BHARATHIDASAN UNIVERSITY

Tiruchirappalli- 620024,
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Department of Physical Education and Yoga

Course Title : SPORTS BIOMECHANICS AND KINESIOLOGY
Course Code : 21MPE22

Unit- (I)

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What is kinesiology?

The Greek words kinesis meaning ‘movement’ And logia which means ‘study’ the scientific study of the body movements.

kinesiology is the study of human movement and muscle function.

Objectives of kinesiology

- Under standing the human body's physiology and psychological response to acute short term physical activity.
- Understanding the various adaptations of the human body to chronic long term physical activity.
- Understanding the culture, social and historical importance .
- Understanding the mechanical qualities of movement.
- Understanding the psychological effects of physical activity on human behaviour.

Importance of kinesiology

- Kinesiology helps to prepare educators to teach effective perforamance in fundamental and specialized motor skills.
- It deals with the mechanical prinicipals such as motion , center of gravity, equilibrium, force, lever .
- Kinesiology is important for physiotherapy and physical medicine purpose.
- Kinesiology helps to avoid unwanted movements that are maximum expenditure of energy and minimum output.
- Kinesiology helps to perfecting the performance and perfecting performers him self.

ROLL OF KINESIOLOGY

- To learn to improve the motor skills.
- Effectiveness of movements can be ensured
- The knowledge of kinesiology has great importance clinical purpose.
- Provides the knowledge about designing and teaching of exercise and conditioning.
- Self realization about own performance by the athlete.

What is kinesiology?

Kinesiology is the study of human movement. (Or)

The study of the mechanics body movement.

Definition of kinesiology?

The Greek words kinesis meaning ‘movement’ And logia which means ‘study’ the scientific study of the body movements.

kinesiology is the study of human movement and muscle function.

Need and Importance of kinesiology

- to improve performance
- For safe movements
- Use movements for therapy
- Helps to evaluate exercise

Need and Importance of kinesiology

- Kinesiology is the branch of science which helps to detect the various imbalances in our body, which otherwise cannot be detected even by the most modern medicines.
- It helps to maintain the mental and emotional balance of a person.
- It helps to get rid of the back and neck pains, which is nowadays very common in all the professions.

Need and Importance of kinesiology

- The various learning disabilities of a child can be easily cured by using the method of kinesiology.
- The kinesiology therapy helps to boost the self confidence of person.
- Over stress and anxiety are the root cause of many diseases. This can be cured with the help of kinesiology.

Fundamental movements

Flexion – bending of a joint

Extension- straightening of a joint

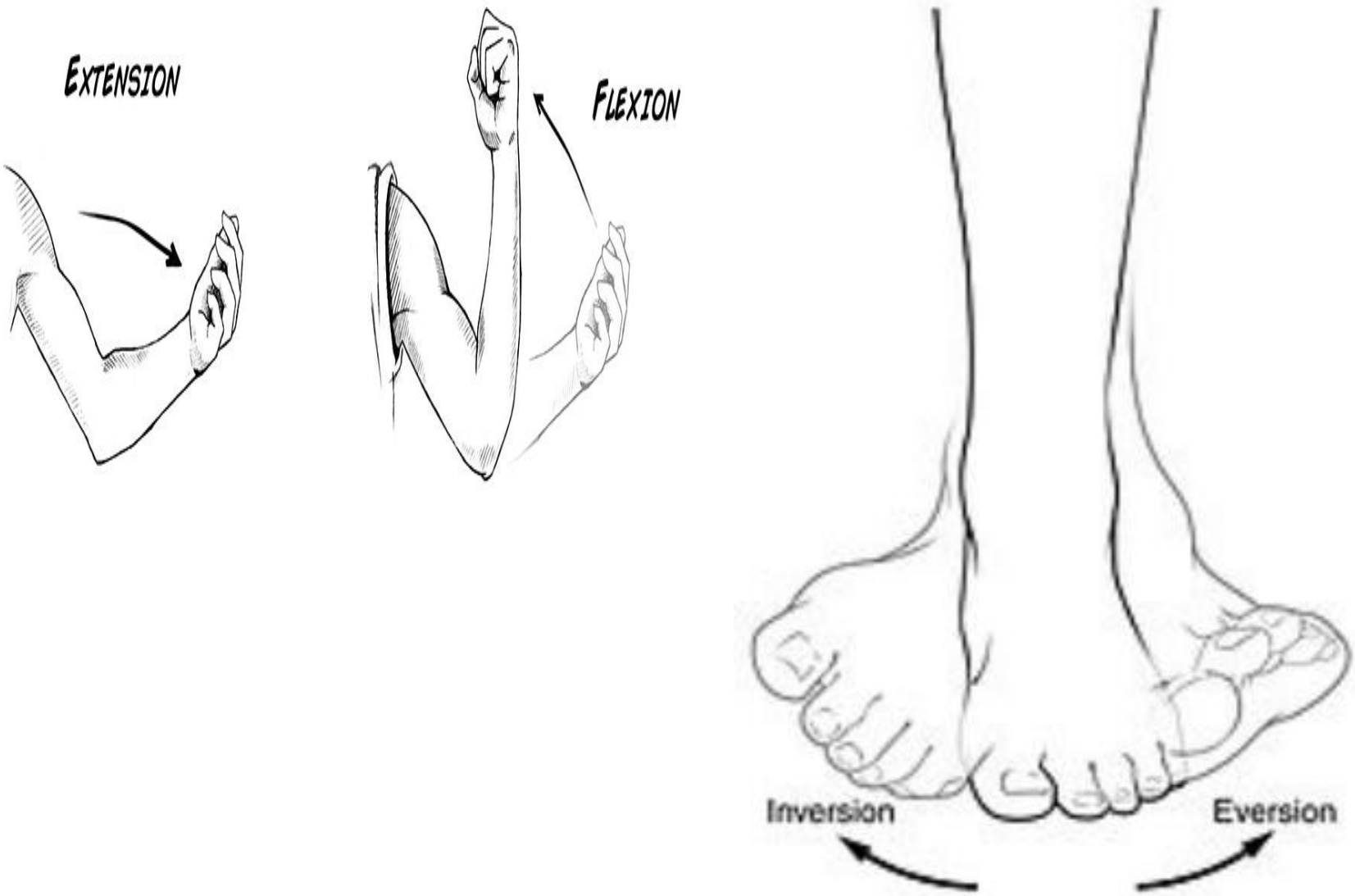
Abduction- movements is away from the mid line of the body

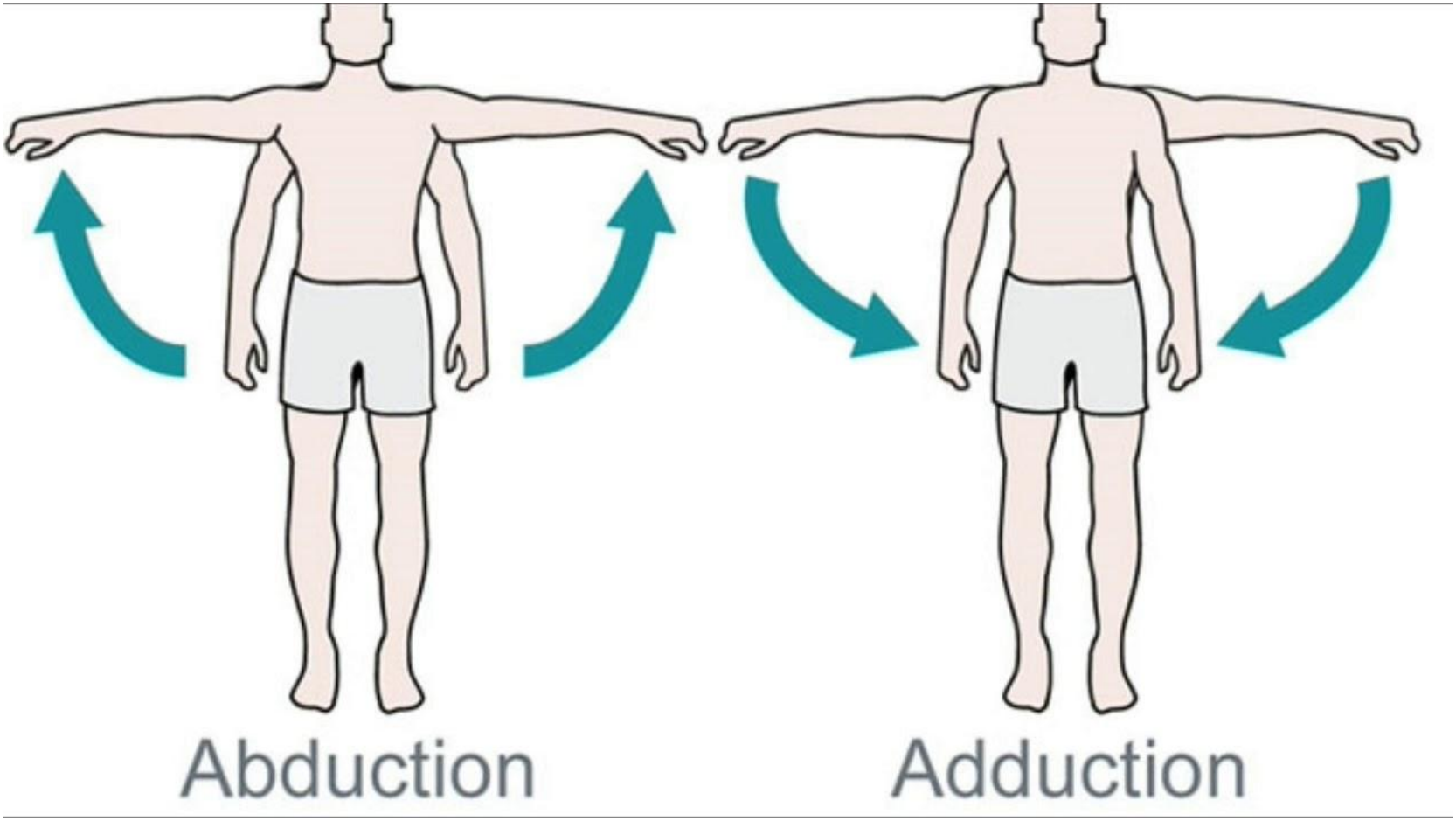
Adduction – movements is towards the mid line of the body

Rotation- movement of bone arround

Inversion- turning inwards of the foot

Eversion- turning outwards of the foot


EXTENSION
FLEXION
Inversion
Eversion


Abduction
Adduction

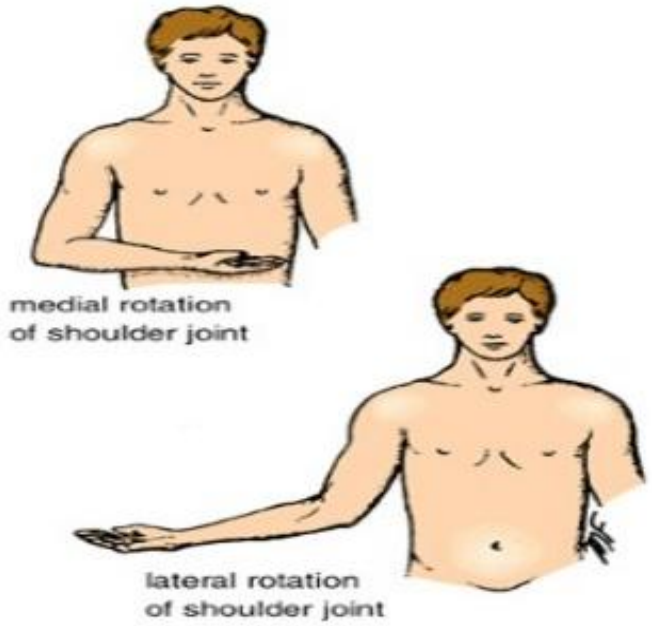
Medial & Lateral Rotation

- **Medial Rotation:**

  Inwards rotation

- **Lateral Rotation:**

  Outwards rotation



Meaning of Biomechanics

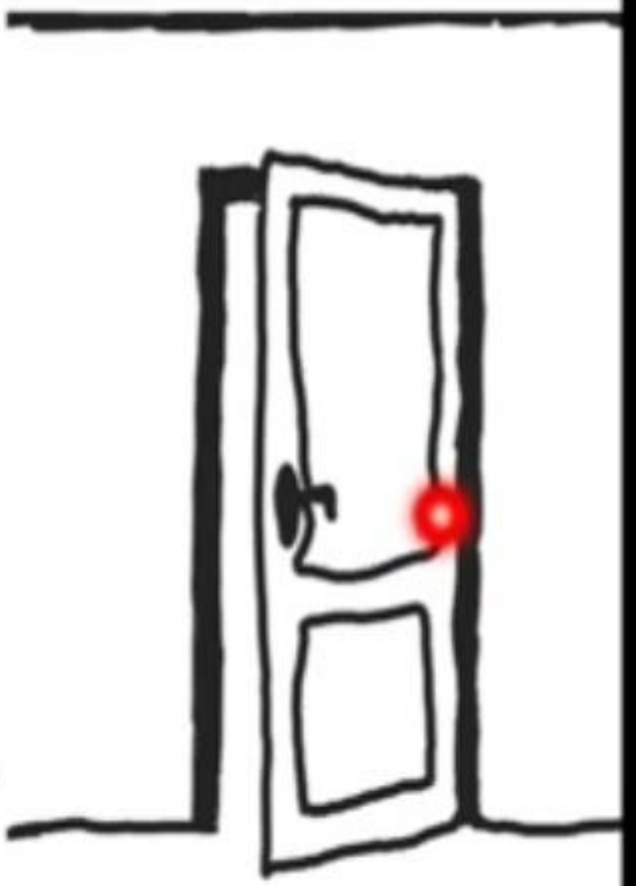
- The word bio-mechanics is derived from two words bio and mechanics deals with the principles and methods of mechanics applied to the study the structure and function of biological system .
- Bio – means the life or the body (living system) Mechanics means is the branch of physics which deals with motion and its causes of motion .

Biomechanics definition

Biomechanics is the study of mechanical laws relating the structure of human body.

Or

The study of mechanism in the human body is called as ***Biomechanics.***



Meaning of kinesiology and biomechanics

An analysis of the component parts of the words reveals kinesiology to mean literally the study of motion and biomechanics to **mean the study of the mechanics of life**. Kinesiology is, therefore, inclusive of the biomechanics of motion and the neural and cardiovascular elements of movement.

NEED AND IMPORTANCE OF BIO-MECHANICS

- Knowledge of biomechanics helps to improve motor qualities
- Knowledge of biomechanics helps to understand the underlines principles of efficient structure of a competitive sports performance.
- Knowledge of biomechanics helps to evolve and understand new rules and regulation of games and facilities.
- Knowledge of biomechanics helps for development of new technique.
- Knowledge of biomechanics helps in selection of the player for particular games and sports.

Nature of kinesiology and biomechanics

Kinesiology is the term referring to the whole scholarly area of human movement study, while **biomechanics is the study of motion and its causes in living things**. Biomechanics provides key information on the most effective and safest movement patterns, equipment, and relevant exercises to improve human movement.

Scope of kinesiology and biomechanics

- Kinesiology is the study of human movement and muscle function. The field seeks to understand the impact of muscle function on health. Kinesiology draws upon concepts from several sciences, including biomechanics, anatomy, physiology, and neuroscience. ... The purpose is to **stabilize the joint during movement**.

Axes and planes

- Three imaginary planes (Cardinal) divide the body in half by mass are known as the:

1-Sagittal

2-Frontal

3-Transverse planes (Horizontal).

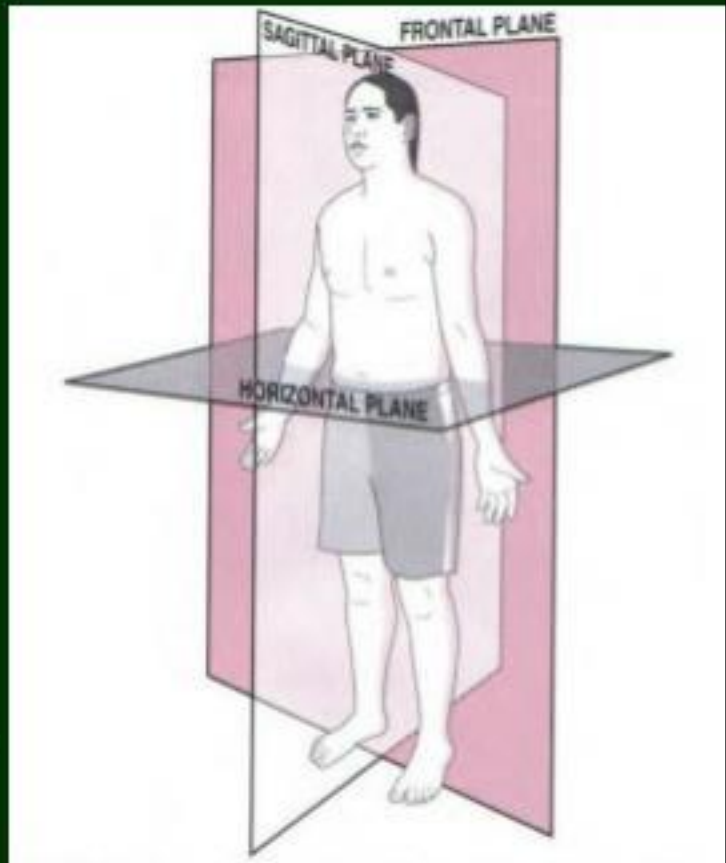
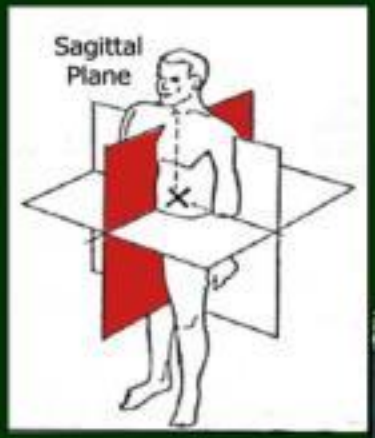


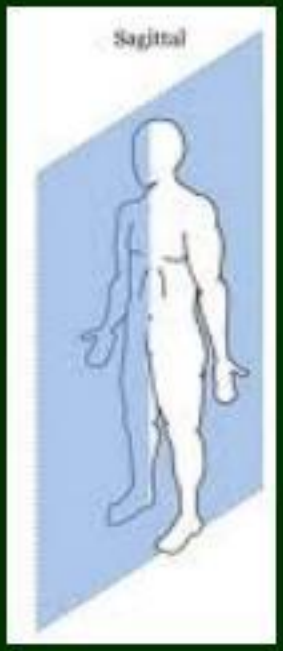
FIGURE 1–4. The three cardinal planes of the body are shown as the person is standing in the anatomic position.

The Sagittal plane



The median plane divides the body vertically into left and right halves Any plane parallel to the median plane is called a sagittal plane

in which forward and backward movements of the body occur.

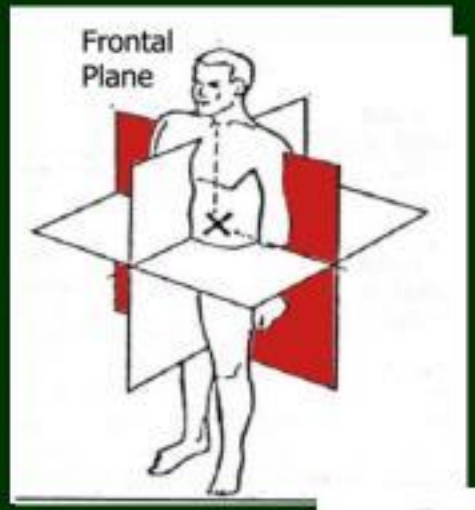


Movements in this plane can be seen from the side.

e.g: Flexion / Extension dorsiflexion plantarflexion

The frontal plane

The frontal plane splits the body vertically in front (**anterior**) and back (**posterior**) halves in which lateral movements of the body occur.

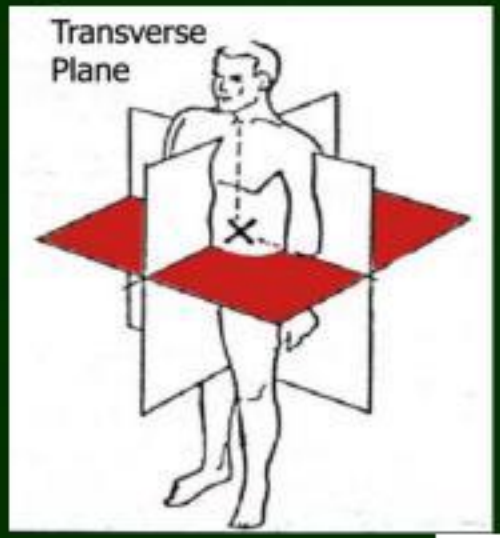


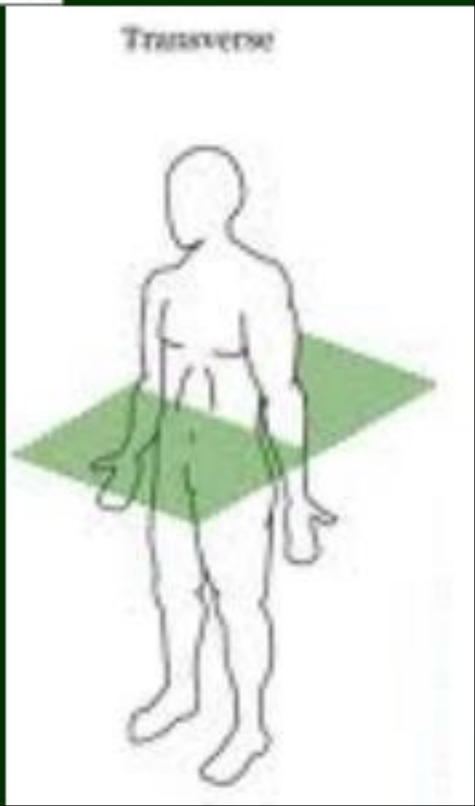
- Movements in this plane can be seen from the **front or back**

e.g: **Abduction Adduction, lateral flexion**

The transverse plane

The transverse plane separates the body into top (**superior / upper**) and bottom (**inferior /** lower) halves in which horizontal body and body segment movements occurs when the body is in the erect standing position.





-Movements in this plane can be seen from the top or bottom e.g:

shoulder rotation

-This movements rotate around the **longitudinal axis**

-The longitudinal axis is perpendicular to the transverse plane

Definition of axis of rotation:

- **an imaginary line about which the body rotates or spins,** at right angles to the plane.

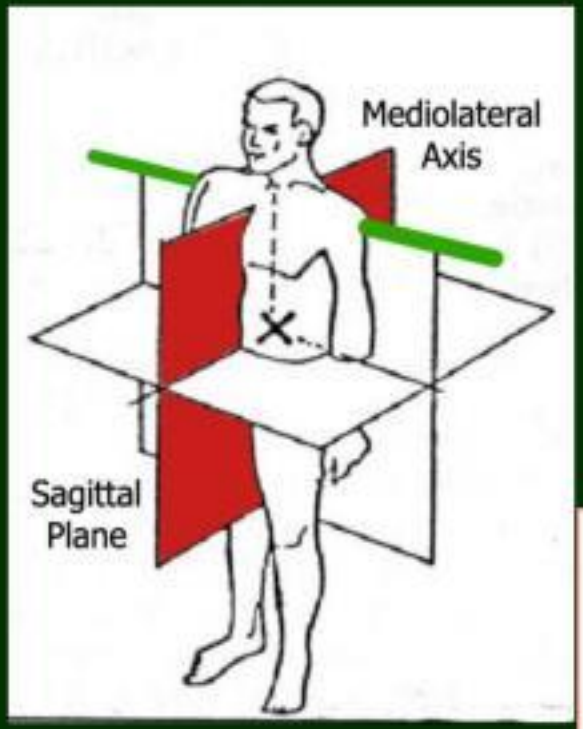
There are three axes:

- 1-The Frontal (Mediolateral) axis.
- 2-The Longitudinal (Vertical) axis.
- 3-The Anterior-posterior (Sagital) axis.

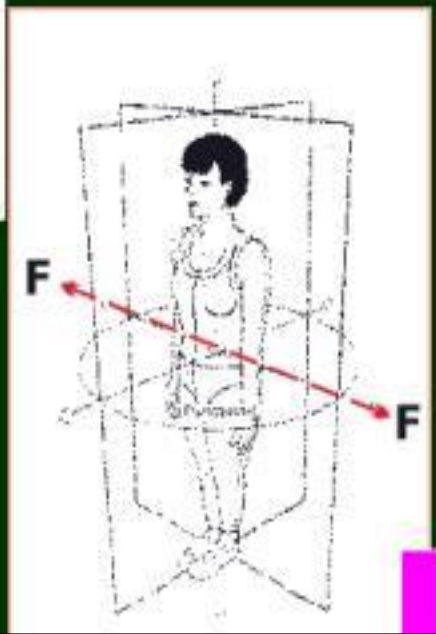
★ The Frontal (mediolateral) axis

- ***The Frontal axis (mediolateral):***

is an imaginary line around which sagittal plane rotations occur.



e.g: **Flexion / Extension**



-The frontal axis is perpendicular to the sagittal plane

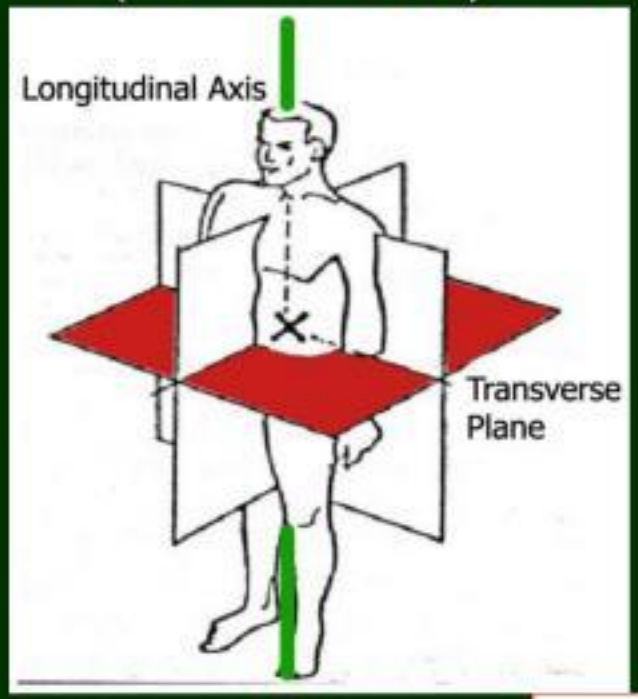
★The Longitudinal (vertical) axis

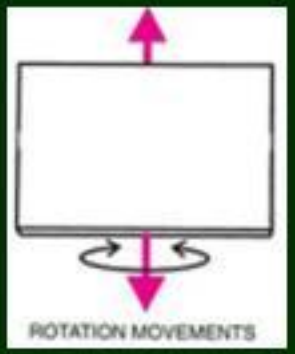
The Longitudinal axis:

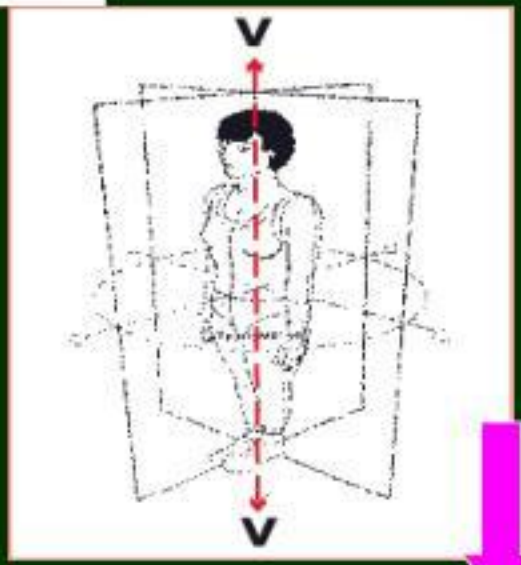
is an imaginary line around which transverse plane rotations occur.

i.e. medial and lateral rotations movements, supination and pronation.

-The longitudinal axis is perpendicular to the transverse plane



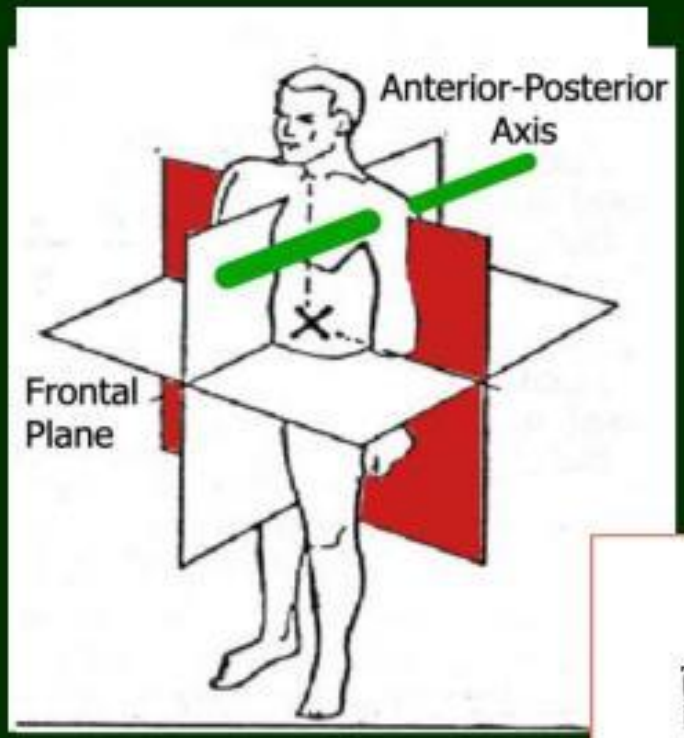




The Anterior-posterior (sagittal) axis

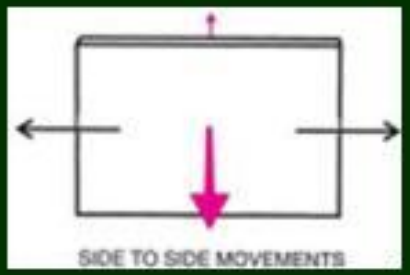
The Anterior-posterior (Sagital) axis :

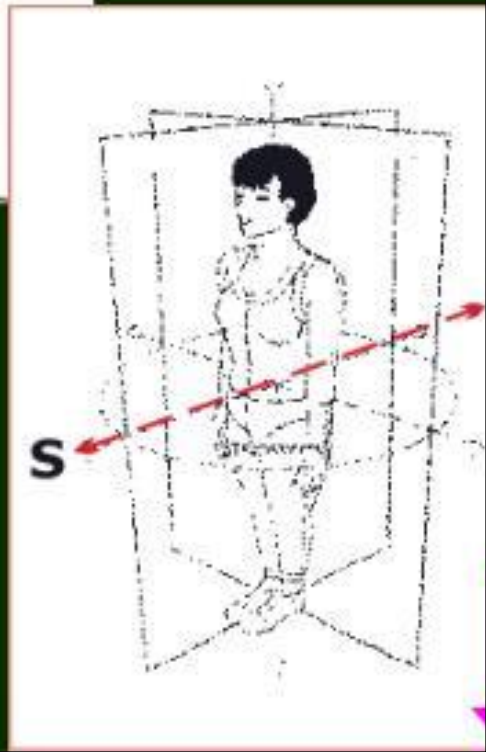
is an imaginary line around which frontal plane rotations occur.



e.g: Abduction
Adduction

-The sagittal axis is perpendicular to the frontal plane





Fluid mechanics

Mechanics of rigid bodies

Static

Dynamic

Kinematics

Kinetics

Categories applied to movement analysis used in Biomechanics

Static and dynamic

- Static is a state where bodies are at rest Static is defined as **without motion** .
- dynamic is a state where bodies are **with moving.**

Kinematics

Kinematics is the area of biomechanics which describes the movement, without regarding the forces producing the movement.

Description of movement includes

1. Type of the movement
2. Location of the movement
3. Direction of the movement
4. Magnitude of the movement
5. Rate or Duration of the movement

Kinetics

Kinetics is the area of biomechanics which concentrates on the forces producing the movement without regarding the description of movement.

Kinematics – Movement

Kinetics – force producing the movement.

Types of motion

There are four types of movement.

1. Rotatory or Angular motion
2. Translatory or linear motion
3. Gliding motion
4. Curvilinear motion

Rotatory or Angular motion

- Movement of a segment around a fixed axis in a curved path.
- Each point on the segment moves through the same angle,at the same time,at a constant distance from the axis of rotation.

Fr Ex – Elbow flexion,in this each point on the hand or forearm segment moves through the same angle,at the same time, at a constant distance.

Gliding motion

Articular surface of one bone moved parallel to the flat articular surface of another bone

Fr Ex – Carpal bones

Curvilinear motion

The object rotates about an axis and moves through the space at the same time.

Fr Ex

Outside the human body – A thrown ball. It is rotating and moving through the space at the same time.

In human body – Hand segment holding a glass is rotating around the elbow joint,while the elbow joint is moving in the space by shoulder flexion.

Translatory or linear motion

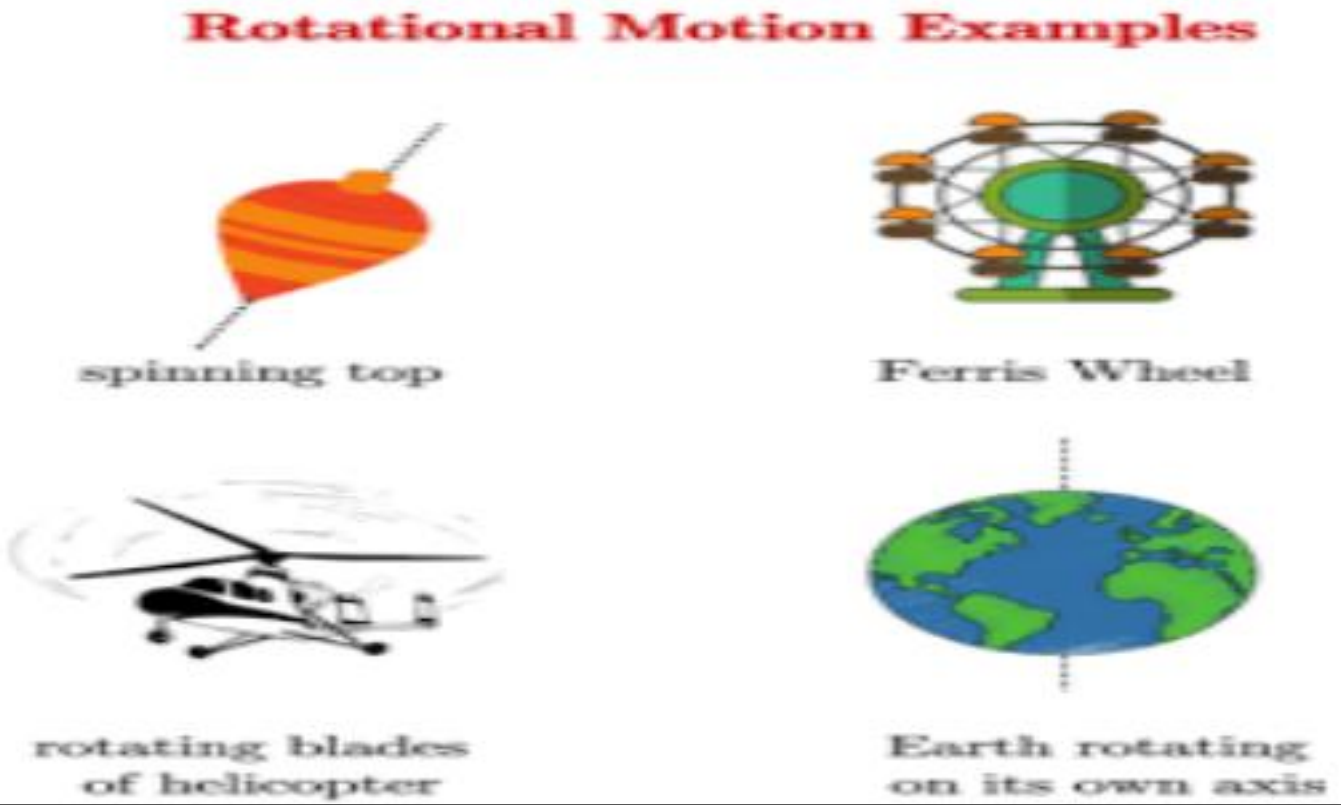
Movement of a segment in a straight line.

Each point on the segment moves through the same distance at the same time.

Fr Ex – grasping a glass on the table,in this each point on the hand or forearm segment moves through the same distance at the same time.

Angualr kinamatics

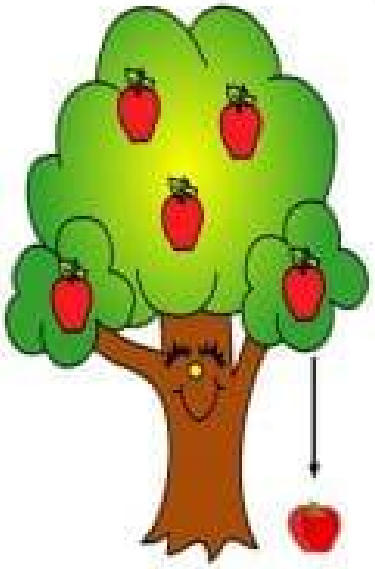
- Angular kinematics is **the study of rotational motion in the absence of forces**



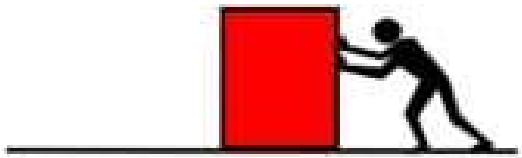
Linear kinematics

- **Linear kinematics** is the study of how an object moves through time in a straight line

Examples of Rectilinear or Linear Motion



An apple falling from a tree



Pushing of box

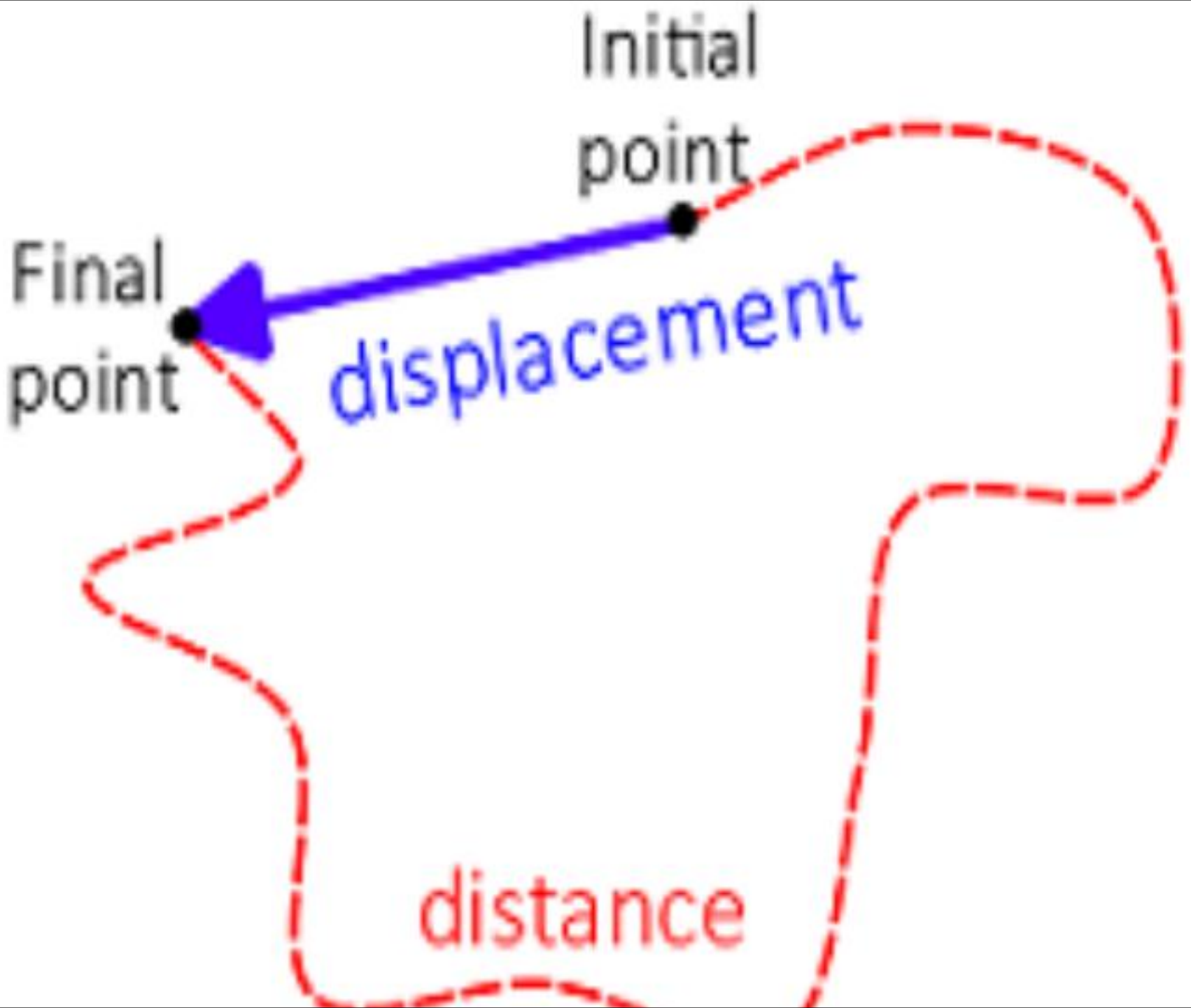
March past by student on straight path

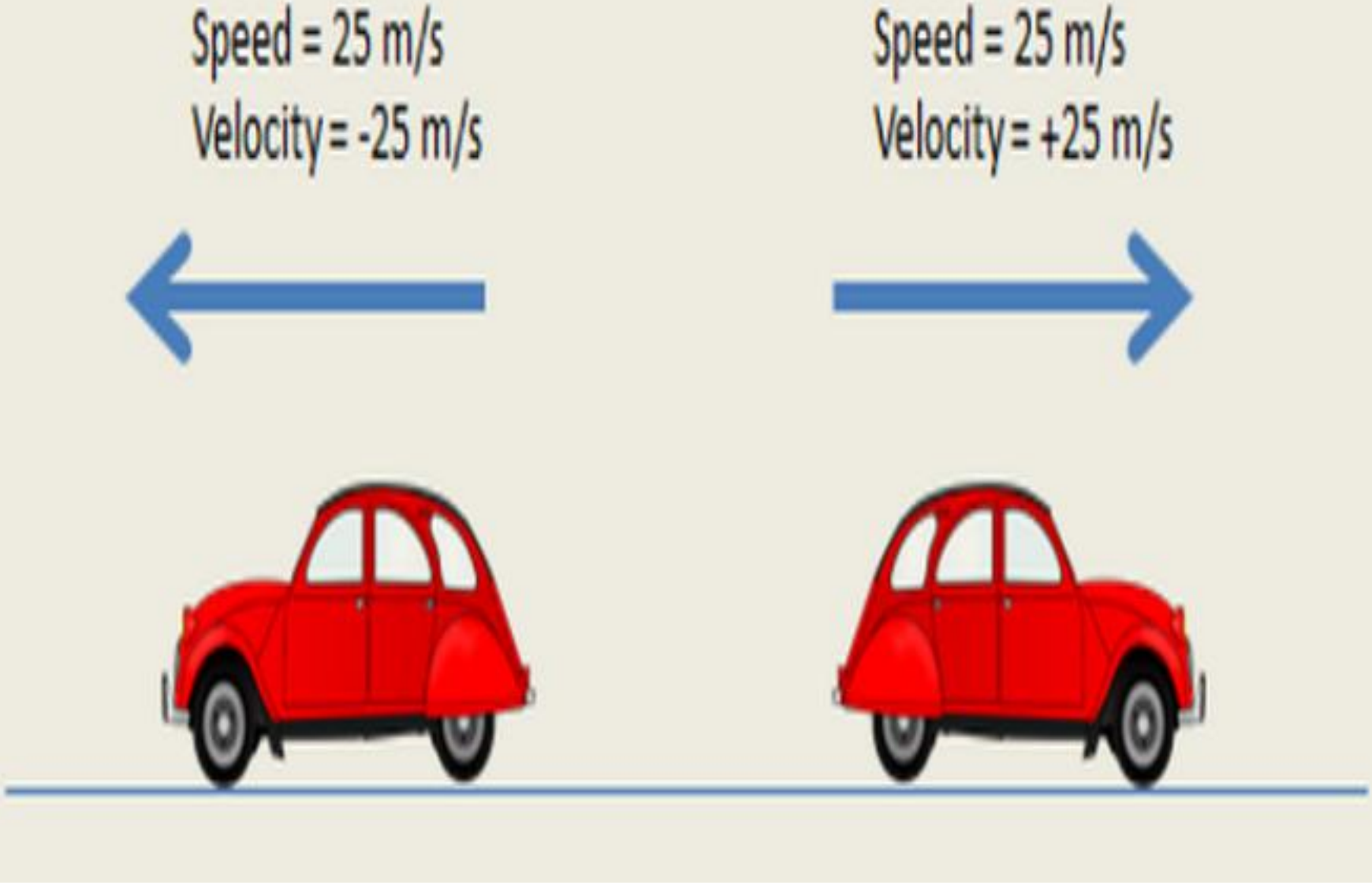
Vector vs. Scalar

- Vector- a measurement that has both size and direction
  - Example: Displacement, Velocity
- Scalar- a measurement that only has size
  - Example: Distance, Speed

scalar

- A scalar quantity is defined as the physical quantity with only magnitude and no direction. Examples of Scalar Quantities
- Some examples of scalar include:
- Mass
- Speed
- Distance
- Time
- Area
- Volume
- Density
- Temperature


Initial
point
Final
point
displacement
distance


Speed = 25 m/s
Velocity = -25 m/s
Speed = 25 m/s
Velocity = +25 m/s

Mass

- **Mass is a scalar quantity**. The mass of a body is a scalar quantity. The mass has only magnitude, not direction. If we consider the weight, it is the force experienced by the object due to its mass. The area is a **scalar quantity in geometry and mensuration**. What Is Density Training? Density refers to **the amount of work you do within a given time**.

Volume

- **If you do five reps with a 100-pound barbell and increase to 10 reps with the same barbell, you have increased the volume**. If you do five reps but increase the barbell weight to 150 pounds, you have increased the intensity.
- Volume refers to **the total amount of physical work performed in either a single workout session or over the course of an extended exercise program**.

Vector

- A vector quantity is defined as the physical quantity that has both directions as well as magnitude Examples of Vector Quantities
- Examples of vector quantity include:
- Linear momentum
- Acceleration
- Displacement
- Angular velocity

	Vector	**Scalar**
Definition	A physical quantity with both the magnitude and direction.	A physical quantity with only magnitude.
Representation	A number (magnitude), direction using unit cap or arrow at the top and unit.	A number (magnitude) and Unit
Symbol	Quantity symbol in bold and an arrow sign above	Quantity symbol
Direction	Yes	No
Example	Velocity and Acceleration	Mass and Temperature

Line of Gravity

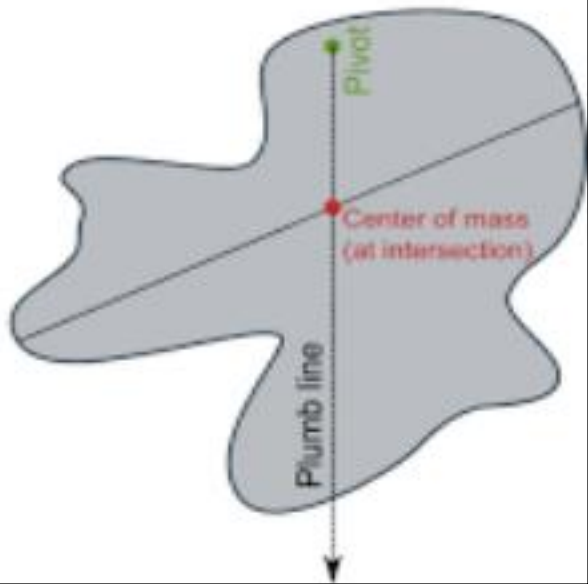
- **The Line of Gravity is a line that starts at the COG and stretches straight down to the ground.**
- It is also known as the line of action of the force of Gravity.

Gravity

- Gravity is **the force that attracts a body toward the earth** (downward) Center of Gravity/Center of Mass is the point of application of the gravitational force. The direction of gravity is the Line of Gravity (LOG) and is always perpendicular to the ground

Center of gravity

- center of mass is a point where the amount mass of an object is equal in all directions where the center of gravity is a point where the amount weight of an object is equal in all directions.



Line of gravity

- The line of gravity is **an imaginary vertical line from the centre of gravity to the ground or surface the object or person is on**. It is the direction that gravity is acting upon the person or object.