มหาวิทยาลัยราชภัฏนครปฐม
Nakhon Pathom Rajabhat University

Chapter 4

Force , Mass & Newton's Laws of Motion

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Content 4 Force and motion.

Standard : Sc. 4.1

Understand about the nature of electromagnetism , Gravity and nuclear power.

There must be a knowledge process. Communicate the acquisition of knowledge and apply knowledge for Benefits and virtues.

FORCE , MASS & NEWTON'S LAW OF MOTION

FORCE

- Resultance
- Vector
- Resultance
- Force
- FRICTION

MASS

WEIGHT

NEWTON'S LAWS OF MOTION

- Newton's law of Gravity between mass
- Newton's laws of motion1
- Newton's laws of motion2
- Newton's laws of motion3

VECTORS

Vectors are quantities that are fully described by both a magnitude and a direction.

Displacement , Speed , Acceleration , Force

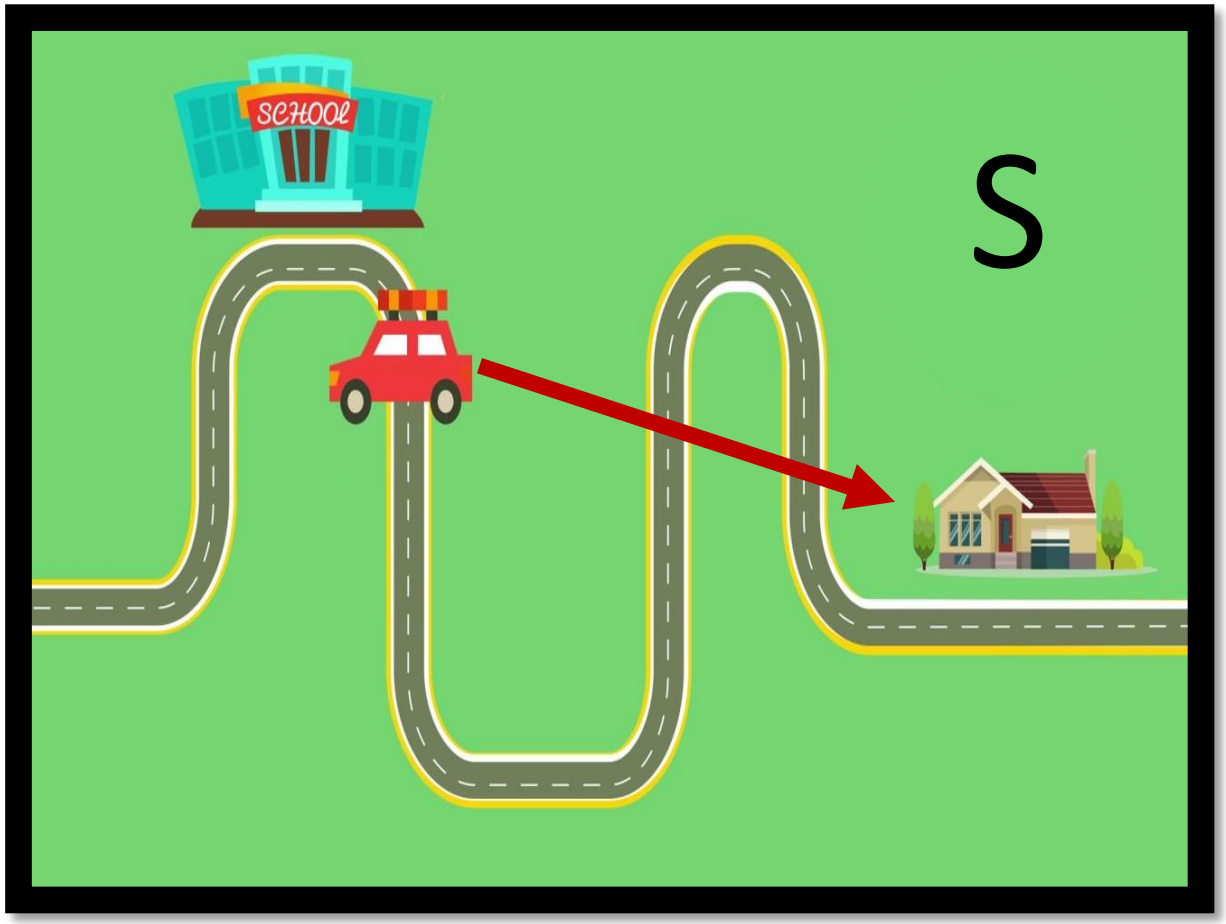
SCALAR

Scalars are quantities that are fully described by a magnitude (or numerical value) alone.

Distance , Mass , Time , Work , Capacity

Distance (S) = Scalars

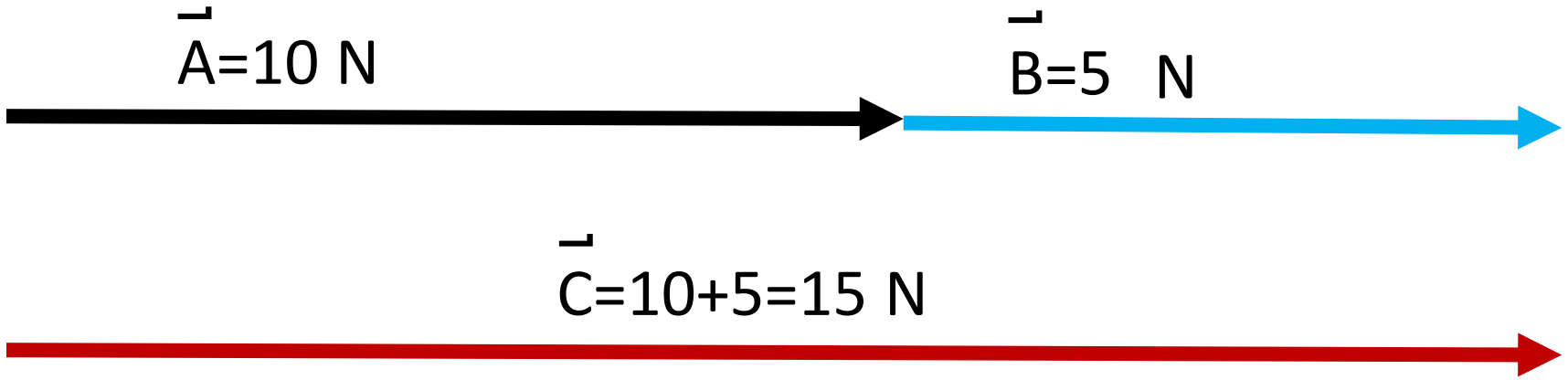
Displacement (S) = Vectors



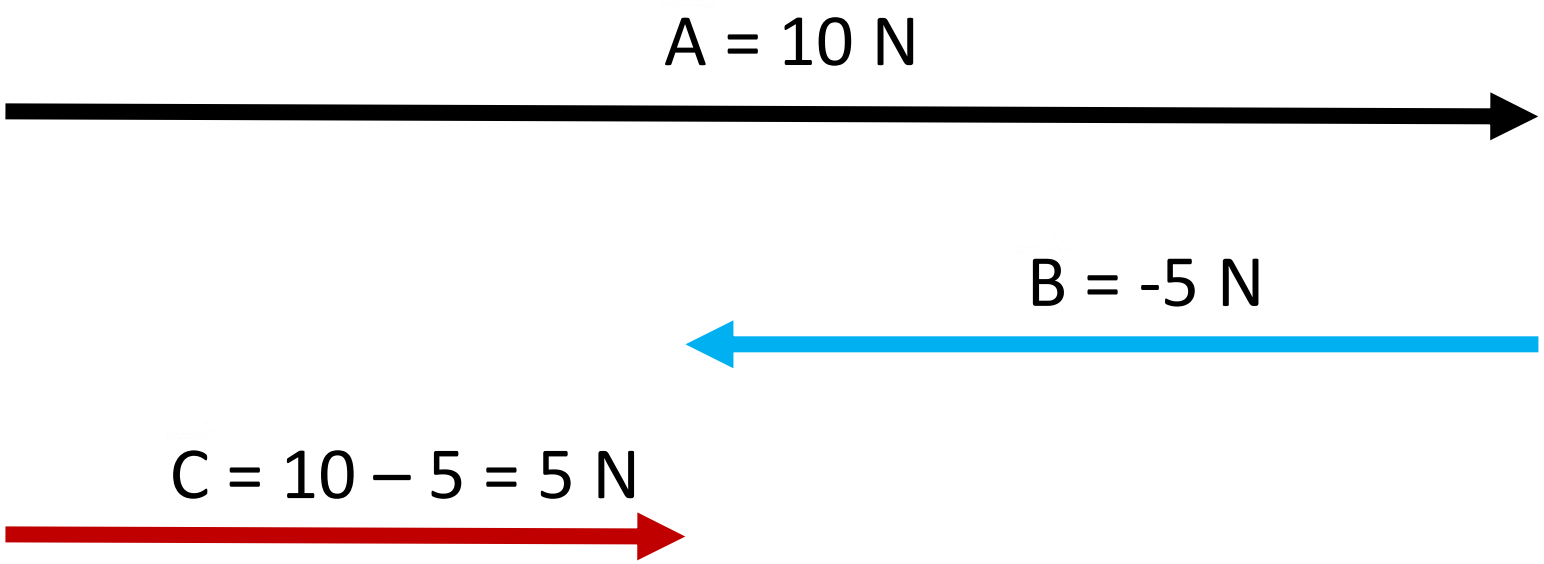
Resultance Vector

- Same direction (+)
- Opposite direction (-)
- Corner
- Calculate

Same Direction (+)

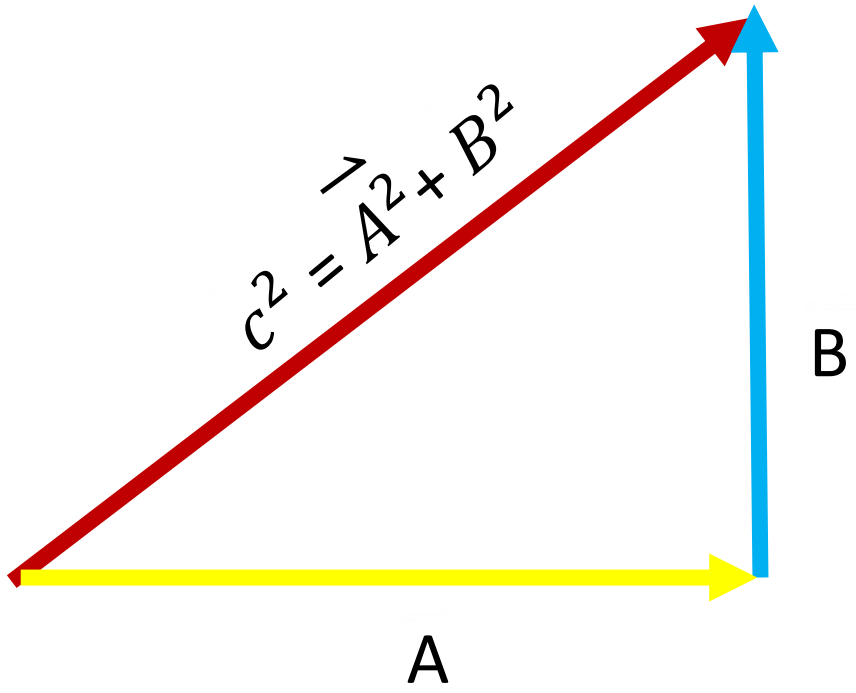


Opposite Direction (-)



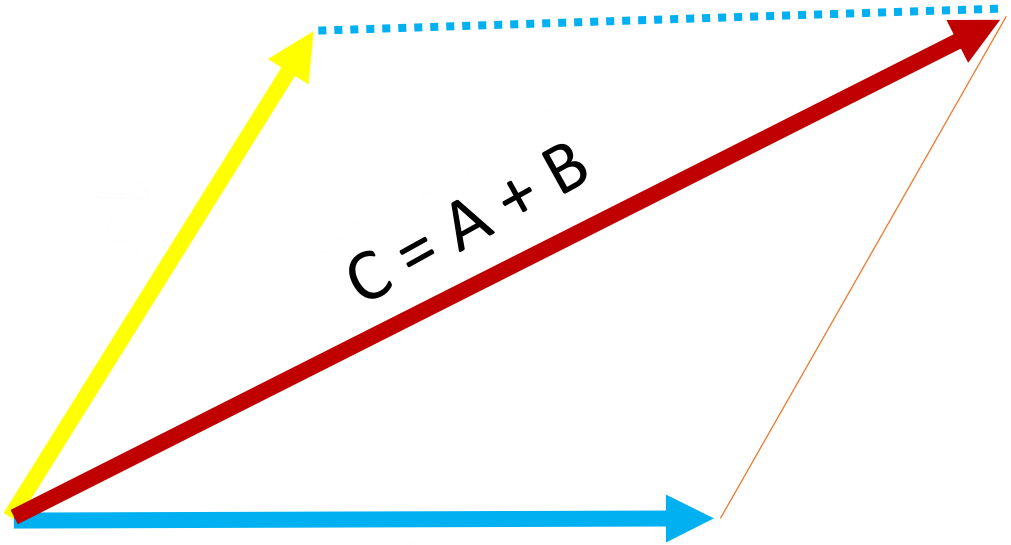
Corner

90°

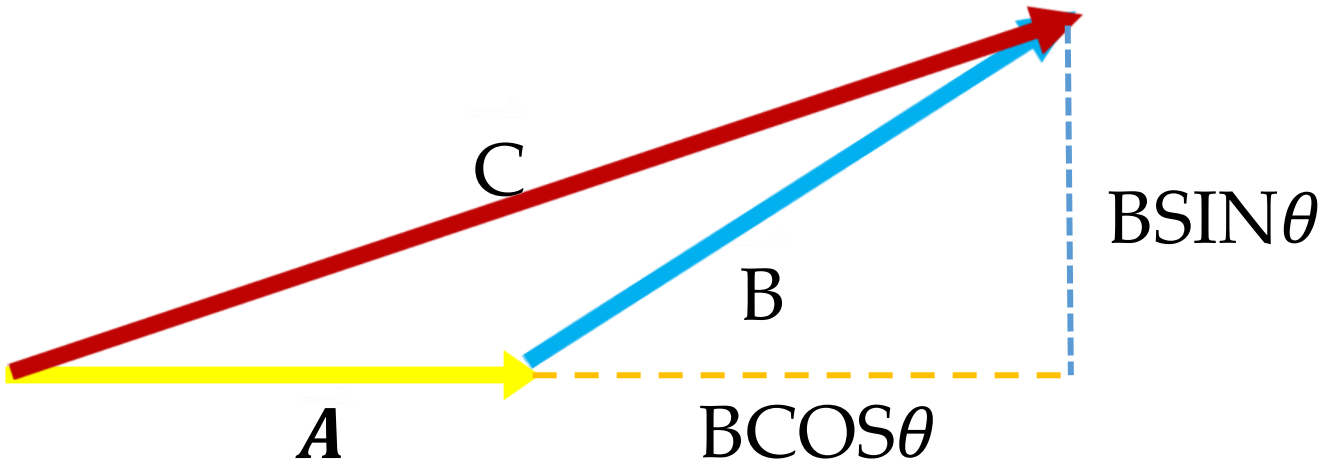


X°

Parallelogram



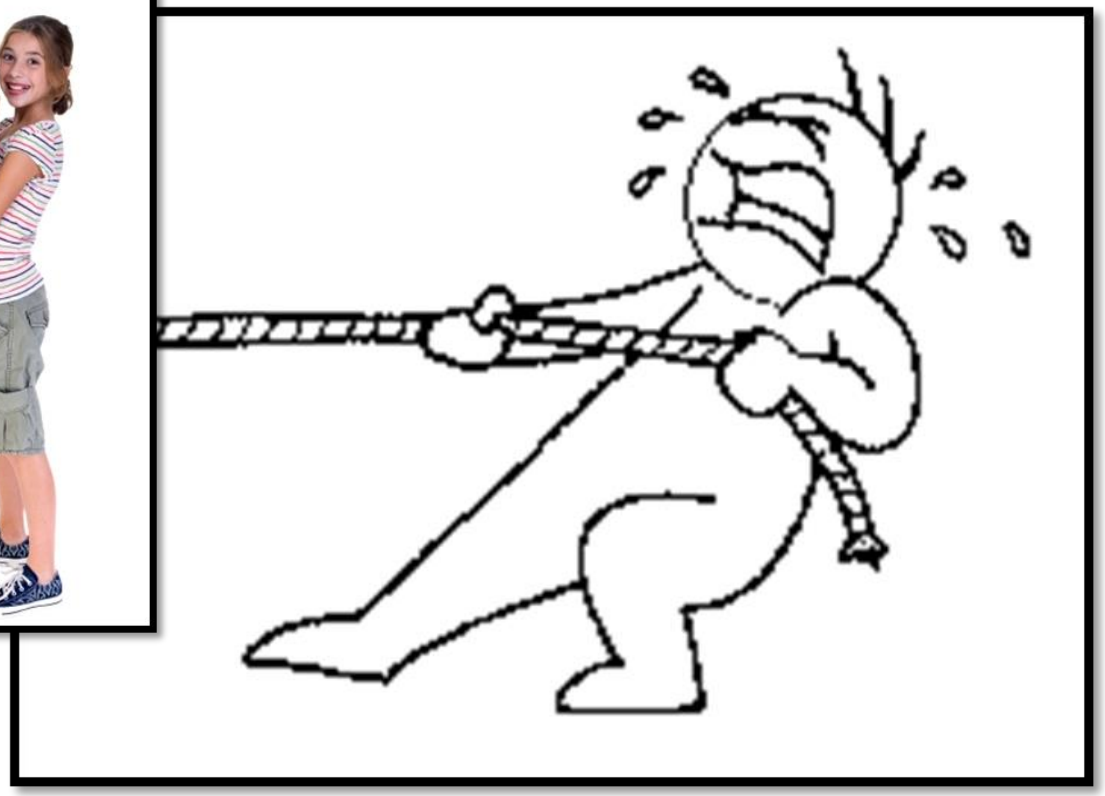
Calculate



$$C^2 = A^2 + B^2 + 2ABCOS\theta$$

FORCE

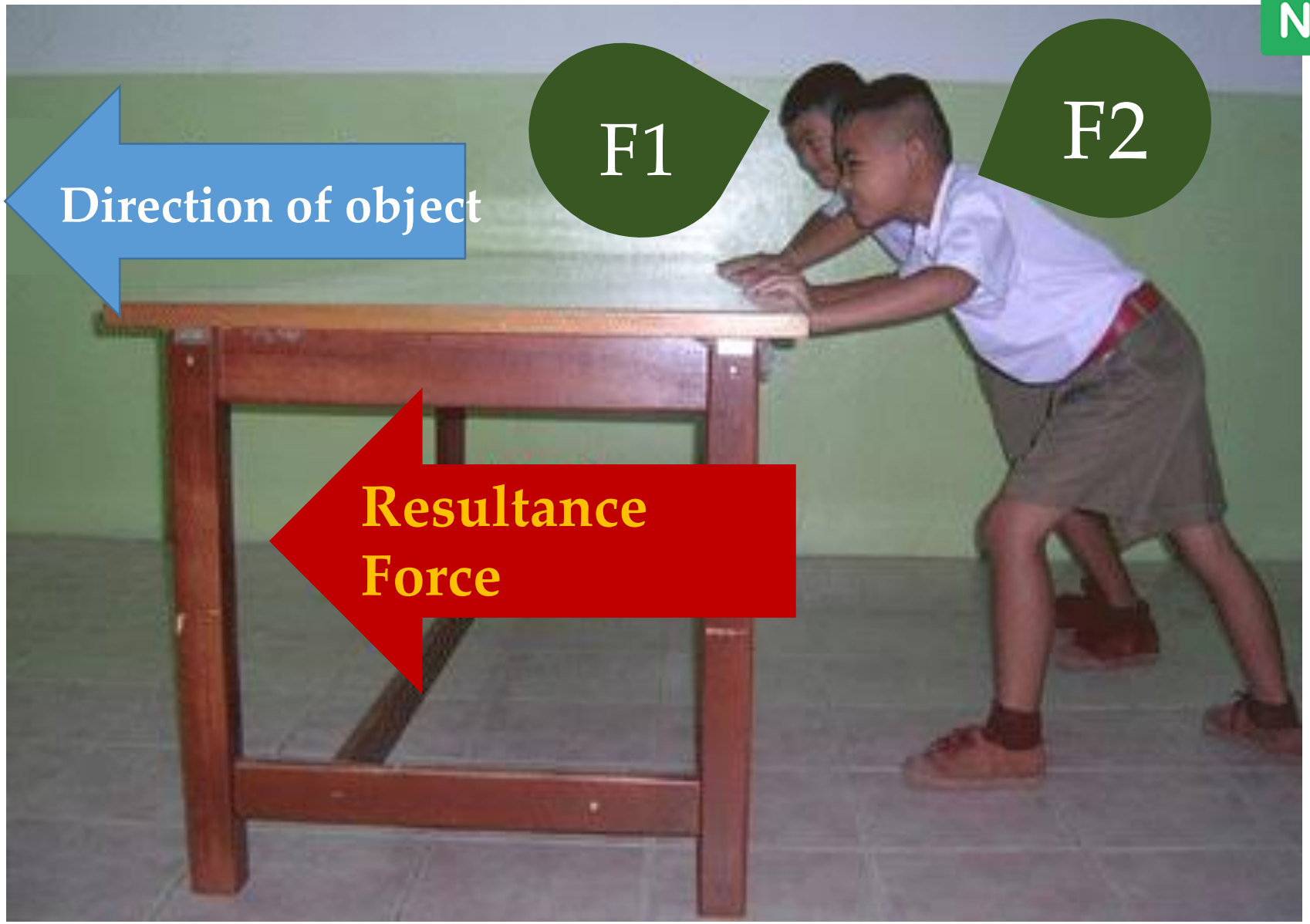
- The quantity of the object causes the object to change from it's original state.
- **Force is the vector quantity.**
- F ; N



http://www.krusarawut.net/wp/?p=8981

http://www.cybermart9.com/index.php?mo=28&id=821500

Resultance Force


F1
F2
Direction of object
Resultance Force


F1=50N
F2=30N
Direction of object
Resultance Force

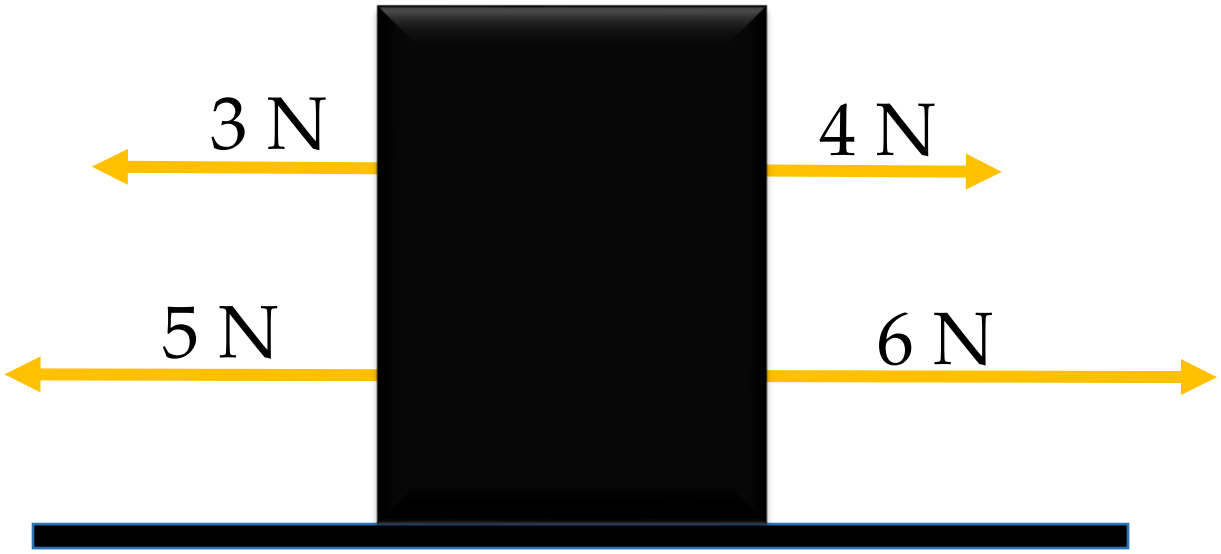

F1=30N
F2=30N
Not-move

Resultance Force

= (-3)+(-5) + (+6)+(+4)

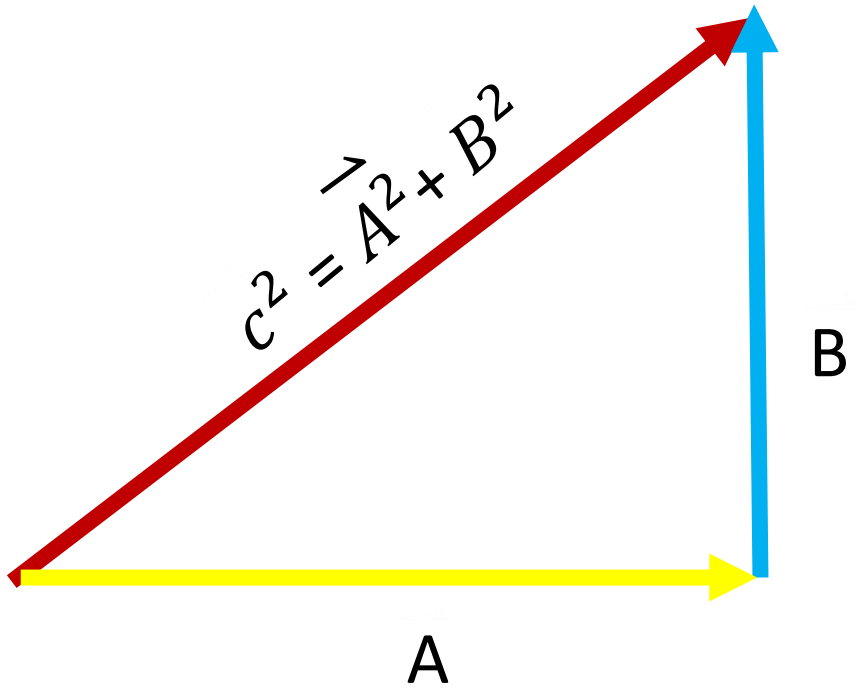
= - 3 - 5 + 6 + 4

= 2 N



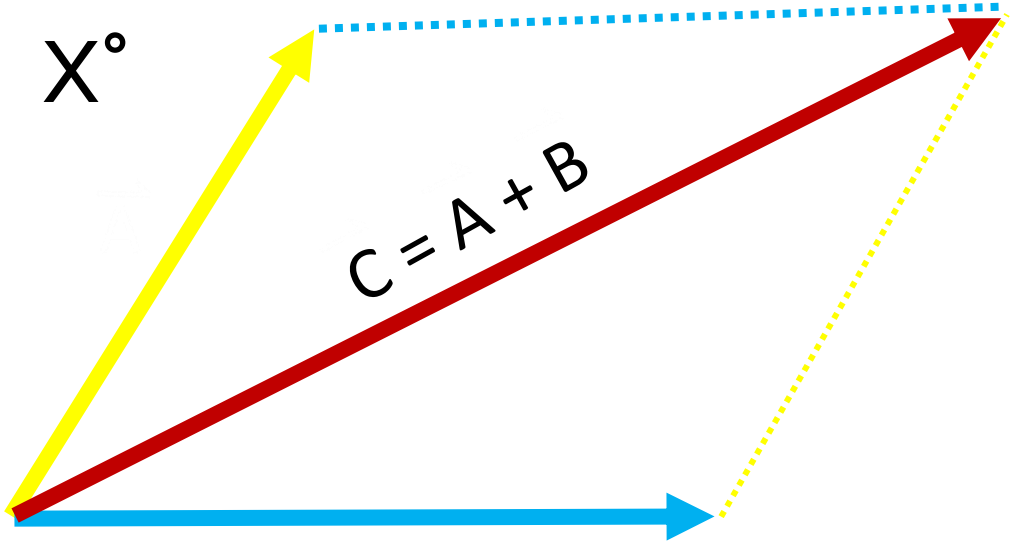
Corner

90°

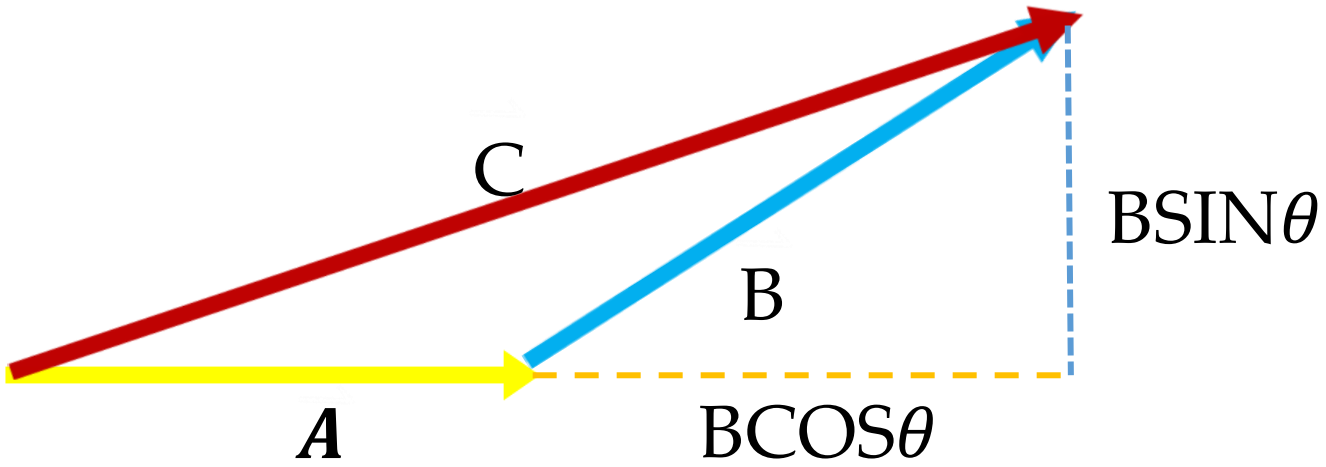


Parallelogram

X°



Calculate



$$\boldsymbol{C^2 = A^2 + B^2 + 2ABCOS\theta}$$

MASS

- Mass is the property of the object indicates the amount of existing objects.
- Mass is the scalar quantity.
- M ; Kg.

WEIGHT

- The force that the earth or planet pulls the object to the ground.

-The weight of the object depends on the gravity .

-W ; N

$$W=mg$$

where

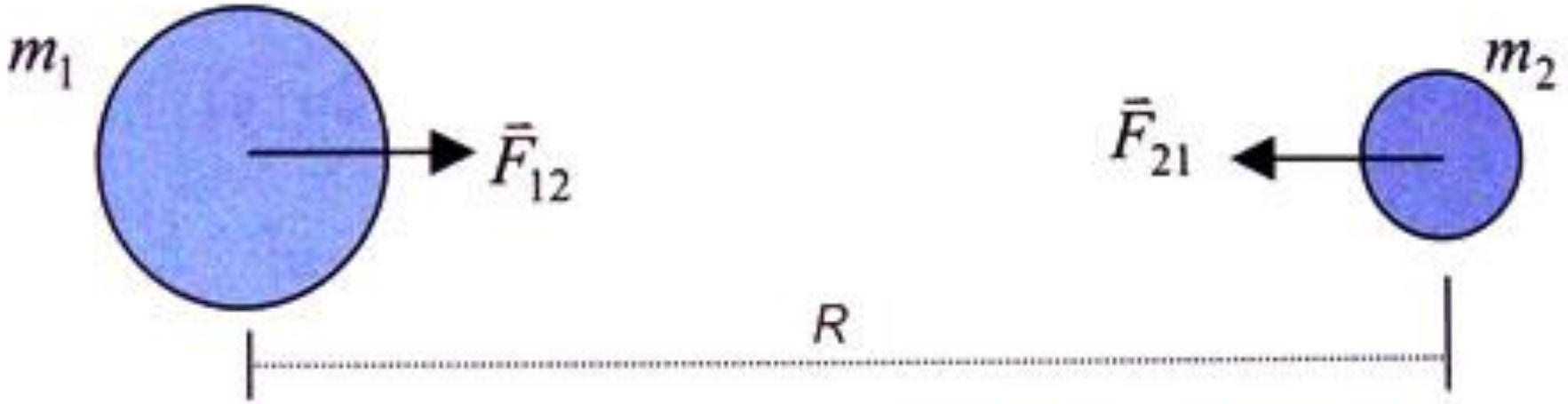
W =Weight

m = Mass

g = Gravity

Newton's law of gravity between mass

“Mass and mass are always attracted. If force between mass centers of each cube. Force is direct variation with mass and inverse with quadric of distance between mass”



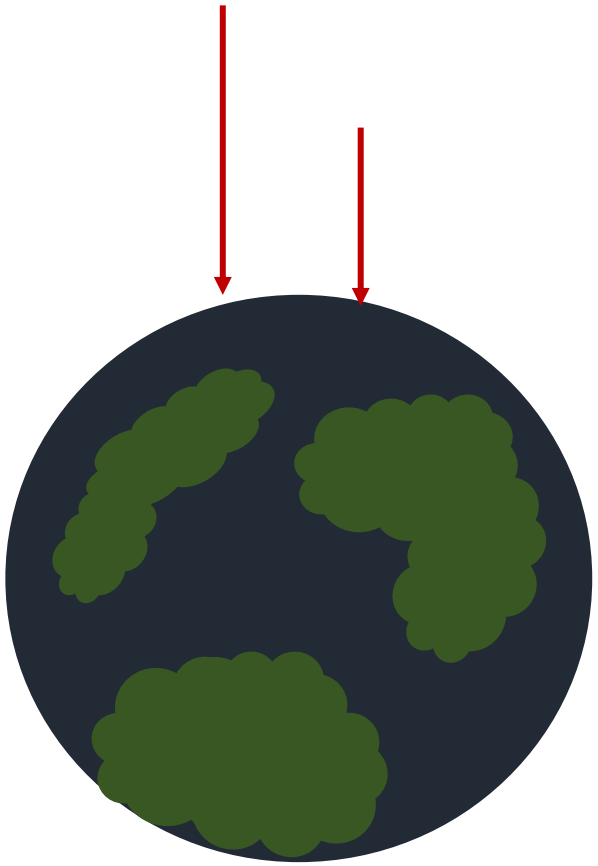
$$F_G = \frac{Gm1m2}{R^2}$$

$$G = 6.673 \times 10^{-11} Nm^2/Kg^2$$

Gravitational field

Area with gravity. Which cause the object to fall.

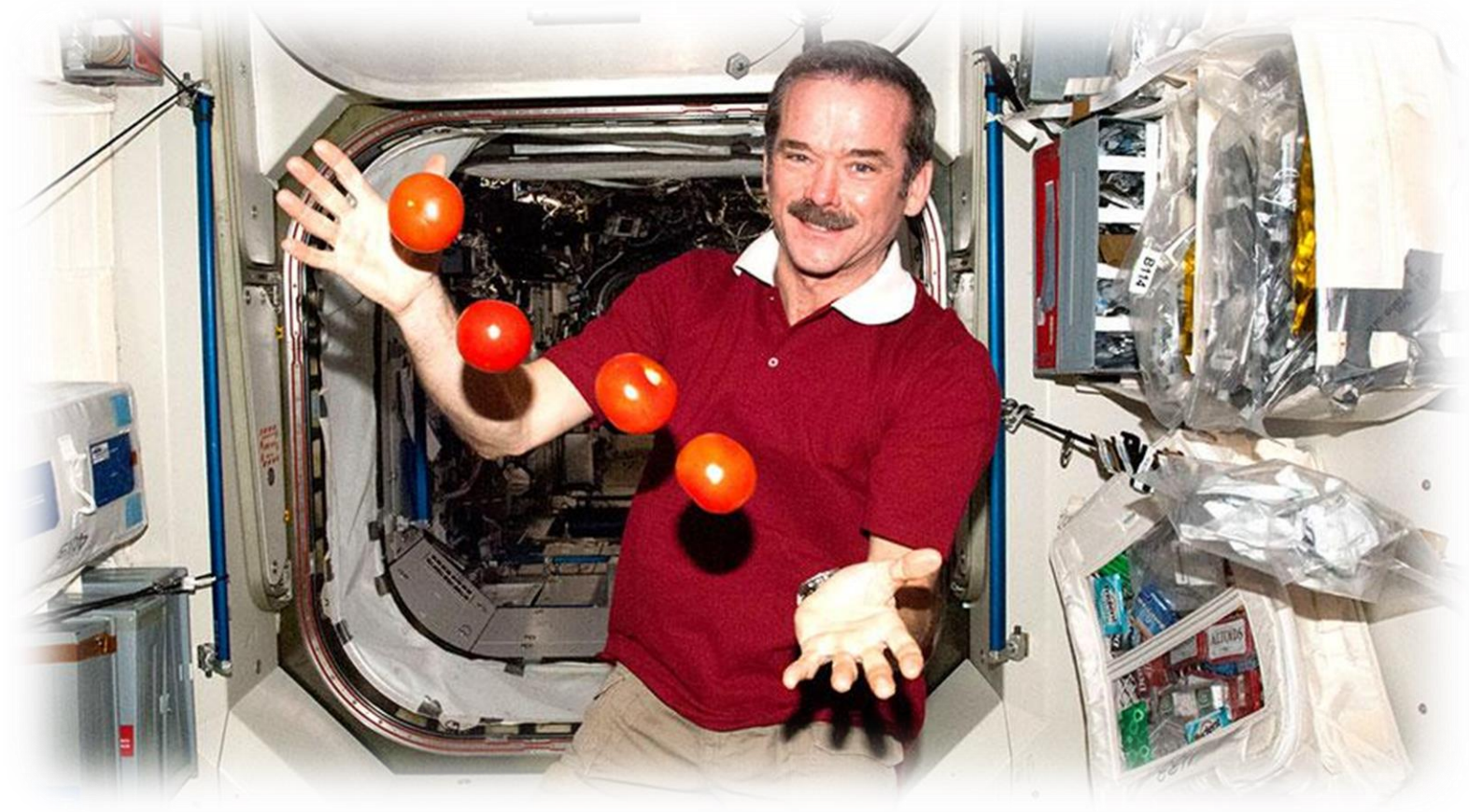
Gravity away from the surface of the earth.



$$g = \frac{Gm_e}{R^2}$$

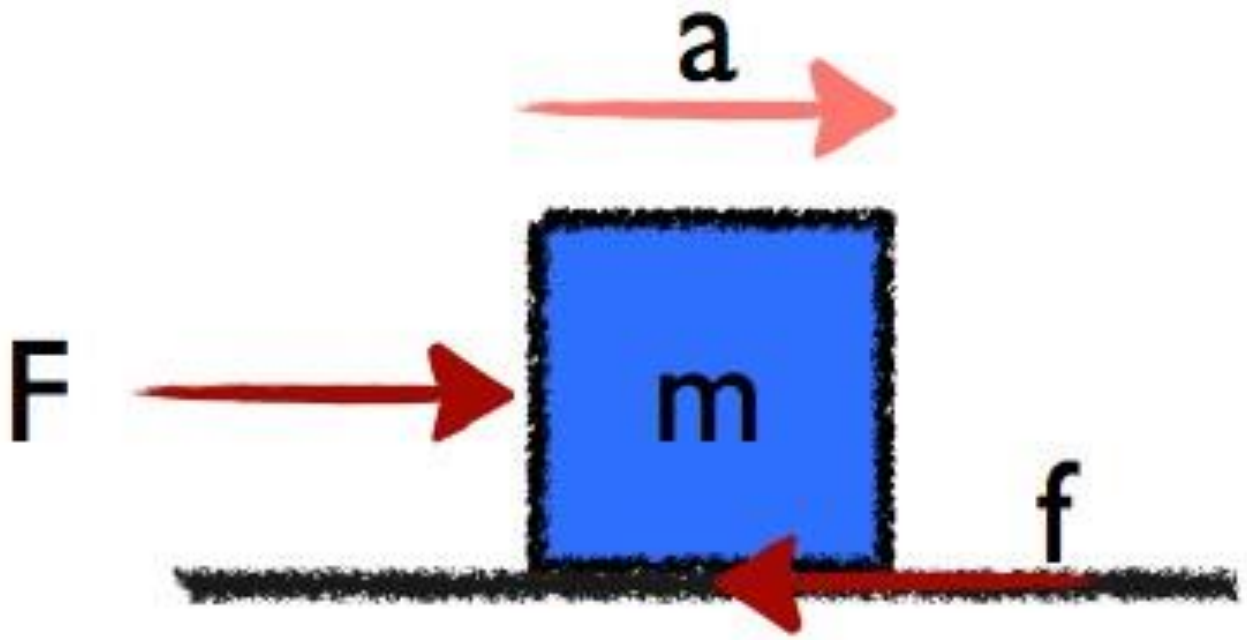
Weightless

It is a condition where the object does not have any force on the environmer



FRICTION(f)

-The force acting on the object in the opposite direction to the direction of movement of the object.



Static friction

Friction occurs between the surface of the object in the state where the object has been forced to stand still.

Kinetic friction

Friction occurs between the surface of the object in the state where the object is subjected to force, the motion is constant.

Newton’s Law of Motions

- Newton’s laws of motion1
- Newton’s laws of motion2
- Newton’s laws of motion3

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Newton's laws of motion1

"An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted up on an unbalanced force"

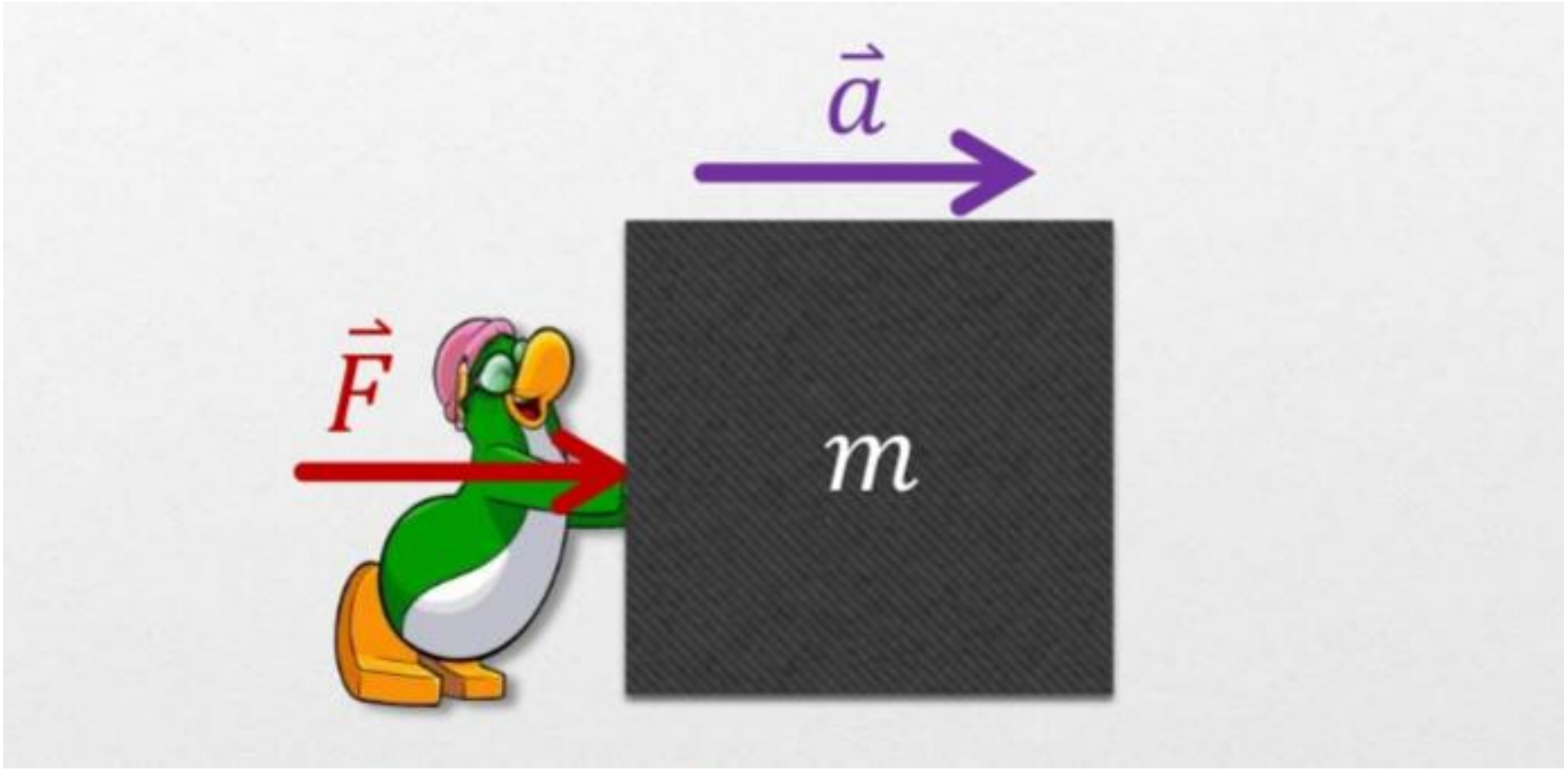
$$\sum \vec{\mathbf{F}} = \mathbf{0}$$


$\vec{F}$
$\vec{F}$

Newton’s laws of motion2

“The natural state for an object is to be at rest. If you don’t push on an object, it will stop moving”

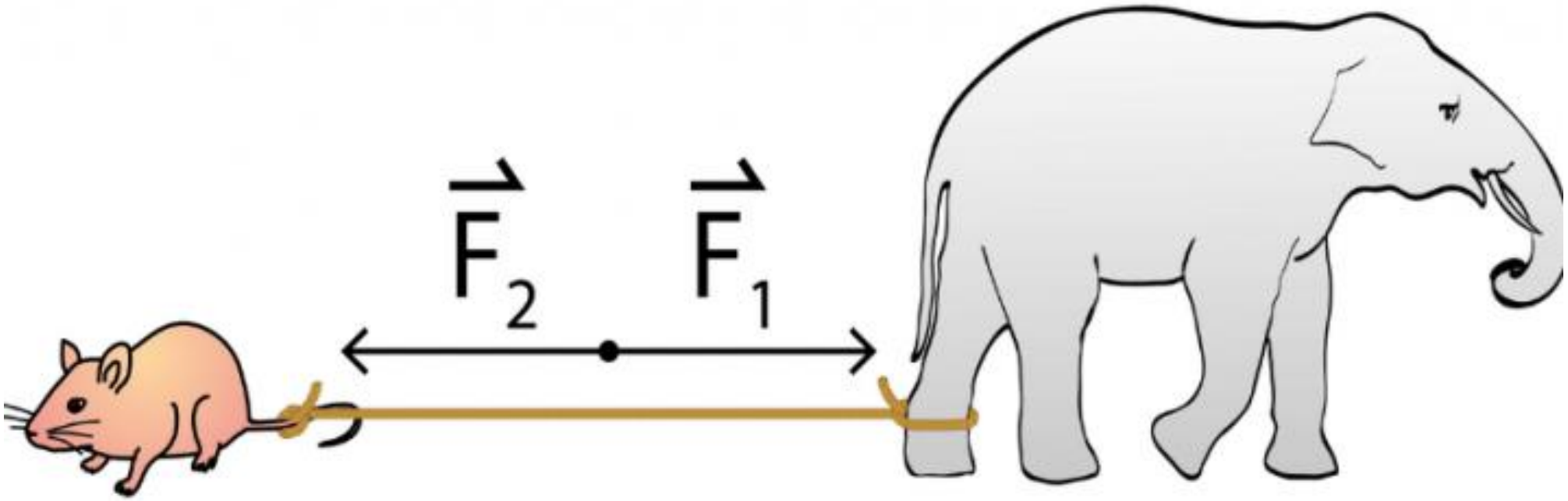
$$\Sigma \vec{F} = ma$$

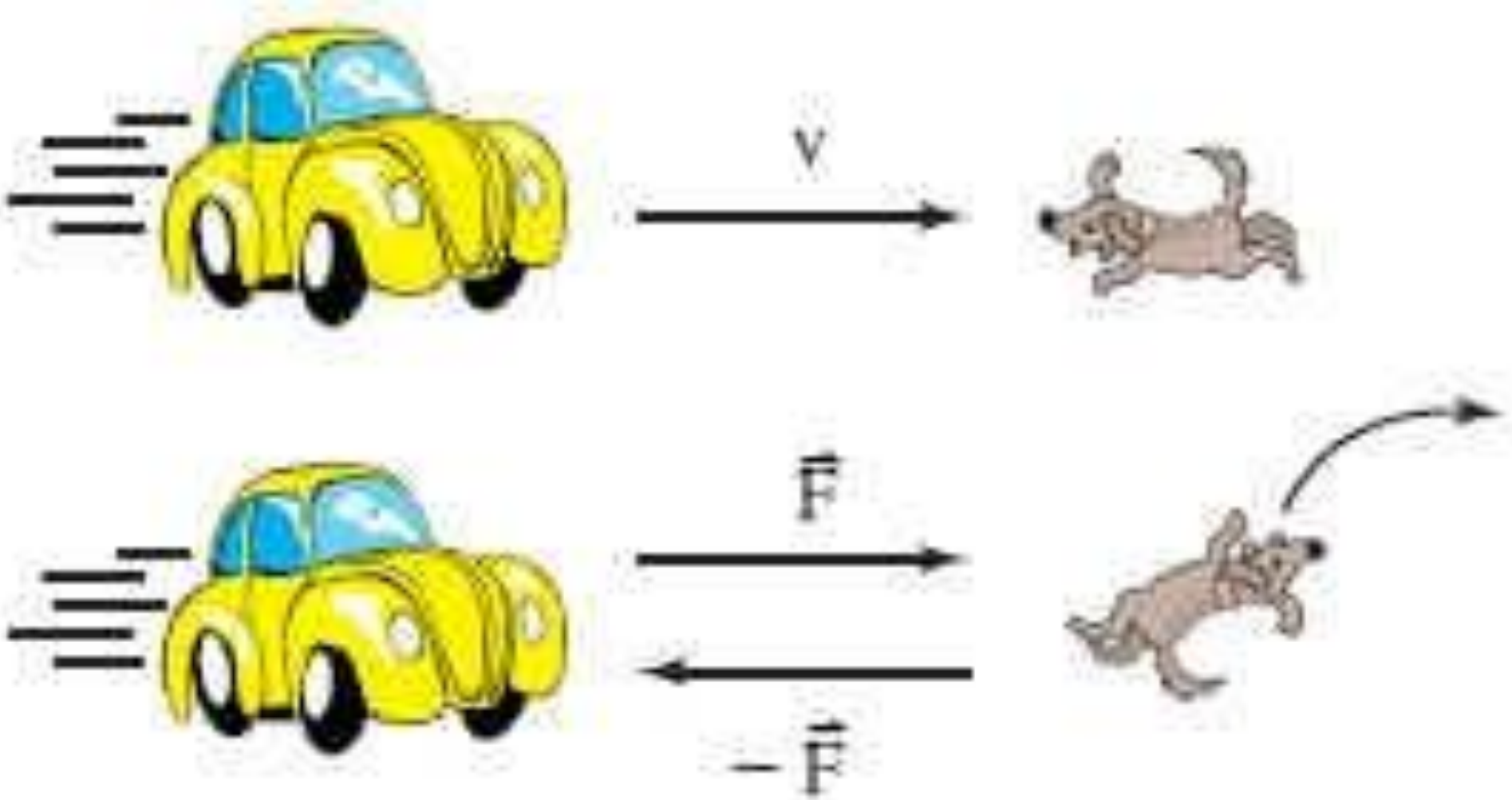

$\vec{a}$
$\vec{F}$
m

Newton's laws of motion3

"The time rate of change of linear momentum of an object is proportional to the net external force acting on it and occurs in the direction of the resultant force" (Action = Reaction)

$$\vec{F}_A = -\vec{F}_R$$


$\vec{F}_2$
$\vec{F}_1$


v
F
−F

Ex 1. Football has a mass 0.5 Kg moving by speed 20 m/s . If goaltender used the hand to get the football to stop in 0.4 seconds. Average force of hand action to football ?

A.100 N B. 250 N C. 500 N D.750 N

Ex 2.Double reaction force from Newton's law of motion 3. What it wrong?

A. Action on different objects, but related.

B. The size is the same, but the opposite direction.

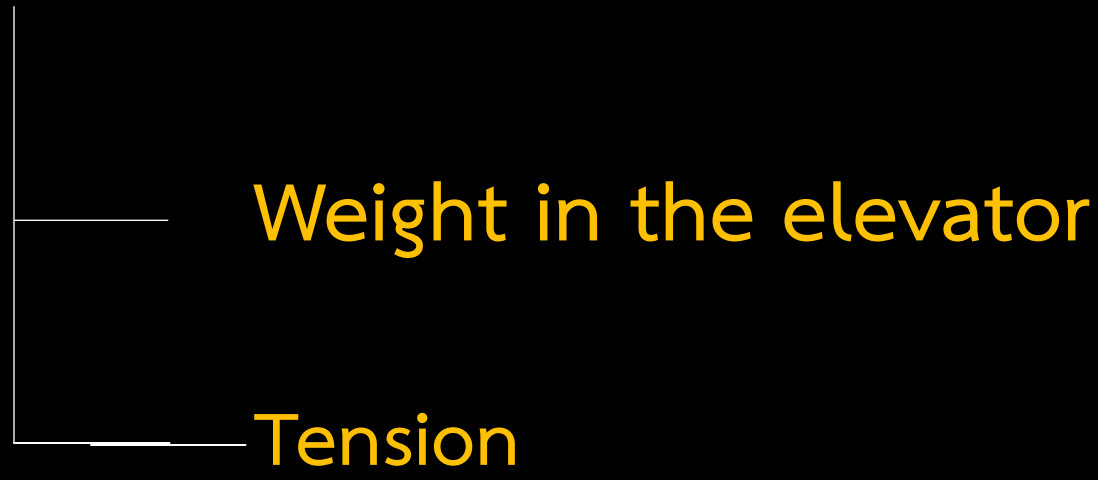
C. Occurs when objects are stationary or moving with acceleration.

D. Occurs when both objects touching.

Ex 3.The locomotive has mass 1000 Kg. Used to drive the train 5000 Kg. On the railroad in the horizontal plane. Since stop it. into speed 50 m/s within 1 minute. If bring locomotive to drive the train 2000 Kg. And use the same force used to drive the first train. The speed of the train behind?

A.5/6 B. 5/4 C. 5/3 D. 5/2

Applying Newton's law of motion.



Weight in the elevator.

Weightlifting on acceleration (a)

Ex 1.The parachutis hass mass 65 Kg. Down to the ground by crouch. While straighten up , mass center of boby has acceleration 3 m/s^2 . The floor sends a force to the feet ?

A. 650 N

B. 1300 N

C. 1950 N

D. 2600 N

Tension → The force in the rope or wire.

EX.1

The pendulum has mass 45 Kg. Hang on the wooden beams with a rope. And the rope is not moving. Tension = ?

EX.2

From1. If the rope is pulled up with the acceleration 2 $\mathbf{m/s^2}$. Tension = ?

NEWTON'S LAW OF MOTIONS

1. $\mathbf{\Sigma F = 0}$

2. $\mathbf{\Sigma}F = ma$

3. $\boldsymbol{F_A = -F_R}$

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