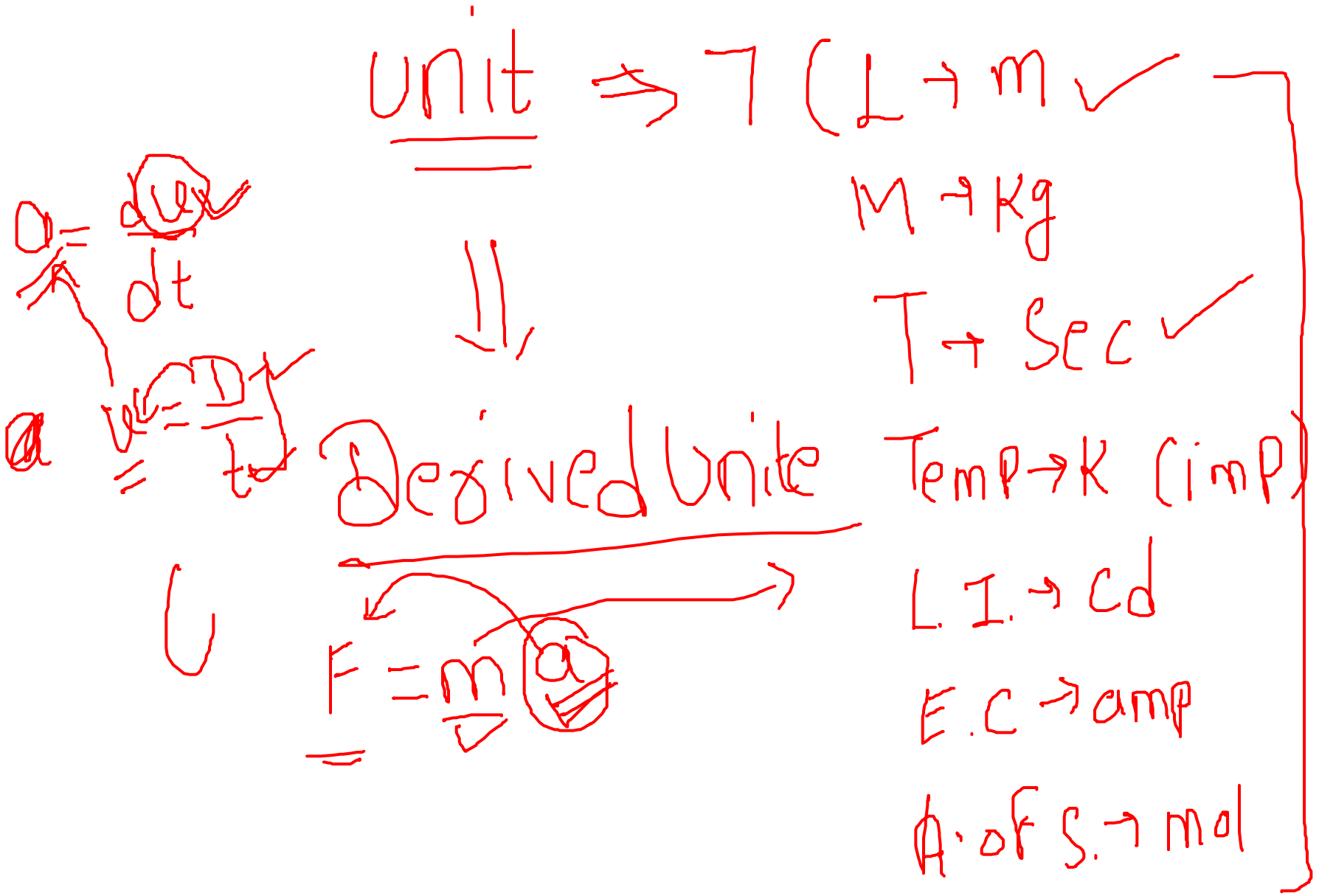
SAFALTA CLASS™

An Initiative by अमर उजाला


unit ⇒ 7 (L → m ✓
M → kg
T → Sec ✓
Temp → K (imp)
L.I. → cd
E.C → amp
A. of S. → mol
Derived Units
a = dv/dt
v = Dx/t
F = ma

* Smallest unit of Length = Fermi ⇒ $1F = 10^{-15}$ m

Largest " " " = Parsec

1 Parsec = 3.46 LY

Parsec > LY > AU

* Dimensions: L ⇒ [L] T = [T]

M ⇒ [M] Temp = [θ, K]

A of S. = [mol] C. Current = [A], L I = [cd]

* $\text{Force} = ma = [M][LT^{-2}] = [MLT^{-2}]$

$a = \frac{dv}{dt} \Rightarrow v = \frac{d}{t} = \frac{[L]}{[T]}$

$v = [LT^{-1}]$

$a = \frac{[LT^{-1}]}{[T]}$

$a = [LT^{-2}]$

$G = ?$ ⇒ Gravitational constant

$G = \frac{F \cdot r^2}{m_1 m_2} = \frac{[MLT^{-2}][L^2]}{[M^2]} = [M^{-1} L^3 T^{-2}]$

$F = G\frac{m_1 m_2}{r^2}$ ✓

Work = F · d = $[ML^{-2}][L]$

→ Energy = $[ML^2T^{-2}]$

(K.E.)

(P.E.)

W = E = Torque ($\tau = F \cdot d$)

Kinematics Graph

- Three types
- Distance-time graph (d-t)
- Speed-time graph (v-t)
- Acceleration-time graph (a-t)

Dist → Actual Length → m

Displ → Shortest Dist. b/w 2 points

(m)

Speed = m/s

Vector → Velocity

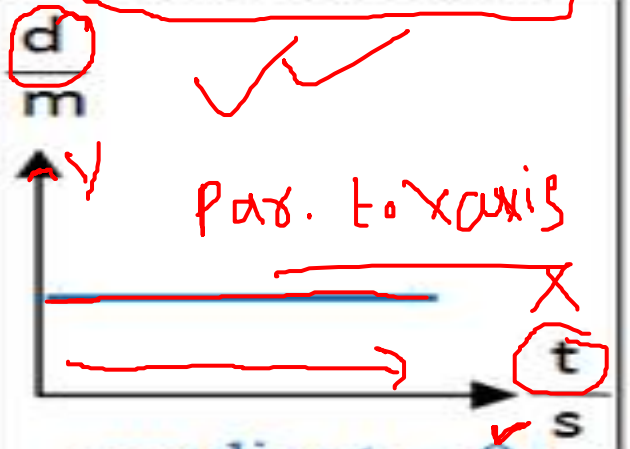
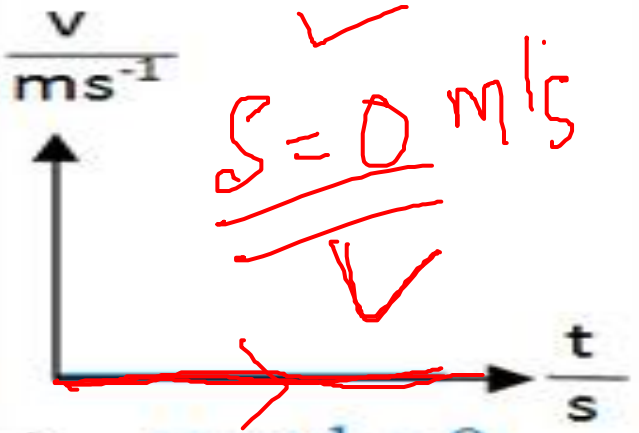
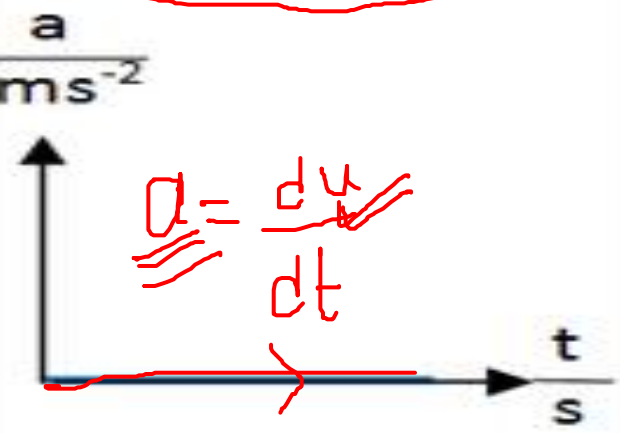
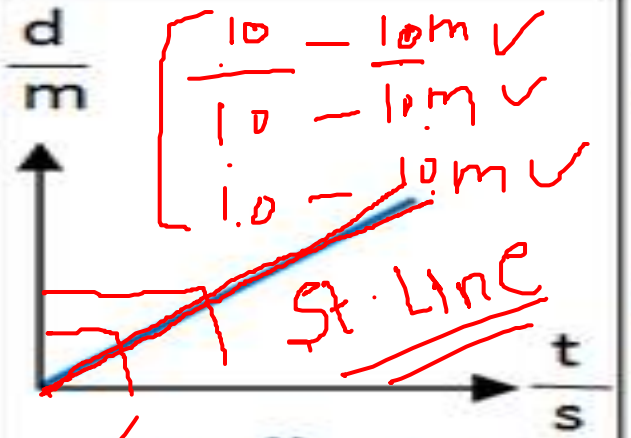
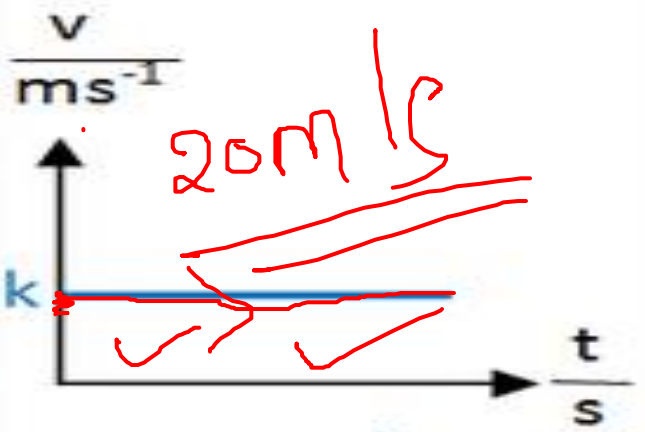
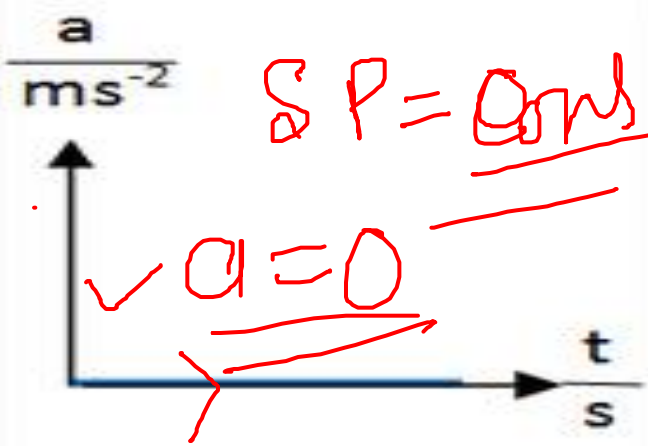
Acc → m/s²

(+) → Vector

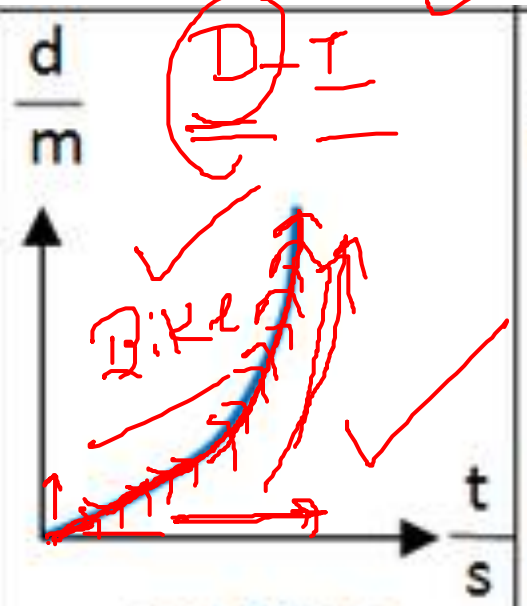
(-ve) (0)

(A → time)

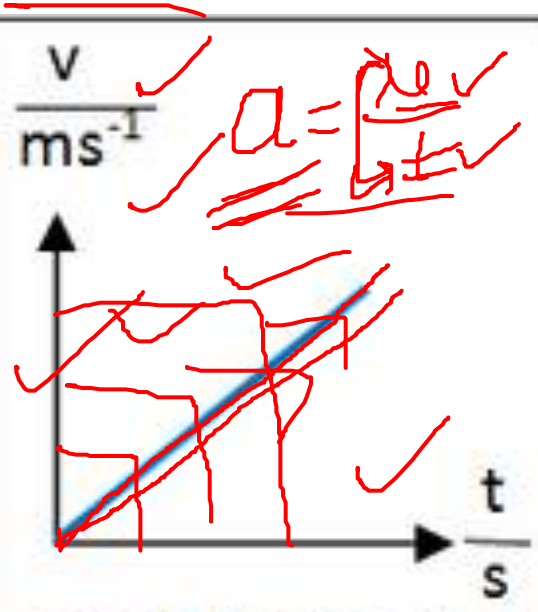
Retard.

Motion of object	Distance-Time graph	Speed-Time graph	Acceleration-Time graph
At rest	 gradient = 0	 speed = 0 gradient = 0	 acceleration = 0
At constant speed or uniform speed	 gradient = constant, k	 speed = constant, k gradient = 0	 acceleration = 0

Uniform acceleration

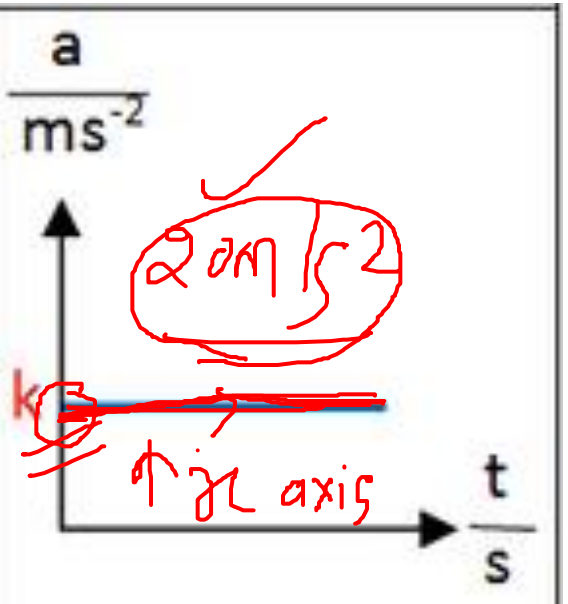


gradient varying

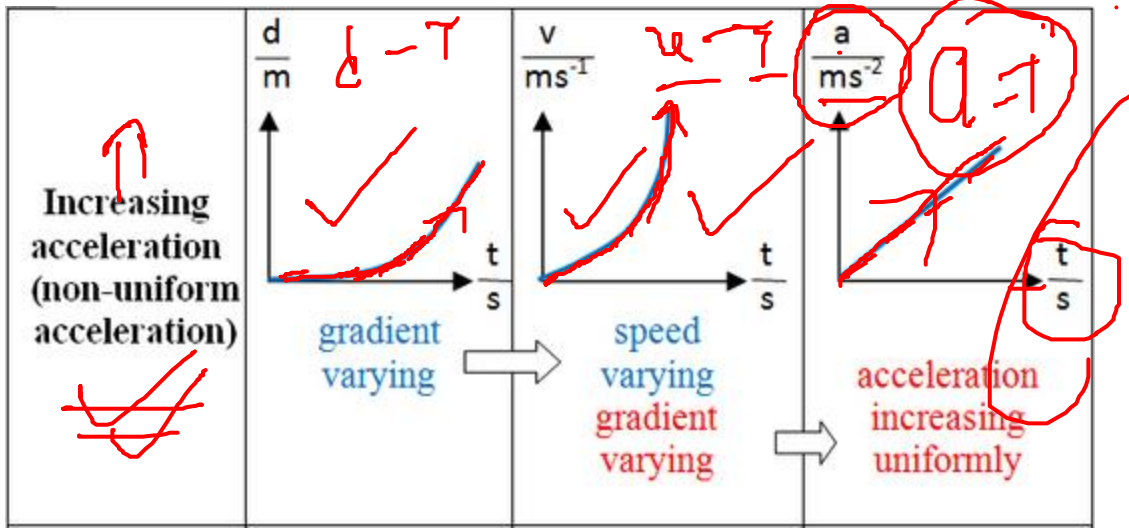


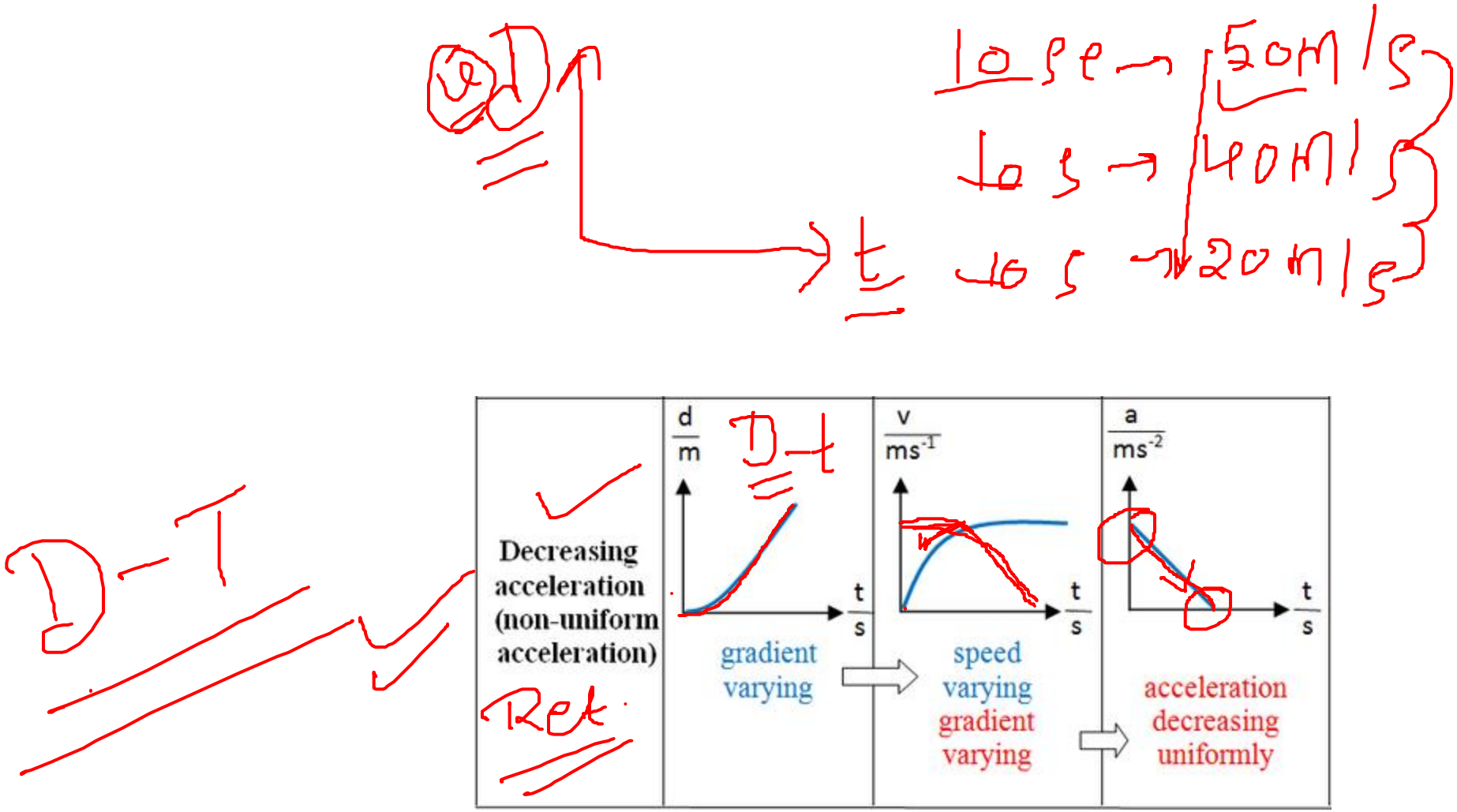
speed increasing uniformly

gradient = constant, k



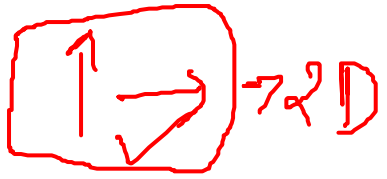
acceleration = constant, k

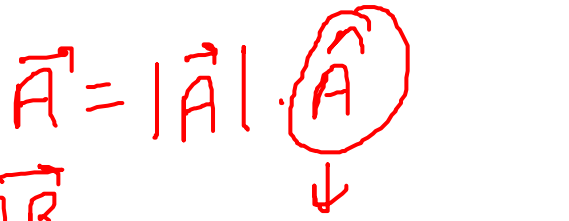

Increasing acceleration (non-uniform acceleration)
d / m
t / s
gradient varying
v / ms⁻¹
t / s
speed varying gradient varying
a / ms⁻²
t / s
acceleration increasing uniformly

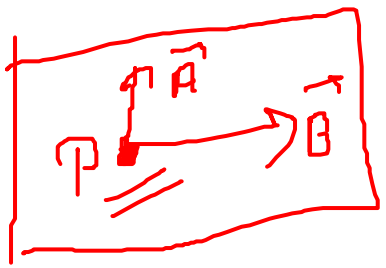

Decreasing acceleration (non-uniform acceleration)
d / m
t / s
gradient varying
v / ms-1
t / s
speed varying gradient varying
a / ms-2
t / s
acceleration decreasing uniformly

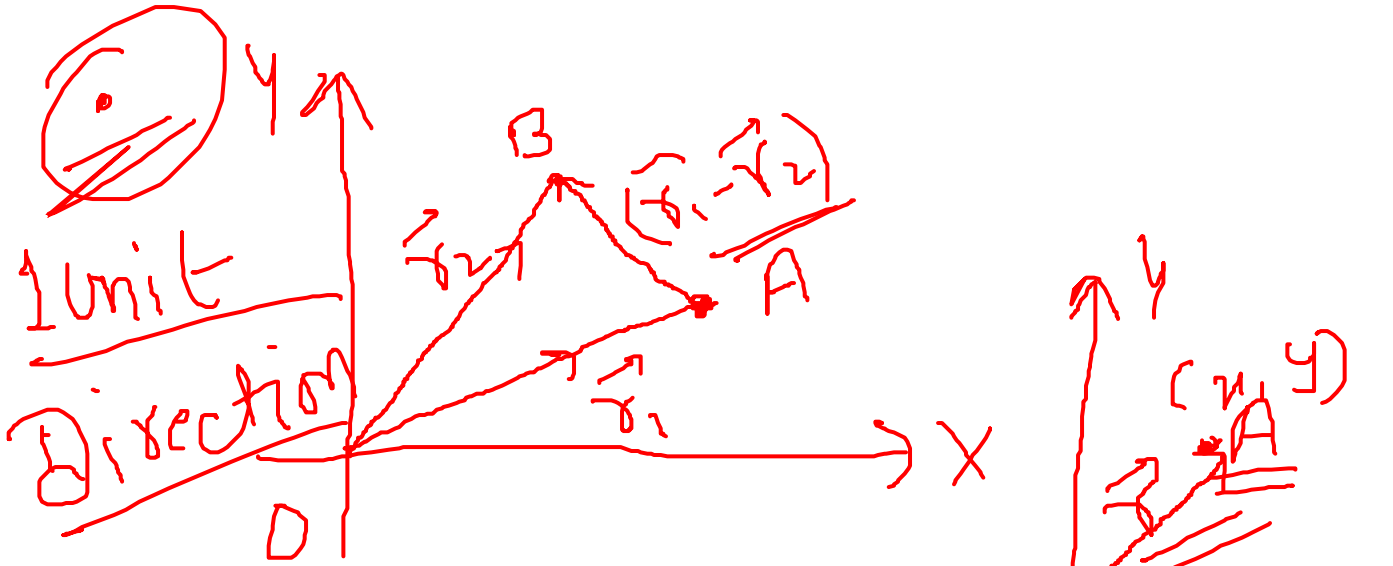
VECTORS

- There are 10 different types of vectors that are generally used in math and science.
- Types of Vectors List
- There are 10 types of vectors in mathematics which are:
- Zero Vector
- Unit Vector
- Position Vector
- Co-initial Vector
- Like and Unlike Vectors
- Co-planar Vector
- Collinear Vector
- Equal Vector
- Displacement Vector
- Negative of a Vector

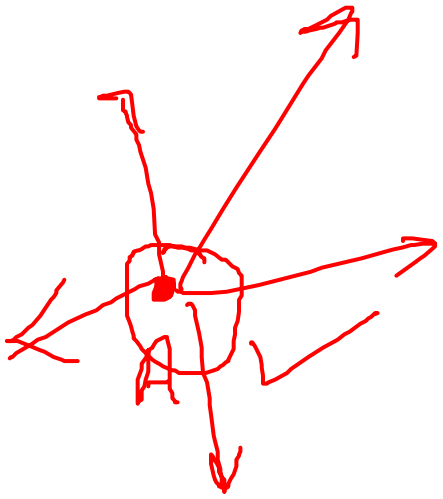


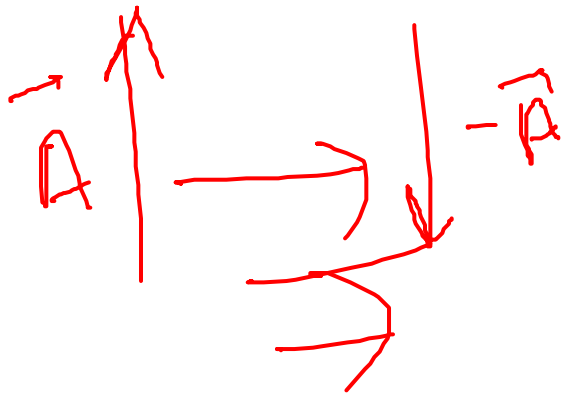





Y
B
$\vec{r}_2 - \vec{r}_1$
A
Unit
Direction
$\vec{r}_2$
$\vec{r}_1$
O
X

y
(x, y)
A
O
x


A


$\vec{A}$
$-\vec{A}$


10
5

→ Vector :- $\vec{A} \times \vec{B} = AB \sin\theta$

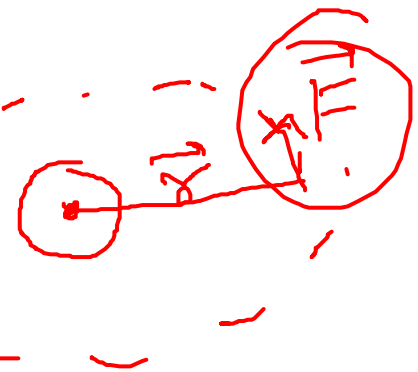
Scalar :- $\vec{A} \cdot \vec{B} = AB \cos\theta$

$\Rightarrow W = \vec{F} \cdot \vec{d}$ (scalar) $= F d \cos\theta$

$\vec{F}$ → vector, $\vec{d}$ → vector

Ex :- $\vec{T} = \vec{F} \times \vec{r}$

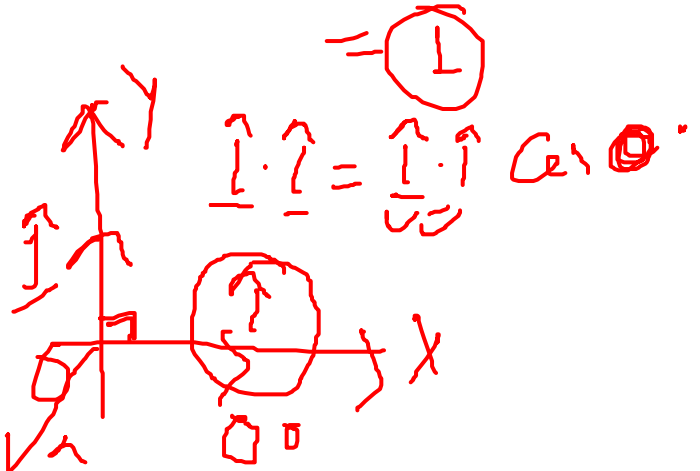
$= F \cdot r \sin\theta$



$$\vec{A} \cdot \vec{B} = AB \cos\theta$$

$$\vec{A} = (a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k})$$

$$\vec{B} = (b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k})$$



$$\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1 \cdot 1 \cos 0^\circ = 1$$

$$\hat{i} \cdot \hat{j} = 0$$

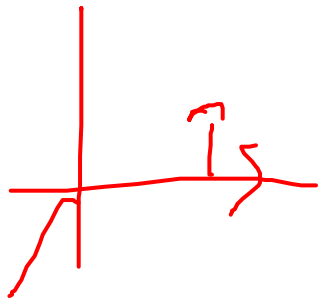
$$\vec{A} \cdot \vec{B} = (a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k}) \cdot (b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k})$$

$$= (a_1 b_1 + a_2 b_2 + a_3 b_3)$$

$$\vec{A} \times \vec{B} = AB \sin\theta$$

$$\begin{bmatrix} \hat{i} \times \hat{i} = 0 \\ \hat{j} \times \hat{j} = 0 \\ \hat{k} \times \hat{k} = 0 \end{bmatrix}$$

$$\begin{bmatrix} \hat{i} \times \hat{j} = \hat{k} \\ \hat{j} \times \hat{k} = \hat{i} \\ \hat{k} \times \hat{i} = \hat{j} \end{bmatrix}$$



$$\vec{A} = (a_1 \hat{i} + a_2 \hat{j} + a_3 \hat{k})$$

$$\vec{B} = (b_1 \hat{i} + b_2 \hat{j} + b_3 \hat{k})$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \hat{i}(a_2 b_3 - b_2 a_3) - \hat{j}\,\_\_\_\_$$

2nd Projectile Motion ⇒ Parabolic

Time of flight

* Time of Flight :

$u = 10\ m/s$

$\theta = 30^\circ$

$g = 10$

$T = \frac{2u\sin\theta}{g}$ ⇒ $g(9.8\ m/s^2)$

$\sin 2\times 30$

$\sin 60$

* Range :-

$R = \frac{u^2 \sin 2\theta}{g}$ ($\sin 2\theta = 2\sin\theta \cdot \cos\theta$)

$= \frac{100 \times \sqrt{3}/2}{10} = 5\sqrt{3}\ m$

$$H_{max} = \frac{u^2 \sin^2\theta}{2g}$$

⇒ ex. $u = 20\ m/s$, $\theta = 45°$ $\left(\frac{1}{\sqrt{2}}\right)$, $g = 10$

Special case :- $\sin^2\theta = 90$

(1) $45° \Rightarrow R = \frac{u^2 \sin 2\theta}{g}$ $\theta = 45$ $H_{max} = \frac{20 \times 20 \times \frac{1}{2}}{20}$

$= 10\ m$ ✓

Newton's Laws

(1) Law of Inertia (1st Case)

$F \propto \frac{dP}{dt} \Rightarrow F \propto \frac{d(mv)}{dt} \Rightarrow \boxed{F = ma}$

$P = mv$

(2) Law of Force (2nd Case) $\Rightarrow$

$F = ma$ (a)

$F \propto \frac{dP}{dt}$ (b)

$F = k(a)$

$F = mv$ (c)

Force $\rightarrow \propto \left[\frac{dP}{dt}\right]$

(3) Law of Action & Reaction :-

Rocket

Concept of Lift

$F = ma$

$W = mg$

① Rest ⇒ W = Actual W.

② Const Vel. ⇒ W = No change

③ Acc. ↑ W ⇒ ↑ W ⇒ increase

⑤ Free Fall W ⇒ ? 0

④ Acc. ↓ ⇒ W ⇒ Decrease

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