0] N$$

$$\vec{F}_{pull\,①} = [150\cos 70°, 150\sin 70°]$$
$$= [51.3030, 140.9539] N$$

$$\vec{F}_{net} = \vec{F}_g + \vec{F}_{pull\,①} + \vec{F}_{pull\,②}$$
$$[0,0] = [0, -98.0] + [51.3030, 140.9539] + [x,y]$$

x:
$$0 = 0 + 51.3030 + x$$
$$x = -51.3030 N$$

y:
$$0 = -98.0 + 140.9539 + y$$
$$y = -42.9539 N$$

∴ $\vec{F}_{pull\,②} = [-51, -43] N$ has to be exerted to maintain the object in equilibrium. ⊛