VISUAL PHYSICS

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SHORT NOTES

CHAPTER

Motion in 1 Dimension

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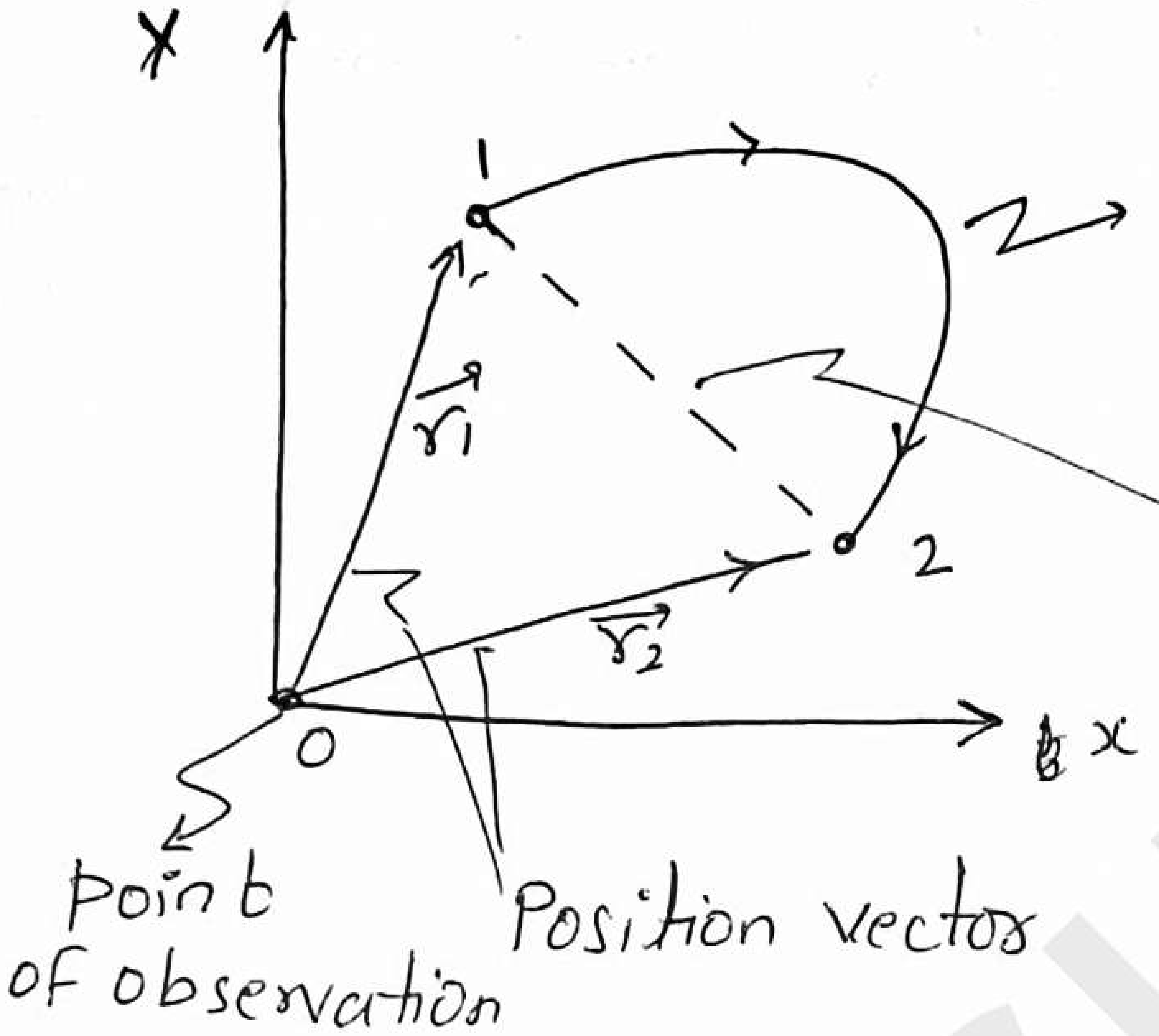
Motion in 1-D

Distance & Displacement



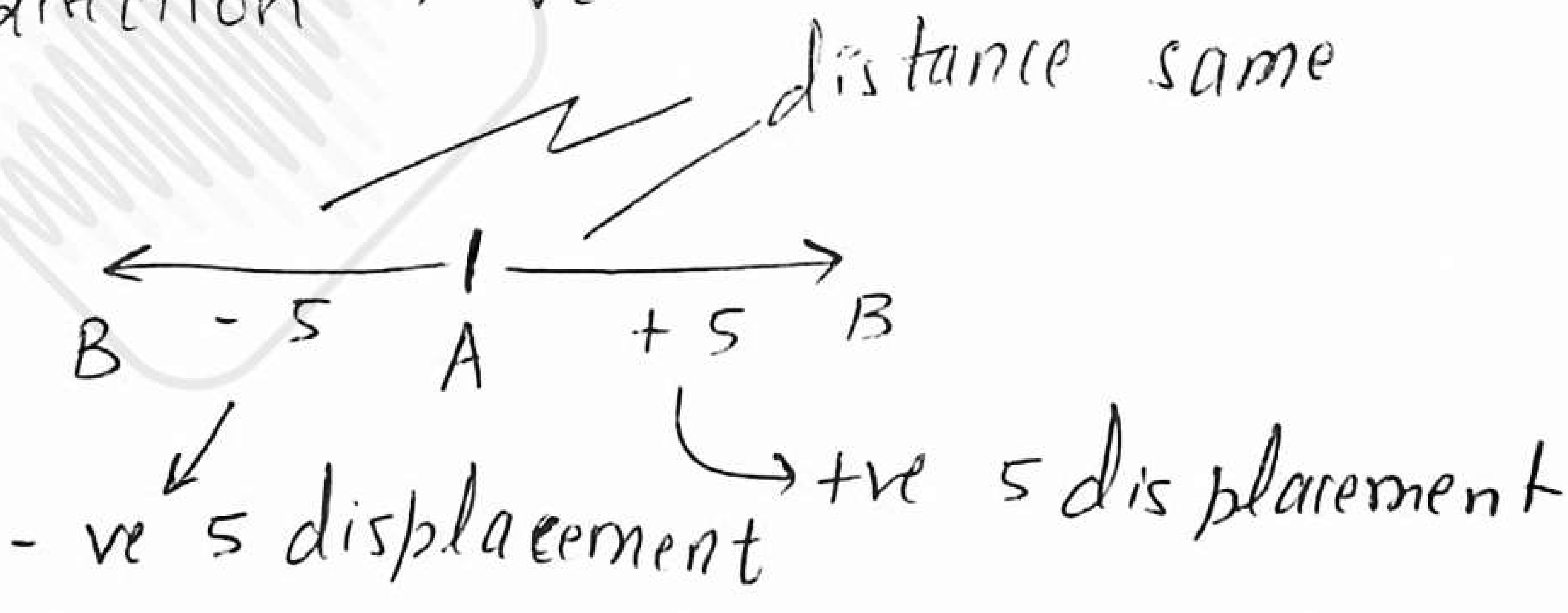
while moving the length of actual path covered is 'DISTANCE'

The shortest distance between initial and final position is "DISPLACEMENT".

Distance → scalar → No direction

Displacement → vector → direction

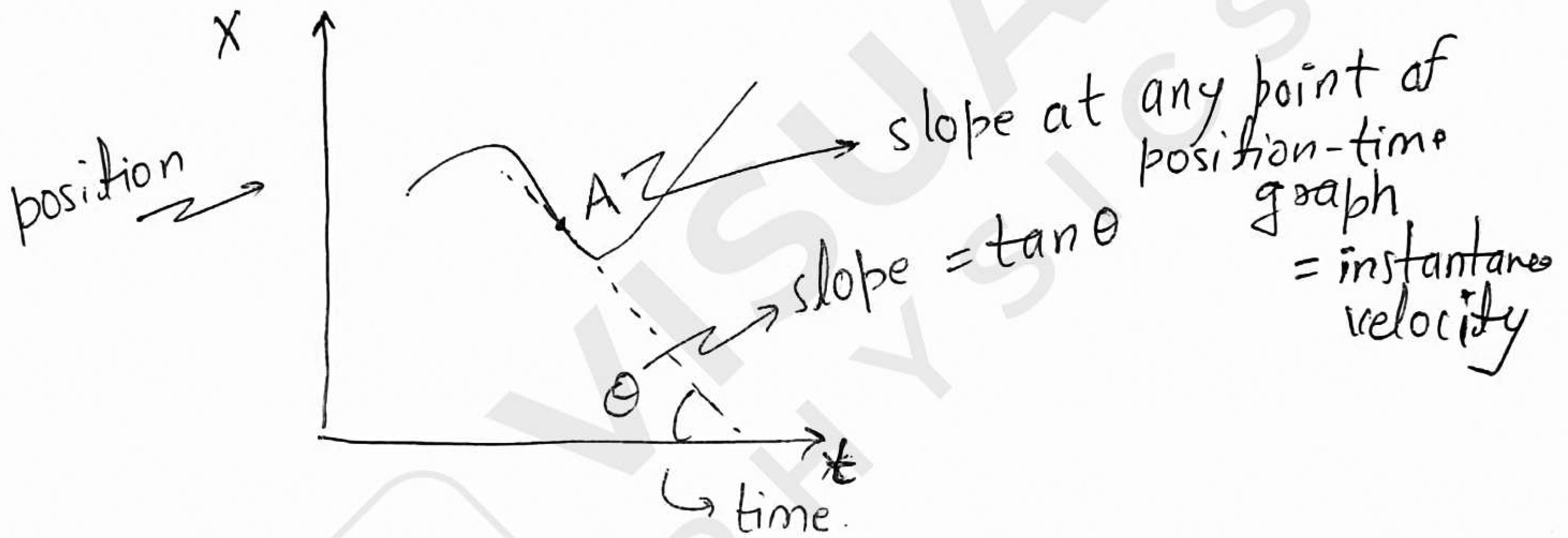
for motion in one direction if we take say +x direction as + direction, so negative x-direction → -ve.



Speed & Velocity (in 1-D)

Average speed = $\dfrac{\text{Total distance covered}}{\text{Time required to cover that distance}}$

Average velocity = $\dfrac{\text{Total displacement}}{\text{Time elasped to cover that displacem}}$



⇒ Instantaneous speed : = magnitude of instantaneous velocity

Instantaneous velocity = $\dfrac{dx}{dt}$ → position

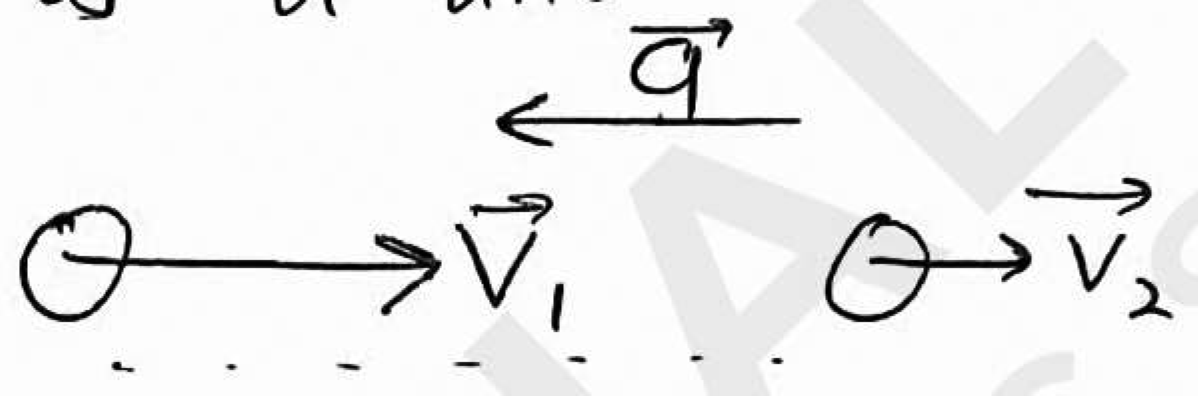
⇒ We always consider one direction as positive and other negative and positive negative sign gives direction of velocity.

Instantaneous Acceleration:

Rate of change of velocity = Acceleration

$$\boxed{\frac{dv}{dt} = a}$$

direction of a and v can be different



$v_1 > v_2$

so, $\vec{a}$ is opposite to $\vec{v}$

slope of position - time → velocity (instantaneous)

slope of velocity - time graph → Instantaneous acceleration

$$\boxed{\text{average acceleration} = \frac{\text{change in } \vec{v} \text{ in given time}}{\text{time elapsed}}}$$

⇒ Uniform speed motion → speed of object remains constant throughout the motion

⇒ Uniform velocity motion → velocity of object remains constant throughout

does not mean

uniform speed motion → uniform velocity motion, in general

always mean

uniform velocity motion → uniform speed motion

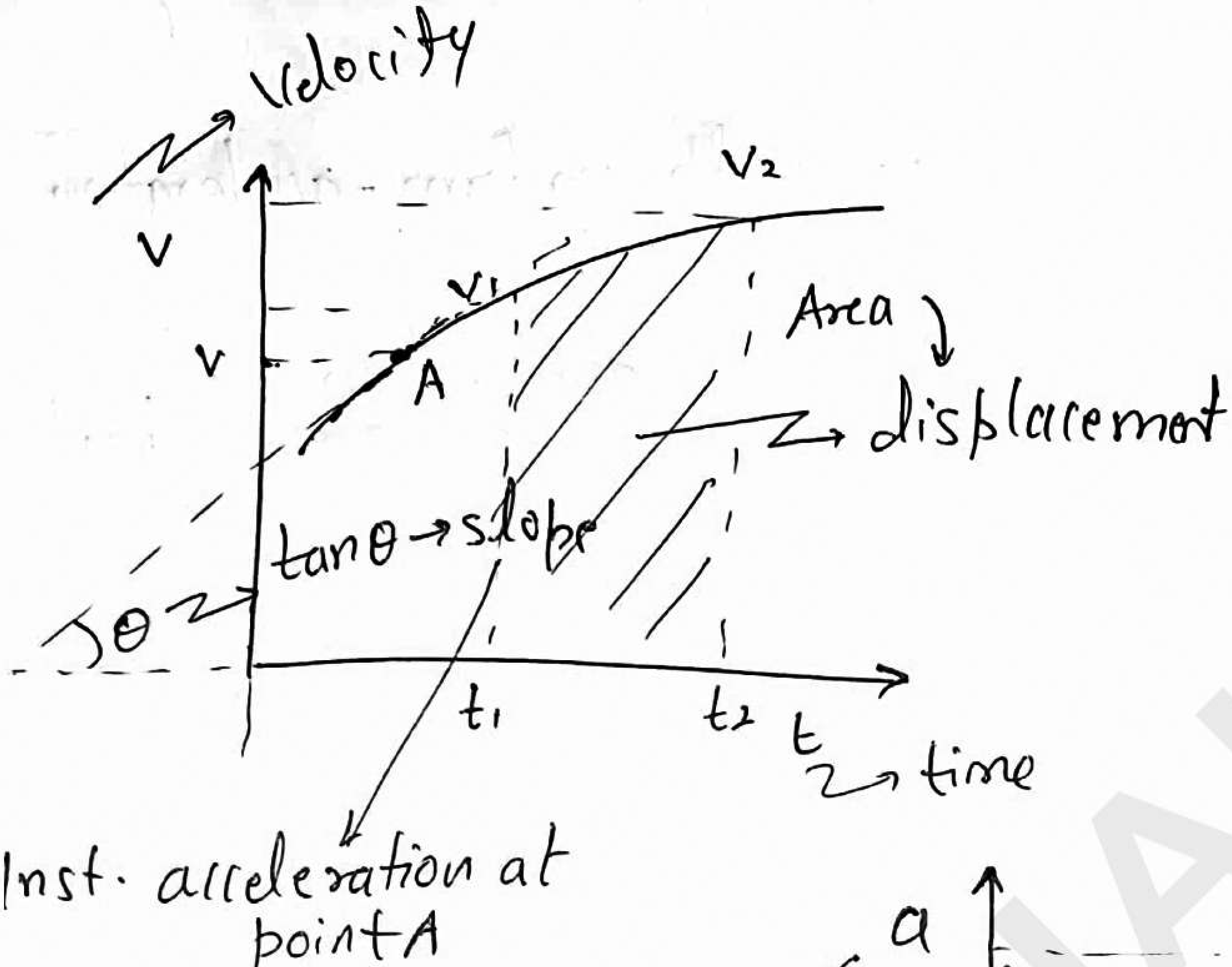
Graph & its outcomes

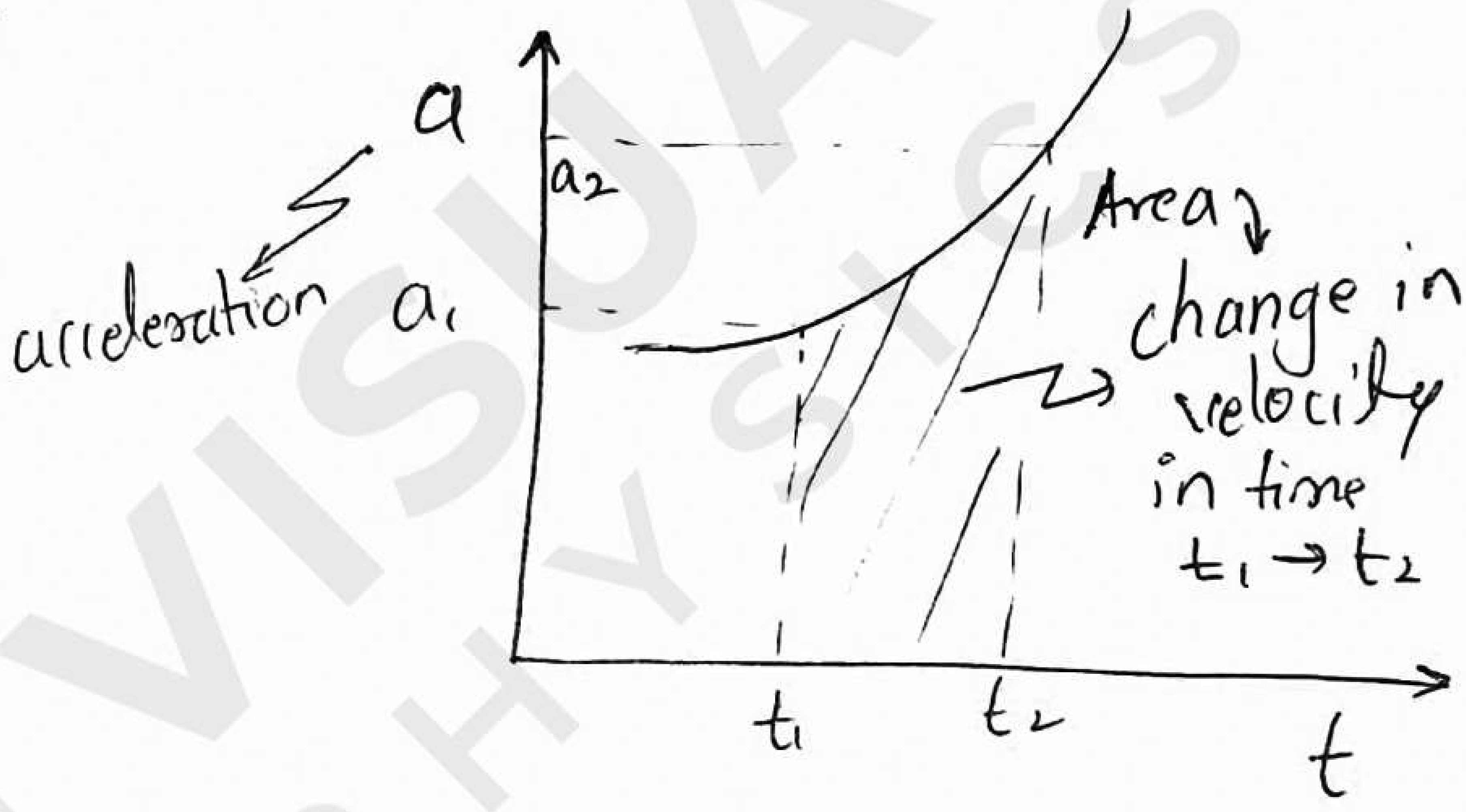
(1) slope of position - time graph → velocity

(2) slope of velocity - time graph → acceleration

(3) Area under acceleration - time graph → change in velocity

(4) Area under velocity - time graph → displacement


Velocity
V
v_2
v_1
v
A
Area
displacement
$\tan\theta \to$ slope
θ
t_1
t_2
t
time
Inst. acceleration at point A


a
acceleration
a_2
a_1
Area
change in velocity in time $t_1 \to t_2$
t_1
t_2
t


S
position
s
A
θ_1
θ_2
$\tan\theta_2 \to$ slope
Velocity at A at time 't'.
t
t

→ We will consider motion with uniform-acceleration

acceleration will remain constant

→ As,

$$a = \frac{dv}{dt}$$

$$a\,dt = dv$$

$$a\int_0^t dt = \int_u^v dv$$

$$at = v - u$$

$$\Rightarrow \boxed{v = u + at}$$

acceleration

time elasped

final velocity

initial velocity

→

$$a = \frac{dv}{dt}$$

$$a = \frac{dv}{dt}\frac{dx}{dx}$$

$$= \frac{dv}{dx}\frac{dx}{dt}$$

velocity

$$a = v\frac{dv}{dx}$$

$$\int_0^s a\,dx = \int_u^v v\,dv$$

$$as = \frac{v^2 - u^2}{2}$$

$$\Rightarrow \boxed{v^2 = u^2 + 2as}$$

→ displacement

acceleration

→ as $v = \frac{dx}{dt}$

$$(u + at) = \frac{dx}{dt}$$

$$\int_0^t (u + at)\,dt = \int_0^s dx$$

$$\Rightarrow \boxed{s = ut + \frac{1}{2}at^2}$$

Three equations:

1. $v = u + at$
2. $v^2 = u^2 + 2as$
3. $s = ut + \frac{1}{2}at^2$

Acceleration due to gravity

$\hookrightarrow g \rightarrow 9.8\,m/s^2$

$\hookrightarrow 10\,m/s^2$

$\downarrow$

Normaly.

→ direction → always downwards towards earth

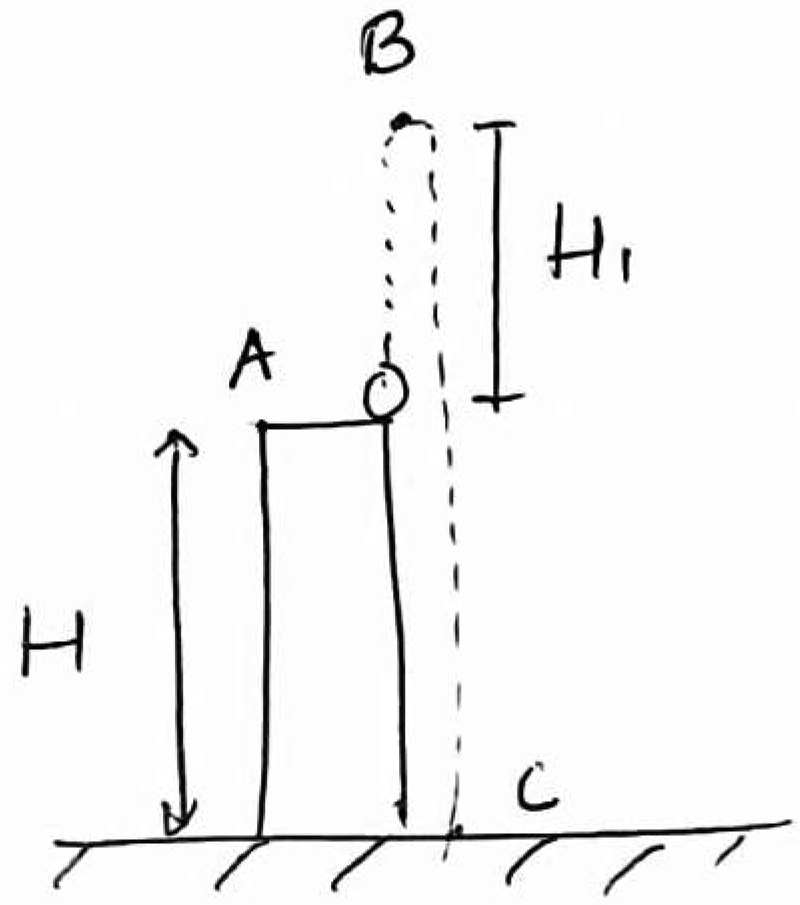
if we take direction $\uparrow$ +ve

than $a = -g$

if we take direction $\downarrow$ +ve

$a = +g$

Using scalar method:



from A→B

$a = -g$ as gravity opposes the motion

$S = H$

from B→C

$a = +g$ → gravity support motion

$S = H + H_1$

Using vector

upward direction → +ve

doward direction → −ve

acceleration = $(-g)$

as gravity is in down direction

$S = (-H)$

as object ultimately goes from A→C displacement → −H