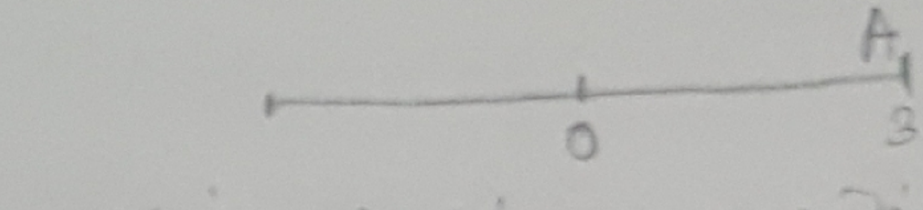
Name- Tanusree Debnath
Chapter outline -2

2.1

position → An object's position is the location of the object with respect to a reference point.



Object A's position with respect to O is 30m.

Displacement → Displacement's equation

$$\Rightarrow \Delta x = x_f - x_i$$

Displacement of an object is the change of its position in some time interval.

Distance is not same as displacement. Distance is the total length of the path that an object travels. And displacement is only the position Lifference of an object between its final position and initial position.

if object A travels from position 0m to 30m and travels back to 0m, the displacement of car

Object is 0 as displacement is final position of A - initial position of A

$$0m - 0m$$
$$= 0m$$

But the distance travelled by A is $= (30+30)m$
$$= 60m$$

Average velocity → An object's average velocity is the object's displacement divided by the time it took for the displacement.

Equation of average velocity →

$$V_{x,avg} = \frac{\Delta x}{\Delta t} \ m/s$$

The average velocity of an object moving in one direction can be positive or negative.

Average speed ⇒ Speed is a scalar quantity which has no direction.

The average speed of an object is the total distance travelled by the object divided by the total time during.

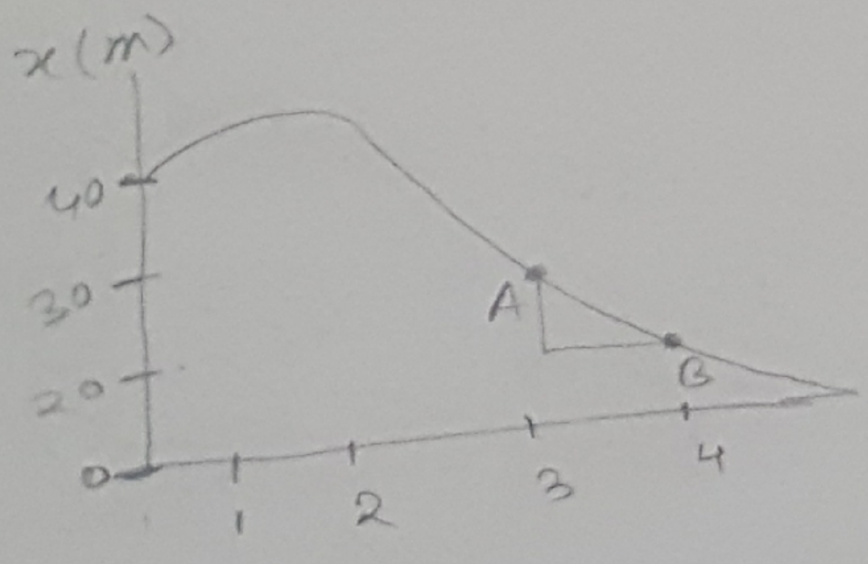
equation of average speed ⇒ $V_{avg} = \frac{d}{\Delta t} \ m/s$ → total distance

2.2

Instantaneous velocity ⇒

equation = $V_x \Rightarrow \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$

The instantaneous velocity is when we limit the value of ration of displacement divided by time interval when Δt approaches 0. The instantaneous velocity can be positive, negative or zero. The instantaneous speed is the magnitude of instantaneous velocity.



$$V_x = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$$

$$V_x = \frac{30-20}{3-2}$$

$$= \frac{10\,m}{1\,s}$$

2.3 Analysis model → Analysis model is a common situation that occurs in many physics problem.

For example, A car is moving on the freeway at a constant speed. And a ball is moving on the floor at a constant speed. So, the main point here is an object is moving at a constant speed.

2.3 Analysis model looks at the behaviour of a physical entity and the interaction between the entity and the environment.

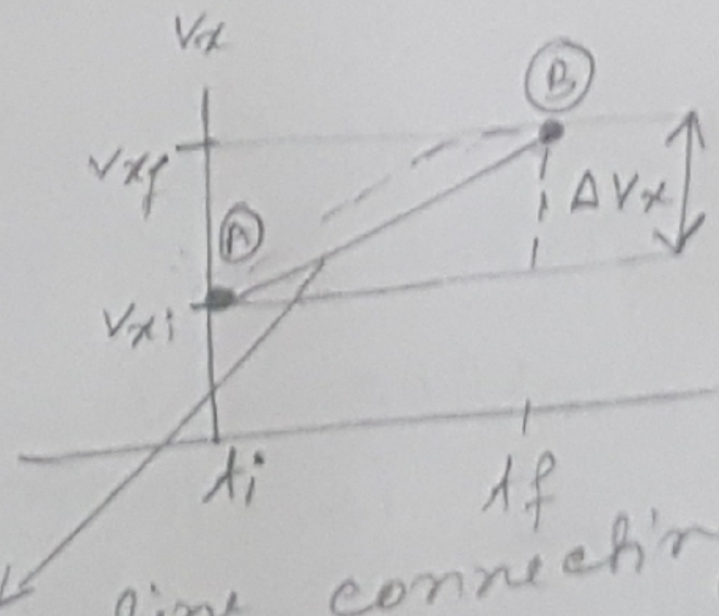
2.4 Acceleration

Acceleration happens when an object changes its velocity with time.

The average acceleration happens when an object's change in velocity is divided by the duration of time in which the object changed its velocity.

equation of average acceleration ⇒

$$a_{x,avg} = \frac{\Delta v_x}{\Delta t} = \frac{v_{xf} - v_{xi}}{t_f - t_i} \ m/s^2$$



This line connecting A and B is the average acceleration of the car during the time interval $\Delta t = t_f - t_i$

Instantaneous acceleration is the limit of average acceleration as Δt approaches zero.

2.4

equation of instantaneous acceleration $a_x = \lim_{\Delta t \to 0} \frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt}$

The force on an object is proportional to the acceleration of the object:

$$F_x \propto a_x$$

equation of instantaneous acceleration:

$$a_x = \frac{dv_x}{dt} = \frac{d}{dt}\left(\frac{dx}{dt}\right) = \frac{d^2x}{dt^2}$$

2.5 Motion Diagrams →

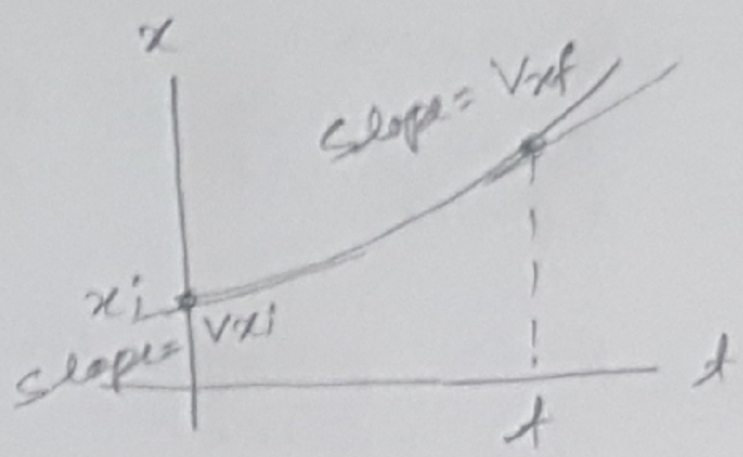
A motion diagram is useful to show the differences between velocity and acceleration of an object on a diagram.

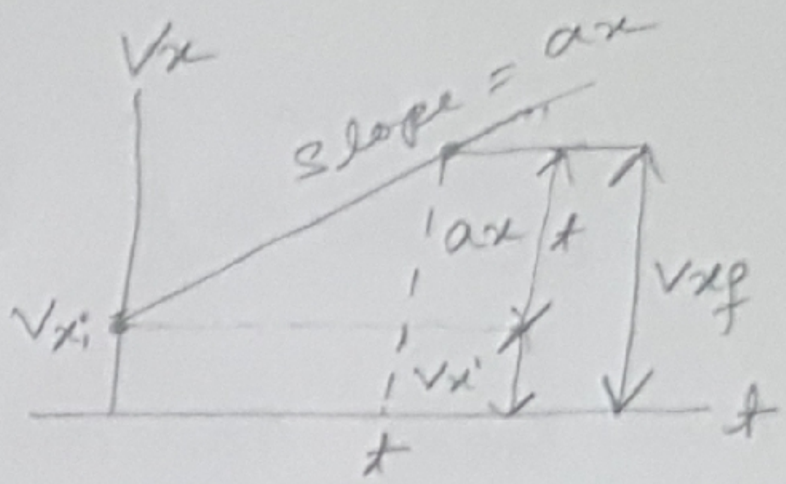
2.6 If an object has a constant acceleration, then we can use this formula to solve many problems

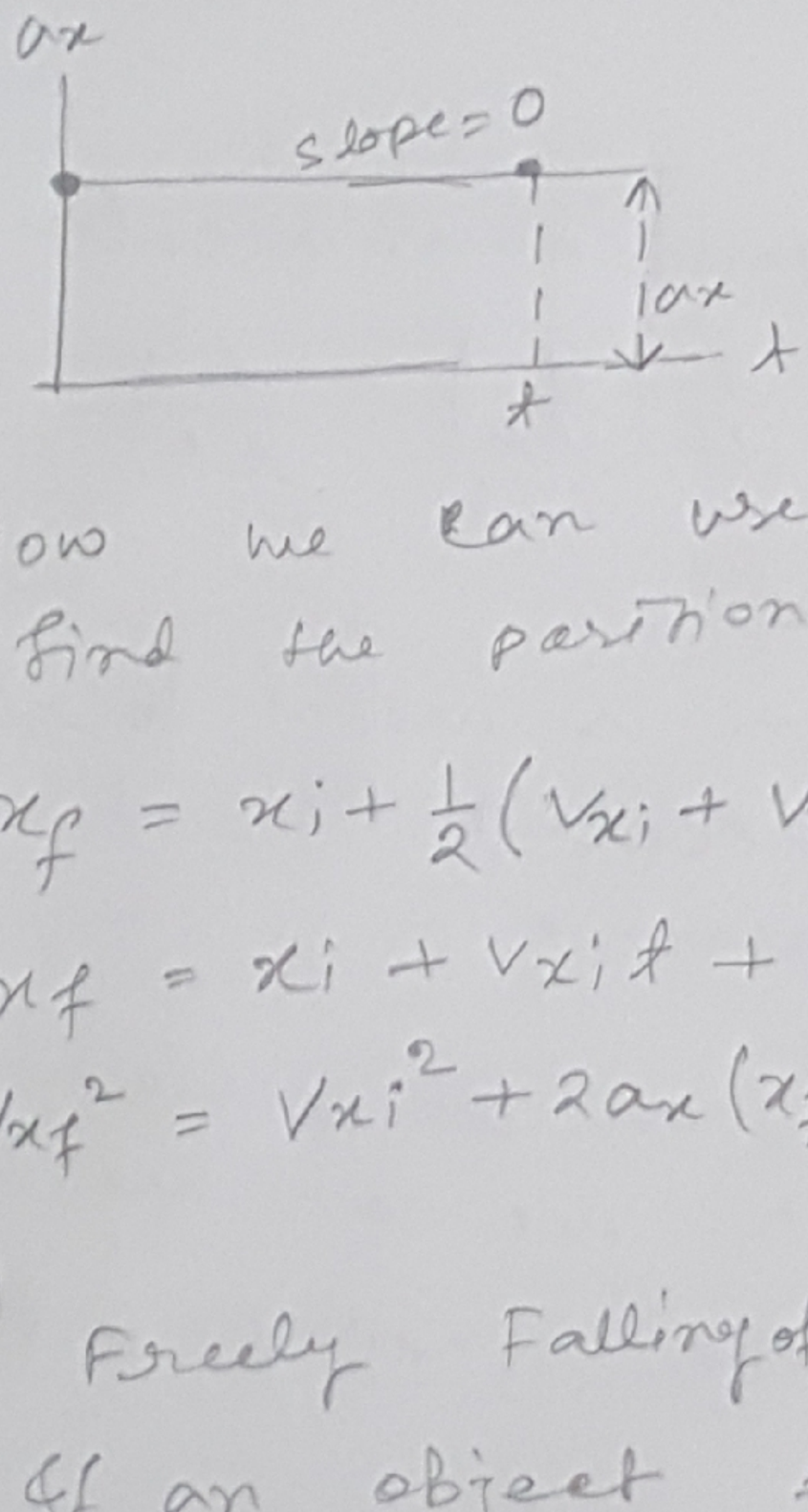
→ $v_{xf} = v_{xi} + a_x t$ (for constant acceleration)

We can also use the following formula for average velocity when the object has a constant acceleration

$v_{x,avg} = \frac{v_{xi} + v_{xf}}{2}$ (for constant acceleration)







Now we can use the following equations to find the position of an object.

$$x_f = x_i + \frac{1}{2}(V_{xi} + V_{xf})\,t \quad \text{---} \quad (\text{constant acceleration})$$

$$x_f = x_i + V_{xi}\,t + \frac{1}{2}a_x t^2 \quad \text{---} \quad (\text{constant acceleration})$$

$$V_{xf}^2 = V_{xi}^2 + 2a_x(x_f - x_i) \quad \text{---} \quad (\text{constant acceleration})$$

2.7

Freely Falling objects →

If an object falls from a height where air resistance is absent, that motion is called free-fall motion. A freely falling object falls only under the influence of gravity and the objects moves downward due to gravity. The value of g is approximately = $9.8\,m/s^2$.