

KINE 426 Lab Notes – Axes, Planes and Center of Gravity

Axes (plural for axis) – Perform two possible functions in analyzing human movement.

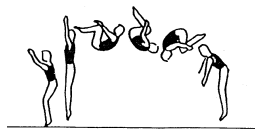
- A) Define Center of Rotation – This is like the Earth’s axis or the axle of a car.
- B) Serve as references for a coordinate system (like the X and Y axes used for graphing).

Cardinal Axes of the Body

- A) X-axis (transverse, mediolateral, frontal, or breadth axis) – Passes from side to side. Forward and backward movements (like forward rolls and back flips in gymnastics) rotate around the x-axis.



x-axis



back flip

- B) Y-axis (longitudinal, vertical, or length axis) – Passes from top to bottom. A skater’s pirouette rotates around this axis.

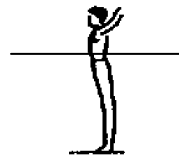


y-axis



pirouette

- C) Z-axis (anteroposterior, sagittal, or depth axis) – Passes from front to back. Sideways cartwheels rotate around this axis.



z-axis



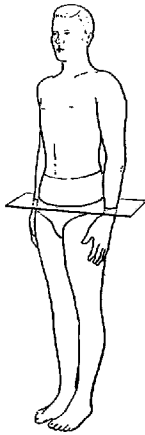
cartwheel

Important Points

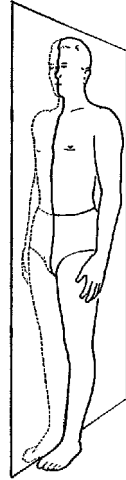
- A) Each cardinal axis is perpendicular to the other two.
- B) The cardinal axes intersect at the center of gravity.

Cardinal Planes of the Body

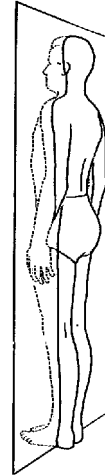
- A) Transverse Plane – Divides the body into an upper and lower half. A skater's pirouette moves **in** the transverse plane.
- B) Sagittal Plane – Divides the body into a left and right half. A back flip moves **in** the sagittal plane.
- C) Frontal Plane – Divides the body into a front and back half. Sideways cartwheels move **in** the frontal plane.



**Transverse
Plane**



**Sagittal
Plane**



**Frontal
Plane**

Important Points

- A) Each cardinal plane is perpendicular to the other two.
- B) The cardinal planes intersect at the center of gravity.

Center of Gravity (also called the Center of Mass) – This is the average position of the body’s weight or mass at any given instant.

Abbreviated c-g (or cg)

Important Points

- A) The position of the c-g will vary from person to person depending on the individual’s general physique. For example, women tend to have a higher percent of their overall muscle mass in their legs than do men. For that reason a woman will tend to have a lower center of gravity than a man of equal height and general fitness level.
- B) Changing the position of the body’s segments will move the c-g within the body. For example, raising an arm will raise the c-g within the body since it changes the overall average position of the body’s mass.
- C) The c-g can actually pass outside of the body. In some events this can be beneficial. For example, in the high jump and pole vault the athletes may clear the crossbar while their center of gravity passes below it.



By sharply bending their bodies, these athletes are passing over a crossbar while their centers of gravity (and therefore the points representing their body weights) might actually pass below it.



- D) Movement of the c-g represents movement of the whole body.



By lowering the torso when the lead leg is raised, hurdlers keep their c-g from excessive up and down movement, thus decreasing the overall length of their path of travel.