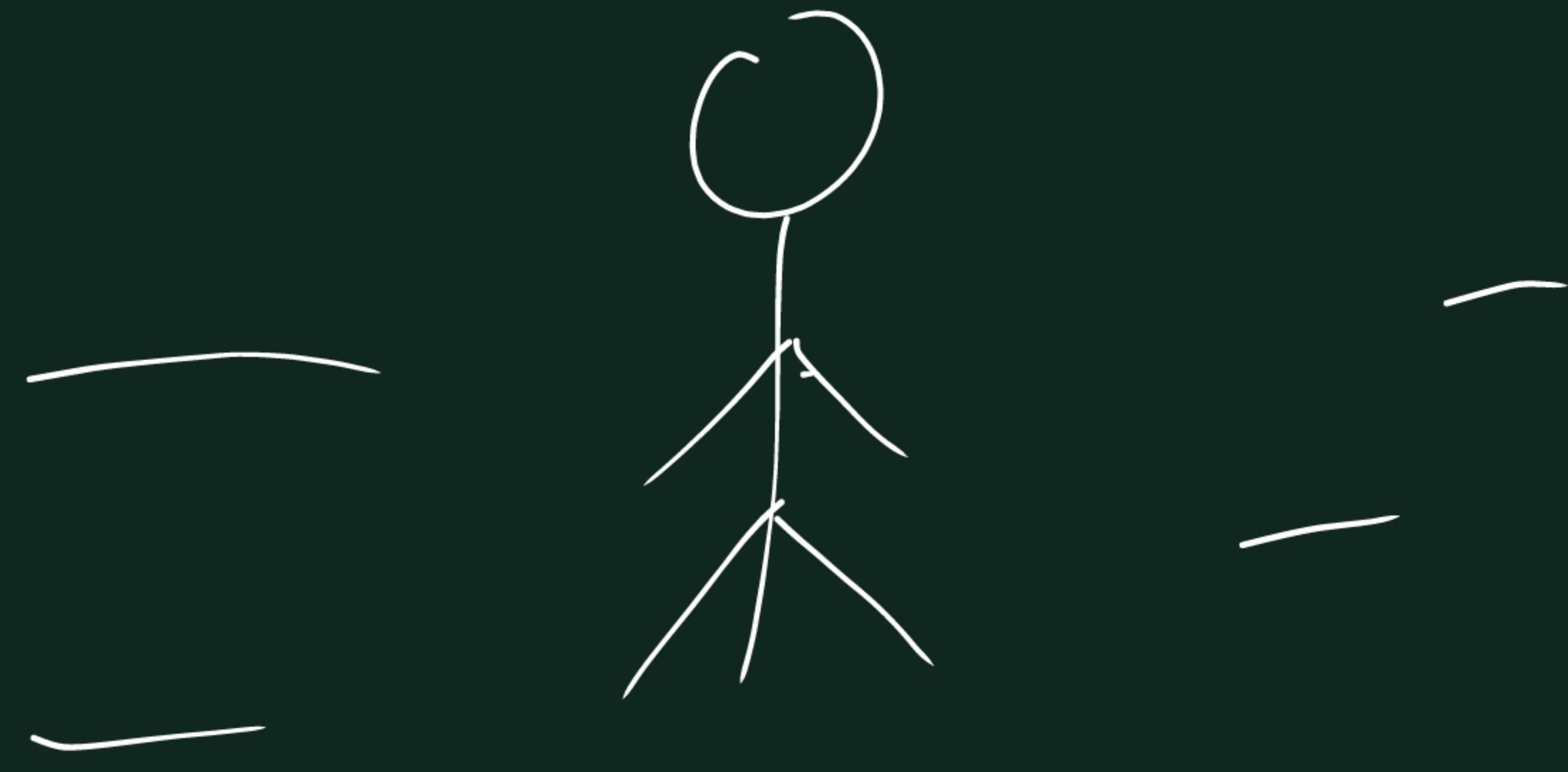


Motion

Rest →

When the

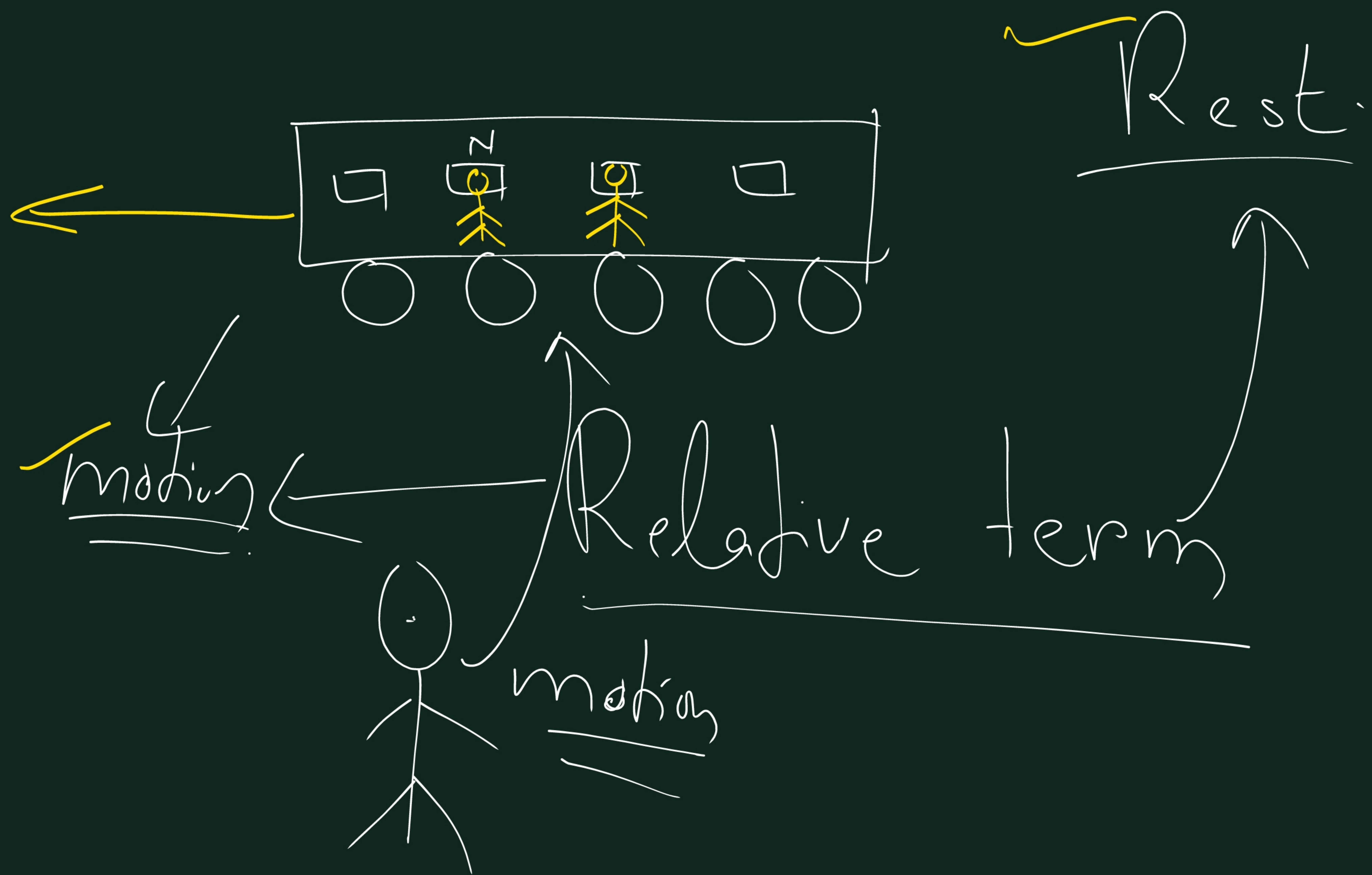
surrounding
with time



does not not change

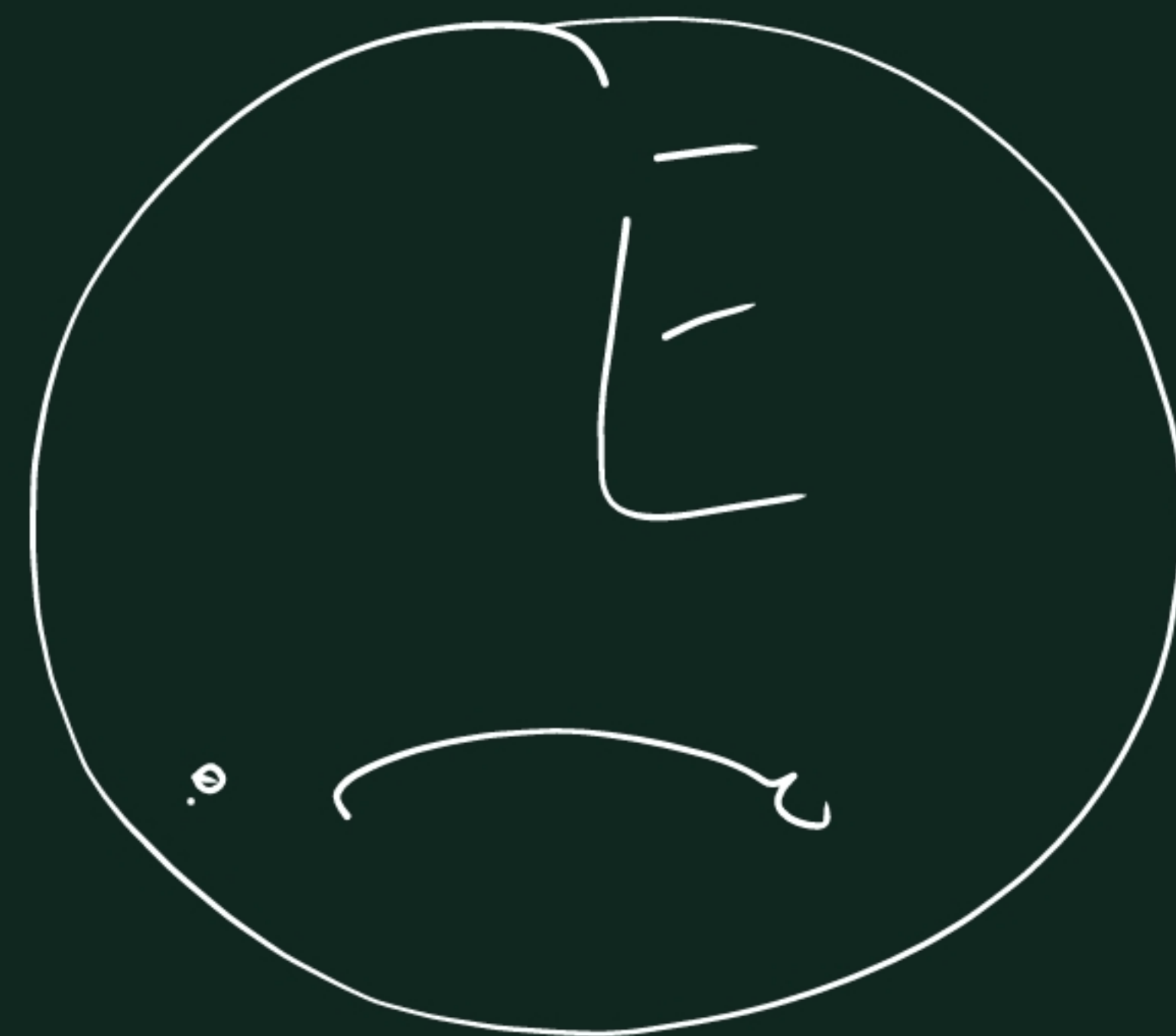
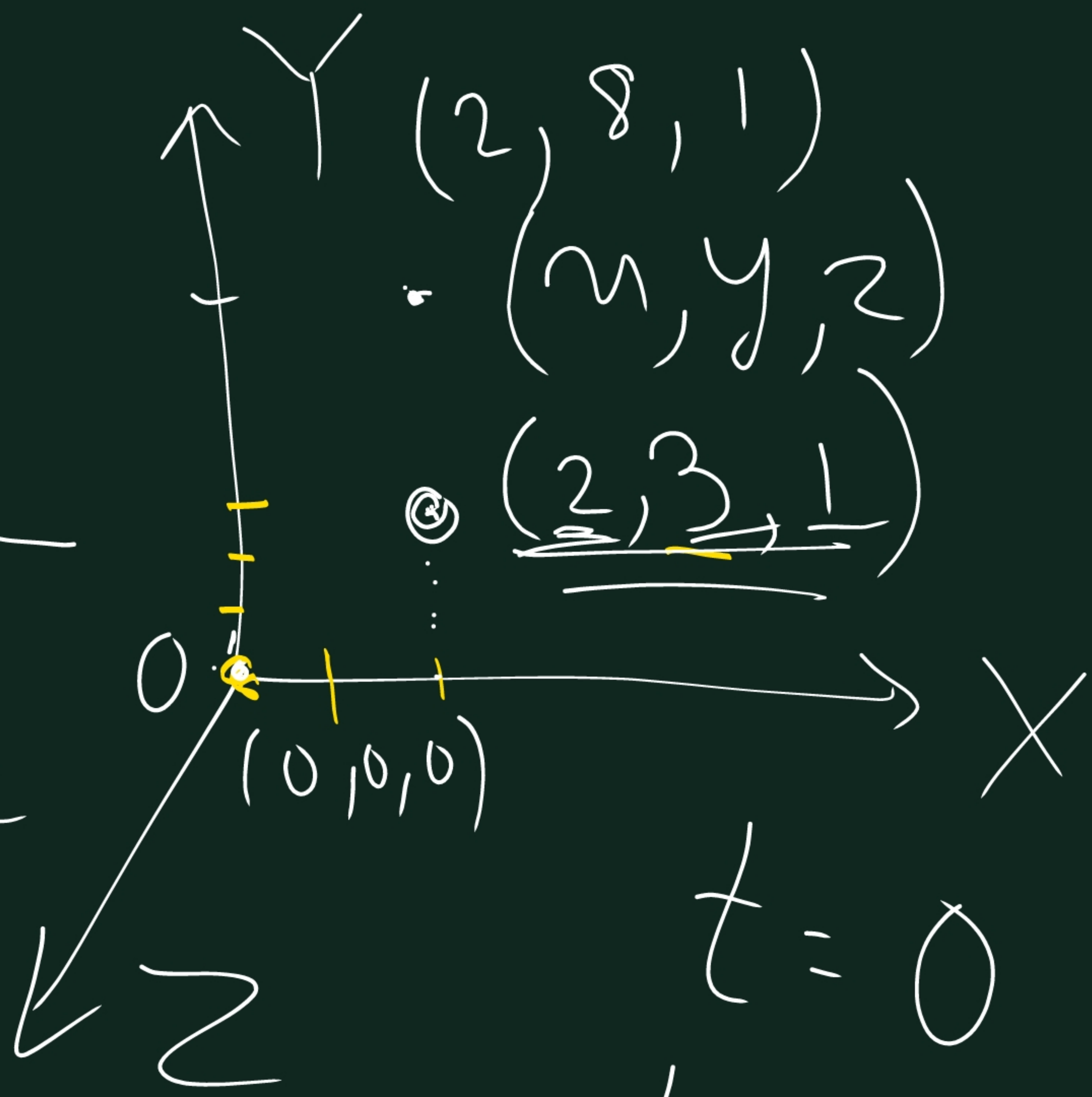
Motion → When the surrounding
changes with time.





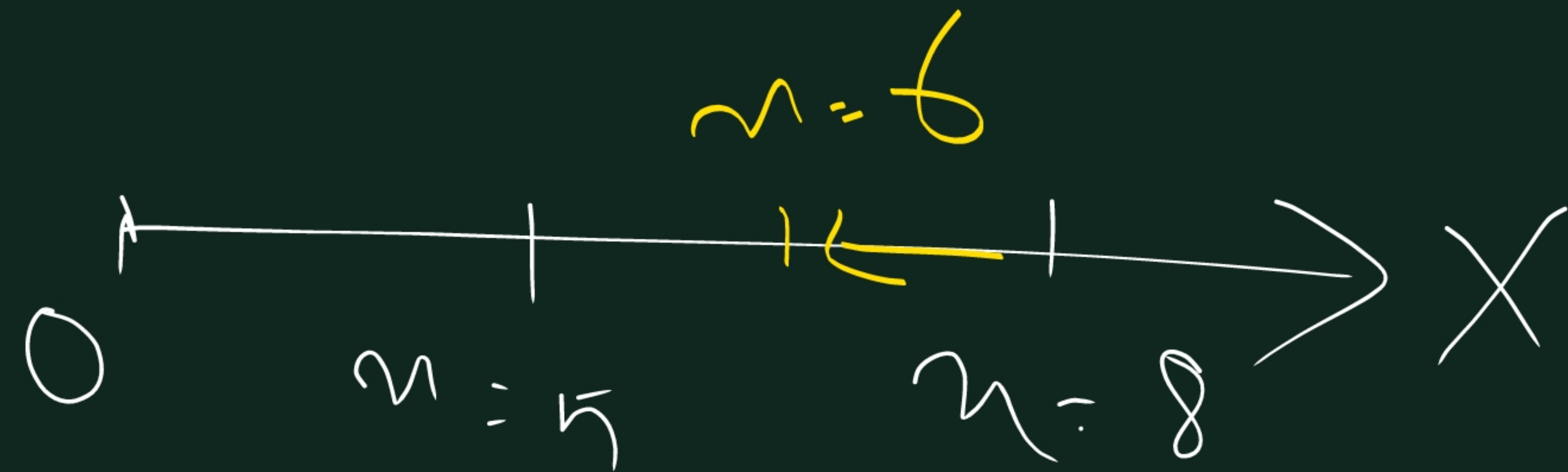
Point of observation

3D
Coordinate

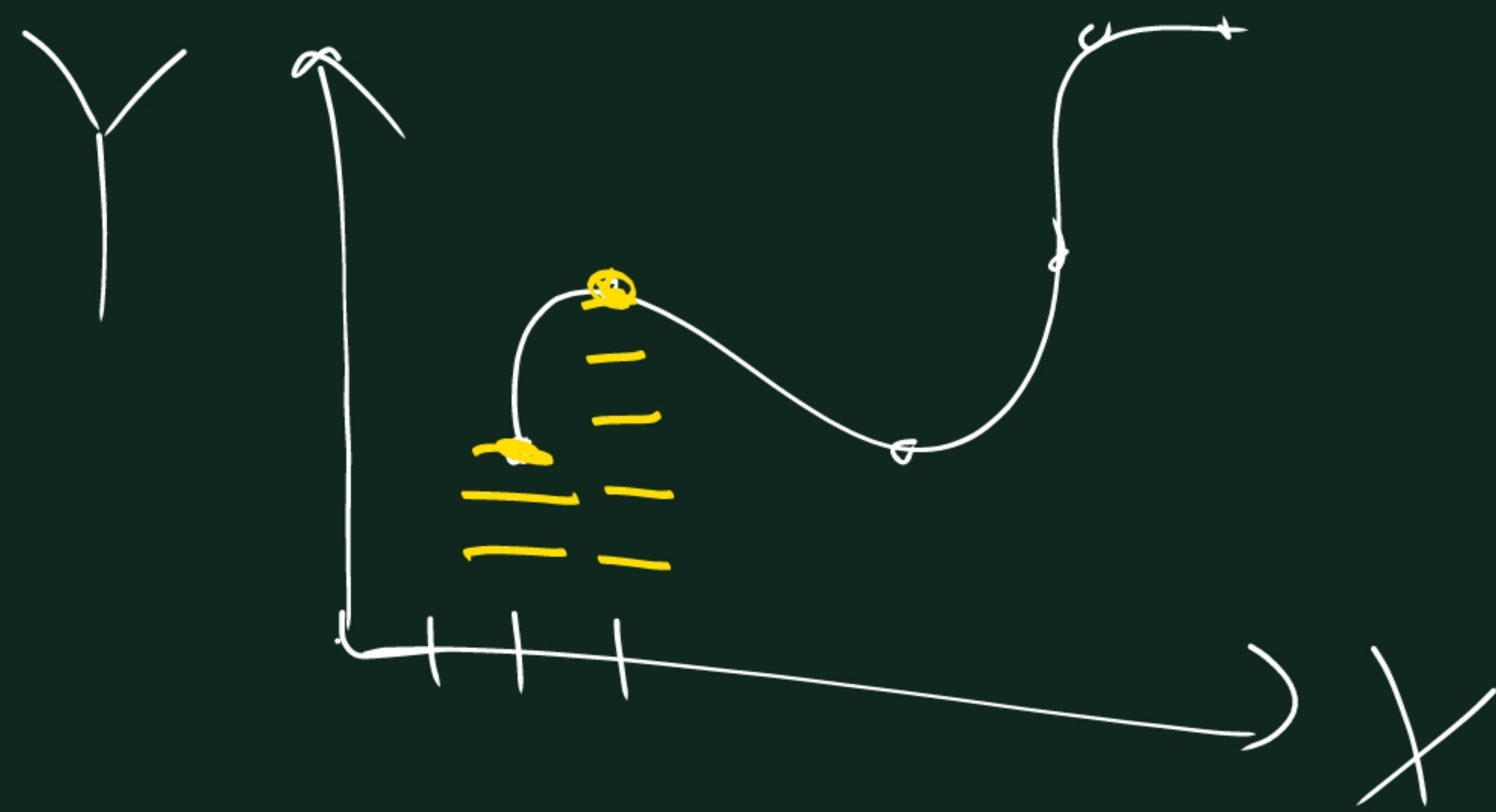


S

1D



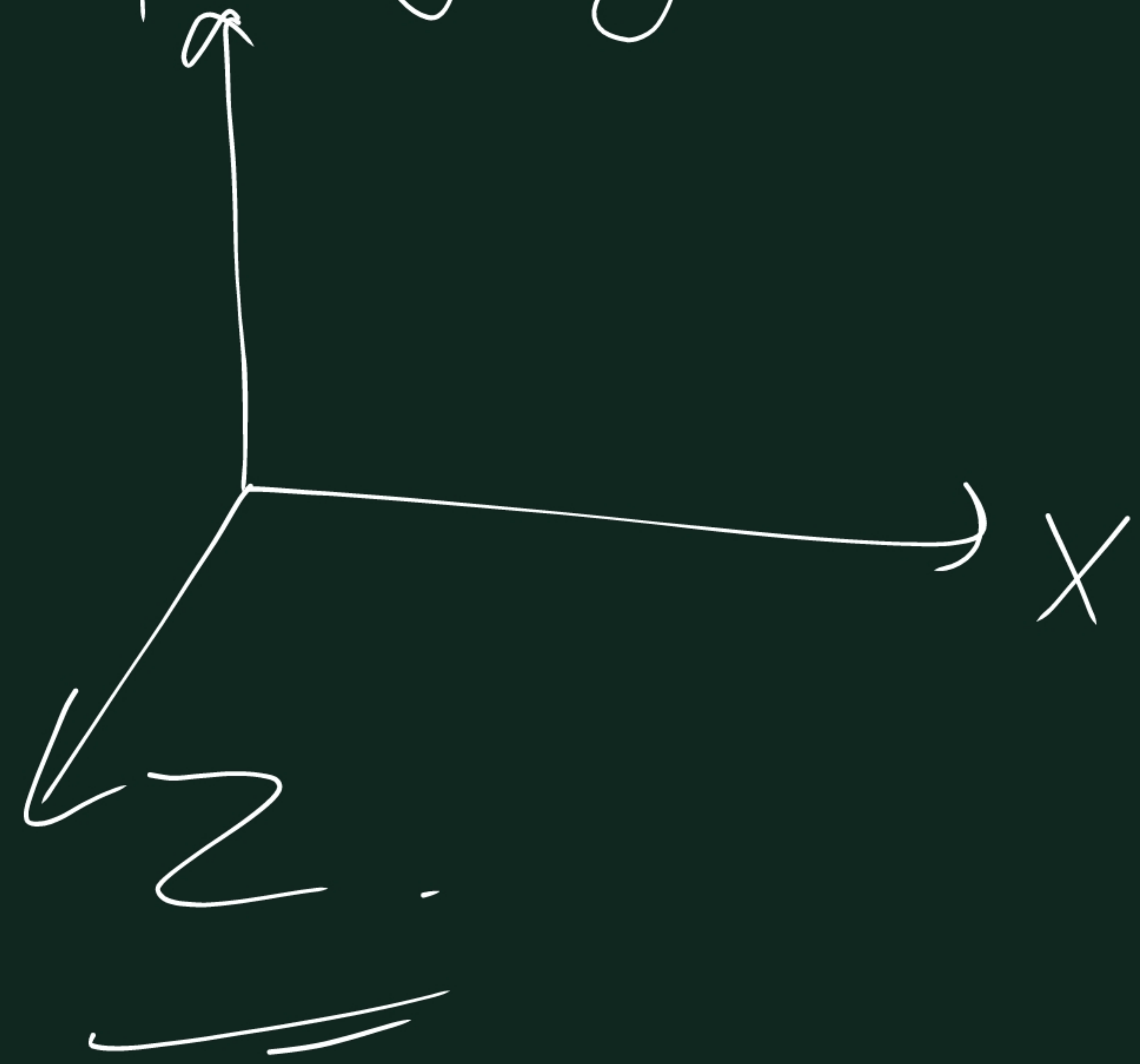
2D



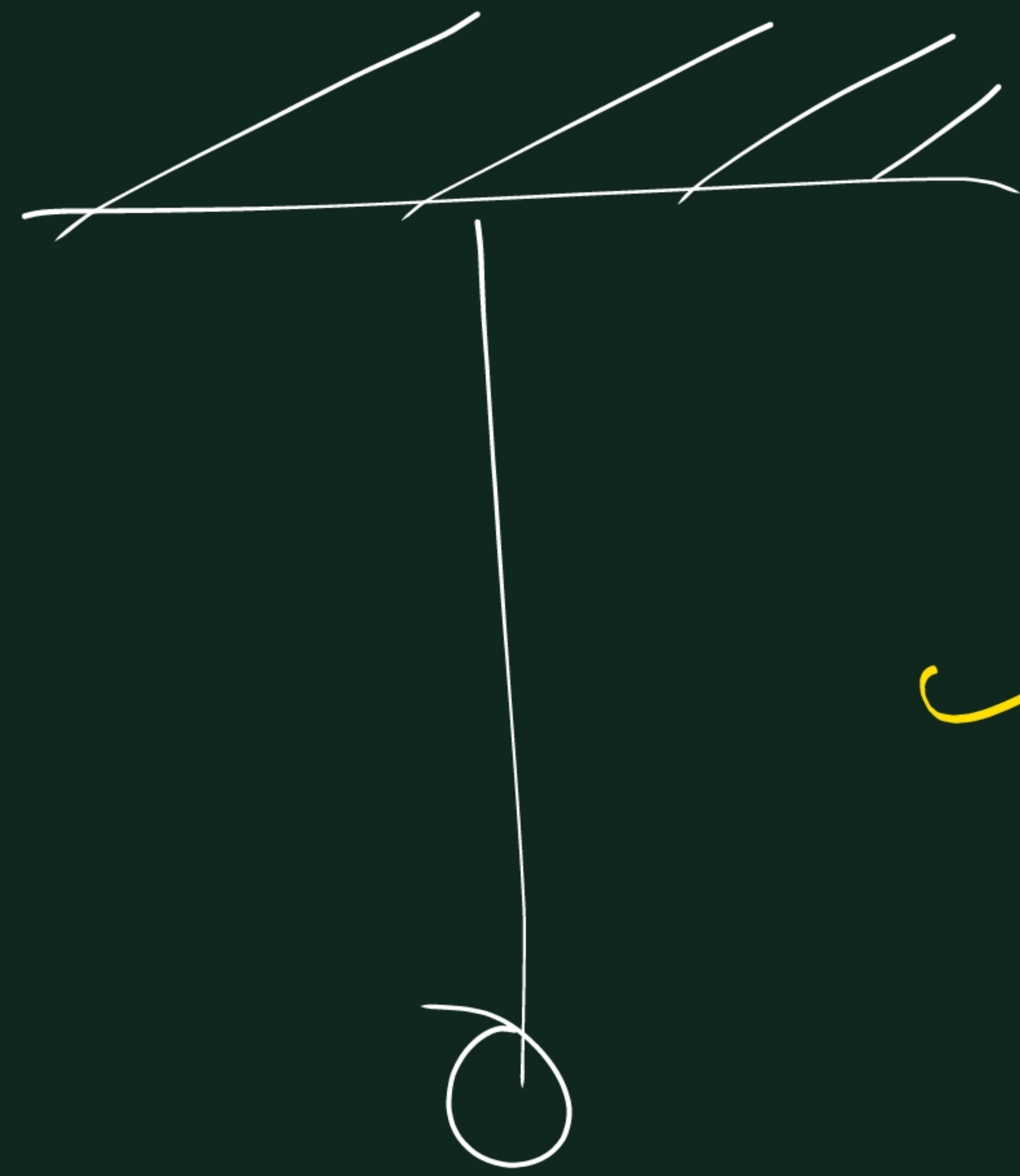
3D

Aeroplane

flying Bird



Types of Motion

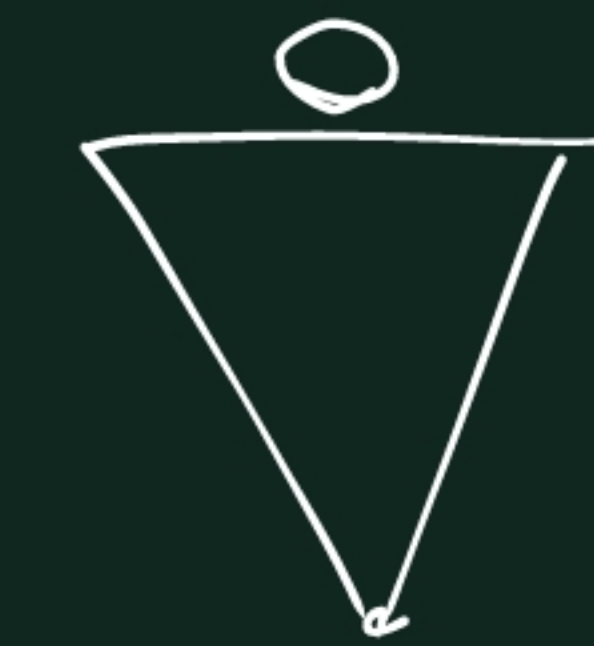


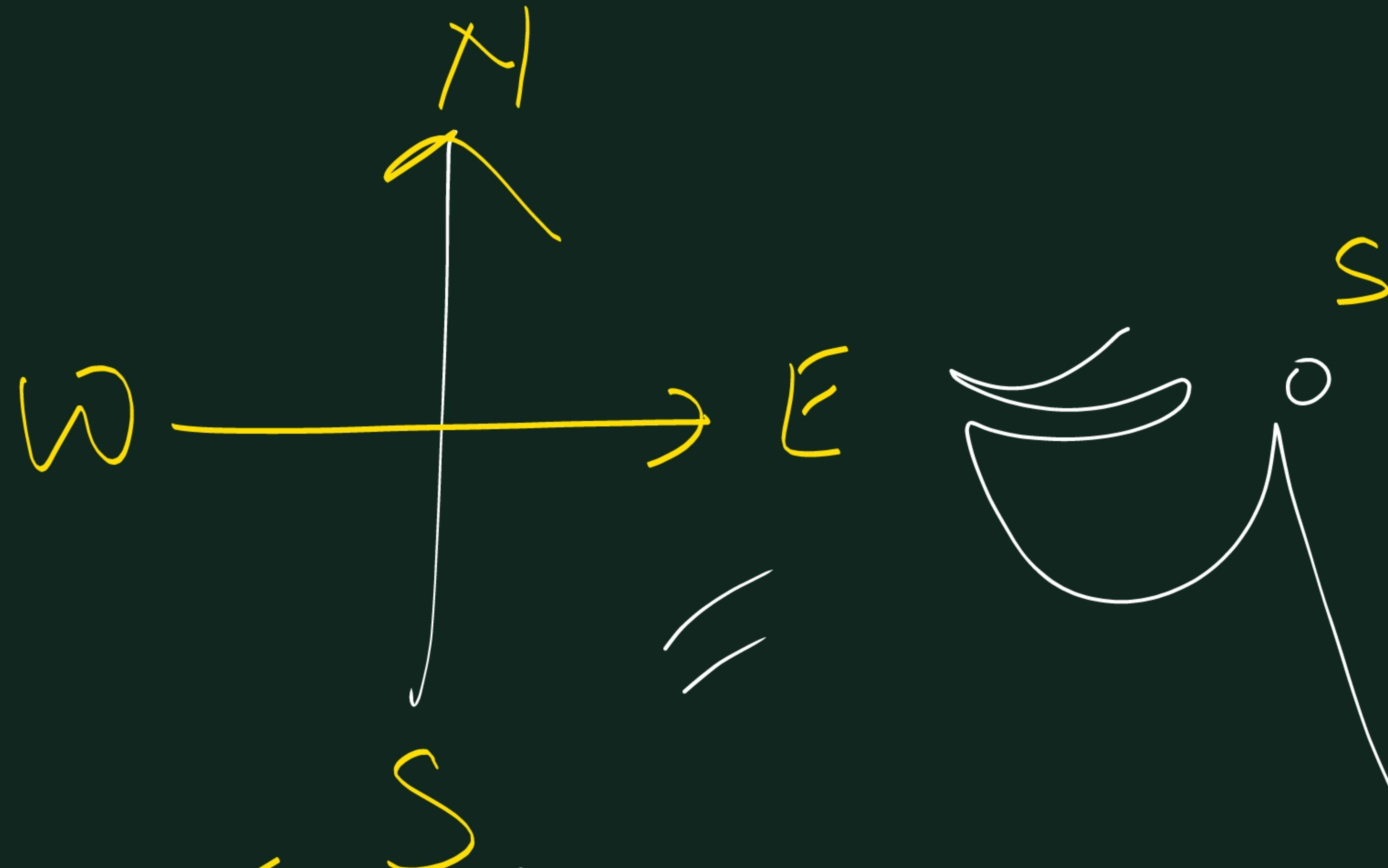
(i) Linear motion

(ii) Rotational motion

(iii) Vibrational motion.

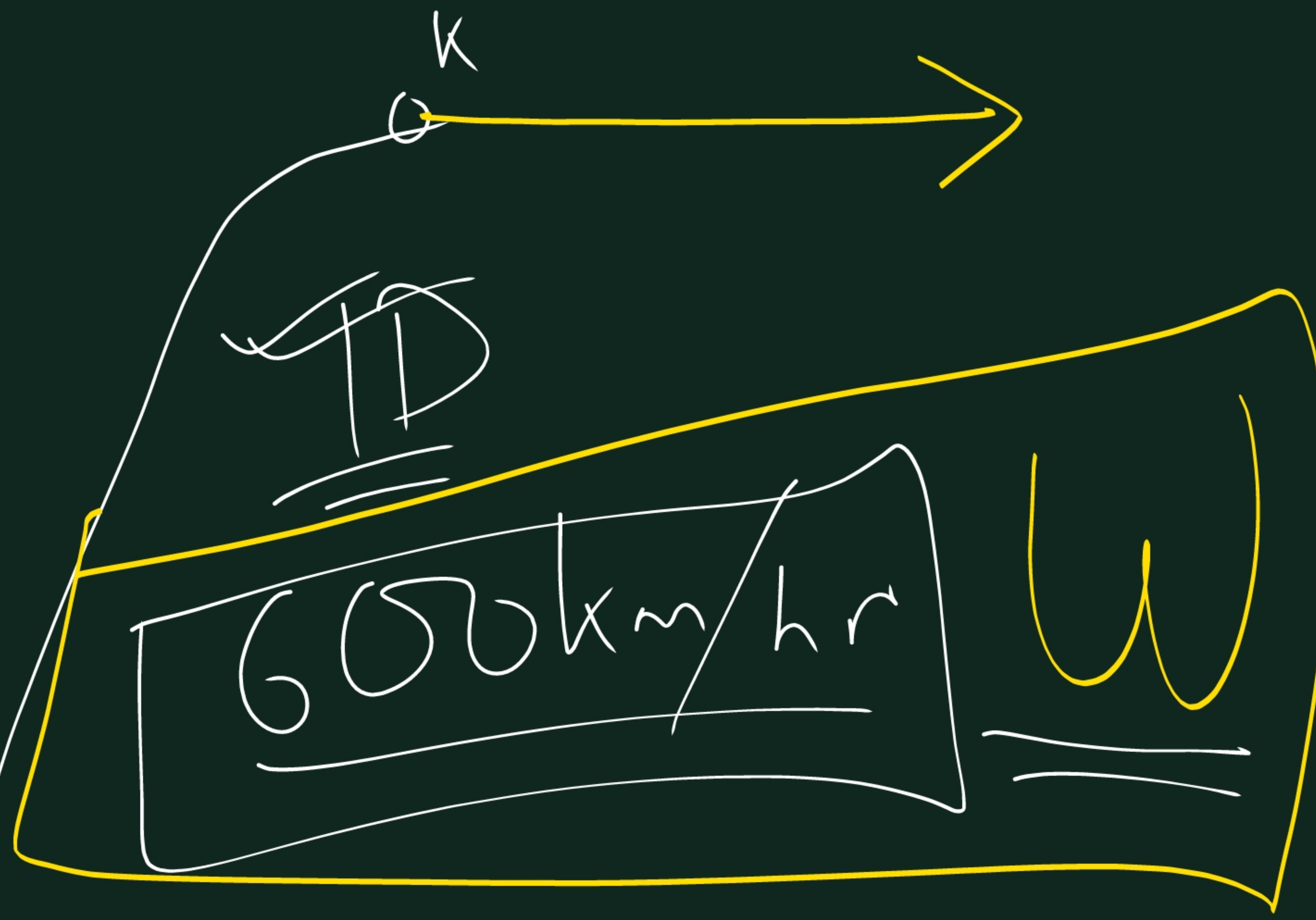
to & fro



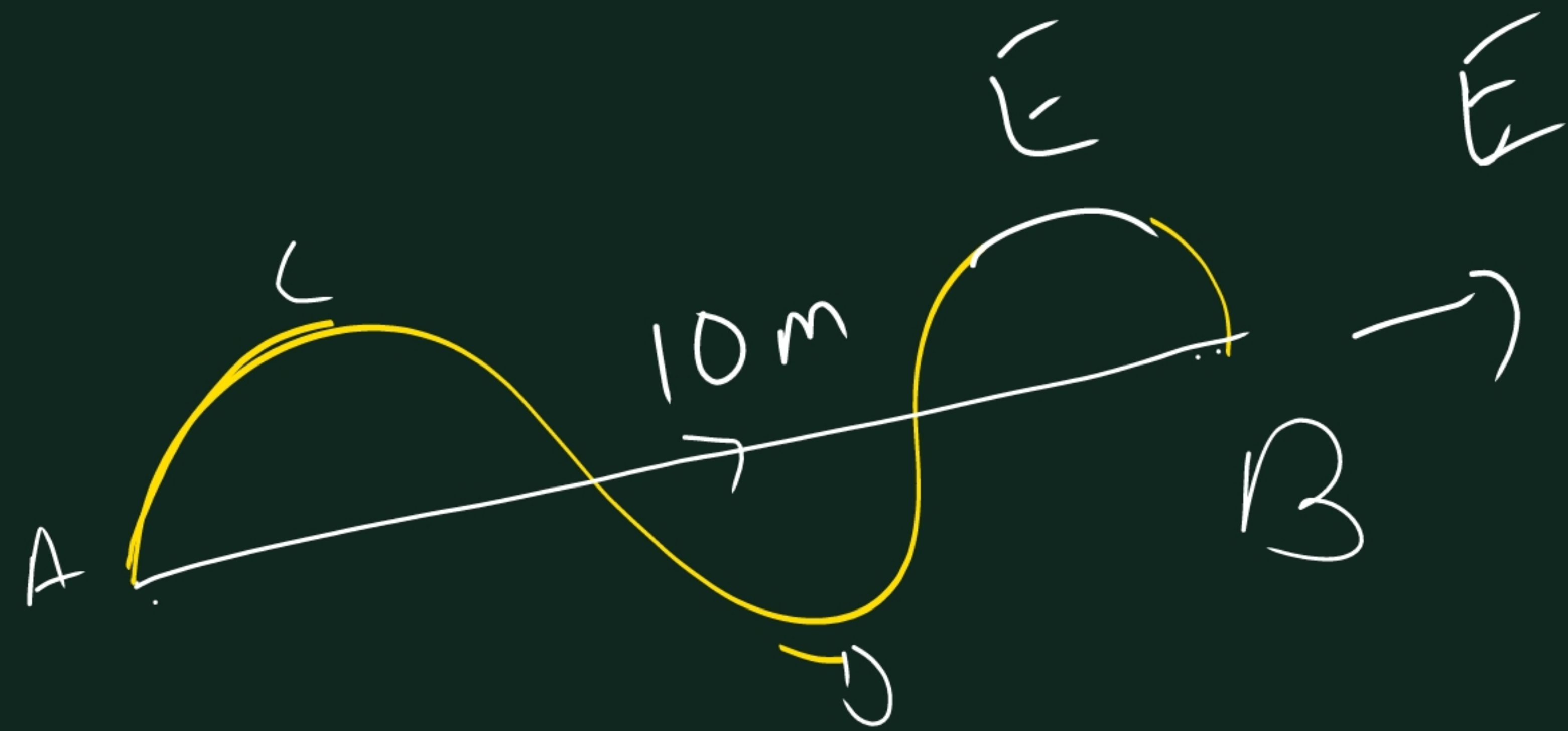


✓ Scalar = $\text{mag}(a)$

Vector = mag. + direction (\vec{a})



→ length of
the actual

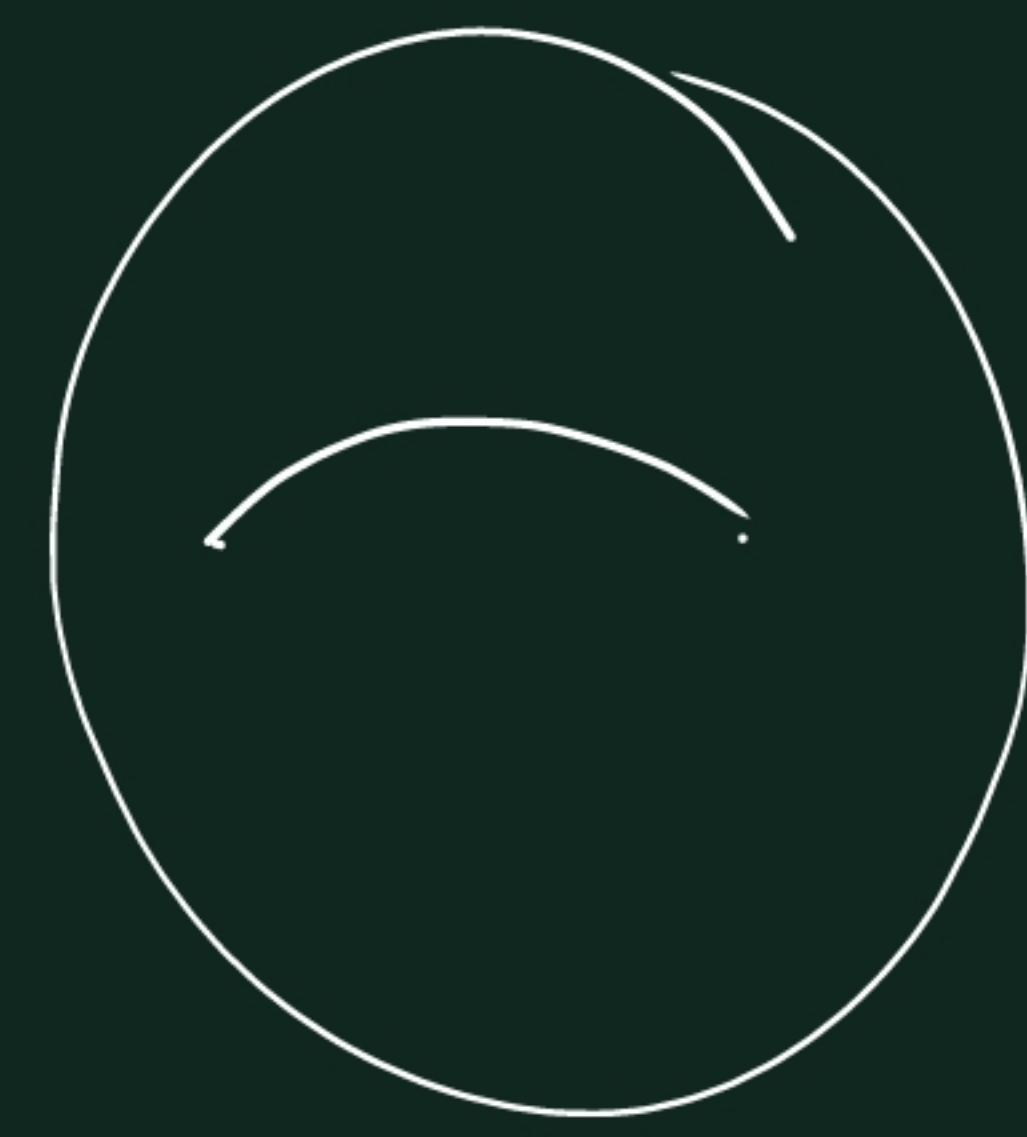


time
Path (length)

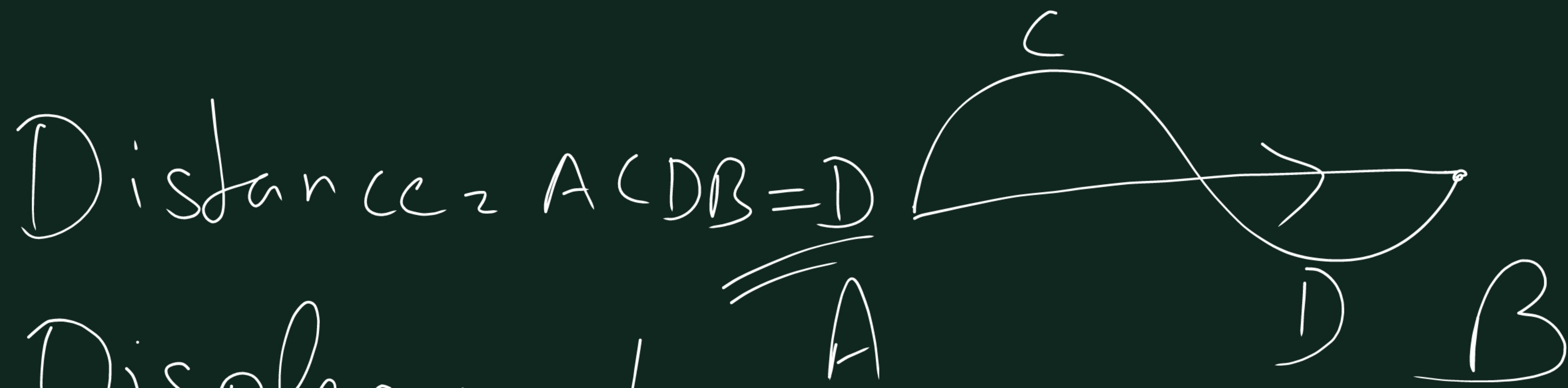
path = Distance = ACDEB = 15m

→ Shortest distance from initial position to final position = Displacement

st. line



AB = 10m downwards
E



Displacement

$$= \vec{AB} = \vec{S}$$

$$|-3| = 3$$

$$|\vec{S}| = S$$

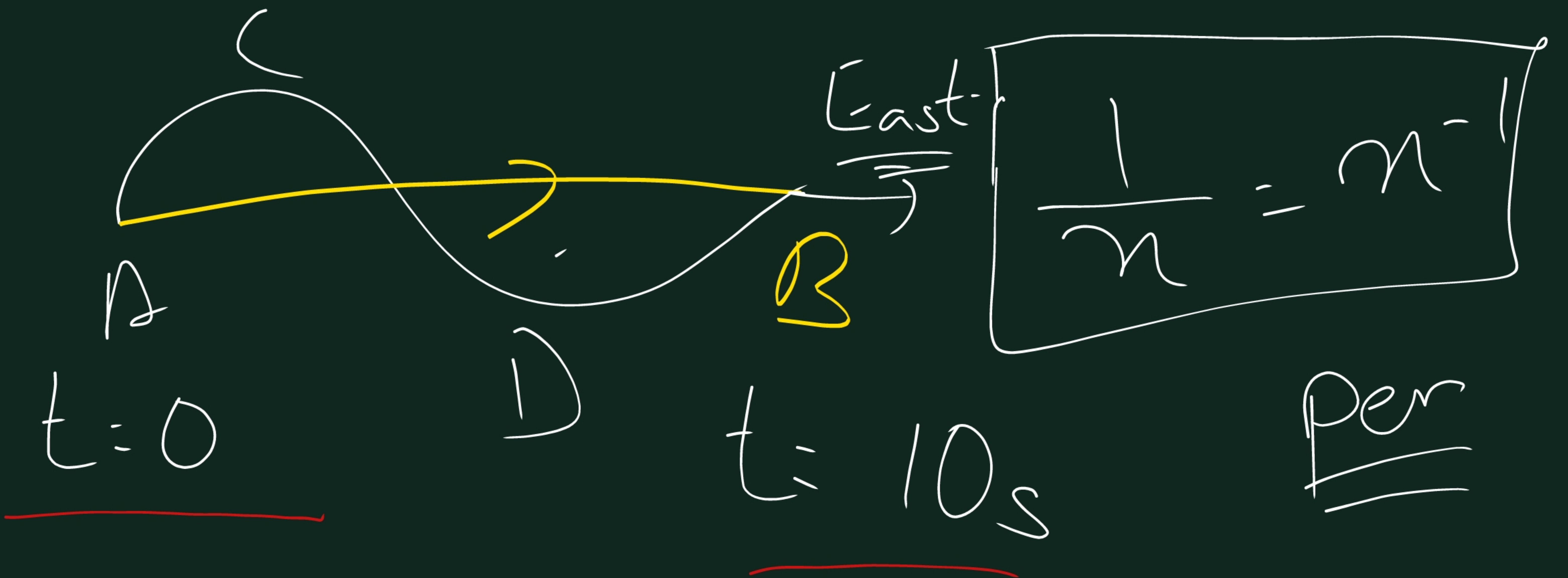
$$|3| = 3$$

|| \rightarrow magnitude

$$|3 \text{ m W}| = \underline{3 \text{ m}}$$

$$|3 \text{ m E}| = \underline{3 \text{ m}}$$

$$t = 10s$$



$\frac{D}{t}$ = Rate of change of distance.

Speed = $\frac{15m}{10s} = 1.5ms^{-1}$

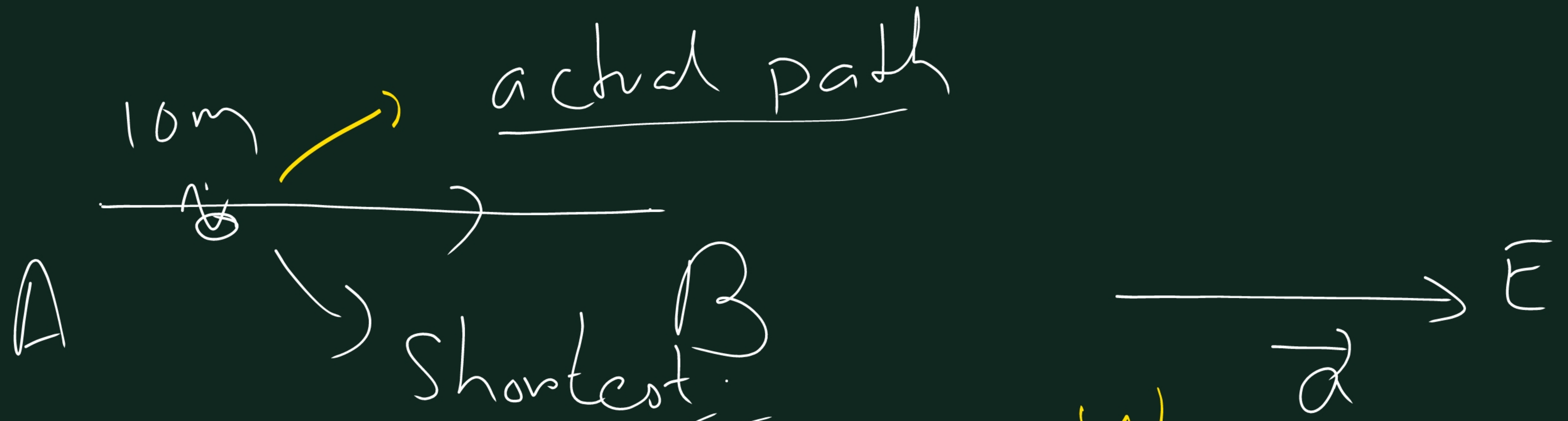
$[Speed] = \frac{[D]}{[t]} = \frac{m}{s} = \underline{\underline{ms^{-1}}}$

$\frac{\vec{S}}{t}$ = Rate of change of displacement

= Velocity

= \vec{V}

	S-I	C-G-S
mass	kg	g (1 kg = 1000g)
Length	m	cm (1 m = 100 cm)
time	s	s



$$D = 10m$$

$$S = \underline{\underline{10m}}$$

$$D \geq S$$



$$D = AB + BA$$

$$= 10m + 10m = \underline{\underline{20m}}$$

$$S = 0$$

$$= +10m - 10m$$

$$= 0$$

D	S
① Length of the actual path.	① Length of the shortest path.
② D cannot be zero	② Can be zero.
③ Scalar	③ Vector
④ $D \geq S$	④ $S \leq D$

Speed = $\frac{D}{t}$ =

Velocity = $\frac{s}{t} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$

Instantaneous velocity

$\Delta t = 0.00000001$

$\Delta t \rightarrow 0$

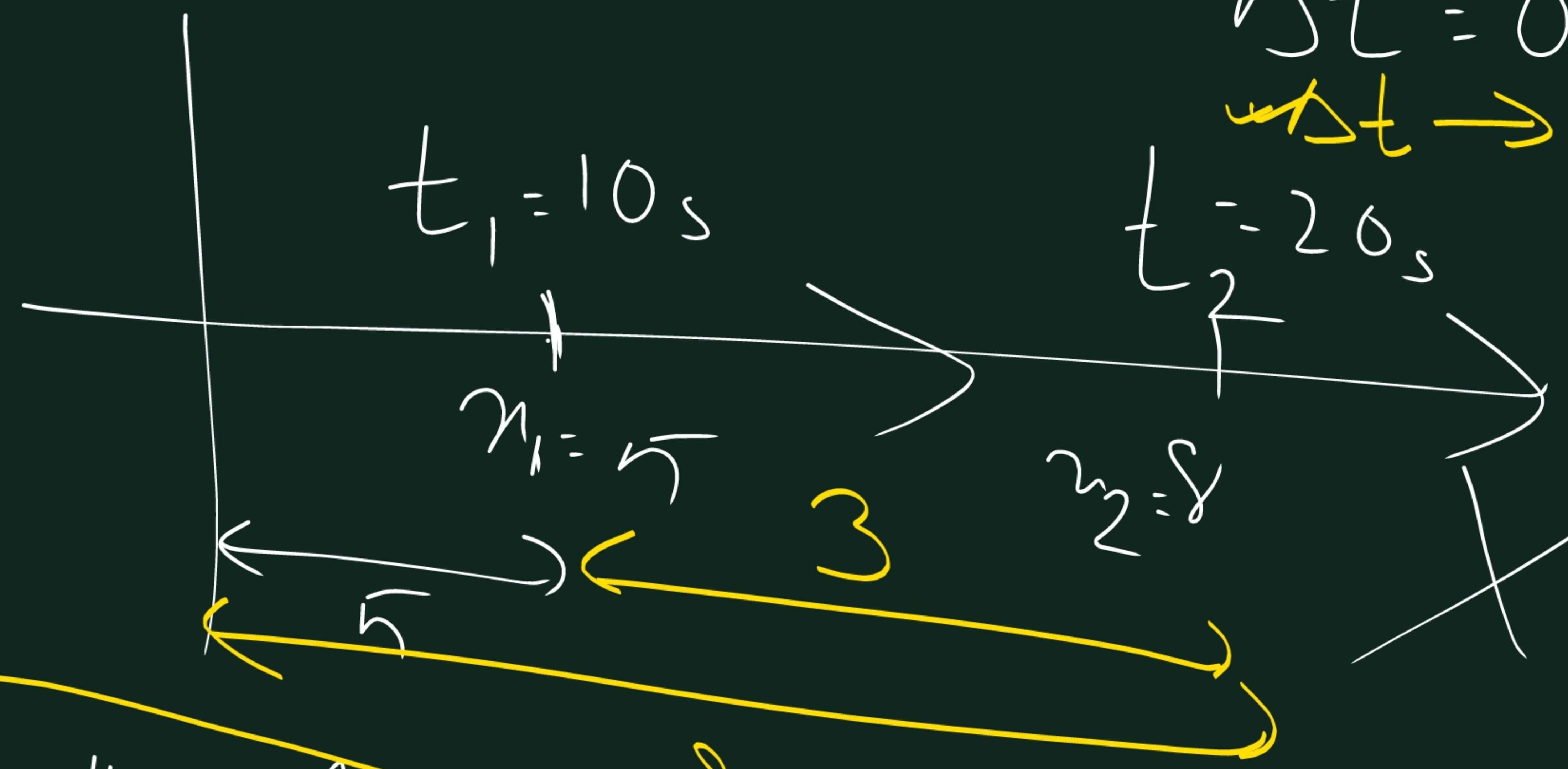
$\Delta t = t_2 - t_1$

delta

$D = 3m$

$S = 3m$

$D = S$



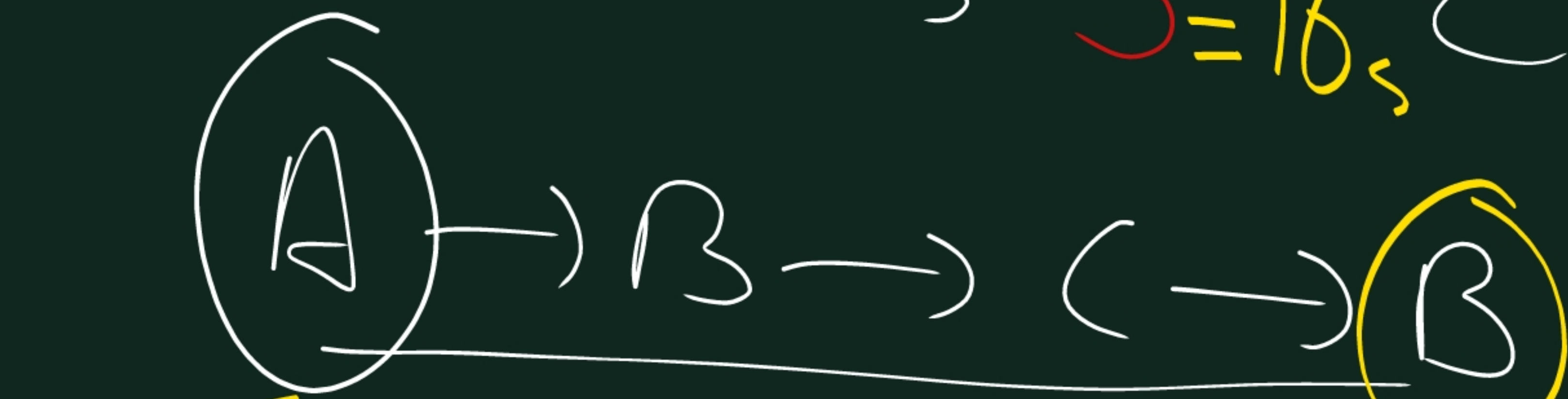
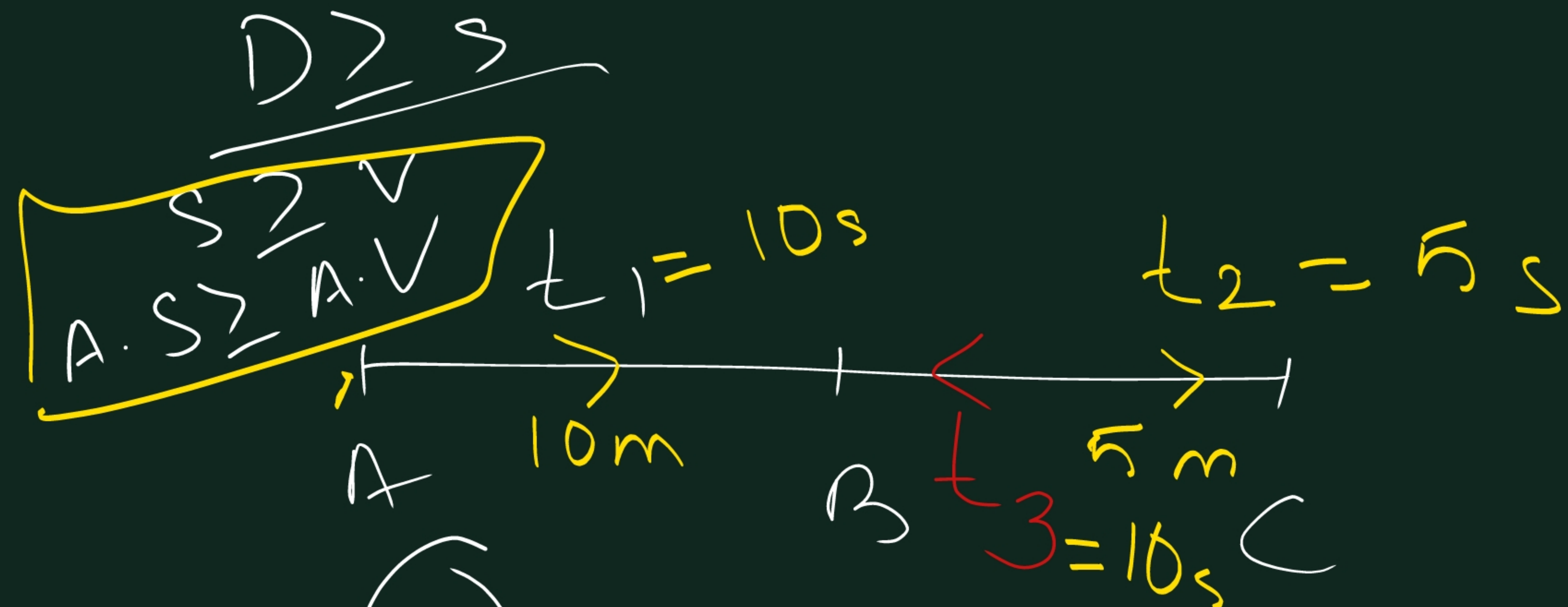
- ① st. line
- ② same direction.

$$S = \frac{D}{T}$$

$$V = \frac{S}{T}$$

$$I \cdot V = \frac{dW}{dt}$$

$$I \cdot S = \frac{dW}{dt}$$



$$\text{Total } D = AB + BC + CB$$

$$\text{Total Time} = t_1 + t_2 + t_3 = 10 + 10 + 5$$

$$\text{Avg. Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{20}{25}$$

$$= \frac{80}{100} = 0.80 \text{ m/s}$$

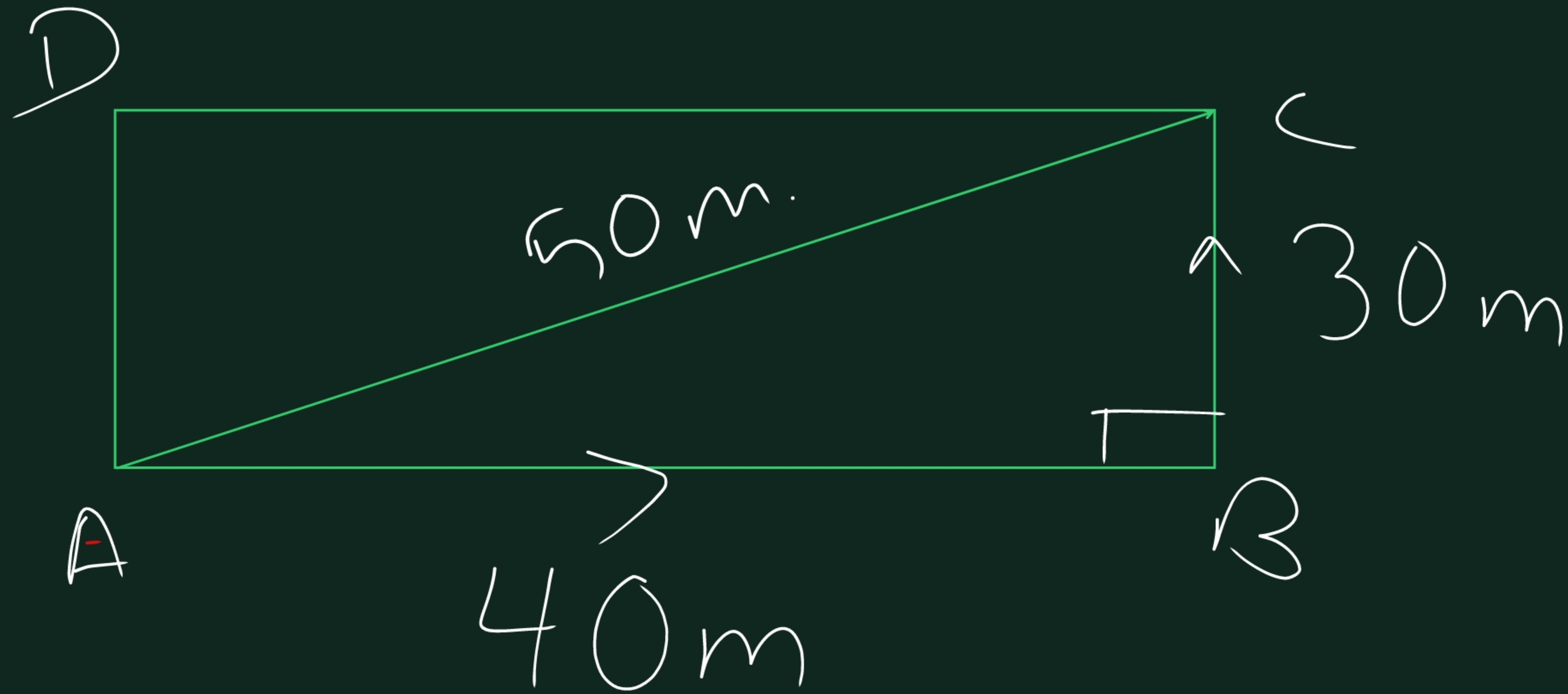
$$\text{Total Displacement} = AB = 10 \text{ m}$$

$$\text{Total time} = t_1 + t_2 + t_3 = 25 \text{ s}$$

$$\text{Avg. } V = \frac{\text{Total Displacement}}{\text{Total time}}$$

$$= \frac{10}{25} = 0.4 \text{ m/s}$$

Q.)

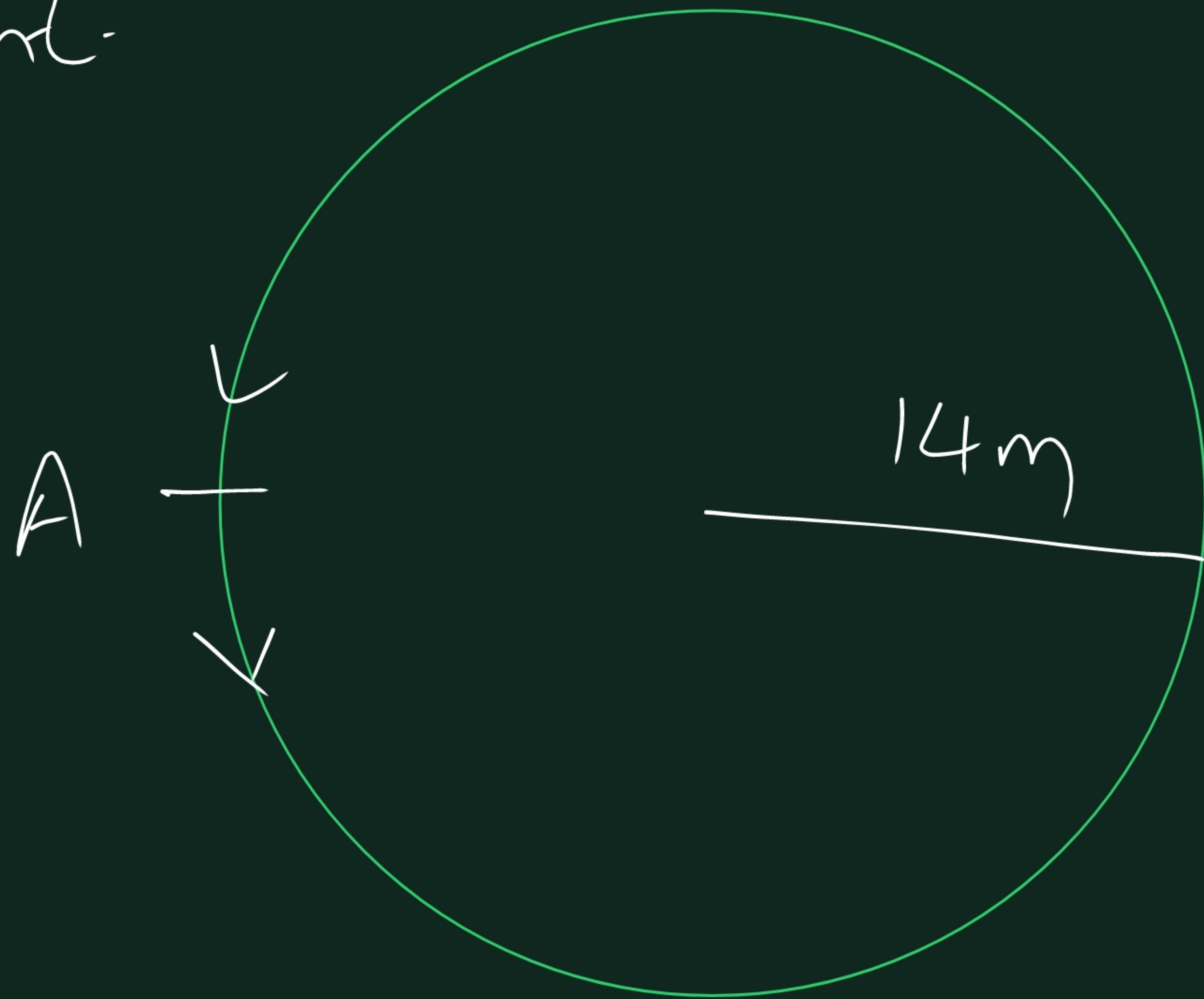


$$\text{Distance} = AB + BC = 40 + 30 = 70\text{m}$$

$$\text{Displacement} = AC = \underline{\underline{50\text{m}}}$$

$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ AC &= \sqrt{AB^2 + BC^2} \\ &= \sqrt{(40)^2 + (30)^2} \\ &= \sqrt{1600 + 900} \\ &= \sqrt{2500} \\ &= \underline{\underline{50\text{m}}} \end{aligned}$$

Displacement.



Distance - ?

$$= 2\pi R$$

$$= 2 \times \frac{22}{7} \times 14^2$$

$$= 4 \times 22$$

$$= \underline{\underline{88m}}$$

Velocity = Speed.

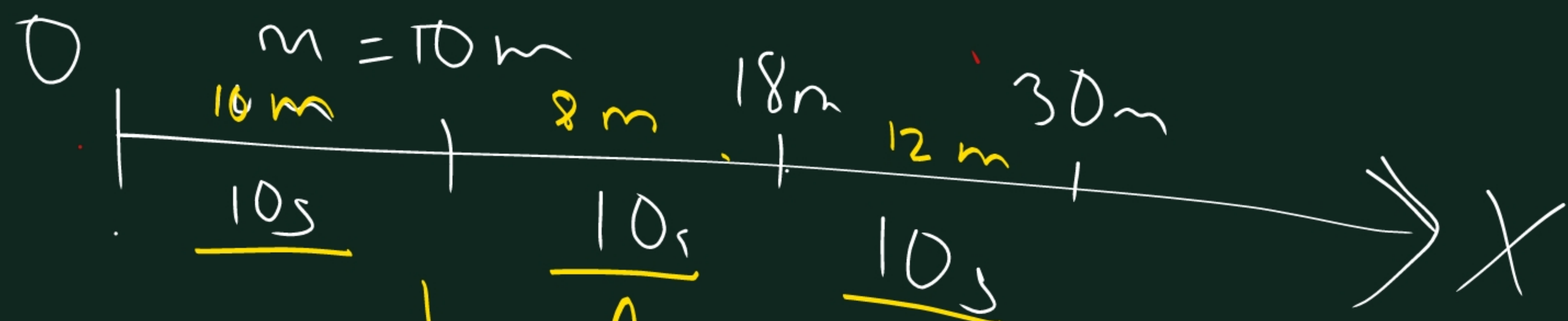
Equal time interval

↓ displacement

unequal distance

↓ non-uniform motion

↓ non-uniform speed = speed not constant.



Equal distance displacement

Cover → equal time interval

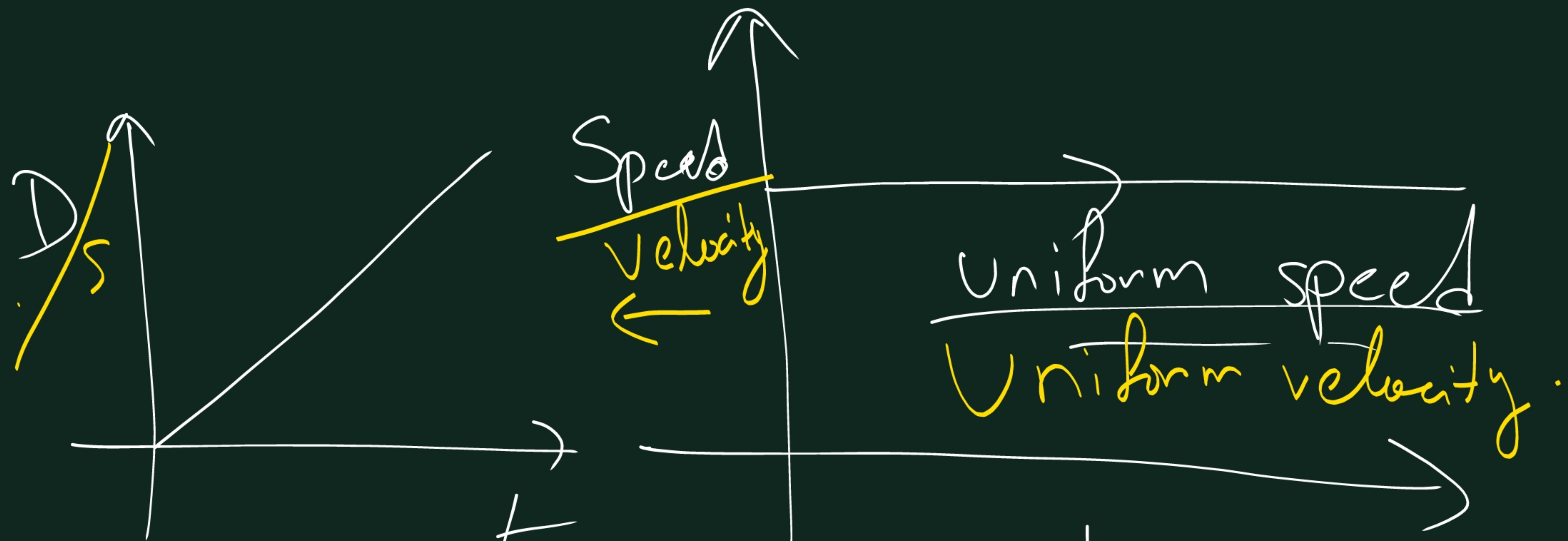
Uniform motion = Uniform speed = constant speed

+ Same direction

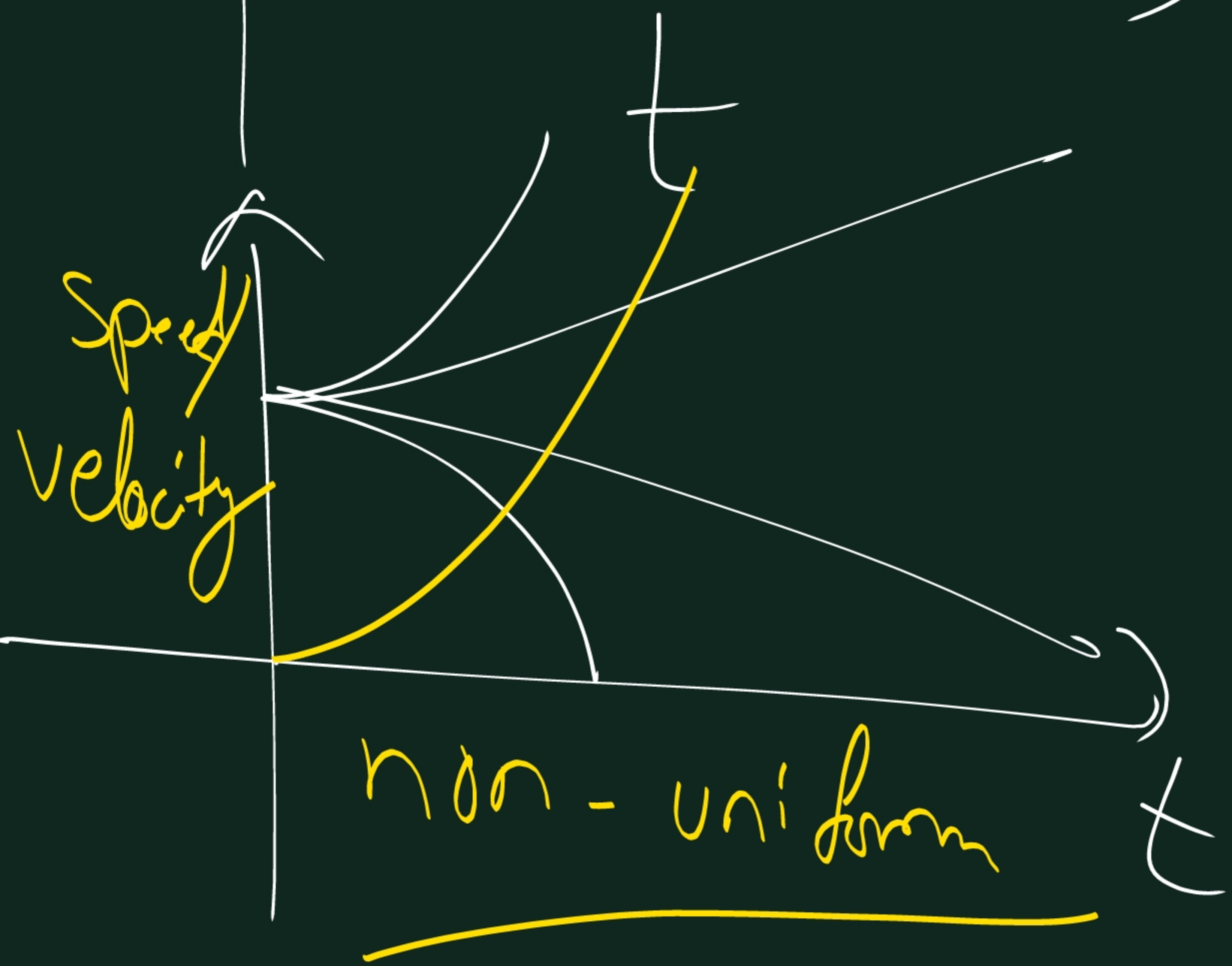
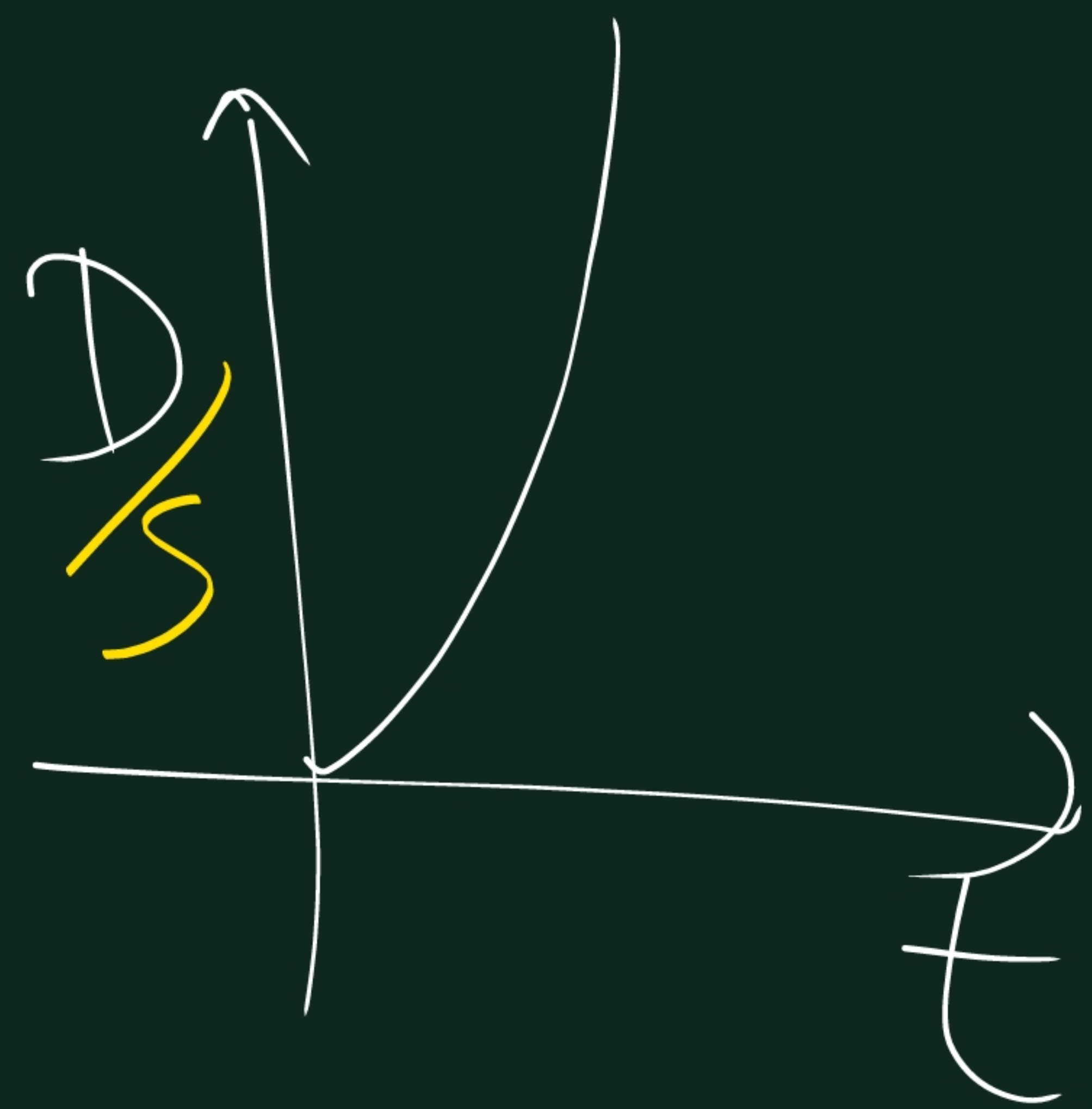
+ not same direction

↓ Uniform velocity.

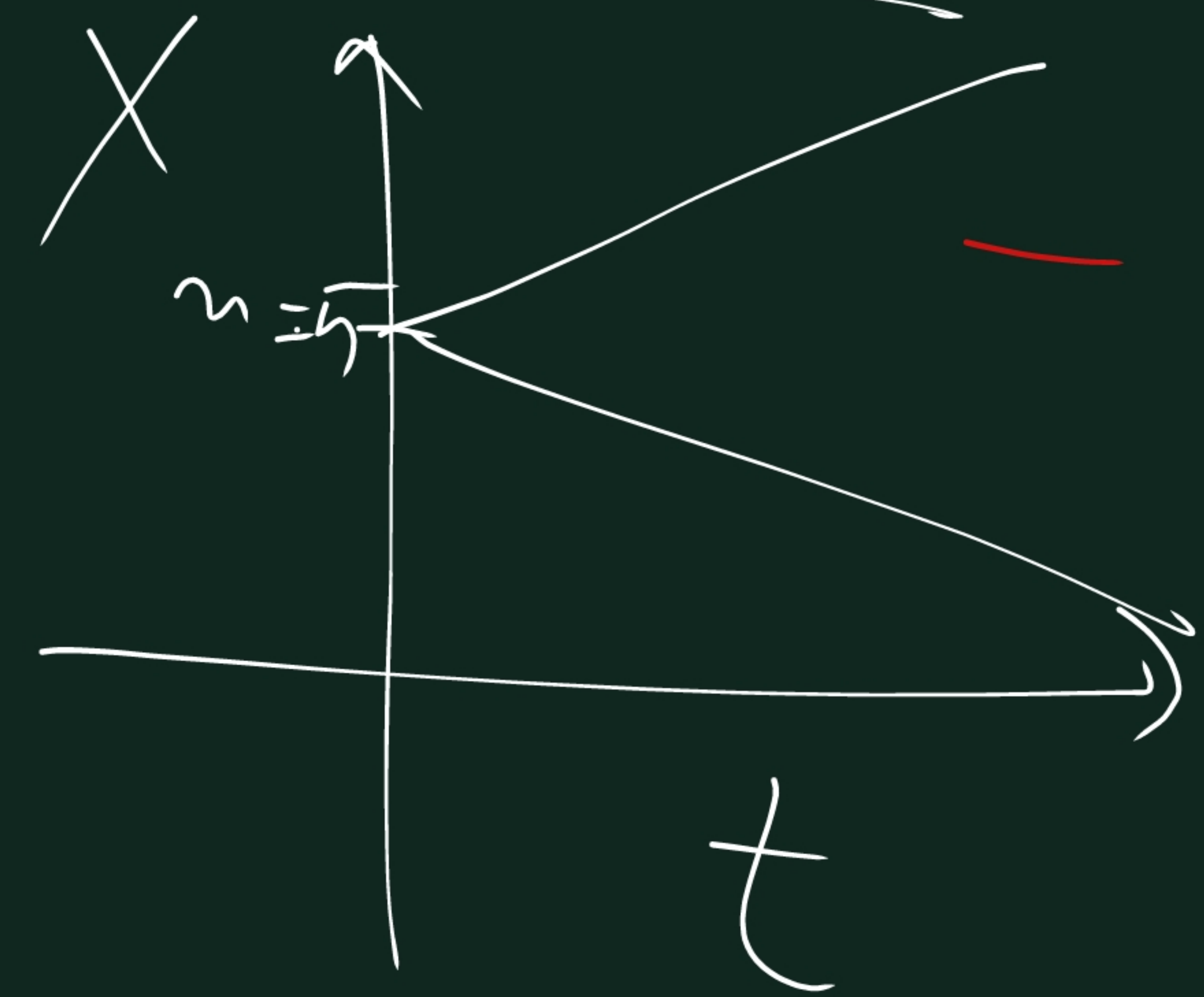
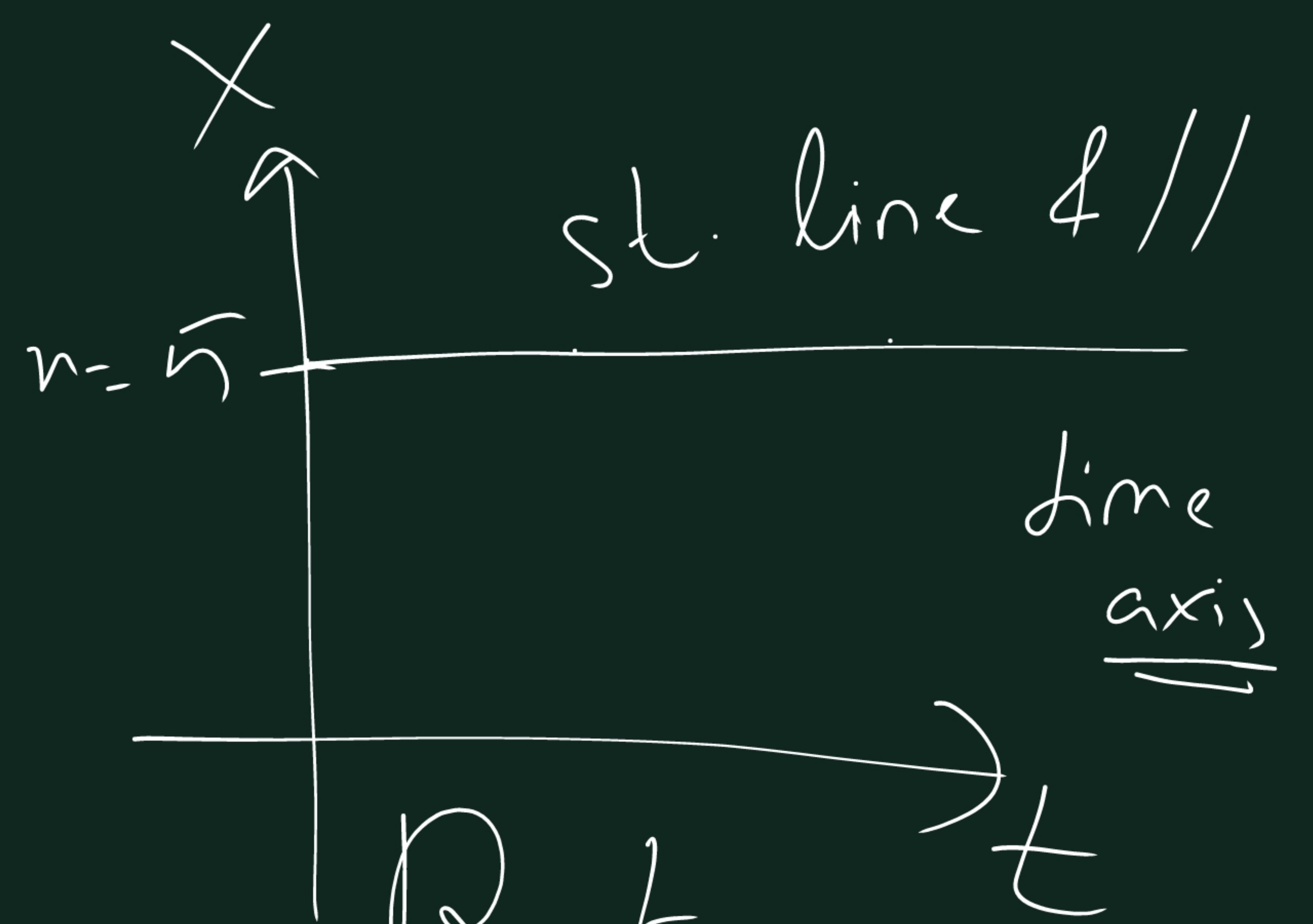
non-uniform velocity



Uniform speed
Uniform velocity.



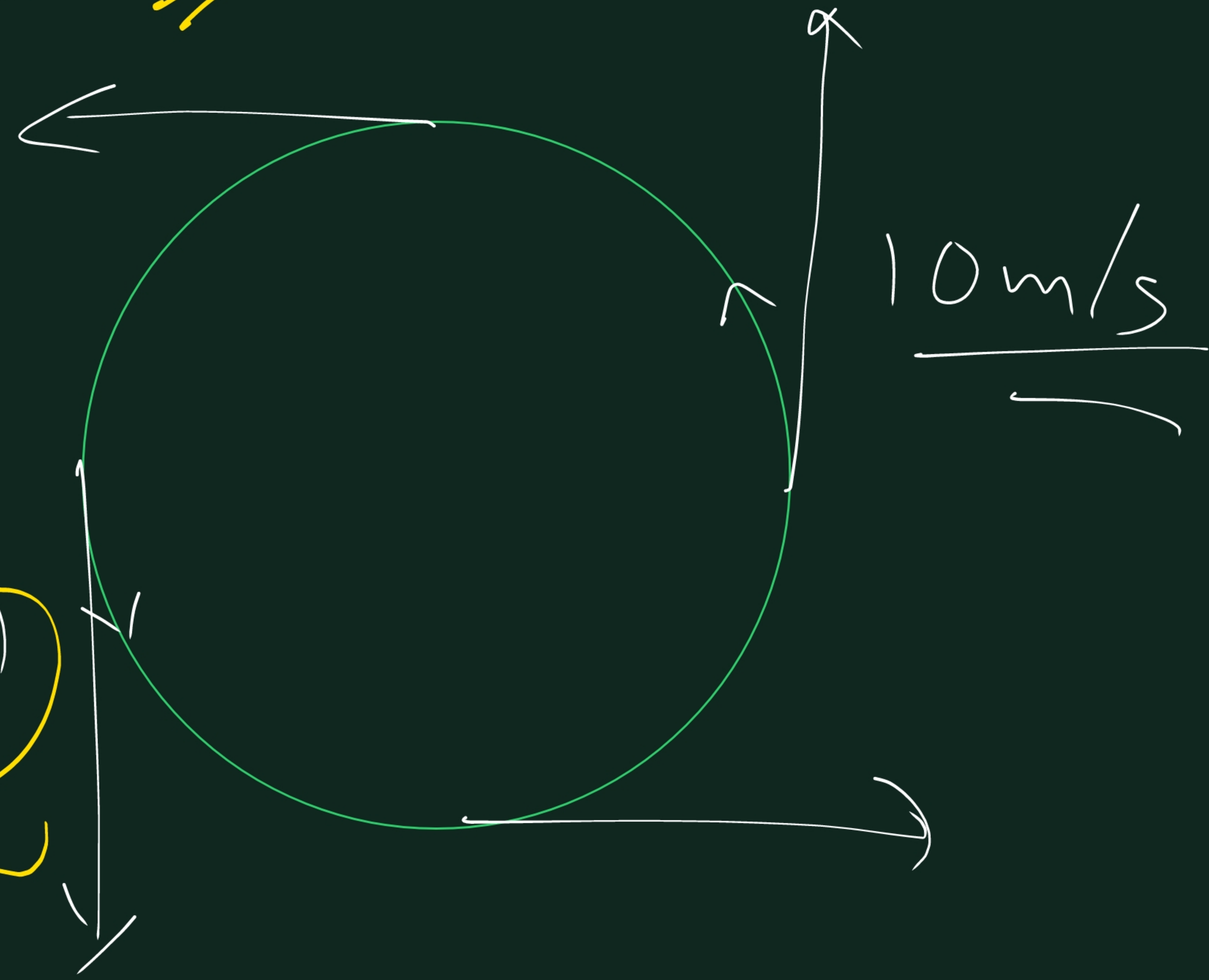
non-uniform



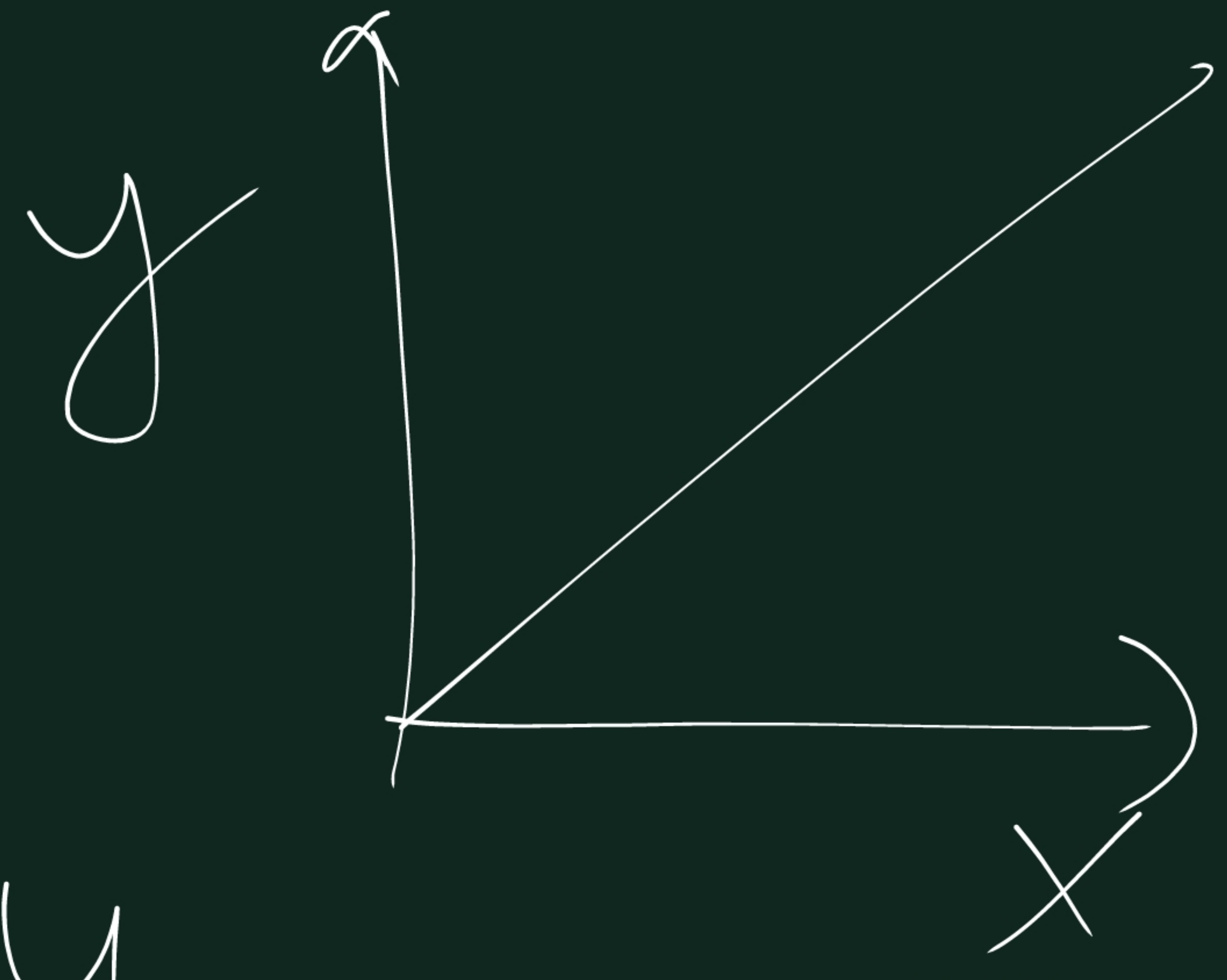


Speed cont

Velocity
= mag + dir



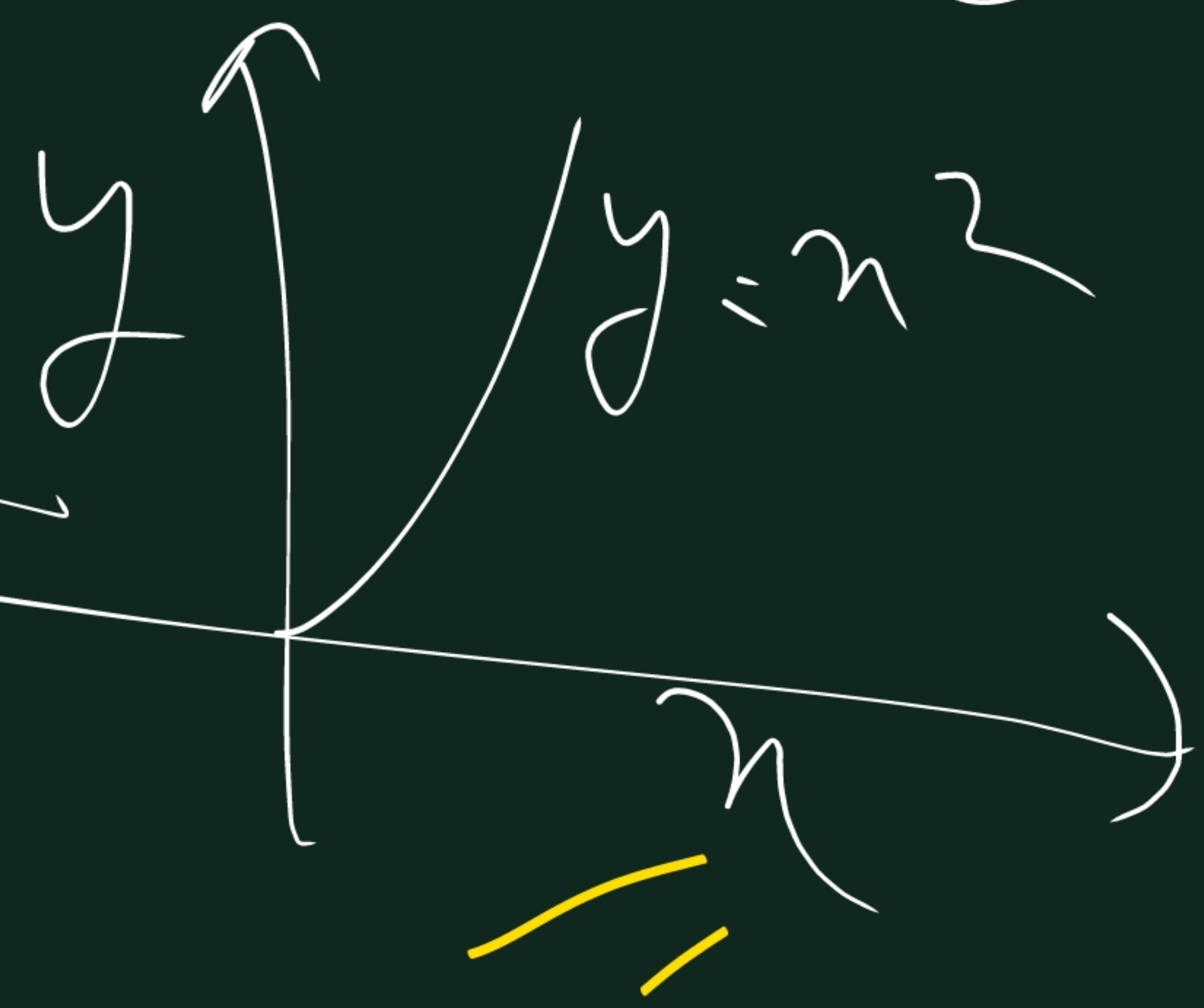
- (0,0)
- (1,1)
- (2,2)
- (3,3)



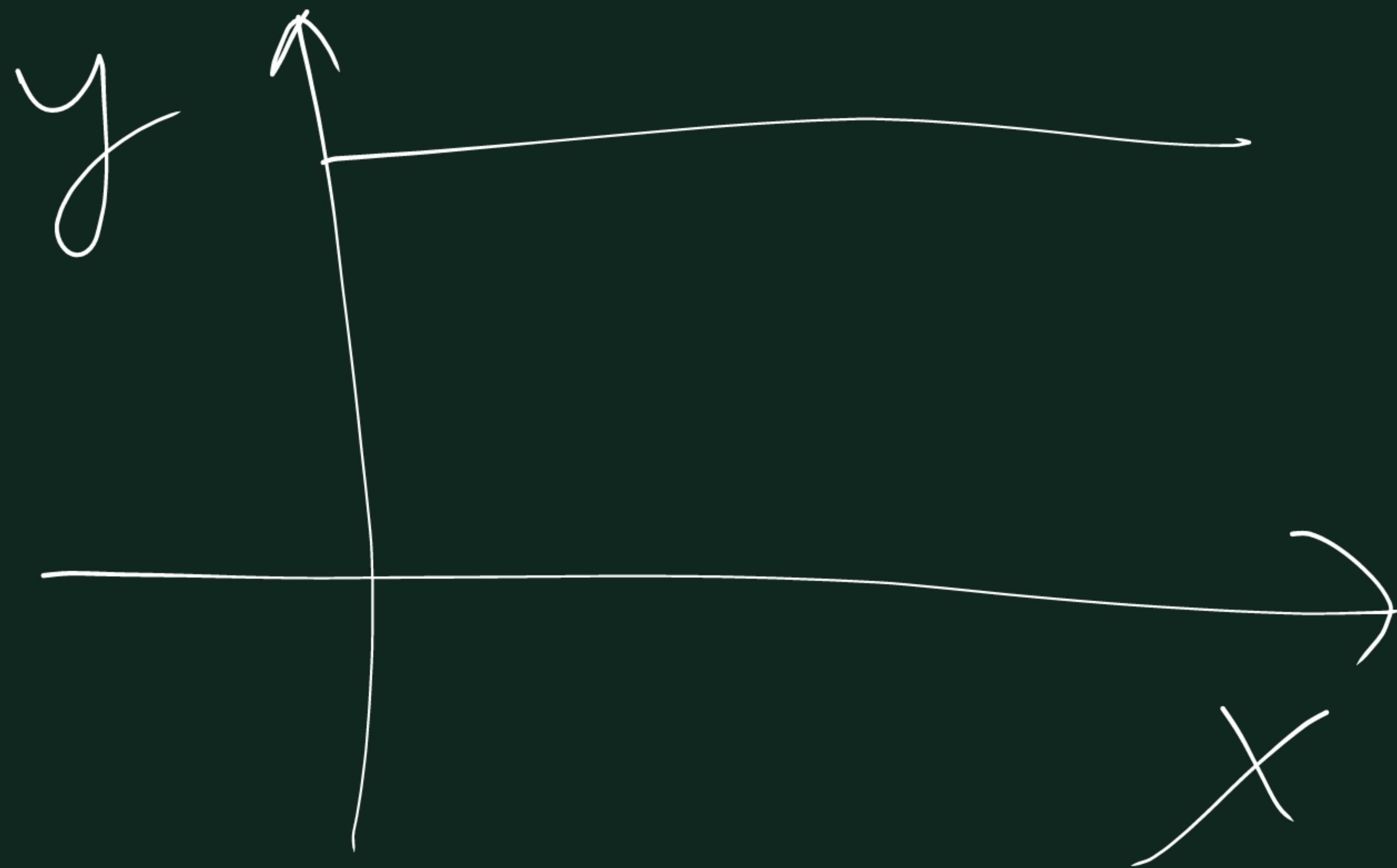
y is increasing

w.r.t x ($y \propto x$)

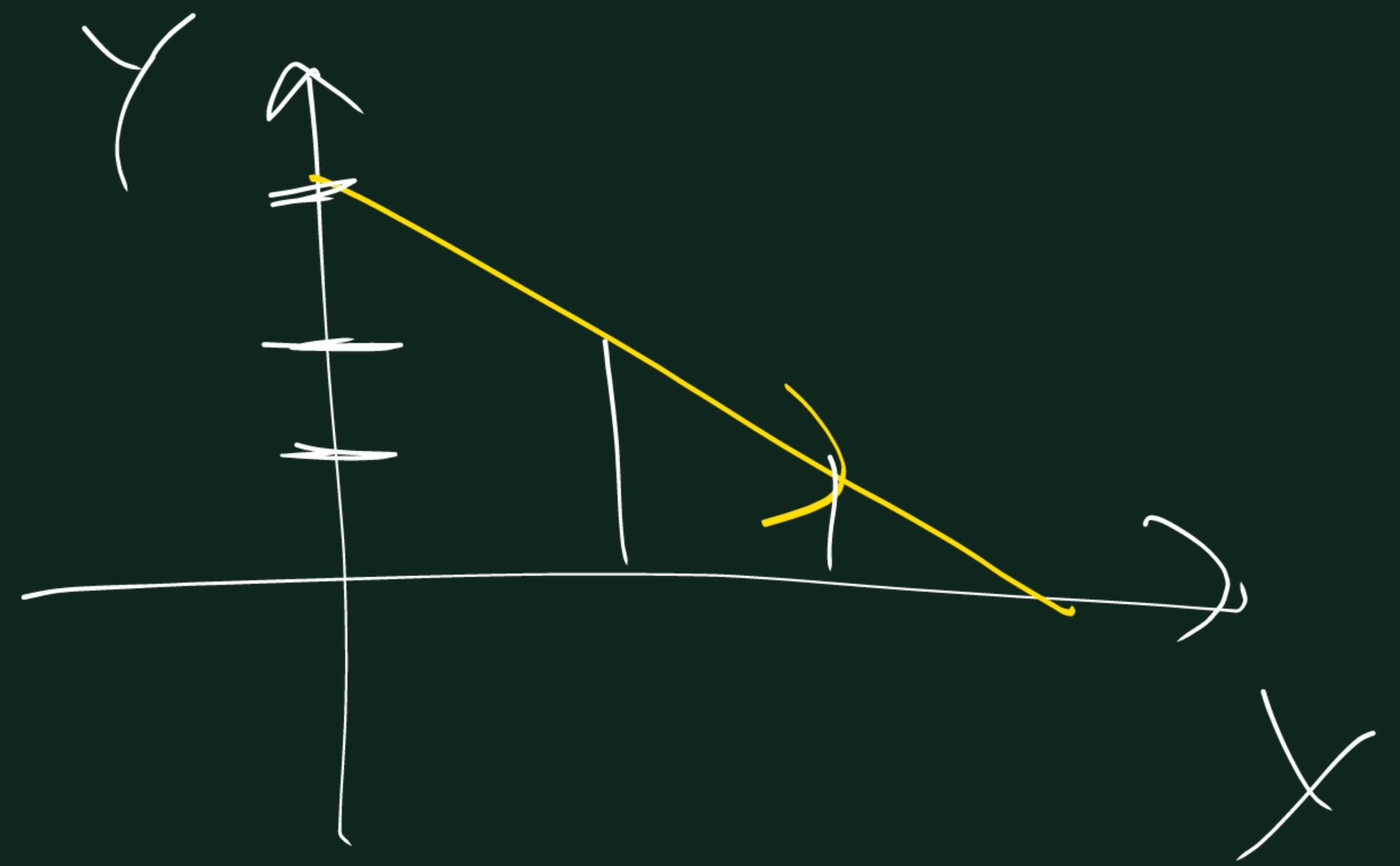
x	0	1	2	3
y	0	1	4	9



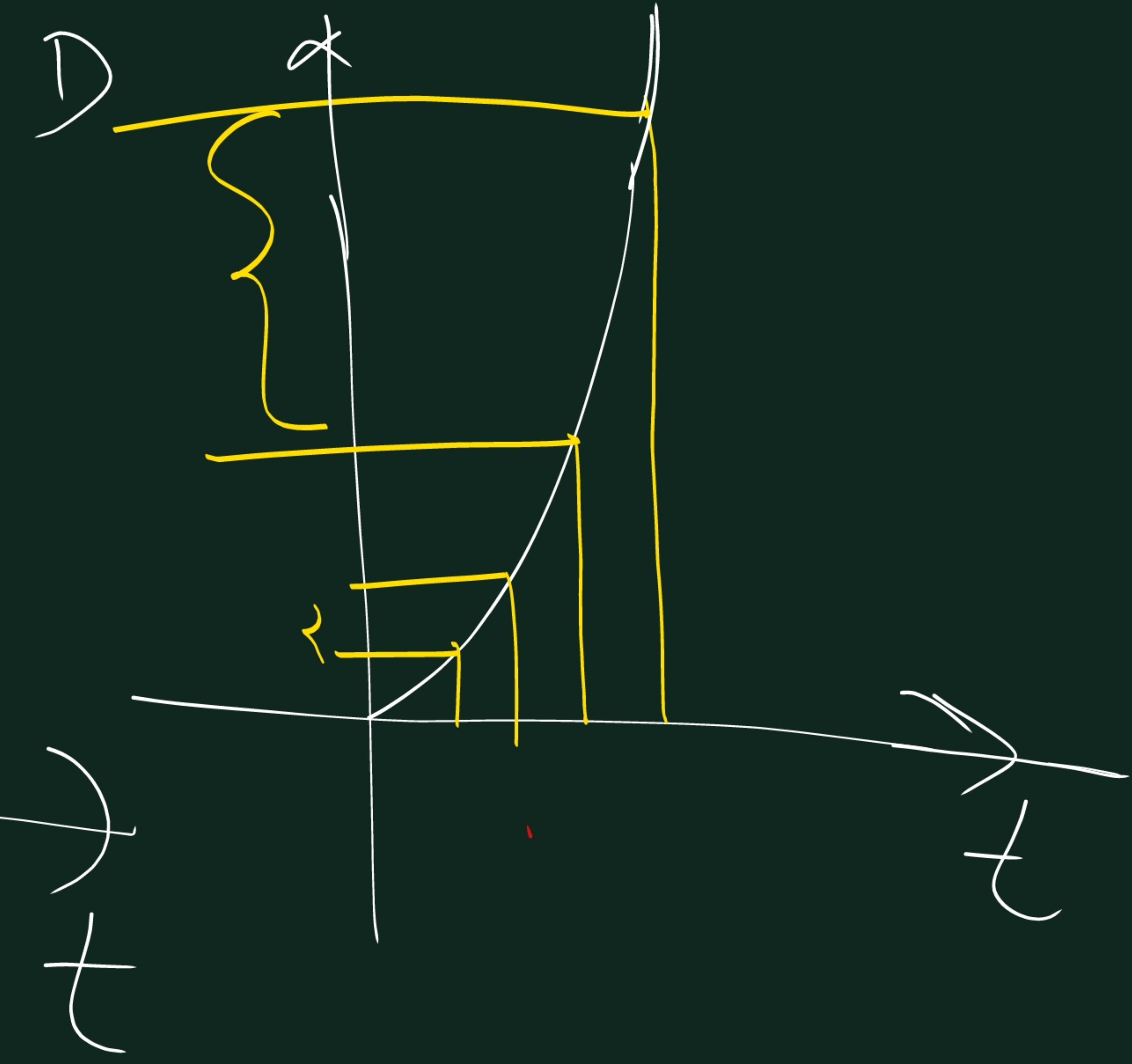
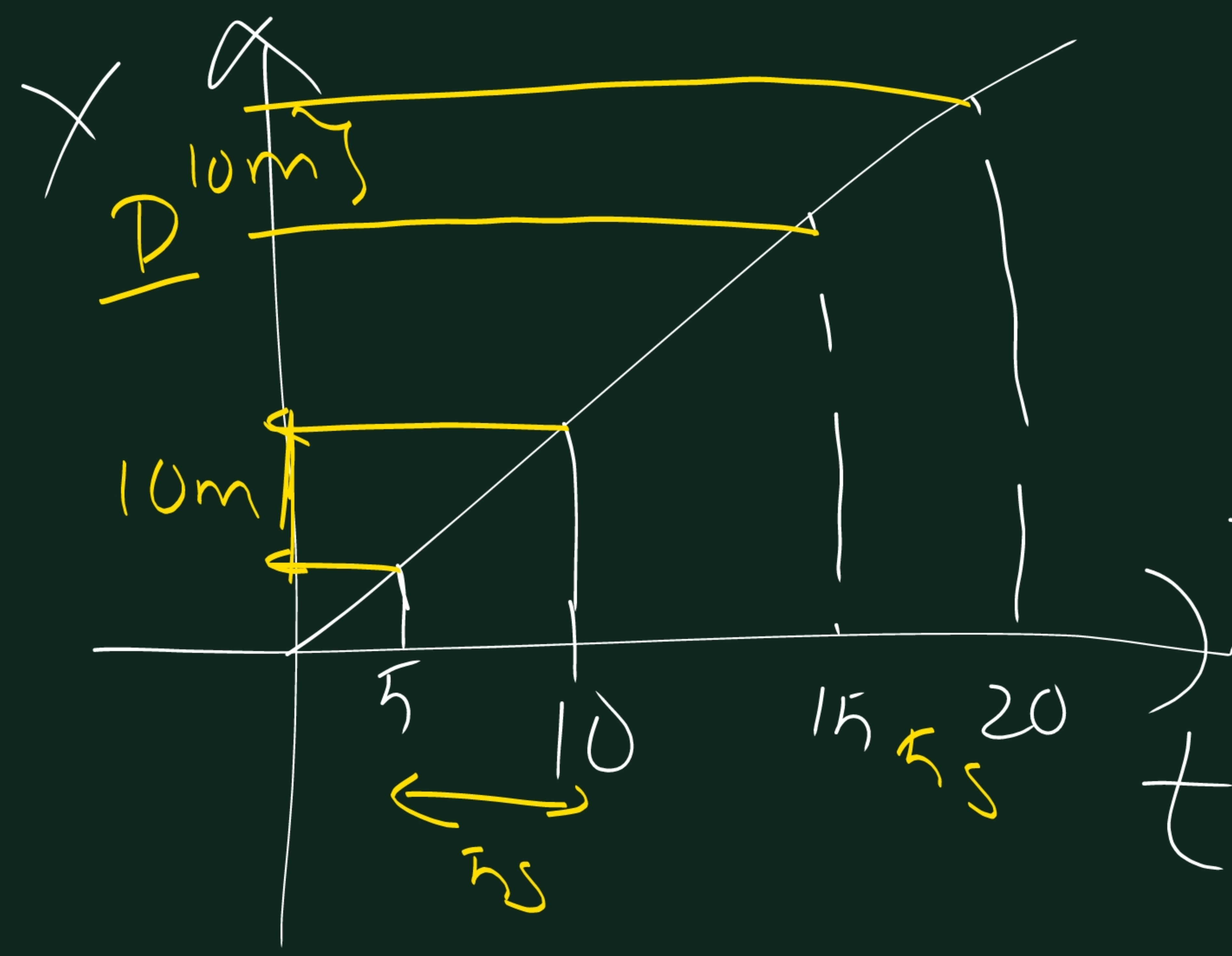
($y \propto x^2$)



$y = \text{const.}$



y is decreasing
w.r.t x



$$v = \frac{s}{t}$$

$\frac{v}{t}$ = Rate of change of velocity.

= acceleration.



$$a = \frac{v - u}{t}$$

$$v < u$$

$$a = \frac{v - u}{t} = \frac{8 - 10}{t}$$

$$a = -ve$$

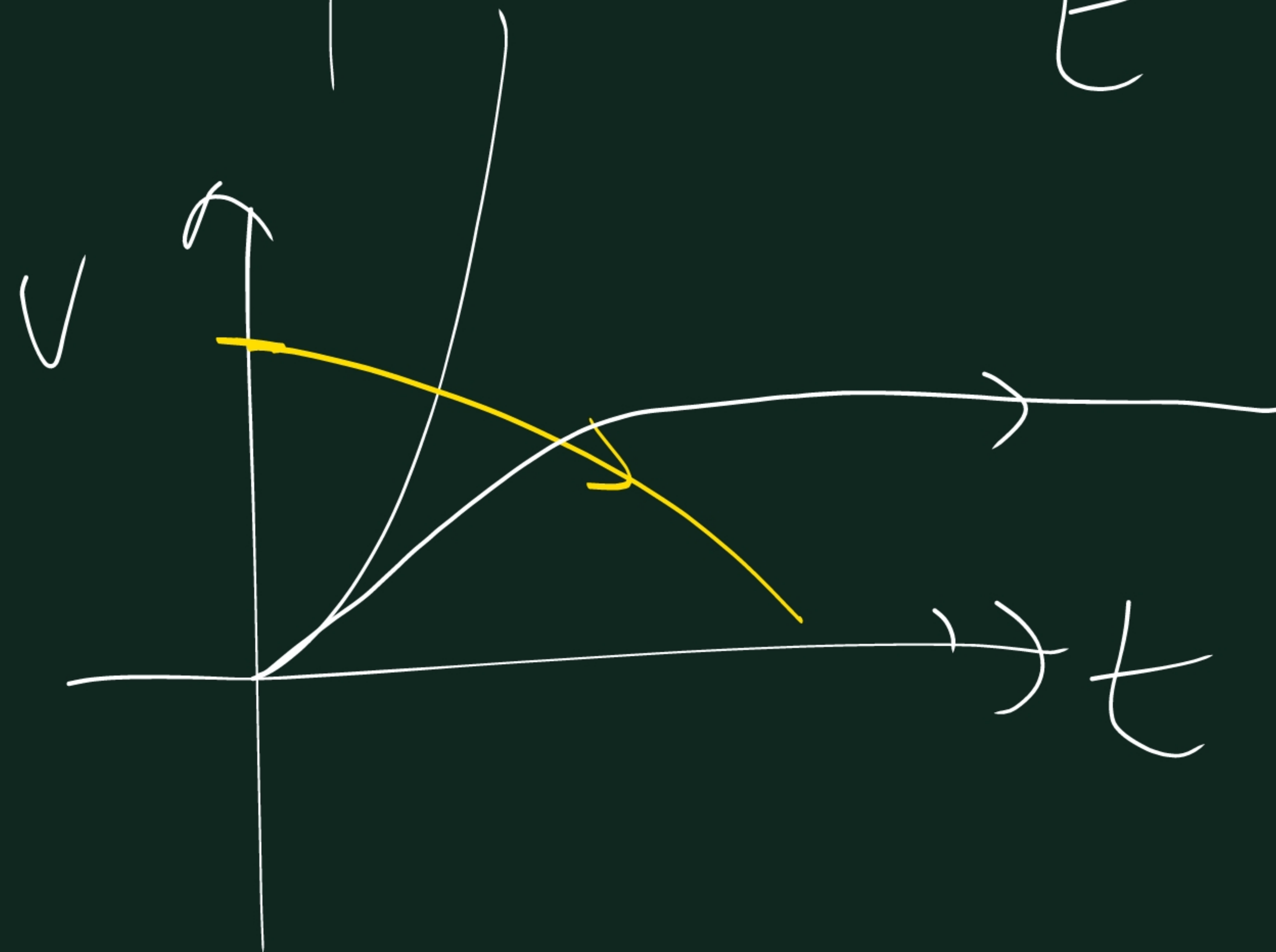
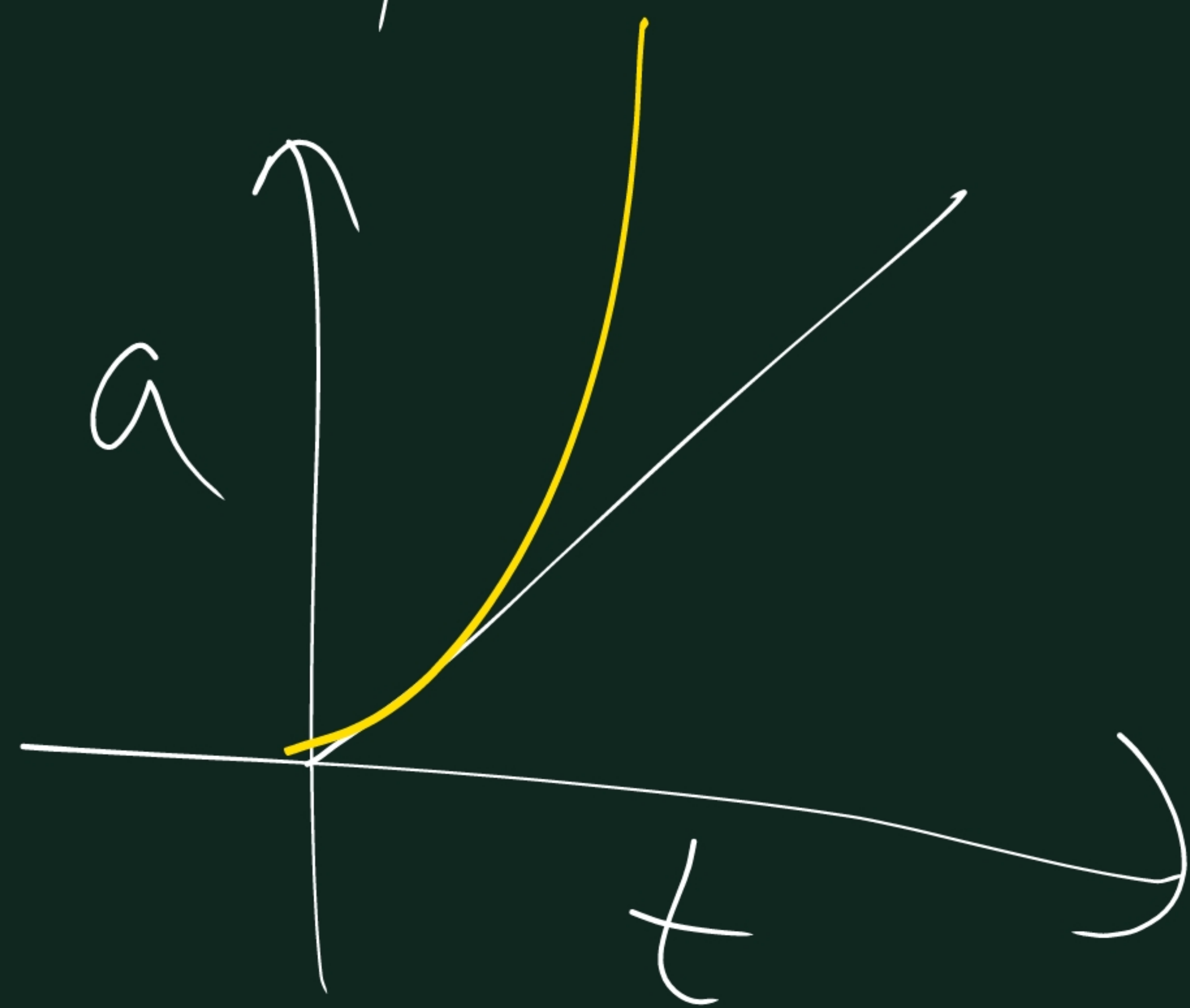
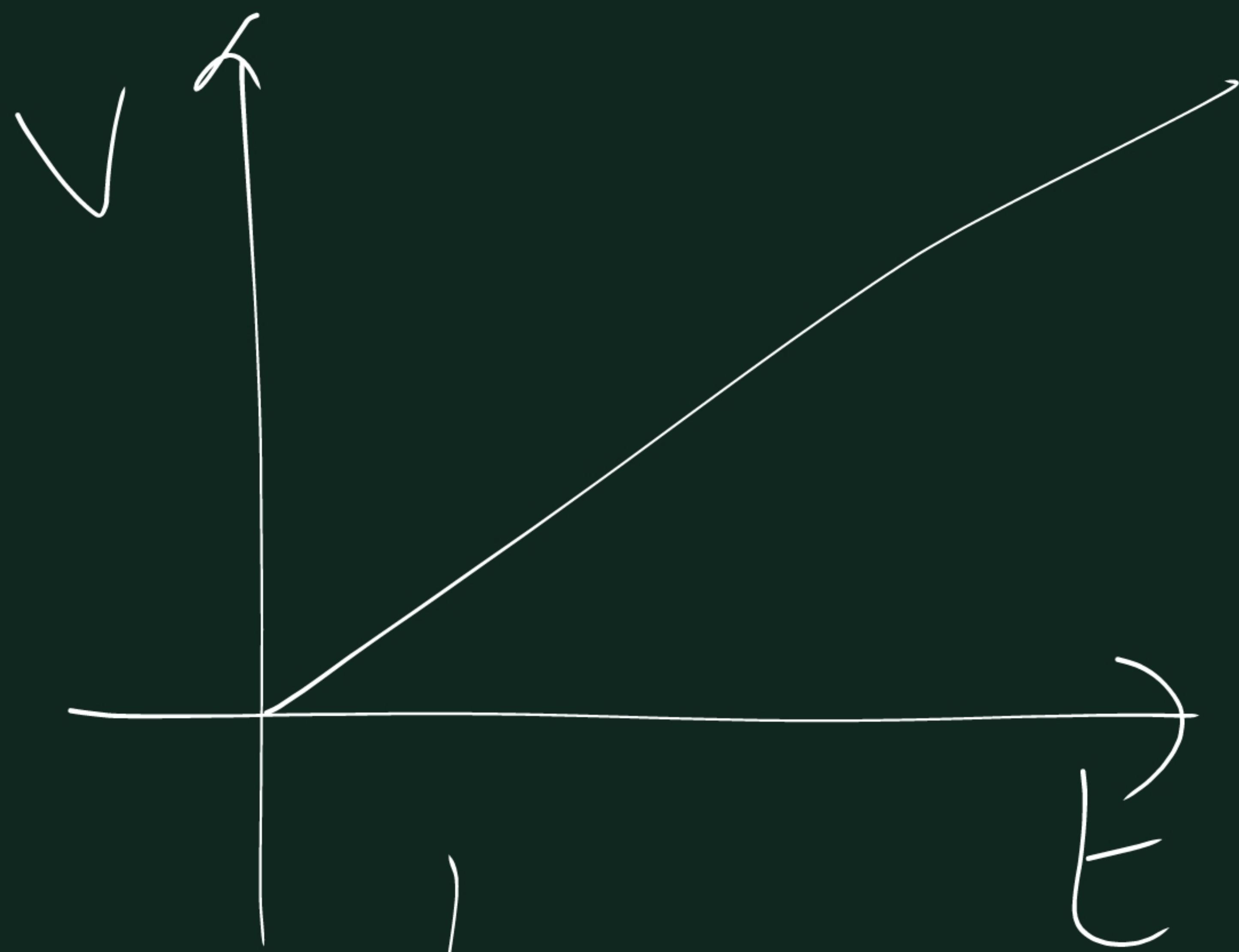
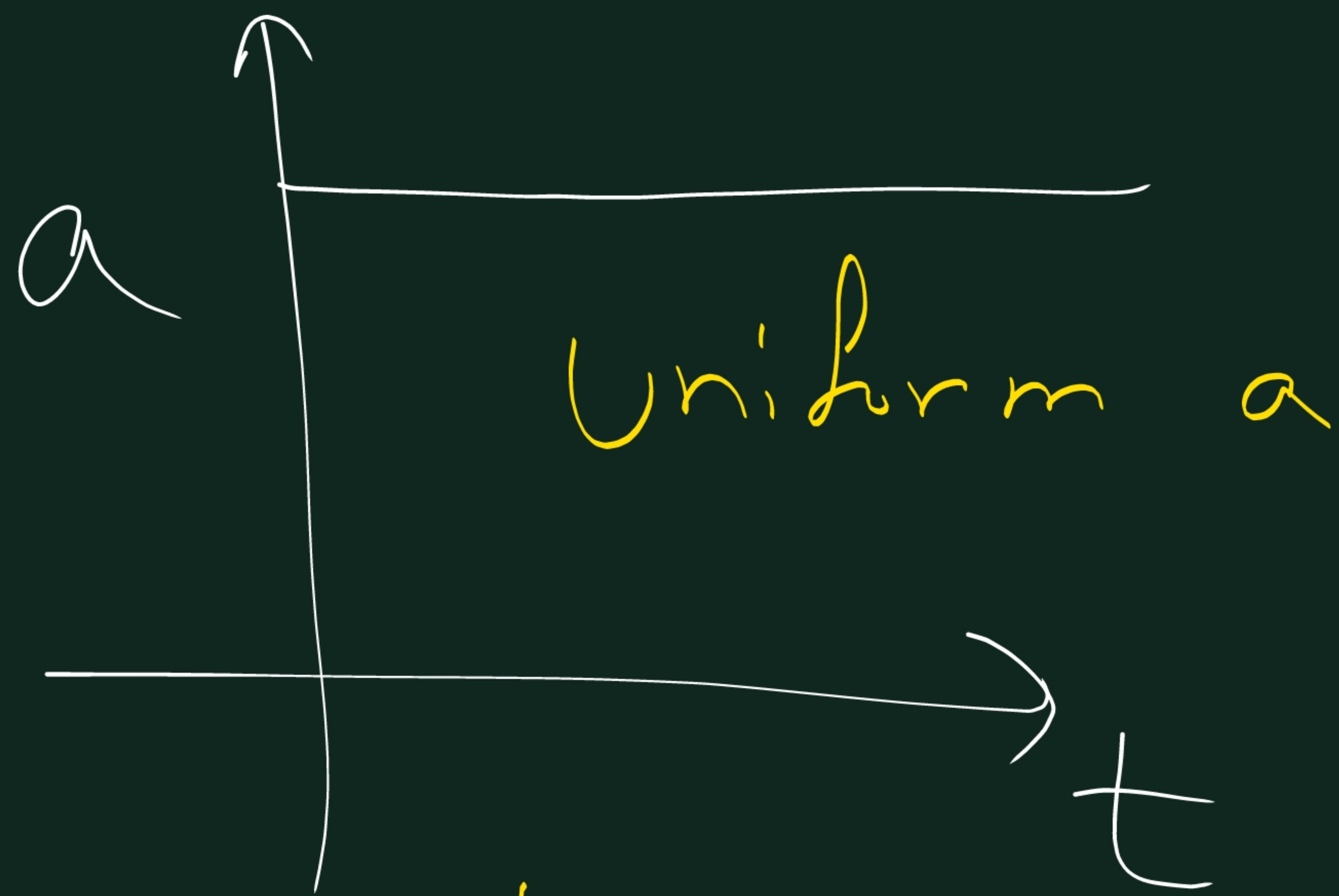
$$u = 10 \text{ m/s}$$
$$v = 8 \text{ m/s}$$

→ deceleration
retardation.

Uniform acc : Cont. acc. =

Equal time interval
↓
Equal velocity
change

Non-uniform acc : Equal time interval
↓
Variable
↓
Unequal velocity
change



Equations of motion



$$S = ut + \frac{1}{2}at^2$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

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