YAKEEN NEET 2.0

2026

Kinematics - - -

Motion in a straight line

PHYSICS | Lecture -12

By - Saleem Ahmed Sir

Todays Goal

Motion under gravity (part 02)

Ex. If a particle travels the first half distance with speed v_1 and second half distance with speed v_2. Find its average speed during journey.

H/W

Ex. A body is freely dropped from a height h above the ground. Find the ratio of distances fallen in first one second, first two seconds, first three seconds, also find the ratio of distances fallen in 1st second, in 2nd second, in 3rd second etc.

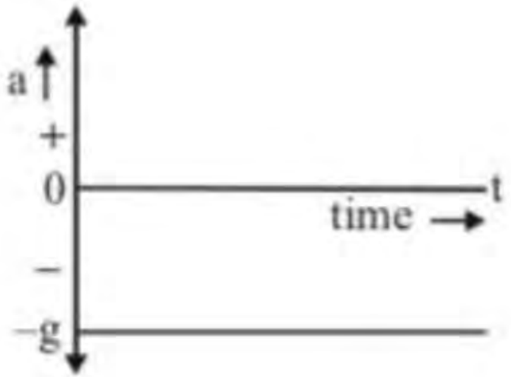
H.W

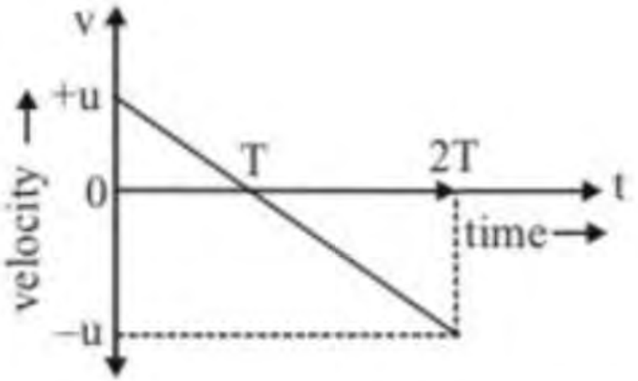
take reading

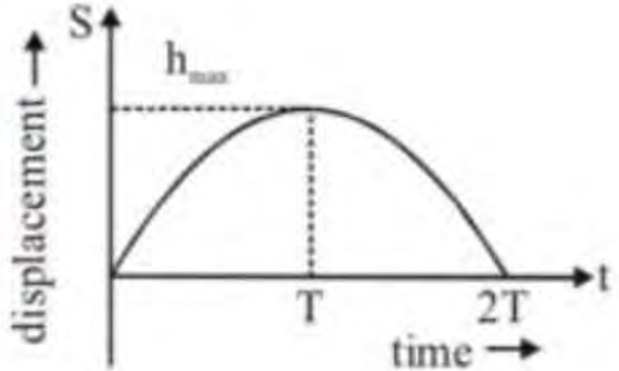
u

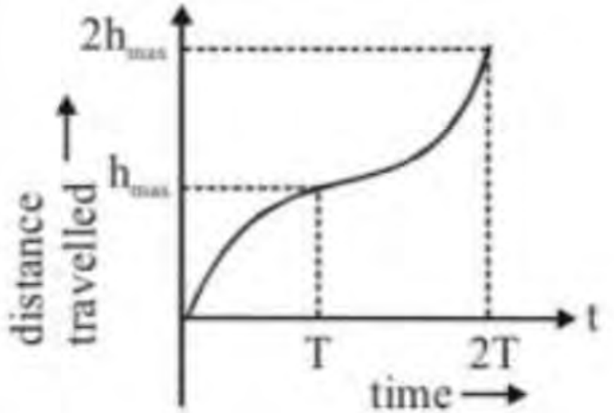
(upward +ve)

GRAPHS









11. A body falls freely from rest. It covers as much distance in the last second of its motion as covered in the first three seconds. The body has fallen for a time of :

एक वस्तु को विरामावस्था से मुक्त रूप से छोड़ा जाता है। यह प्रथम तीन सेकण्ड में जितनी दूरी तय करती है, अपनी गति के अंतिम सेकण्ड में उतनी दूरी तय कर लेती है। वस्तु को गिरने में लगा कुल समय होगा

(A) 3 s (B) 5 s (C) 7 s (D) 9 s

Ans. (B)

12. A particle moves along the X–axis as $x = u(t-2s) + a(t-2s)^2$

(A) The initial velocity of the particle is u

(B) The acceleration of the particle is a

(C) The acceleration of the particle is 2a

(D) At $t = 2s$ particle is at the origin.

एक कण x अक्ष के अनुदिश $x = u(t-2s) + a(t-2s)^2$ के अनुसार गति करता है तो :-

(A) कण का प्रारम्भिक वेग u होगा।

(B) कण का त्वरण a होगा।

(C) कण का त्वरण 2a होगा।

(D) $t = 2s$ पर कण मूल बिन्दु पर होगा।

Ans. (C,D)

JEE

Bestsellers | Hot New Releases | Most Wished For

#1

PW SKC Physics Crush Class 11 Handwritten Format...

★★★★★ 4

Paperback

₹449.00

✓prime

8:20

Search or ask a question

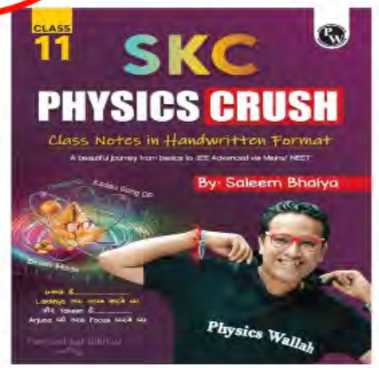
12 July 2025

ISBN-13: 978-93689[illegible]4086 ISBN-10: 936897408X

5.0 ★★★★★ (4)

#1 Best Seller in AIIMS & NEET Exams

20% off



Paperback

₹479.00 incl. GST

M.R.P.: ~~₹599~~

Price: ₹479.00 incl. GST

✓prime

You Save: ₹120 (20%)

Inclusive of all taxes

Home | You | More | Cart | Menu | Rufus

* $t^2 + 4t - 32 = 0$

$t^2 + 8t - 4t - 32 = 0$

$t(t+8) - 4(t+8) = 0$

$(t+8)(t-4) = 0$

$t = 4, \; t = -8$

Q $t^2 + 2t - 15 = 0$

$t^2 + 5t - 3t - 15 = 0$

$(t+5)(t-3) = 0$

$t = 3, \; t = -5$

$15 \equiv 5 \times 3$

$15 \times 1 = 15$

Q $t^2 - 2t - 15 = 0$

$t^2 - 5t + 3t - 15 = 0$

$(t-5)(t+3) = 0$

Q $t^2 - 4t - 21 = 0$

7×3

$t^2 - 7t + 3t - 21 = 0$

$(t-7)(t+3) = 0$

$t = 7, -3$

Q $t^2 + 4t - 21 = 0$

$(t+7)(t-3) = 0$

$t = -7, \; t = 3$

Q $t^2 - 4t - 60 = 0$

$t^2 - 10t + 6t - 60 = 0$

$(t-10)(t+6) = 0$

Q A particle start moving from point A in a circular path of radius R with const speed v as shown in daigram.

$T = \frac{2\pi R}{v}$

(a) From A ⟶ B

Displacement = $R\sqrt{2}$

Distance = $2\pi R/4$

$$\text{Avrg velocity} = \frac{R\sqrt{2}}{T/4} = \frac{R\sqrt{2} \times 4}{2\pi R/V}$$

$$\text{Avrg speed} = \frac{2\pi R/4}{T/4} = \frac{2\pi R}{T} = \frac{2\pi R}{2\pi R/V} = V$$

$$\text{Avrg acc} = \frac{V_f - V_i}{T/4} = \frac{-V\hat{i} - V\hat{j}}{T/4} = \checkmark$$

$$\vec{d}_{AB} = -R\hat{i} + R\hat{j}$$

Q From A $\longrightarrow$ C

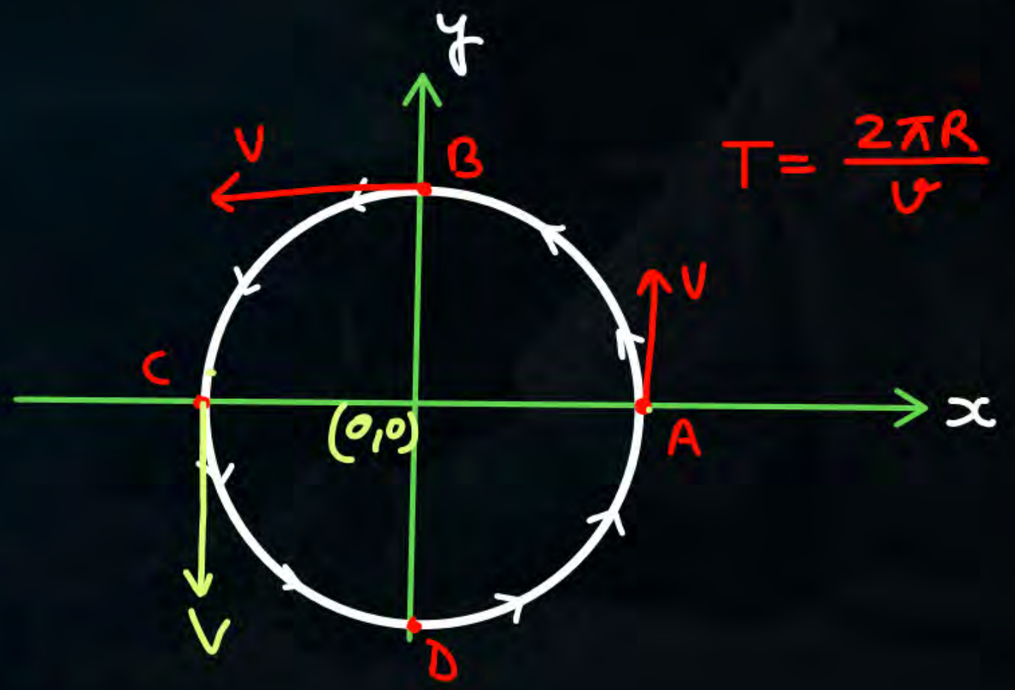
Displacement = $2R$, $(-2R\hat{i})$

(a) Distance = πR

Avg velocity = $\frac{2R}{T/2}$

Avg speed = $\frac{\pi R}{T/2} = \frac{2\pi R}{T} = \frac{2\pi R}{2\pi R/V} = V$

Avg acc = $\frac{(-V\hat{j}) - (V\hat{j})}{T/2} = \frac{-2V\hat{j}}{T/2}$

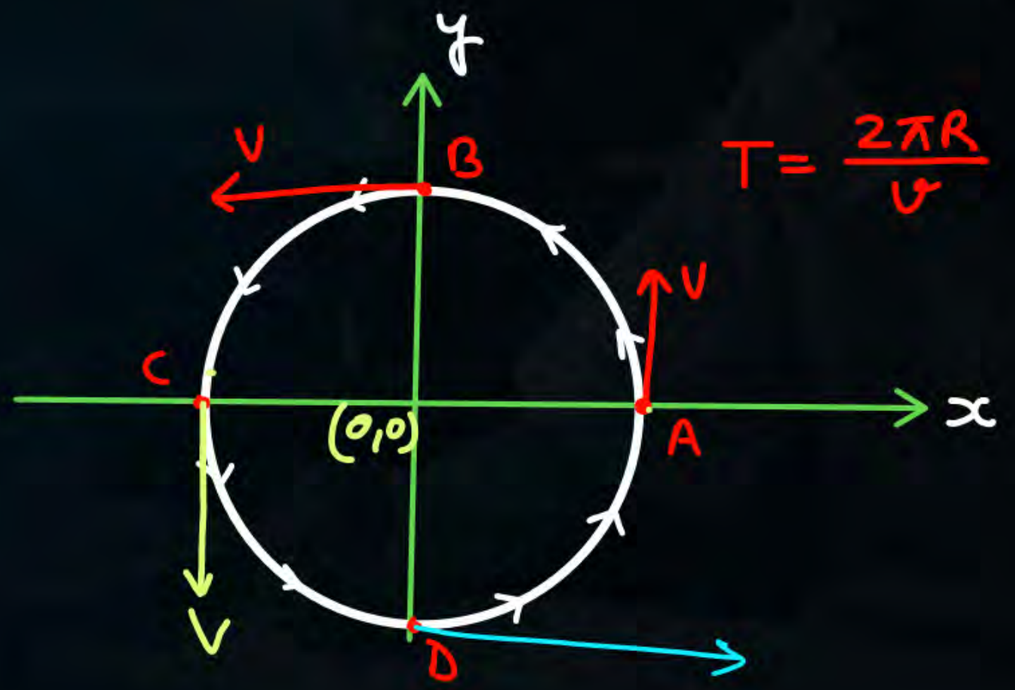


Q From A ⟶ D

Displacement = $R\sqrt{2}$

(a) Distance = $2\pi R \times \frac{3}{4}$

Avrg velocity = $\frac{R\sqrt{2}}{3T/4}$



$T = \frac{2\pi R}{v}$

Avrg speed = $\frac{2\pi R\ 3/4}{3T/4} = \frac{2\pi R}{T} = v$

Avrg acc = $\frac{V\hat{i} - V\hat{j}}{3T/4}$

Revision

motion Under gravity

Q A particle is projected vertically upward with velocity 60 m/s from ground. find

① Time of flight =

② h_{max} =

③ v at t = 2

v at t = 10

④ Draw V-t graph

⑤ *** location of particle at t = 2, t = 10 sec

⑥ Distance traval by particle from t = 0 ⟶ t = 10 sec

⑦ Avg velocity & Avg acc from t = 0 ⟶ t = 6

t = 0 ⟶ t = 10 sec

① $T = 6+6 = 12$

② $0^2 = 60^2 - 2\times 10 \times h_{max}$

$h_{max} = \frac{60^2}{20} = 180$

③ $t=2,\ v = +40$ (up)

$t=10,\ v = -40$

***

⑤ $y = ut + \frac{1}{2}at^2$

$t=2,\ y_2 = 60\times 2 - \frac{1}{2}\times 10\times 2^2 = 100$

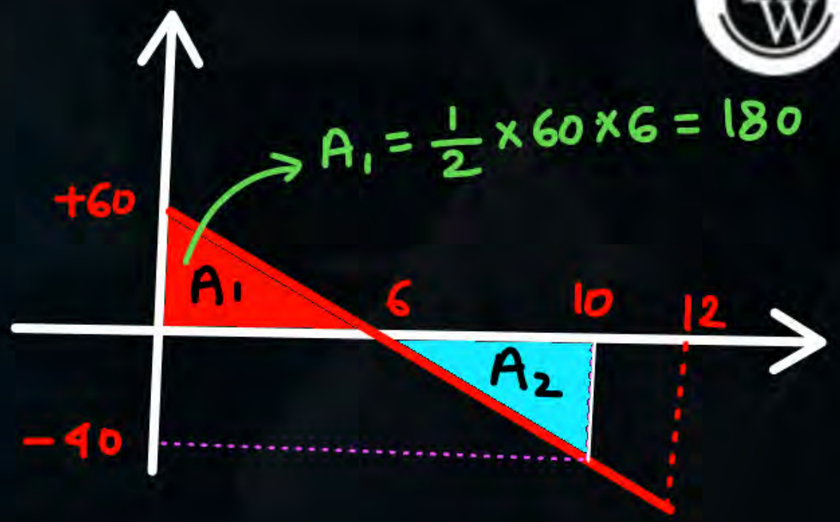
$t=10\quad y_{10} = 60\times 10 - \frac{1}{2}\times 10\times 10^2 = 100$

$t=8,\ y_8 = 60\times 8 - \frac{1}{2}\times 10\times 8^2 =$ ✓

Promise

Graph से भी

H.W ✓



⑥ $t=0 \longrightarrow t=10$

Distance $= A_1 + A_2 = 180 + \frac{1}{2}\times 40\times 4$

$= 180 + 80$

$= 260$

(7) $t=0 \longrightarrow t=6$

$u_i = 60\hat{j}$ $\quad v_f = 0$

$$\langle \vec{v} \rangle = \frac{\vec{u}_i + \vec{v}_f}{2} = \frac{60+0}{2} = 30\hat{j}$$

$$\langle \vec{a} \rangle = \frac{\vec{v}_f - \vec{v}_i}{\text{time}} = \frac{0-60}{6} = -10$$

अगर कुछ change नहीं किया तो

$\langle \vec{a} \rangle \equiv$ Always (-10)

$-\hat{j}$, g Needle

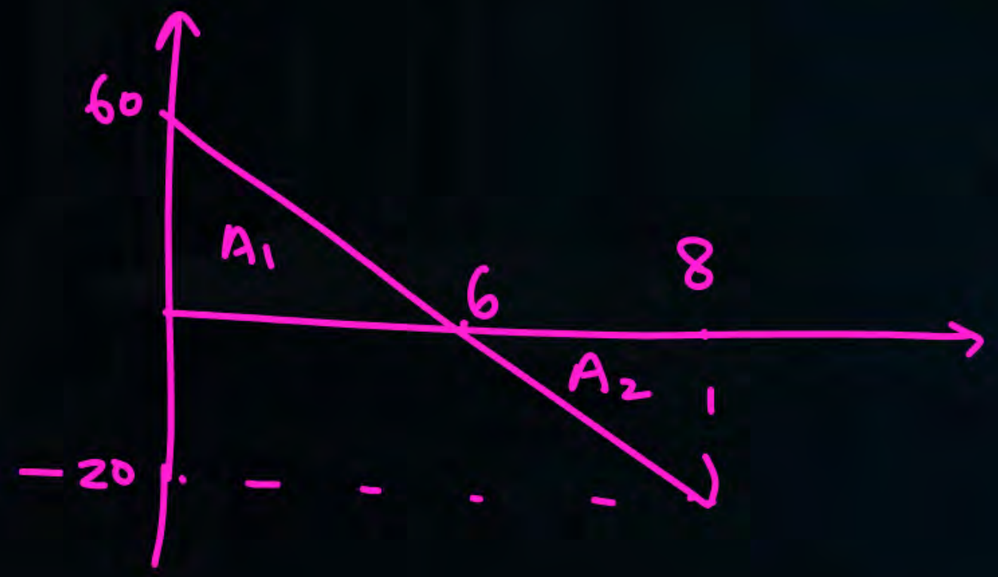
$t=0 \longrightarrow t=10$

$\vec{u}_i = 60\hat{j}$ $\quad \vec{v}_f = -40\hat{j}$

$$\langle \vec{v} \rangle = \frac{60+(-40)}{2} = 10\hat{j}$$

$$\langle \vec{v} \rangle = \frac{\text{Displacement}}{\text{time}} = \frac{100}{10} = 10$$

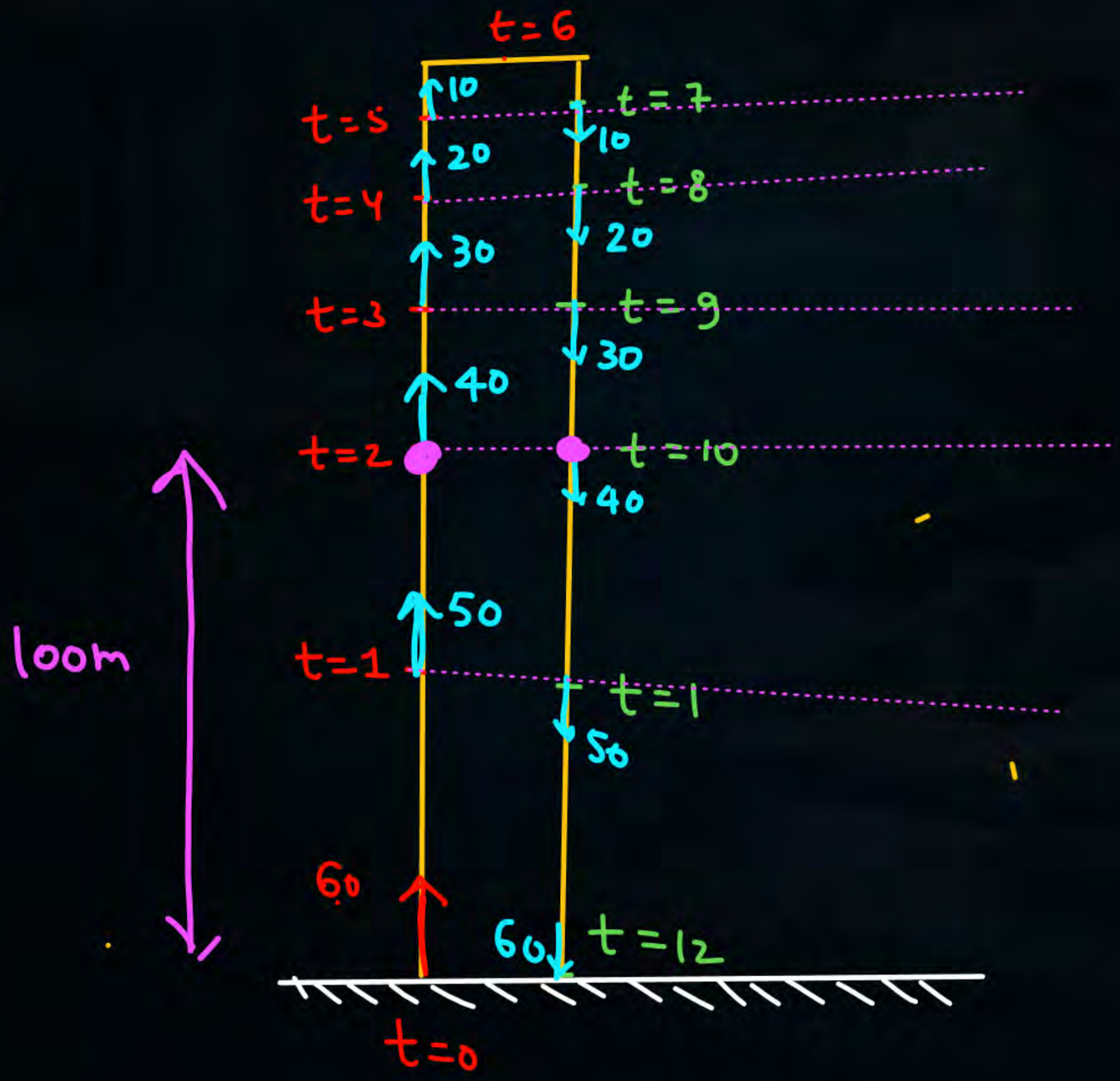
$$\langle \vec{a} \rangle = \frac{-40-60}{10} = -10$$

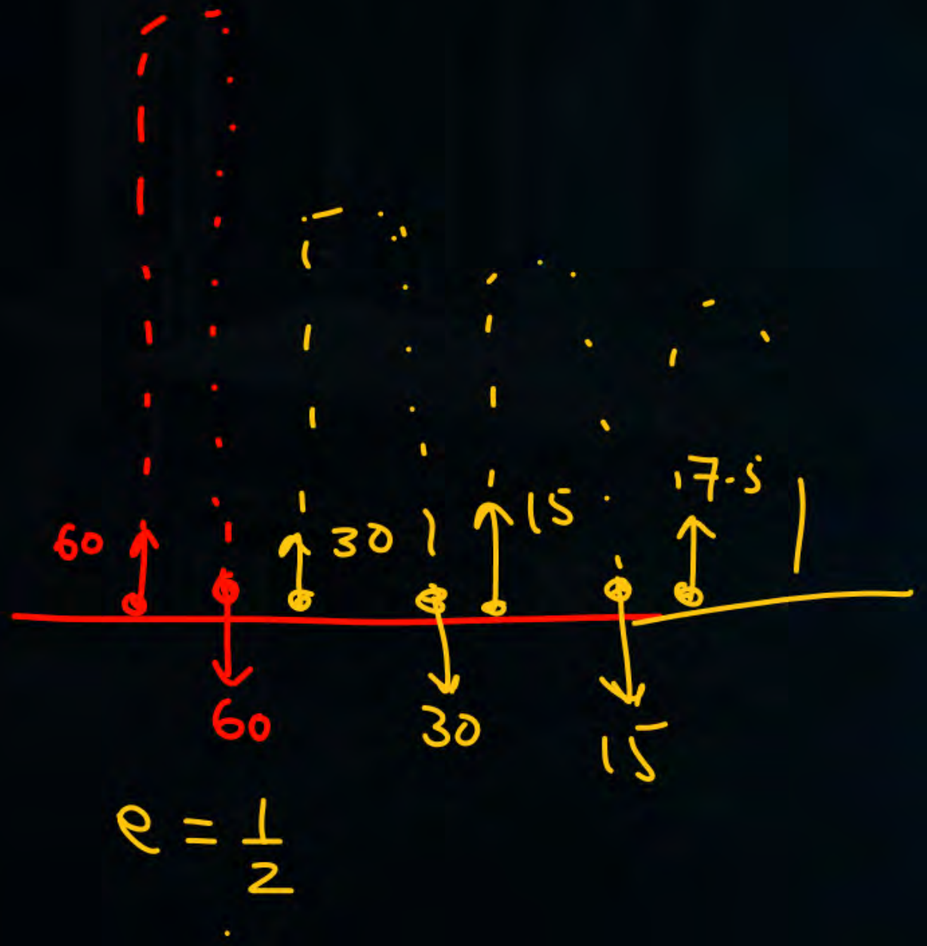


$$A_1 - A_2 = \frac{1}{2} \times 6 \times 60 - \frac{1}{2} \times 2 \times 20$$

$$= 180 - 20 = 160$$

जमीन से same height पर Speed same $\vec{V}$ ⟶ diff





$e = \frac{1}{2}$

(8) Find displacement in last second of upward journey.

$$S_{6^{th}\,sec} = u + \frac{1}{2}(2n-1)a$$

$$= 60 - \frac{1}{2}(2\times 6 - 1)\times 10$$

$$= 5$$

Silly

(9) Find displacement in last second of journey.

$T = 12$ sec

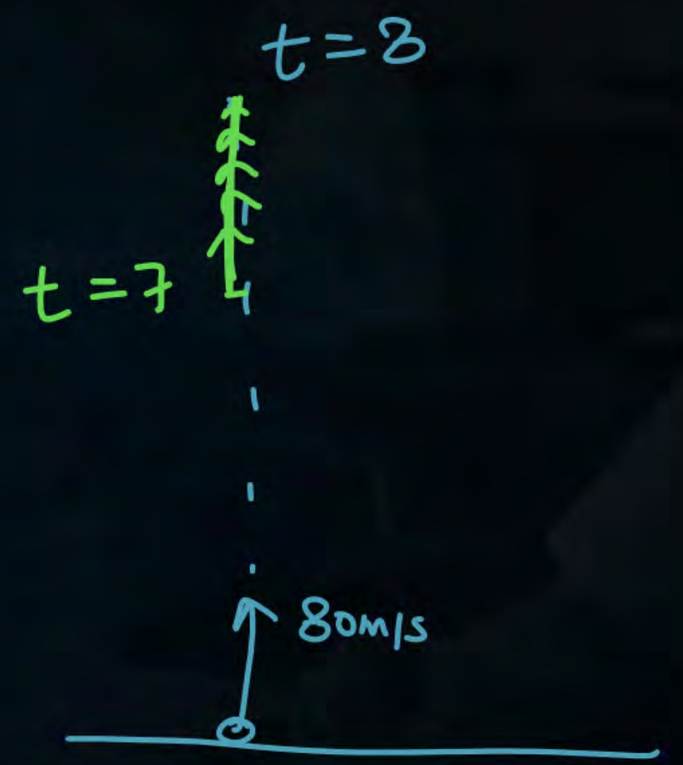
$$S_{12^{th}} = u + \frac{1}{2}(2n-1)a$$

$$= 60 - \frac{1}{2}(2\times 12 - 1)\times 10$$

$$= 60 - 115 = -55$$

$$S_{8^{th}} = 80 - \frac{1}{2}(2\times 8 - 1)\times 10$$

$$= 80 - 75 = \underline{\underline{5}}$$



Q (down ↓ +ve)

$u = 0$

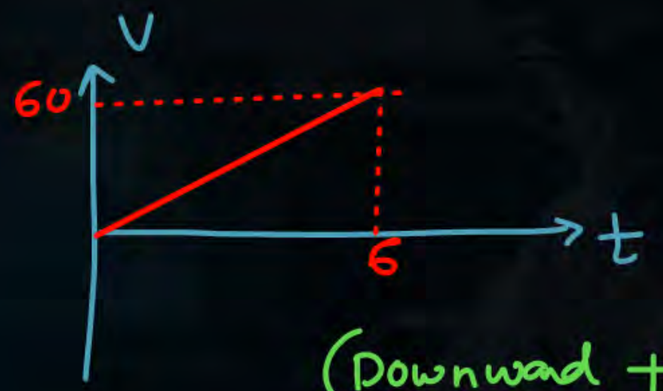
$a = +10$

$s = 180$

$180 = 0 + \frac{1}{2} \times 10 \times t^2$

$\boxed{t = 6}$

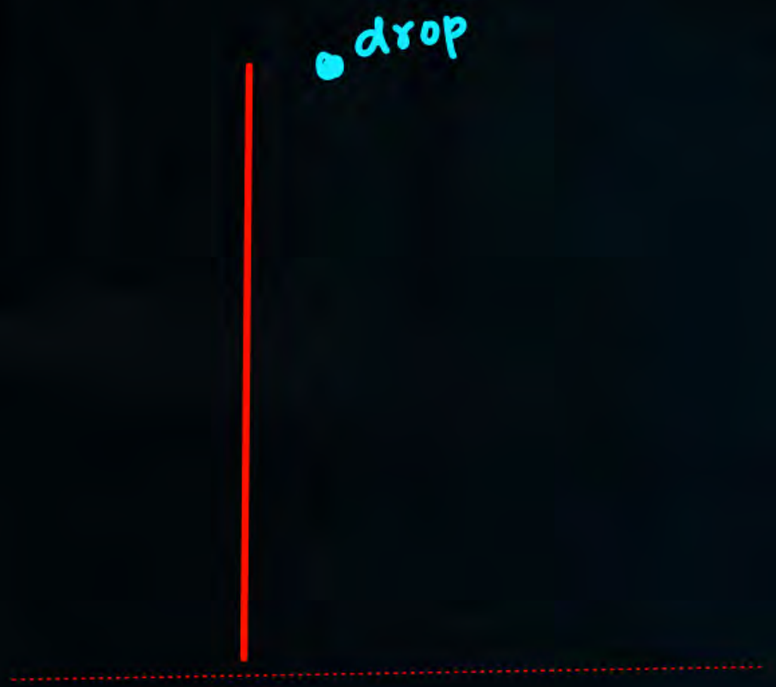
$v = 60$



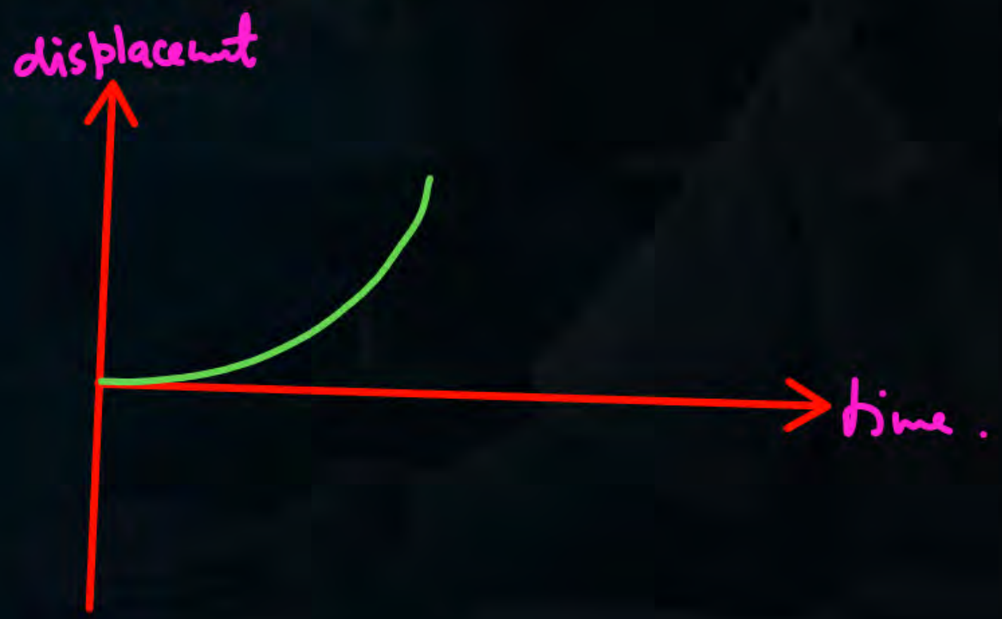
(Downward +ve)

Silly

If Upward is positive
Downward negative.



Downward positive

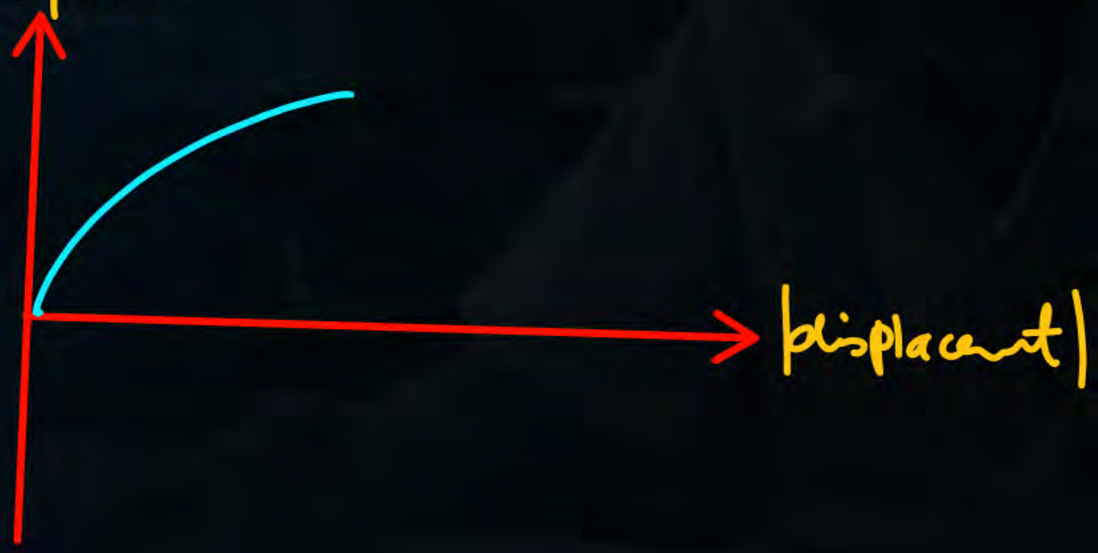


$$S = ut + \frac{1}{2}at^2$$

$$S = 0 + \frac{1}{2} \times 10\, t^2$$

$$\boxed{S = 5t^2}$$ parabola

Downward positive



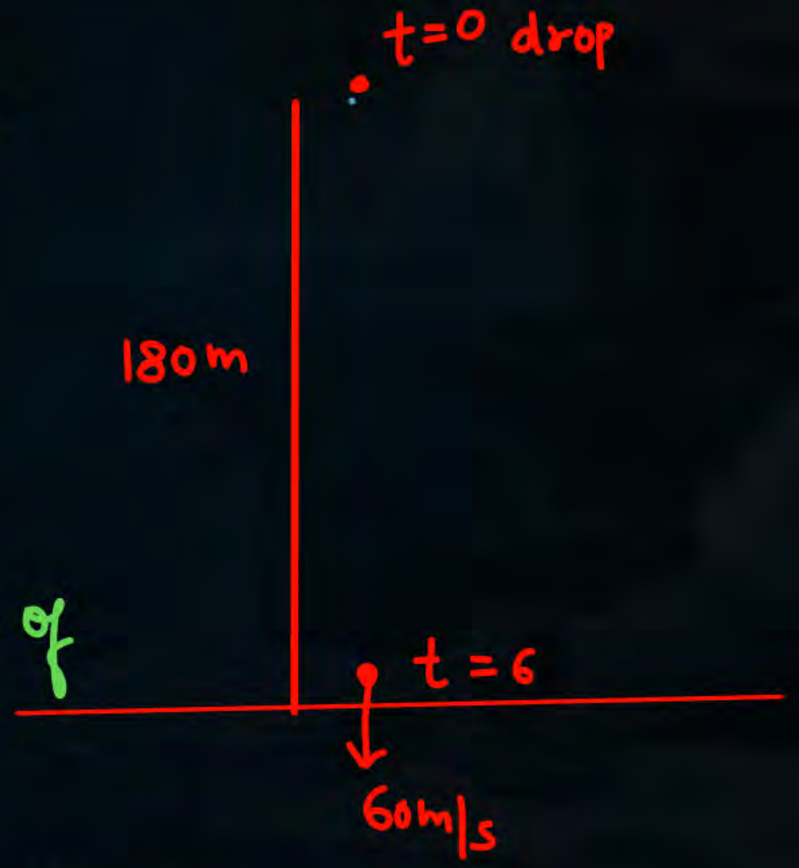
$$v^2 = u^2 + 2as$$

$$v^2 = 0^2 + 2 \times 10 \times s$$

Q Find displacement in last sec. of journey.

$$S_n = u + \frac{1}{2}(2n-1)a$$

$$S_n = 0 + \frac{1}{2}(2\times 6-1)\times 10 = 55$$



Q Find displacement in last three sec. of journey.

Ans $S_{t=0 \to t=6} - S_{t=0 \to t=3}$

$$= \frac{1}{2}\times 10\times 6^2 - \frac{1}{2}\times 10\times 3^2$$

$$= 180 - 45 = \underline{135}$$

Q A particle is drop from a top of a tower of height 'h' s.t it travel 75 m in last sec. of journey. find h.

Sol^n

$$S_n = u + \frac{1}{2}(2n-1)a$$

$$75 = 0 + \frac{1}{2}(2n-1)\times 10$$

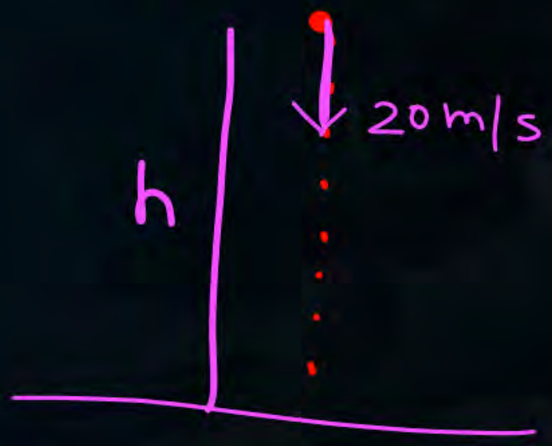
$$15 = 2n-1$$

$$\boxed{n = 8}$$

$$h = 0 + \frac{1}{2}\times 10 \times 8^2$$

$$\boxed{h = 320}$$

Q A particle projected down with $u = 20$ from top of a tower of height 'h' s.t it travel 75 m in last sec. of journey. find h.



Sol^n

$$S_n = u + \frac{1}{2}(2n-1)a$$

$$75 = 20 + \frac{1}{2}(2n-1)\times 10$$

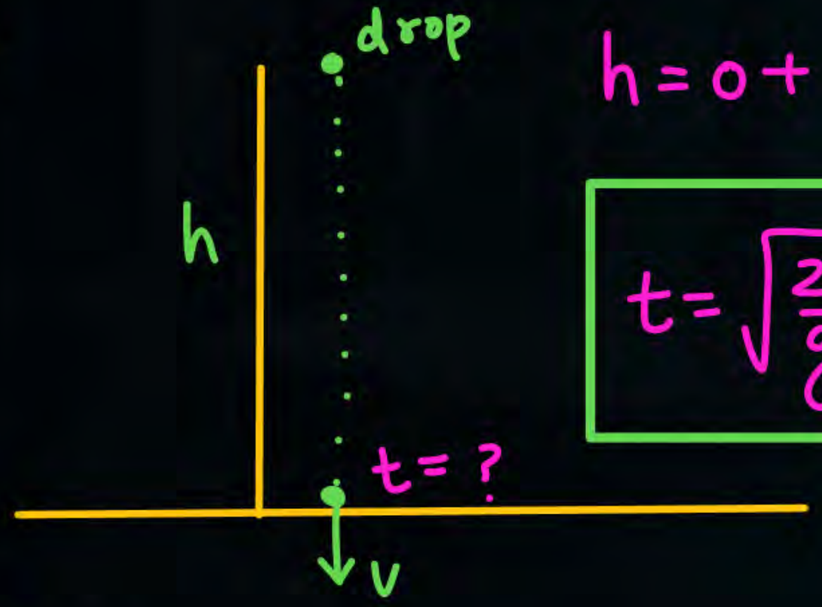
$$55 = 5(2n-1)$$

$$\boxed{n = 6}$$

$$h = 20\times 6 + \frac{1}{2}\times 10\times 6^2$$

$$h = 120 + 180 = \underline{300\ m}$$

#



$$h = 0 + \frac{1}{2}gt^2$$

$$t = \sqrt{\frac{2h}{g}}$$

$$v^2 = 0^2 + 2gh$$

$$v = \sqrt{2gh}$$

**

अगर मैं किसी particle को Drop करूं तो h नीचे आने में $\sqrt{\frac{2h}{g}}$ time लगेगा।

Q (upward +ve)

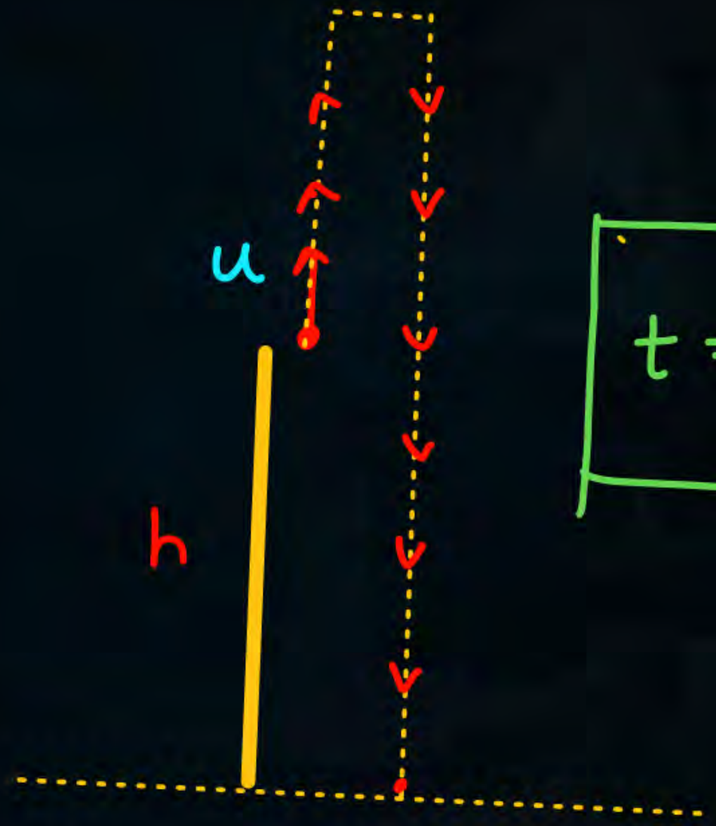
$-h = ut - \frac{1}{2}gt^2$

$-2h = 2ut - gt^2$

$gt^2 - 2ut - 2h = 0$

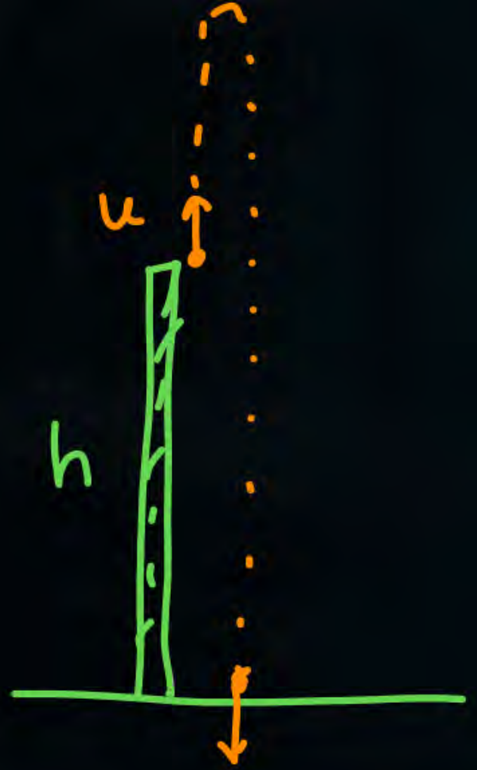
$$t = \frac{2u + \sqrt{(2u)^2 + 4g\,2h}}{2g}$$

$$t = \frac{2u}{2g} + \frac{\sqrt{4u^2 + 8gh}}{2g} = \frac{u}{g} + \sqrt{\frac{4u^2 + 8gh}{4g^2}}$$



$$t = \frac{u}{g} + \sqrt{\left(\frac{u}{g}\right)^2 + \frac{2h}{g}}$$

#



$$t = \frac{u}{g} + \sqrt{\left(\frac{u}{g}\right)^2 + \frac{2h}{g}}$$

① $h = 0$

$$t = \frac{2u}{g}$$

② $u = 0$, drop $\quad t = \sqrt{\frac{2h}{g}}$

③

$$t = \frac{40}{10} + \sqrt{\left(\frac{40}{10}\right)^2 + \frac{2 \times 240}{10}}$$

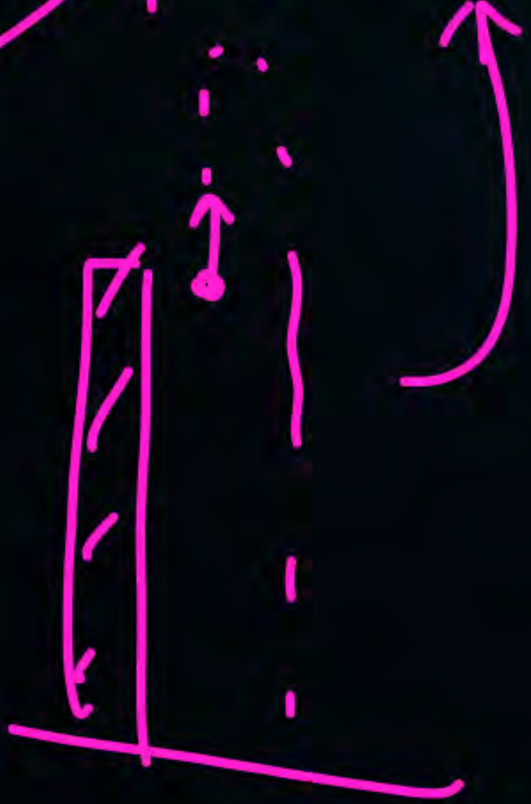
$$t = 4 + \sqrt{16 + 48}$$

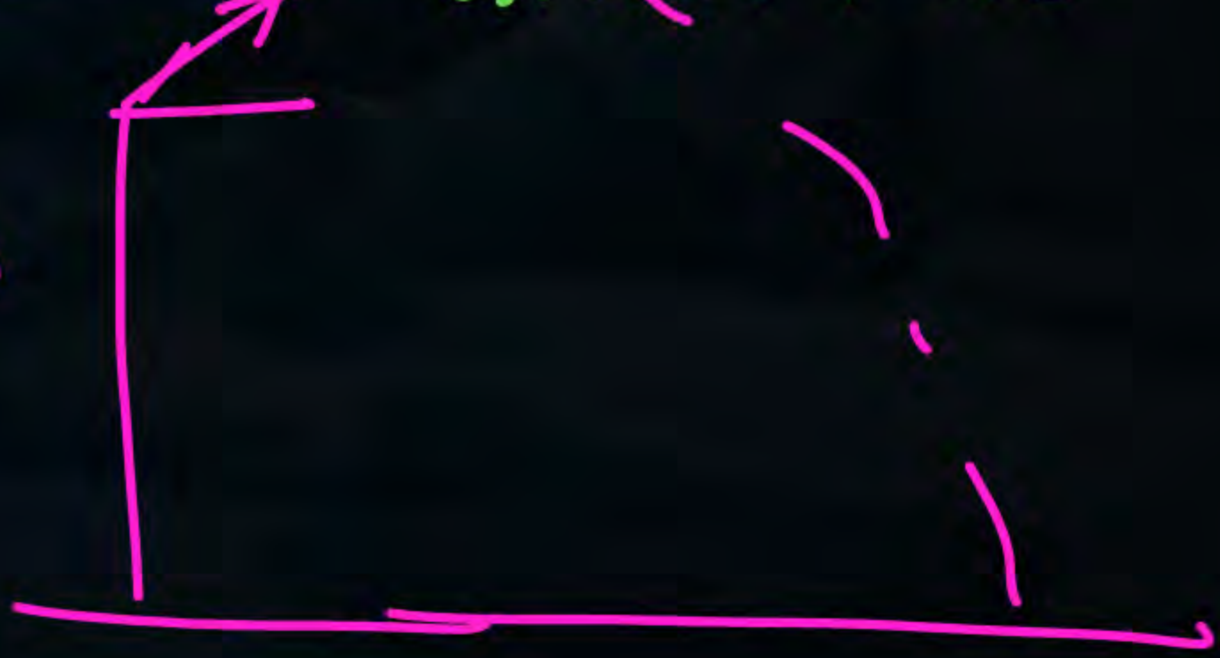
$$t = 4 + 8 = 12$$

$a_x = 0 \equiv V_x = \text{Const}$

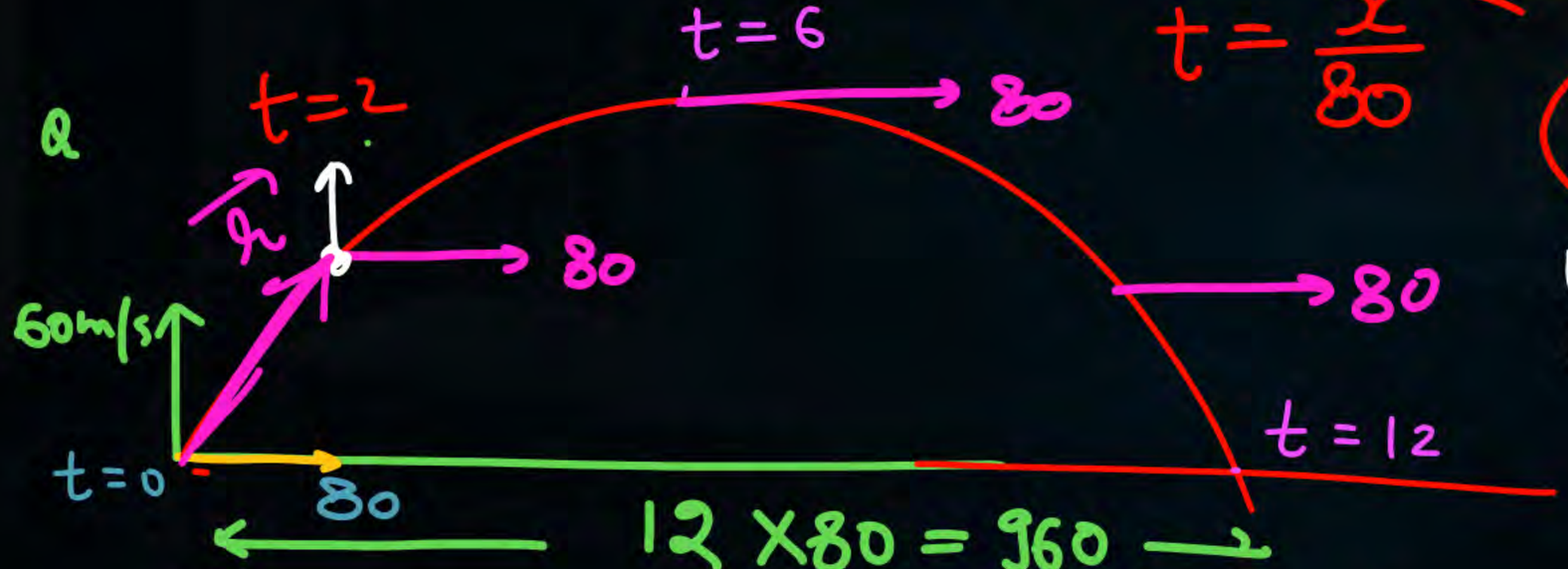
$a_y = g$ (नीचे)

Kinematics सबसे बड़ा हथियार





Q



$t = \frac{x}{80}$

$x = 80 \times t$

$y = 60t - \frac{1}{2} \times 10 \times t^2$

$12 \times 80 = 960$

$a_x = 0$

$V_x = \text{Const}$

$y = 60\frac{x}{80} - 5 \times \left(\frac{x}{80}\right)^2$

$T = 12$

$h_{max} = 180$

$R = 12 \times 80 = \underline{960}$

Eq^n of trajectory

Home work

- Ques are attached
- KPP (NEET level) will be upload today evening 7pm

join it

THANK YOU