Chapter 1 : Kinematics.

1.2 : Distance and Displacement:

→ The **Distance** is the length of the path the object took in travelling from one place to another. The distance is a **scalar quantity** that only have a magnitude

→ The **Displacement** is the distance travelled, but it is a **vector quantity** that has both magnitude and direction.

1.3 : Speed and Velocity :

→ The **velocity** of an object is the change in its position, divided by the time it took for this change to occur. velocity is a **vector** and it has both a magnitude and direction.

$$\vec{v} = \frac{\Delta x}{\Delta t}$$, Δx = displacement. , Δt = time interval.

→ $\Delta x = x_f - x_i$

→ The **Speed** is the magnitude of the velocity. Speed is a scalar, and it doesn't have a direction.

$$V = \frac{\Delta x}{\Delta t}$$, Δx = distance.

1.4 : Acceleration :

→ **Acceleration** is defined to be the rate of change (in time) of the velocity.

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

→ Characteristics of the acceleration:

1) Acceleration is a vector, it has a direction as well as a magnitude.
2) The object may decelerate (slow down) if the acceleration vector points in the opposite direction to that object's velocity vector.
3) There are three ways an object can accelerate: a change in velocity, a change in direction, a change in both velocity and direction.
4) An object may have an acceleration without its speed changing at all.

1.5: Average Velocity or Speed:

$$\vec{V}_{avg} = \frac{\vec{d}}{t} \quad . \vec{d} = \text{displacement}$$

* Deriving a general relationship between the distance, initial velocity, and constant acceleration:

$$\vec{d} = \vec{V}_{avg}\, t$$

$$d = \frac{1}{2}(v_i + v_f)t$$

→ $\vec{a} = \frac{v_f - v_i}{t}$

$$d = \frac{1}{2}(2v_i + at)t$$

$\boxed{at + v_i = v_f}$

$$\vec{d} = v_i t + \frac{1}{2}at^2 \quad \text{—①}$$

$$v_f = v_i + at \quad \text{—②}$$

$$v_f^2 = v_i^2 + 2ad \quad \text{—③}$$