Chapter 1 Introduction to dynamics

Dynamics is the branch of mechanics which deals with the motion of bodies under the action of forces.

Kinematics: the study of motion without reference to the forces which cause motion

Kinetics: The action of forces on bodies to their resulting motions.

Basic concepts (1/2): same as in statics

Newton's law

Law I

$$\sum \vec{F} = 0 \iff \vec{a} = 0$$

- At rest
- Moving at constant speed in a straight line

Law II

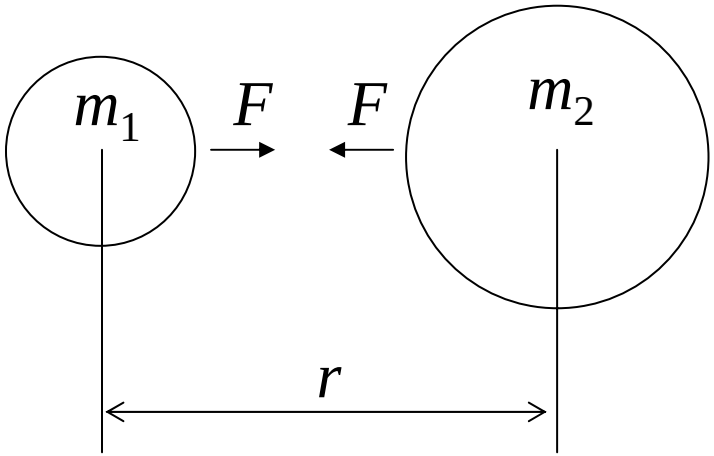
$$\sum \vec{F} = m\vec{a}$$

Law III

Action = Reaction

* Action and reaction are acting on different bodies.

Gravitation



Newton's law of gravitation

$$F = G\frac{m_1 m_2}{r^2}$$

$G = 6.673\ (10^{-11})\ \mathrm{m^3/(kg\ s^2)}$

Object on the earth

$m_1 \longrightarrow m_o$ (Mass of a body)

$m_2 \longrightarrow m_e$ (The mass of the earth)

$$F = G\frac{m_e}{r^2}m_o \Rightarrow \text{weight}$$

and

$$g = G\frac{m_e}{r^2}$$

The value of g depend on r but usually 9.81 $\mathrm{m/s^2}$ is good enough for engineering problem on the earth surface