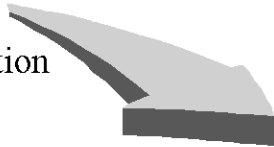


Chapter 10

Kinematics:
Rectilinear Motion



Miami University

1

Objectives

- Review of principles from Physics
- Distance vs. Displacement
- Speed vs. Velocity
- Acceleration due to change in direction

2

Intro to Dynamics

- Review of Statics
 - Sum total of forces acting on a body at rest = zero.
 - Break down forces (vectors) into horizontal, vertical forces and moments

3

Dynamics

- The study of bodies in motion.
 - Kinematics: Analysis of the motion itself – displacement, velocity, acceleration
 - Kinetics: Study of forces that cause motion of a body and the resultant motion – accelerations, inertia and forces acting together.

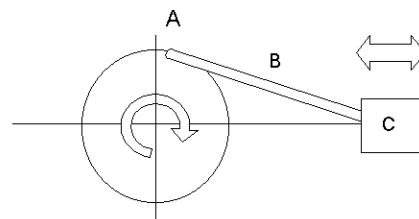
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Types of Motion

- Rectilinear: Part moves in a straight line
- Angular: Part moves along a fixed radius
- Plane: Part moves anywhere, but stays in the same plane

5

Examples of Motion



6

Displacement

- Distance = scalar quantity
 - Miles you drove from A to B
- Displacement = vector quantity
 - Straight line distance and direction from A to B

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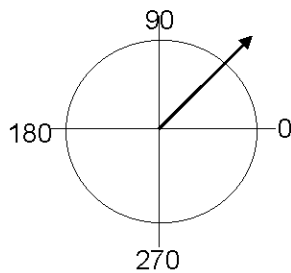
Velocity

- Speed = scalar quantity
- Velocity = vector quantity
 - Example: $v = 5.0 \text{ ft/s @ } 0^\circ (\rightarrow)$

$$v = \frac{\Delta s}{\Delta t} = \frac{s_2 - s_1}{t_2 - t_1} \text{ or } \frac{60 \text{ ft} - 0 \text{ ft}}{12 \text{ s} - 0 \text{ s}} = 5 \text{ ft/s}$$

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Angular Direction



9

Acceleration

- Change in velocity has magnitude and direction

$$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1}$$

- Note: velocity and acceleration vectors are in same direction

10

Rectilinear motion with constant acceleration

- Freefalling body – $9.81 \text{ m/s}^2 \downarrow$
- Initial velocity direction typically chosen as positive
- Deceleration is usually negative

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Equations

$$s = s_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + a t$$

$$v^2 = v_0^2 + 2 a s$$

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Week 2 Homework

- Chapter 10

- 1, 5, 9, 10, 14, 17, 24, 28 & 29

- Read Section 10-6 (Projectiles)