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 = _____ (___ = $\frac{kg \cdot m}{s^2}$)

● **Newton's 2nd Law: Law of _____:** $\Sigma F = F_{net} =$ ____ $a =$ _____

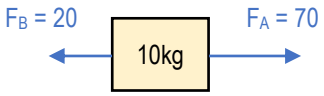
- IF a net force acts on an object, it accelerates _____ of $\boldsymbol{F_{net}}$
  - Net Force = Resultant (Vector Sum) after adding all forces acting on an object.

m = 2kg

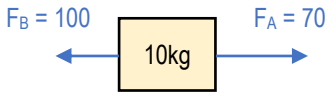
m = 2kg

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 $\boldsymbol{\Sigma F = ma}$
3) Solve

● Signs are very important when expanding **ΣF=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 $\boldsymbol{a}$, 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 $\boldsymbol{\Sigma F = ma}$
3) Solve

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

CONCEPT: NEWTON'S FIRST LAW

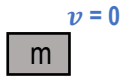
● **Newton's 1st Law: Law of _____:** If F_{net} = ___, a = ___, v = _____

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

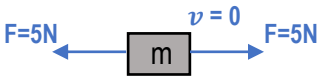
EXAMPLE**:** A box is pushed to the right with 20N and another force of 20N to the left**.** If the box has a mass of 6kg, find its acceleration**.**

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

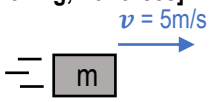
[At rest, no forces]



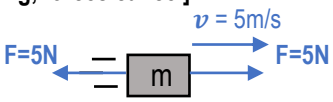
[At rest, forces cancel]



[Moving, no forces]



[Moving, forces cancel]



- Moving objects (v __ 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 $\Delta \boldsymbol{v}$**.**

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