Force and Motion – 1

- force causes accelaration and it's a vector / it's a Motion that can change Motion / push or pull / ↑ or ↓ in speed.
- Newtonian mechanics : 3 laws of motion

- **Newton's first law** : low of Inertia (القصور)

"if no farce acts on a body, the body's velocity cannot change : that is: the body cannot accelarate"

→ if the body is at rest than it stays at rest and if its moving it continuous to move with the same velocity (same magnitude & same direction

- If $\vec{F}_{net} = 0$ → velocity doesn't change → No accelaration *_*

if Mass ↑ → Inertia ↑

- Inertia :
  * خاصية من خواص الجسم التي تقيس مدى قدرته على مقاومة التغير

Mass is the measure of Inertia

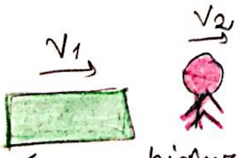
- If the forces are balanced there will be 2 cases :-

* object at Rest
$V = 0$ m/s
↓
stays at Rest

* object in umform motion
($V \neq 0$ m/s)
↓
stays in Motion same velocity & direction

- Inertial & non-inertial frames

: it's an inertial frame
Bcz :- observer's Relative acceleration = 0



: it's an inertial frame Bcz : Relative acceleration = 0 and Relative velocity is umform = $V_2 - V_1$

small umform velocity V_1 — higher uniform velocity V_2 ⇒ No Net force acting

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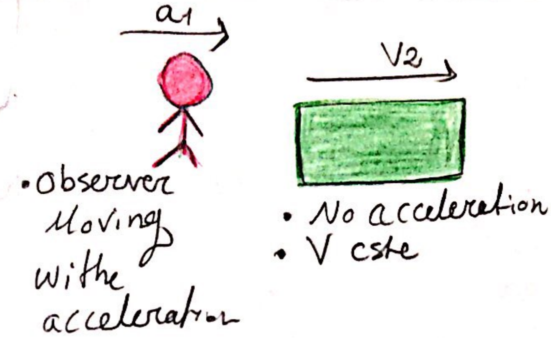
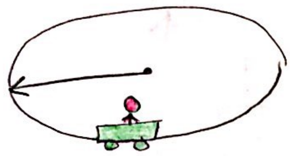


• Observer's frame is non-inertial as person has a Relative Accelerat[ion] with a moving object. The person would see things differently than someone standing stationary on the Ground



• it's a non-inertial frame: observer inside a car would feel the car as stationary, He would feel a centrifugal force throwing him outside the ground
But in an inertial frame: a person standing outside the car on the ground would see the car whirring around

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Newton's second law

"The net force on a body is equal to the product of the body's Mass & it's acceleration"

$$\vec{F}_{net} = m\,\vec{a}$$

• Some particular forces

The Gravitational force $\vec{F}_g$

- Pull toward the center of Earth
- In free-fall

$F_g = mg$

Friction: احتكاك

- opposite of the intended Motion
- it's a resistance

Tension $\vec{T}$

- when a cord is attached to a body and pulled taut the cord pulls on the body with a force $\vec{T}$ directed away from the body
- always a pull
- in the direction of the rope

weight W

- Magnitude of the Net force required to prevent the body from falling freely as measured by someone on the Ground

- $W = |F_g|$
- $W \neq m$
- m is Cste → W is not
  - ↳ if g changes W changengs

The Normal force $\vec{F}_N$

مهم: يجب ان يكون الجسم على السطح ليكون هناك F_N

- when a body presses against a surface, the surface (even a ~~sm~~ seemingly rigid one) deforms and pushes on the body with a Normal force ($\perp$ to the surface)

$\vec{F}_N$ of a body $= m(g + a_{\text{of the body}})$ if $a = 0$ then $\vec{F}_N = mg$

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• Newton's Third Law   force pair

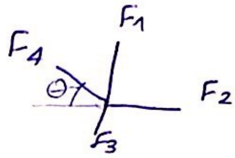
" When two bodies interact, the forces on the bodies from each other are always equal in Magnitude and opposite in direction "

* There has to be 2 bodies

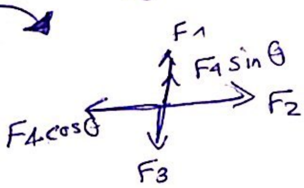
• Notes for doing Exercises

steps:

1) Draw a free body diagram →



2) Break forces into Components →



3) Redraw Free body diagram
4) Sum the forces
5) " " " again

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