

CONCEPT: INTRO TO FORCES AND NEWTON'S SECOND LAW

- A force is either a _____ or _____ (drawn as an arrow) that changes an object's velocity. Unit = _____ (_____ = $\frac{\text{kg}\cdot\text{m}}{\text{s}^2}$)

- Newton's 2nd Law:** Law of _____:

$$\Sigma F = F_{net} = \underline{\hspace{2cm}}$$

$$a = \underline{\hspace{2cm}}$$

- IF a net force acts on an object, it accelerates _____ of F_{net}

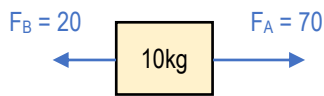
$$m = 2\text{kg}$$

- Net Force = Resultant (Vector Sum) after adding all forces acting on an object.

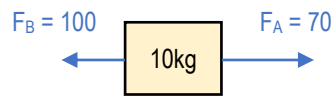
$$m = 2\text{kg}$$

EXAMPLE: A 10 kg block is pulled by multiple horizontal forces. Calculate the block's acceleration.

a)



b)



FORCES

- 1) Choose direction of +
- 2) Write & expand $\Sigma F = ma$
- 3) Solve

- Signs are very important when expanding $\Sigma F = ma$!

- Usually, we choose the direction of positive to be to the [**RIGHT** | **LEFT**] and [**UP** | **DOWN**].
- When expanding ΣF , Forces [**ALONG** | **AGAINST**] the positive direction are written with a [+ | -].
- When expanding ΣF , Forces [**ALONG** | **AGAINST**] the positive direction are written with a [+ | -].
- When solving for a , the sign of your answer gives you the *direction* of acceleration!

CONCEPT: SOLVING FOR FORCES USING NEWTON'S SECOND LAW

EXAMPLE: A 10 kg box accelerates to the right at 9m/s^2 , pushed by 2 forces. If the box is pushed left with 30N, calculate the other force.

- a) 60N
- b) 120N
- c) 150N

EXAMPLE: A 10 kg box accelerates to the left at 6m/s^2 , pushed by 2 forces. If the box is pushed right with 70N, calculate the other force. Assume the direction of positive is to the right.

- a) 130N
- b) -130N
- c) 10N
- d) -10N

FORCES
1) Choose direction of + 2) Write & expand $\Sigma F = ma$ 3) Solve

- **Remember!** When expanding ΣF , Forces **ALONG & AGAINST** direction of positive written with + & - sign, respectively.
- Always write **letter a** as _____ (i.e. don't write $\Sigma F = m(-a)$), but plug in correct sign if known (e.g. $F_1 - 50 = 5(-6)$).
- When solving a , you could get a + or - (direction), but when solving F_s , you always get _____ # (i.e magnitude).

CONCEPT: NEWTON'S FIRST LAW

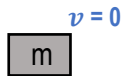
- **Newton's 1st Law:** Law of _____: If $F_{net} = \underline{\hspace{1cm}}$, $a = \underline{\hspace{1cm}}$, $v = \underline{\hspace{1cm}}$

- **Inertia:** Objects _____ changes in velocity unless acted upon by a _____ Force

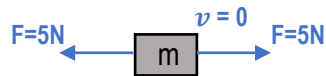
EXAMPLE: A box is pushed to the right with 20N and another force of 20N to the left. If the box has a mass of 6kg, find its acceleration.

FORCES
1) Choose direction of +
2) Write & expand $\Sigma F = ma$
3) Solve

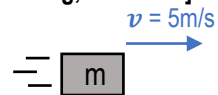
[At rest, no forces]



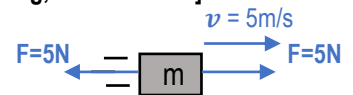
[At rest, forces cancel]



[Moving, no forces]



[Moving, forces cancel]



- Moving objects ($v \neq 0$) **[DO | DO NOT]** require a force to keep moving; without net forces, they keep moving forever!

- _____ = quantity of inertia; a.k.a the amount of _____ to Δv .

- For the same F_{net} , a heavier object accelerates _____ (m , a , Δv)

