

# Newton's 1<sup>st</sup> Law & Net Force

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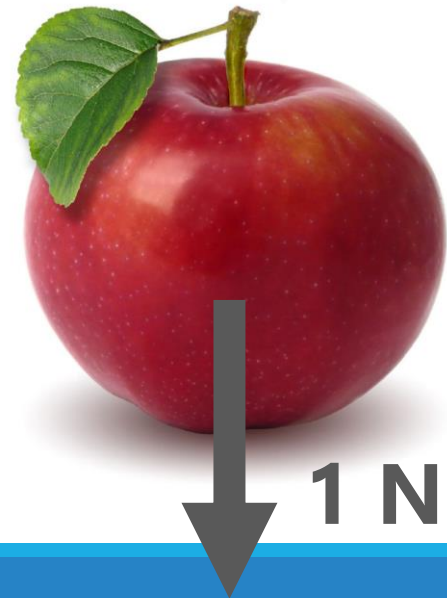
IB PHYSICS | FORCES

# What is a Newton??

## Unit of Force

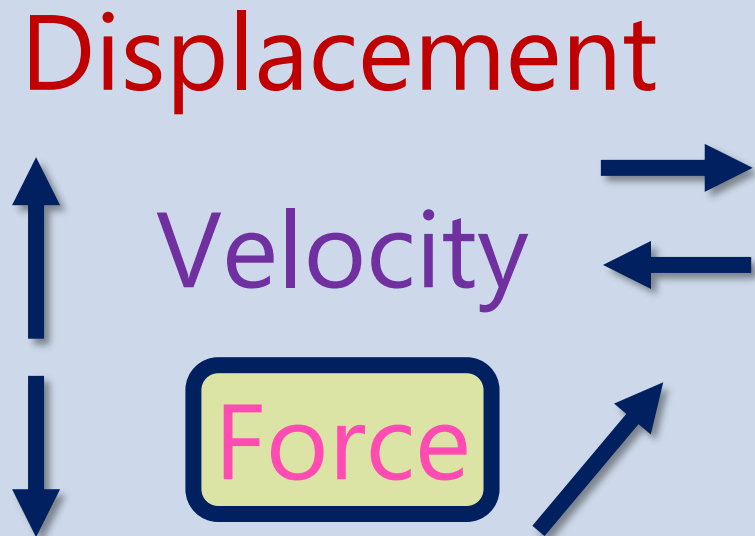
$$\text{N} = \text{kg} \times \text{m s}^{-2}$$

\*An apple weighs about 1 N



# REMINDER: Vector vs Scalar

## Vector Quantities



Can be negative to indicate direction

## Scalar Quantities

Distance  
Speed  
Energy

Only Positive

# Newton's First Law

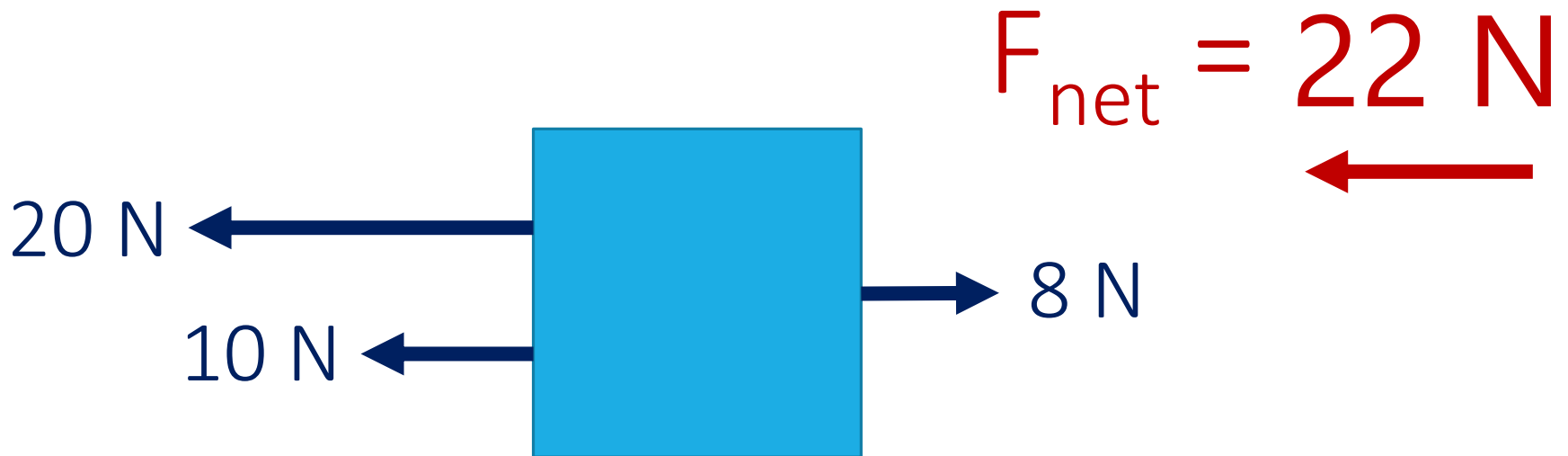
A body will remain at rest or moving with constant velocity unless acted upon by an unbalanced force

“Law of  
Inertia”



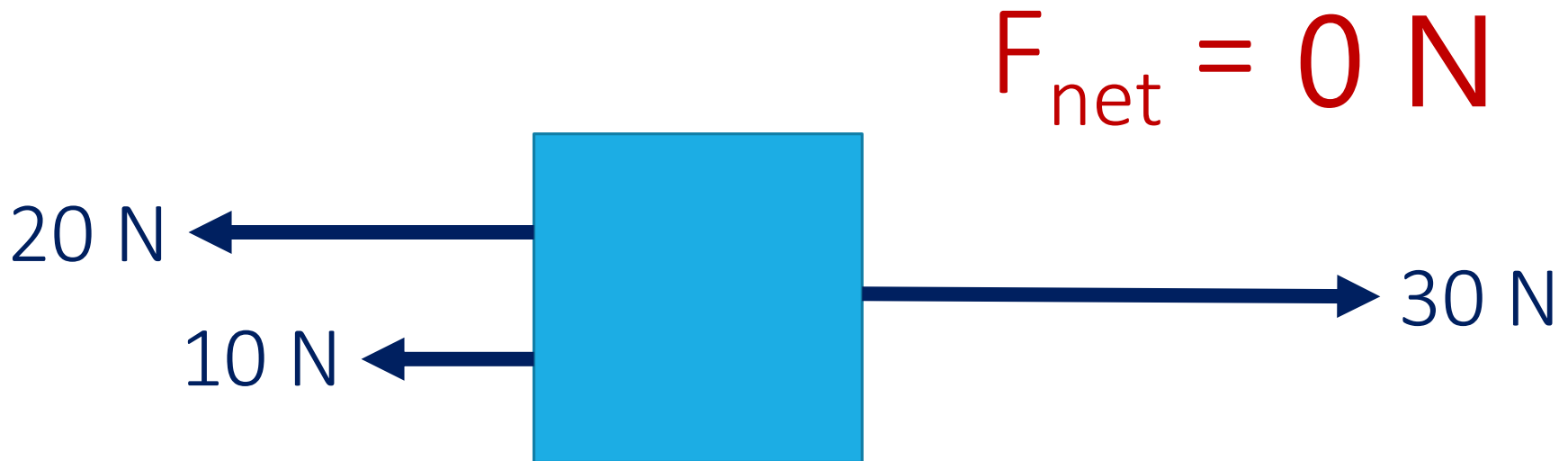
(Total) → Net Force

The vector sum of all the forces acting on an object



# Equilibrium

When all forces cancel out,  
the object is in equilibrium



# Using Equilibrium



What is the tension force on the second cable if the window washers are in equilibrium?

$$F_{net} = 0 \text{ N}$$

$$1350 + T - 750 - 900 - 800 = 0 \text{ N}$$

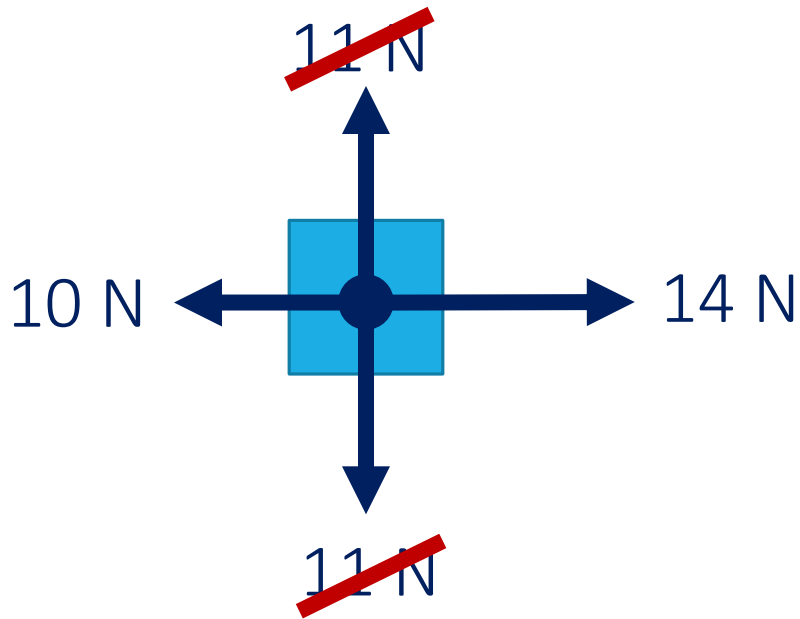
$$T = 1100 \text{ N}$$

Weight of Guy #1 = 750 N

Weight of Guy #2 = 800 N

Weight of Platform = 900 N

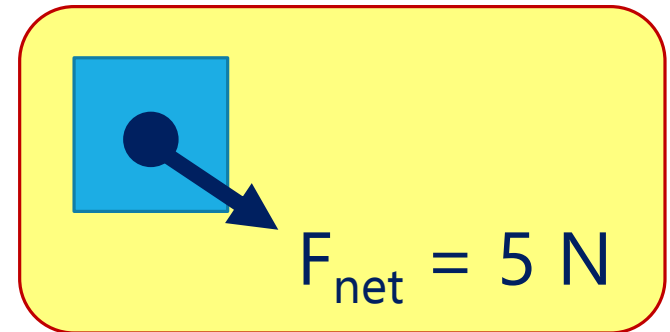
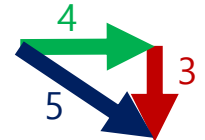
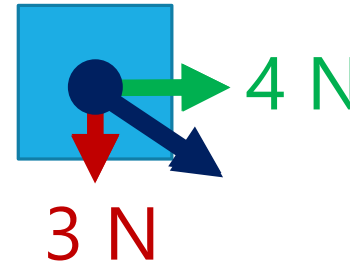
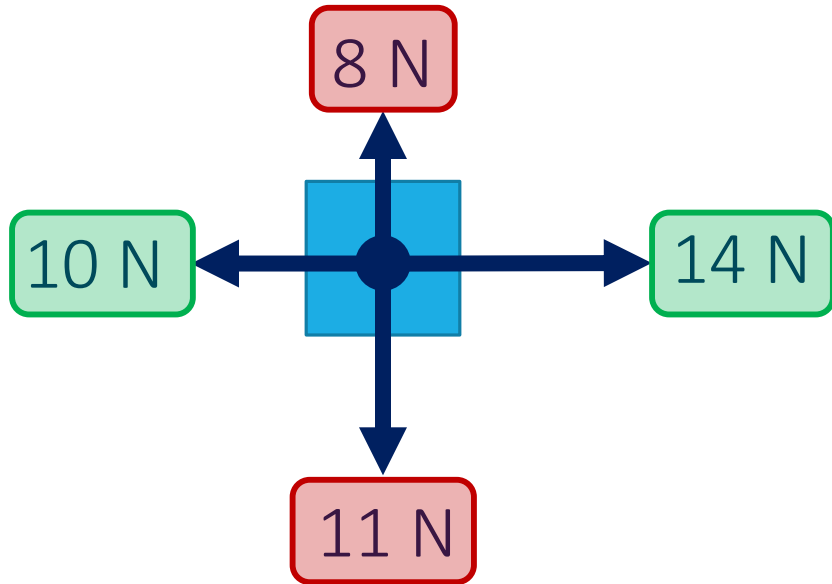
# What is the Net Force? | 1



$$F_{\text{net}} = 4 \text{ N} \rightarrow$$



# What is the Net Force? | 2

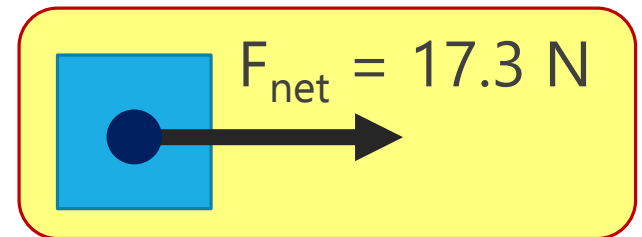
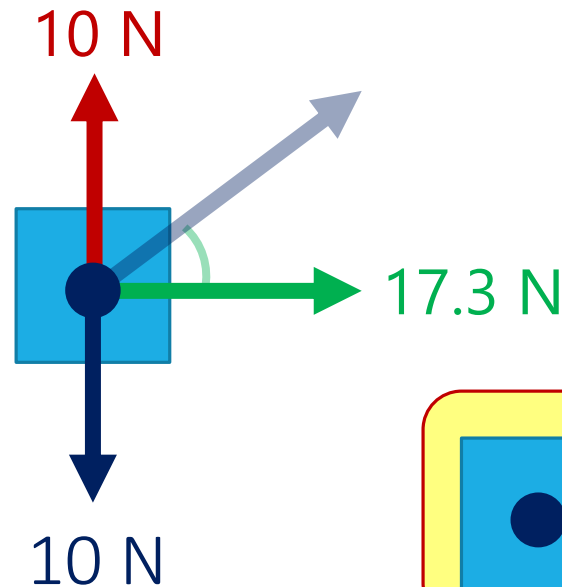
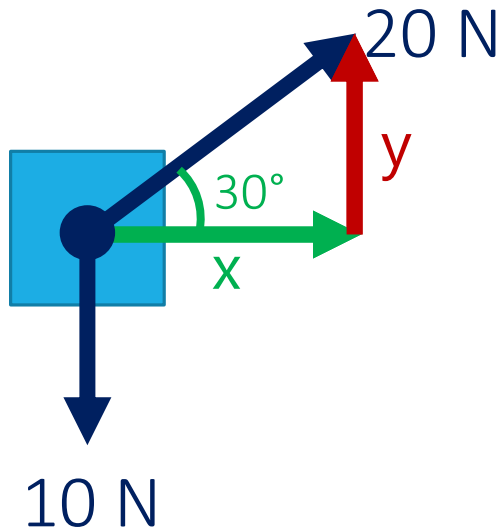


# What is the Net Force? | 3

Remember ~~SOH~~CAHTOA?

$$x = 20 \cos(30) = 17.3 \text{ N}$$

$$y = 20 \sin(30) = 10 \text{ N}$$

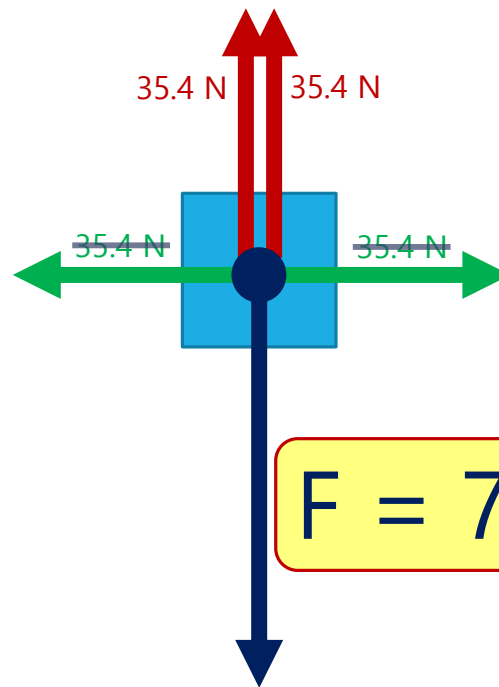
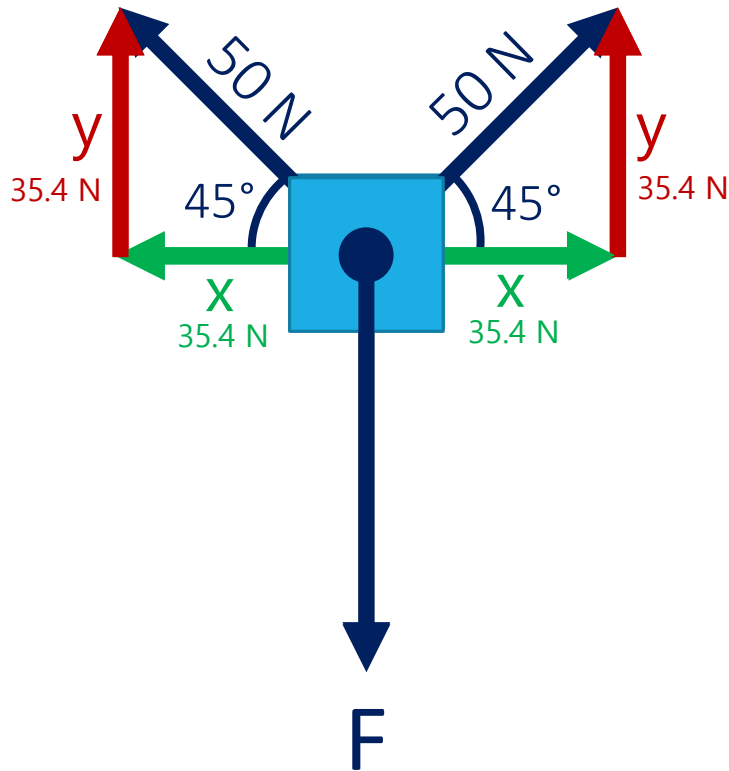


# What is the Missing Force?

$$x = 50 \cos(45) = 35.4 \text{ N}$$

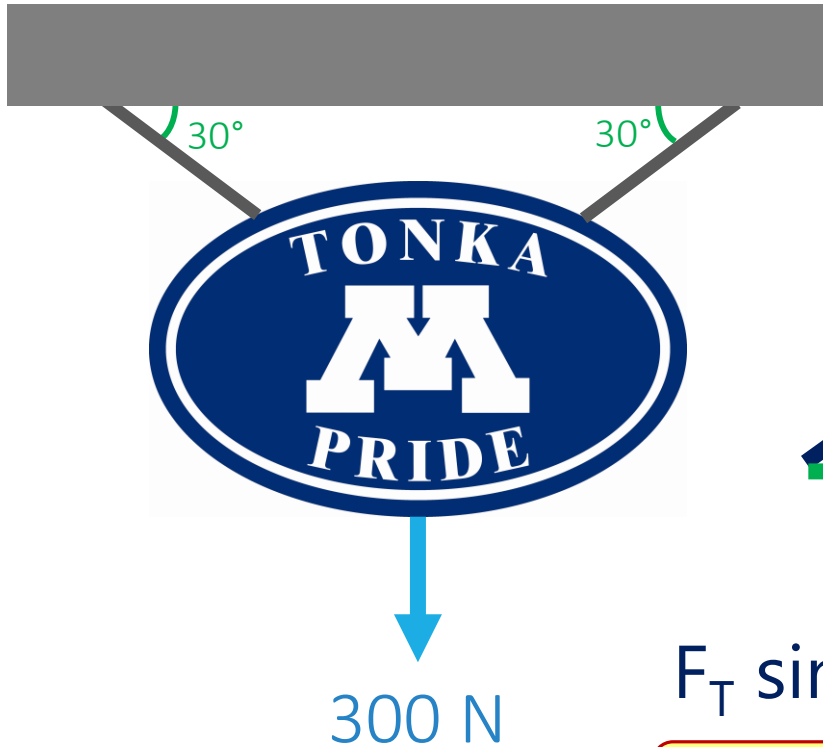
$$y = 50 \sin(45) = 35.4 \text{ N}$$

$$F_{\text{net}} = 0 \text{ N}$$

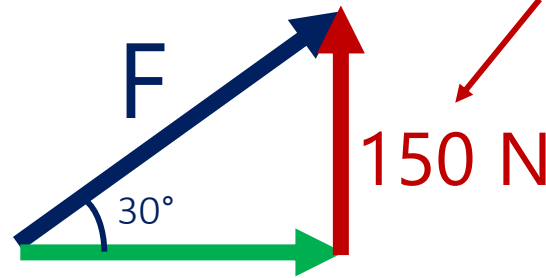


$$F = 70.8 \text{ N}$$

# Cable Tension



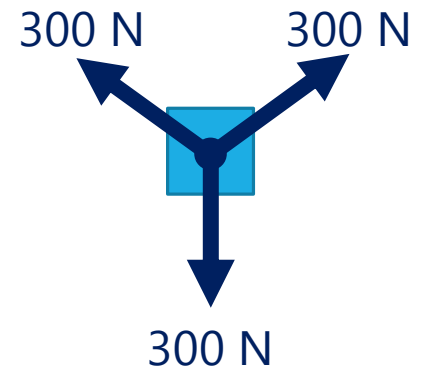
What is the tension of these cables?



Each cable must support half the vertical force if the weight is evenly distributed

$$F_T \sin(30) = 150 \text{ N}$$

$$F_T = 300 \text{ N}$$



# Lesson Takeaways

- I can define a force (with proper units) in terms of the interaction between two objects
- I can describe Newton's first law
- I can calculate the net force on an object
- I can calculate an unknown force for an object in equilibrium