Force and Motion – I

- 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**: law of Inertia (القصور)

"if no force 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

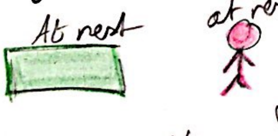
Mass is the measure of Inertia

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

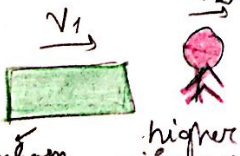
* object at Rest ($V = 0$ m/s) → stays at Rest

* object in uniform 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 uniform = $V_2 - V_1$

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

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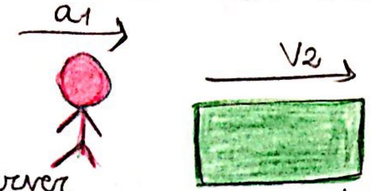
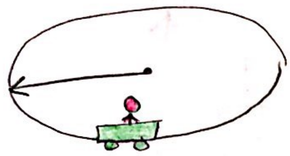


• Observer Moving withe acceleration

• No acceleration
• V cste

• Observer's frame is non-inertial f
as Person has a Relative Accelerat
with a moviing 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 the Earth
- In free-fall

$F_g = mg$

Friction: الاحتكاك

- 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 changes

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 seemingly rigid one) deforms and pushes on the body with a normal force (⊥ 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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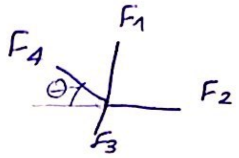
- Newton's Third law   force pair

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

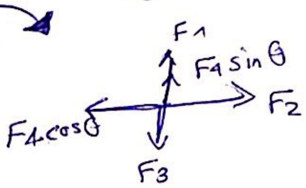
* There has to be 2 bodies

- 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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