

YAKEEN NEET 2.0

2026

Motion in a Plane

PHYSICS

Lecture - 04

By - Saleem Ahmed Sir



Today's Goal

Projectile Motion Question Practice (part 02)

Correction

A particle is projected with velocity u at angle θ with horizontal at $t=0$, such that at $t=3$ sec velocity of the particle makes 45° with horizontal & after 2 more seconds particle move horizontally. find R, T, u .

$$T = 10$$

$$R = 20 \times 10 = 200$$

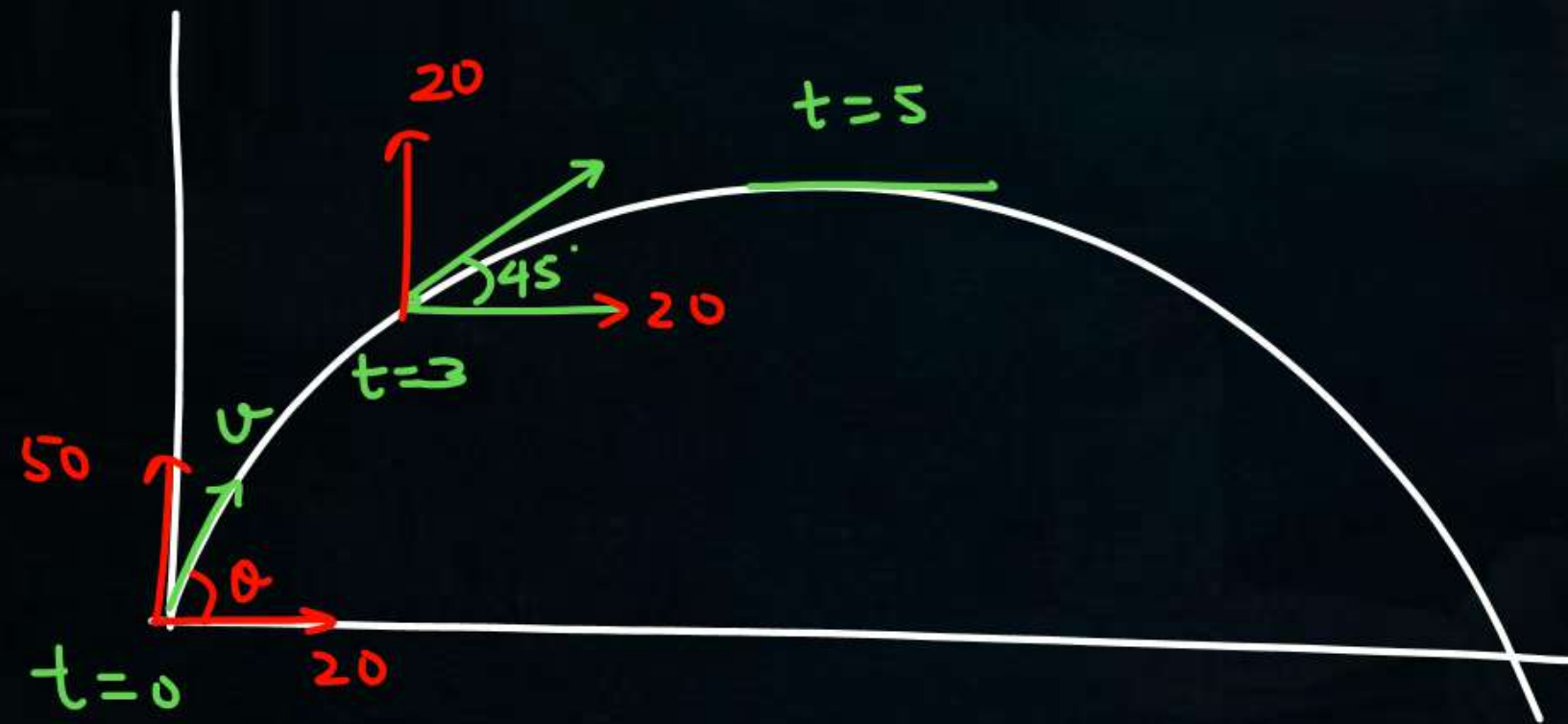
$$\vec{u}_i = 20\hat{i} + 50\hat{j}$$

$$u_i = \sqrt{(20)^2 + (50)^2}$$



Sir shayad is question mai kuch data galat hai kyuki agar velocity makes 53° degree with horizontal hai toh $\tan 53$ ka value $4/3$ hona chahiye but according to the answer $\tan \theta$ is $5/2$.

Agar koi [Add to your story](#) karna chahe toh mat hona sir please @saleem.nitt

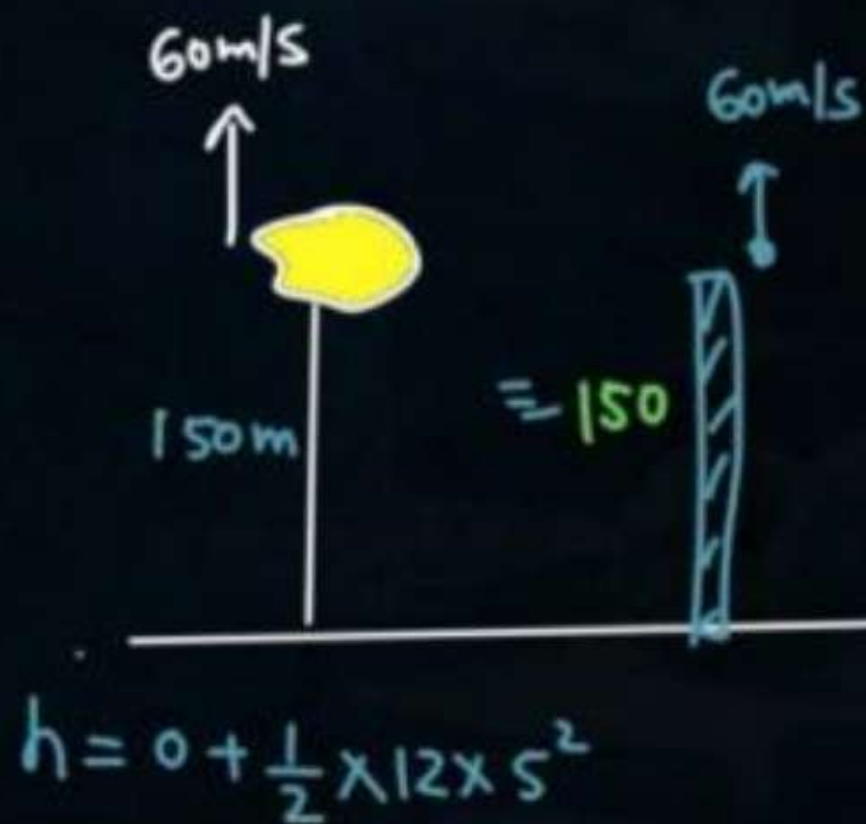


$$\tan \theta = \frac{50}{20} = 2.5$$

Q11

A balloon start rising from ground from rest having upward acc 12 m/s^2 at $t=0$. At $t=5 \text{ sec}$ a particle is drop from balloon find

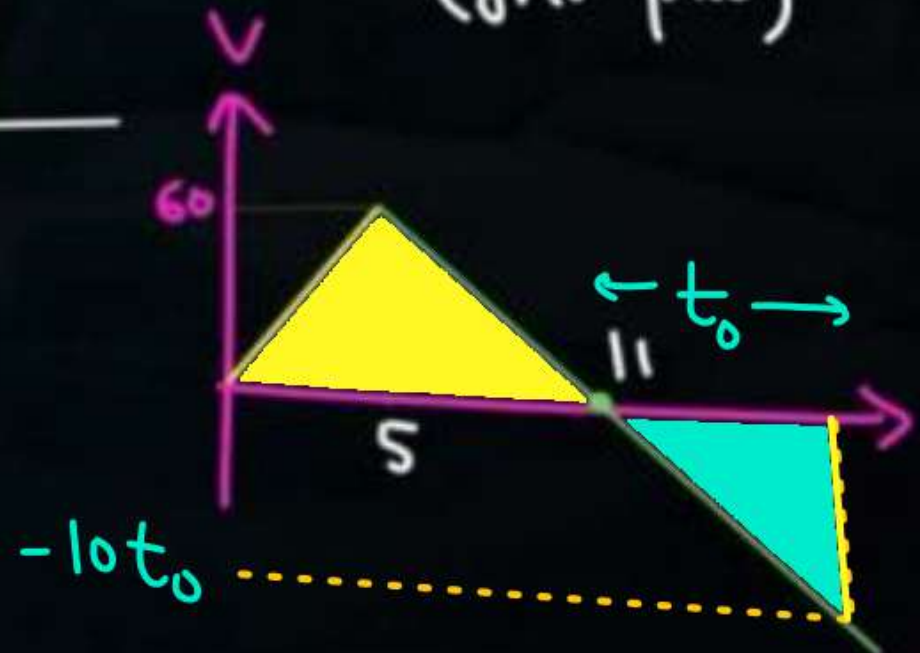
- ① find h_{max} of particle
- ② find when particle will hit the ground
- ③ SSS Q ** v-t graph of particle.



$$h_{\text{max}} = 150 + \frac{(60)^2}{2 \times 10}$$

$$-150 = 60t - \frac{1}{2} \times 10 t^2$$

(zhr pan)

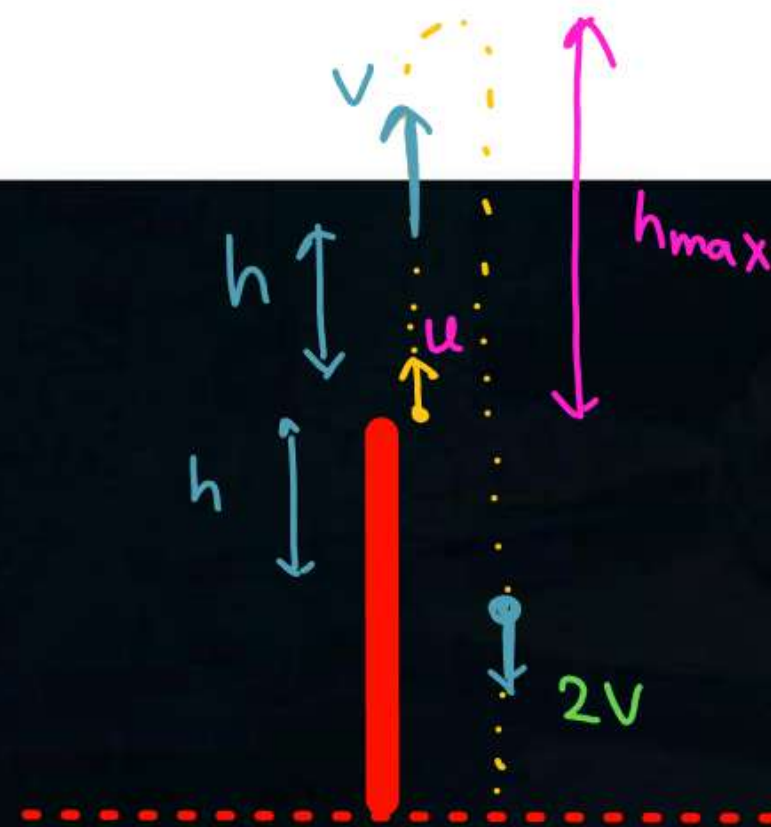


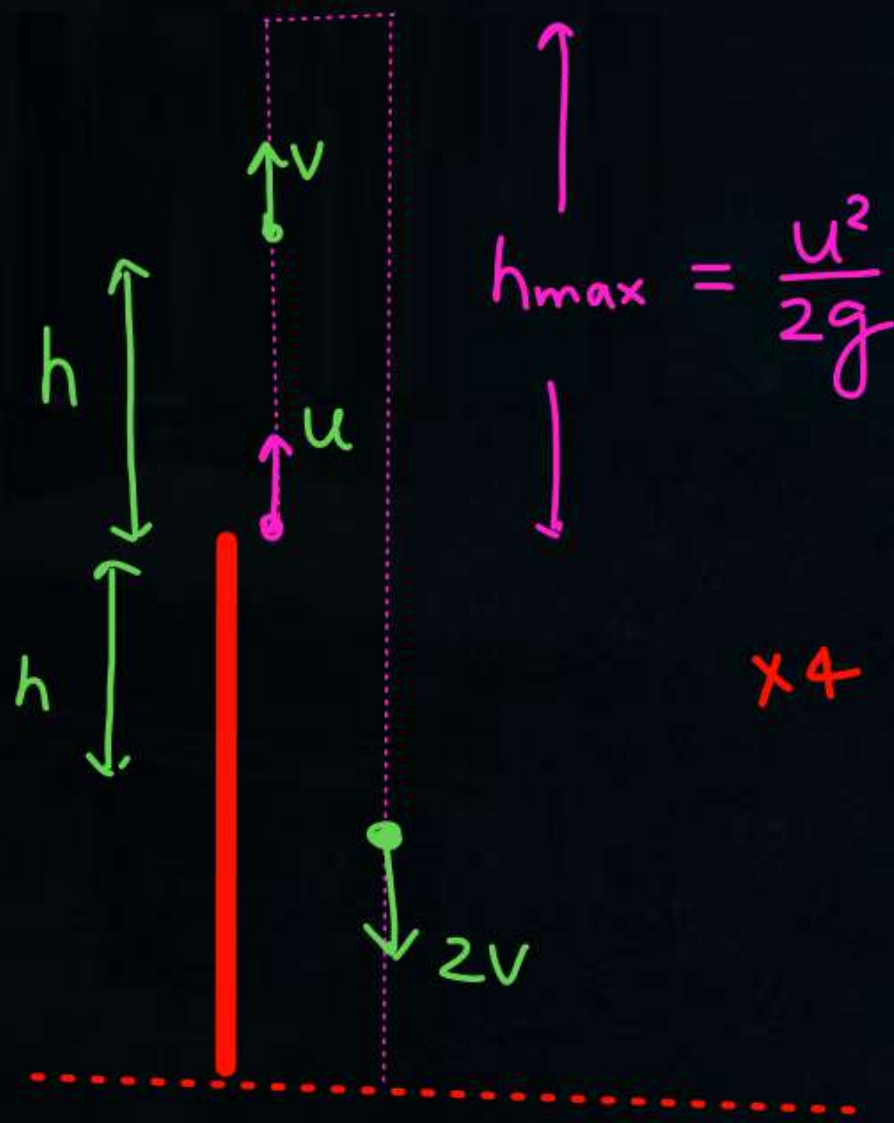
①

From the top of a tower, a ball is thrown vertically upwards. When the ball reaches h below the tower, its speed is double of what it was at height h above the tower. Find the greatest height attained by the ball from the tower.

एक मीनार के शीर्ष से एक गेंद को ऊर्ध्वाधर ऊपर की ओर फेंका जाता है। जब यह मीनार से h ऊंचाई नीचे आती है उस क्षण इसकी चाल उस चाल से दुगुनी हो जाती है, जब यह मीनार से h ऊंचाई ऊपर थी। गेंद मीनार से अधिकतम कितनी ऊंचाई तक गई थी?

Ans. $5h/3$





$$h_{\text{max}} = \frac{u^2}{2g}$$

$$v^2 = u^2 - 2gh$$

$$(2v)^2 = u^2 + 2(-g)(-h)$$

$$4v^2 = u^2 + 2gh$$

$\times 4$

$$4v^2 = 4u^2 - 8gh$$

$$0 = -3u^2 + 10gh$$

$$u^2 = \frac{10gh}{3}$$

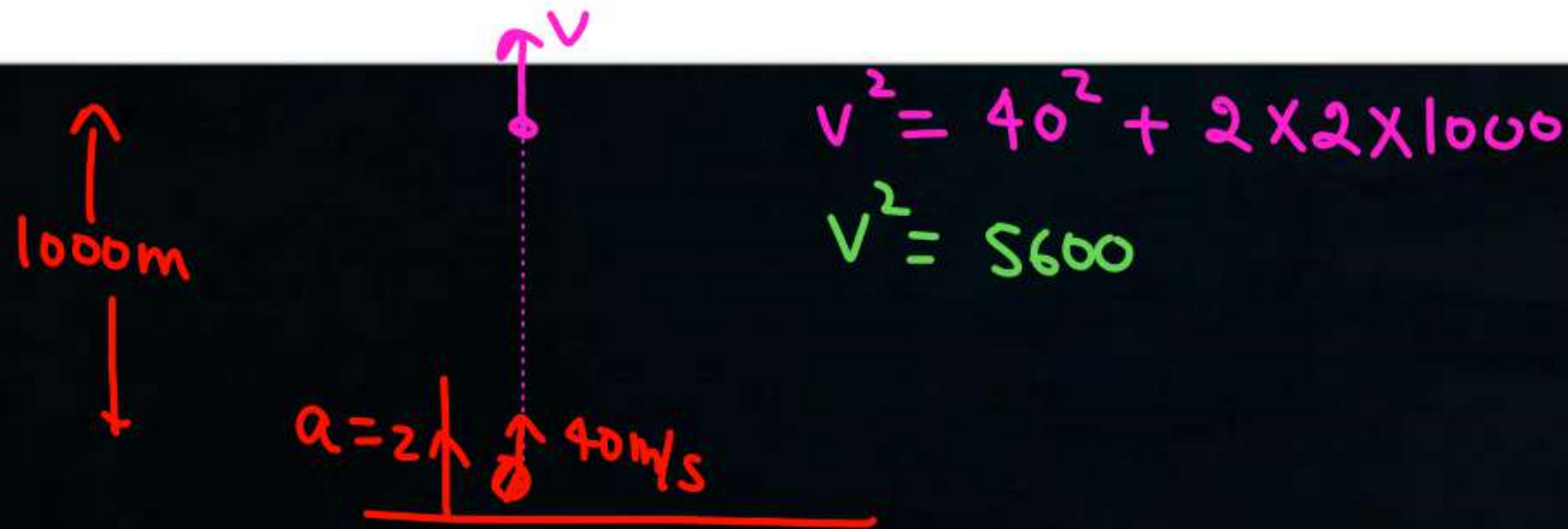
$$h_{\text{max}} = \frac{u^2}{2g} = \frac{10gh}{3 \times 2g} = \frac{5h}{3}$$

②

A rocket is fired vertically upwards with initial velocity 40 m/s at the ground level. Its engines then fired and it is accelerated at 2 m/s^2 until it reaches an altitude of 1000 m . At that point the engines shut off and the rocket goes into free-fall. If the velocity (in m/s) just before it collides with the ground is 40α . Then fill the value of α . Disregard air resistance ($g = 10 \text{ m/s}^2$).

एक रॉकेट को धरातल से 40 m/s प्रारम्भिक वेग के साथ ऊर्ध्वाधर ऊपर की ओर प्रक्षेपित किया जाता है। अब इसके इंजनों को चालू किया जाता है तथा यह 1000 m की ऊँचाई तक पहुँचने तक 2 m/s^2 से त्वरित होता है। इस बिन्दु पर इसके इंजन बंद हो जाते हैं तथा यह मुक्त रूप से गिरने लगता है। यदि धरातल से टकराने से ठीक पूर्व इसका वेग (m/s में) 40α हो तो α का मान ज्ञात कीजिए। वायु प्रतिरोध को नगण्य माने। ($g = 10 \text{ m/s}^2$)

Ans. 4





$$v_f^2 = v^2 + 2(-10)(-1000)$$

$$v_f^2 = 5600 + 20000$$

$$v_f = \sqrt{25600} = \underline{\underline{160}} = 40 \alpha$$

$$\boxed{\alpha = 4}$$

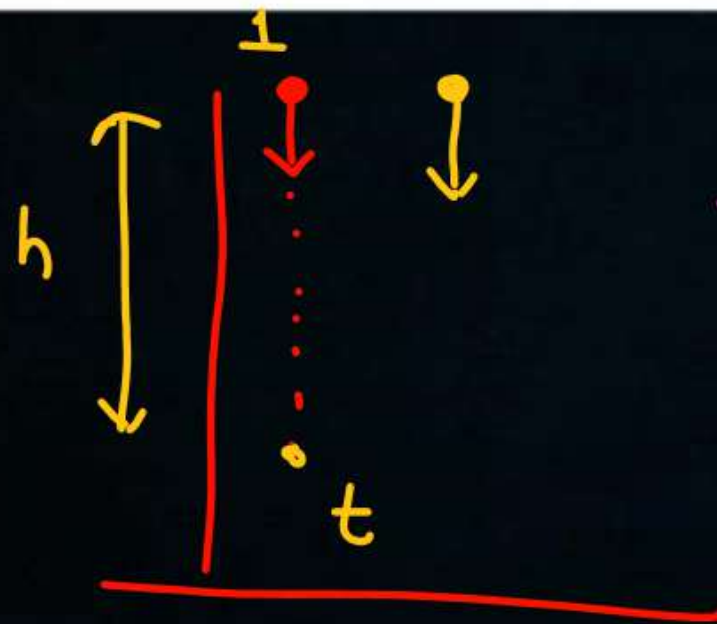
① $mgh + \frac{1}{2}mv^2 = \frac{1}{2}mv_f^2 + 0$

$$2gh + v^2 = v_f^2$$

③
hotm

A stone is dropped from the top of a tall cliff, and 1s later a second stone is thrown vertically downward with a velocity of 20 ms^{-1} . How far below the top of the cliff will the second stone overtake the first?
एक पत्थर को किसी ऊँची पहाड़ी के शीर्ष पर से नीचे गिराया जाता है। इसके 1s पश्चात् एक दूसरे पत्थर को ऊर्ध्वाधर नीचे की ओर 20 ms^{-1} वेग से फेंका जाता है। यह दूसरा पत्थर पहाड़ी के शिखर से कितनी दूर नीचे प्रथम पत्थर से आगे निकल जाएगा ?

Ans. $\frac{45}{4} \text{ m}$



1st
2nd

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

$$h = 20(t-1) + \frac{1}{2} g (t-1)^2$$

HW

4
Notes

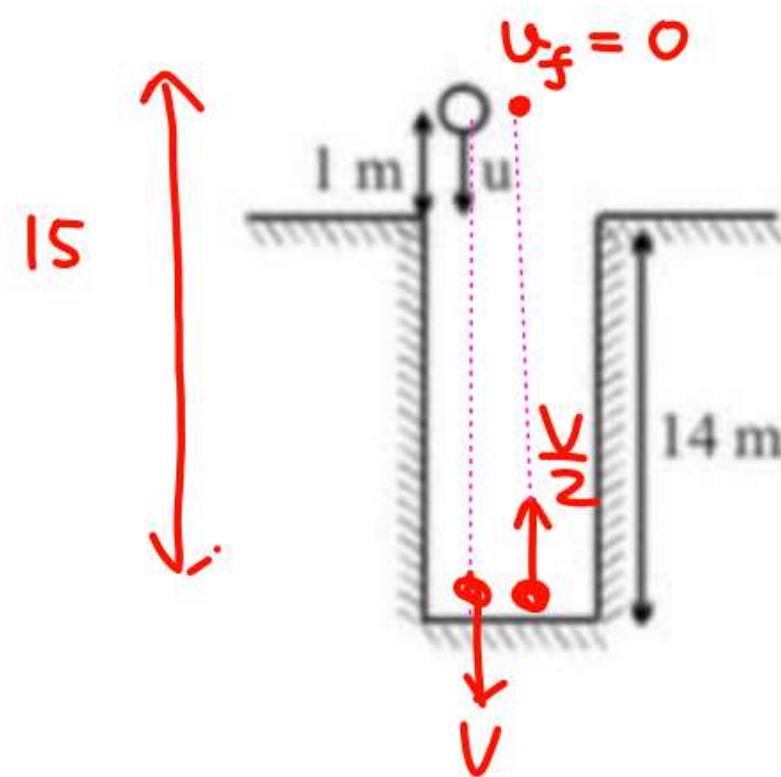
A boy throws a ball with speed u in a well of depth 14 m as shown. On bounce with bottom of the well the speed of the ball gets halved. What should be the minimum value of u (in m/s) such that the ball may be able to reach his hand again? It is given that his hands are at 1 m height from top of the well while throwing and catching.

एक लड़का किसी गेंद को u चाल से चित्रानुसार 14 m गहरे कुँए में फेंकता है। कुँए के तल से टकराने पर गेंद की चाल आधी हो जाती है। u (m/s में) का न्यूनतम मान क्या होना चाहिये ताकि गेंद पुनः उसके हाथों तक पहुँच सके? गेंद को फेंकते तथा पकड़ते समय लड़के के हाथ कुँए के शीर्ष से 1 m की ऊँचाई पर होते हैं।

$$15 = \frac{(v/2)^2}{2 \times 10}$$

$$15 = \frac{v^2}{80}$$

$$v^2 = 15 \times 80$$



$$v^2 = u^2 + 2 \times 10 \times 15$$

$$u^2 = v^2 - 300$$

$$u^2 = 1200 - 300$$

$$u^2 = 900$$

$$u = 30$$

Ans. 30

5
notes

The engine of a motorcycle can produce a maximum acceleration 5 m/s^2 . Its brakes can produce a maximum retardation 10 m/s^2 . If motorcyclist start from point A and reach at point B. What is the minimum time in which it can cover if distance between A and B is 1.5 km. (Given : that motorcycle comes to rest at B)

किसी वाहन का इंजन 5 ms^{-2} का अधिकतम त्वरण उत्पन्न कर सकता है। इसके ब्रेक 10 ms^{-2} का अधिकतम मंदन उत्पन्न कर सकते हैं। वाहन बिन्दु A से गति प्रारम्भ करता है तथा बिन्दु B तक पहुँचता है। वह न्यूनतम समय जिसमें यह A व B के मध्य 1.5 km की दूरी तय कर लेगा, है- (दिया है : वाहन बिन्दु B पर विरामावस्था में आ जाता है।)

(A) 30 sec

(B) 15 sec

(C) 10 sec

(D) 5 sec

Ans. (A)

$$\text{Area} = 1500 = \frac{1}{2} \times \frac{3t}{2} \times 5t$$

$$t = 20$$

$$\text{total time} = t + \frac{t}{2} = \frac{3t}{2} = \frac{3 \times 20}{2} = 30 \text{ sec}$$



⑥

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)

$$0 + \frac{1}{2} \times 10 \times 3^2 = 0 + \frac{1}{2} (2n-1) \times 10$$

$$n=5$$

7

A ball is thrown vertically upward with initial velocity 30 m/sec. What will be its position vector at time $t = 5$ sec taking origin at the point of projection, vertical up as positive y-axis and horizontal as x-axis:-

एक गेंद को प्रारम्भिक वेग 30 m/sec से ऊर्ध्वाधर ऊपर की ओर फेंका जाता है। प्रक्षेपण बिन्दु को मूलबिन्दु, ऊर्ध्वाधर ऊपर की दिशा को धनात्मक y-अक्ष तथा क्षैतिज को x-अक्ष मानने पर समय $t = 5$ sec पर इसका स्थिति सदिश होगा :-

(A) (0, 25)

(B) (0, 20)

(C) (0, 45)

(D) (0, 5)

Ans. (A)

$$y = 30 \times 5 - \frac{1}{2} \times 10 \times 5^2$$
$$= 150 - 125 = 25$$



8

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)

$$x = u(t-2) + a(t-2)^2$$

$$v = u + a \cdot 2(t-2) \times 1$$

$$v = u + 2a(t-2)$$

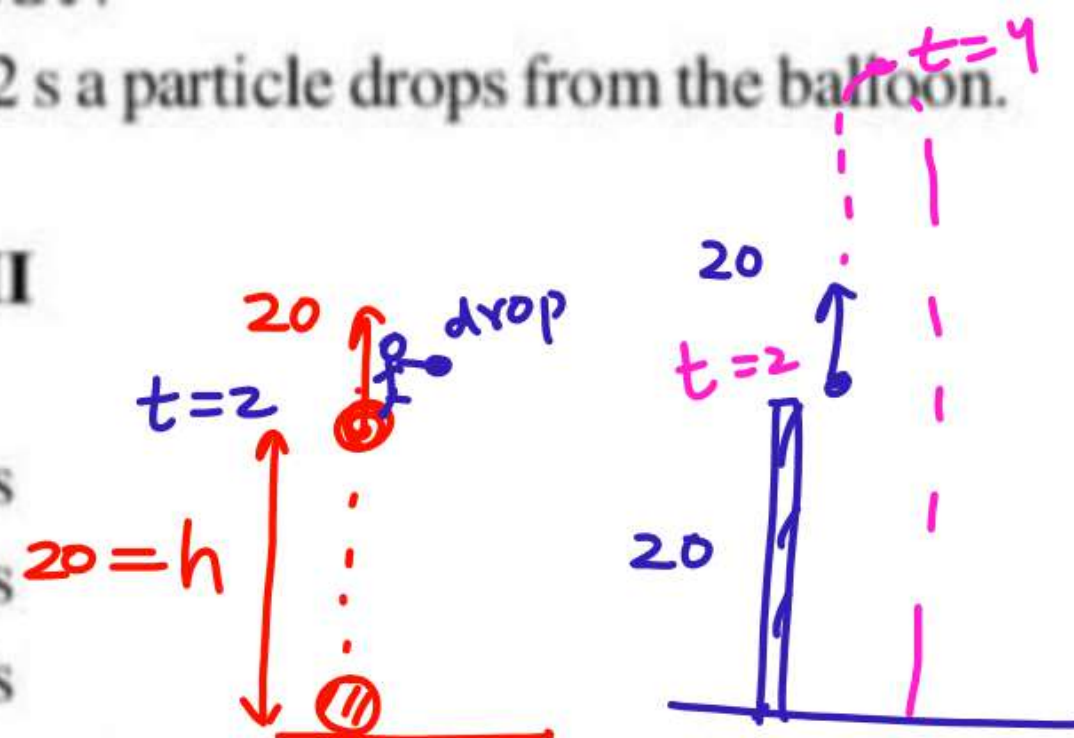
$$a_c = 0 + 2a(1)$$

$$\frac{1}{2} 2a(t-2)^2$$

10 A balloon rises up with constant net acceleration of 10 m/s^2 . After 2 s a particle drops from the balloon. After further 2 s match the following : ($g = 10 \text{ m/s}^2$)

- Column-I**
- (A) Height of particle from ground
 (B) Speed of particle (P)
 (C) Displacement of Particle
 (D) Acceleration of particle Q

- Column-II**
- (P) Zero
 (Q) 10 SI units
 (R) 40 SI units
 (S) 20 SI units



एक गुब्बारा 10 m/s^2 के नियत त्वरण के साथ ऊपर उठता है। 2 s पश्चात् गुब्बारे से एक कण गिराया जाता है। अगले 2s पश्चात् के लिये निम्न का मिलान SI मात्रकों में कीजिये। ($g = 10 \text{ m/s}^2$)

- स्तम्भ-I**
- (A) जमीन से कण की ऊँचाई
 (B) कण की चाल
 (C) कण का विस्थापन
 (D) कण का त्वरण

- स्तम्भ-II (S.I. इकाई)**
- (P) 0
 (Q) 10
 (R) 40
 (S) 20

$$(20)^2 = 0 + 2 \times 10 \times h$$

$$h = 20$$

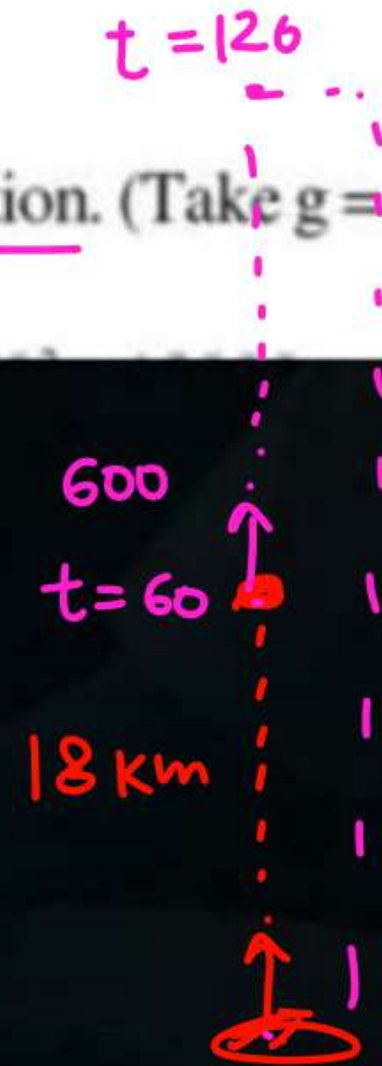
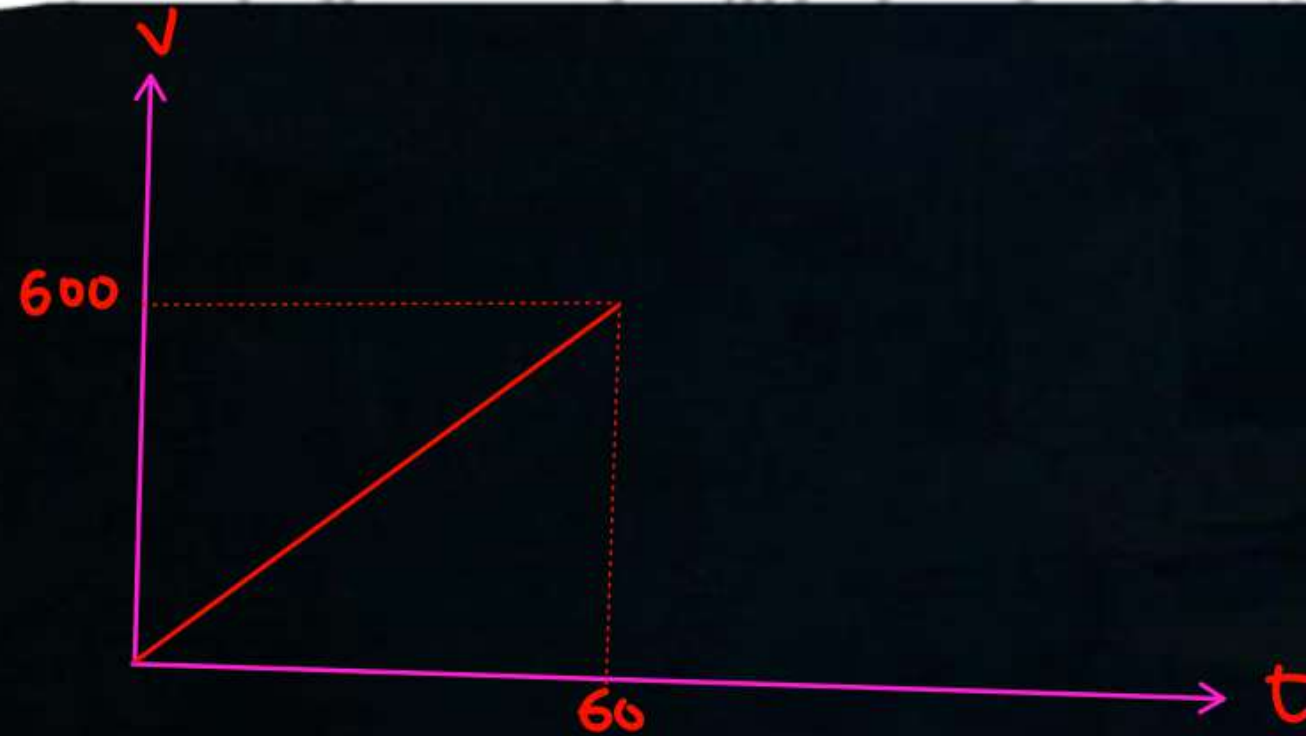
Ans. (A) - (R); (B) - (P); (C) - (S); (D) - (Q)

9 A rocket is fired vertically up from the ground with a resultant vertical acceleration of 10 m/s^2 . The fuel is finished in 1 minute and it continues to move up.

(a) What is the maximum height reached?

(b) After finishing fuel, calculate the time for which it continues its upwards motion. (Take $g = 10 \text{ m/s}^2$)

$$\frac{1}{2} \times 60 \times 600 \\ = \underline{18000}$$



10

A particle is thrown with a speed 60 ms^{-1} at an angle 60° to the horizontal. When the particle makes an angle 30° with the horizontal in downward direction, its speed at that instant is v . What is the value of v^2 in SI units ?

एक कण को क्षैतिज से 60° कोण बनाते हुये 60 ms^{-1} की चाल से फेंका जाता है। जब कण क्षैतिज के साथ नीचे की ओर 30° कोण बनाता है तो उस क्षण पर इसकी चाल v है। v^2 का मान क्या है ?

Ans. 1200



$$V = \frac{60}{\sqrt{3}}$$

$$V^2 = \frac{60 \times 60}{3} = 1200$$

$$60 \cos 60 = V \cos 30$$

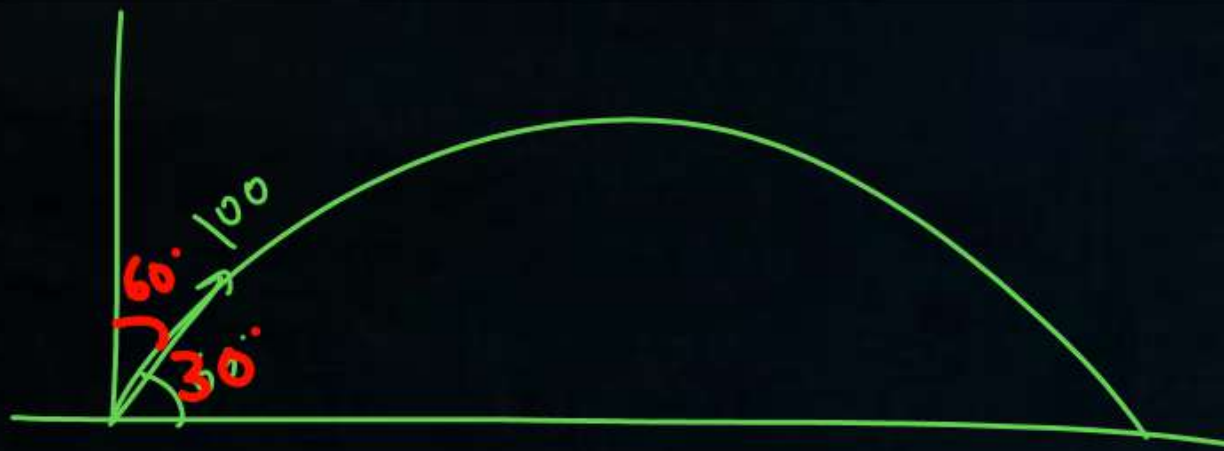
$$30 = v \times \frac{\sqrt{3}}{2}$$

11

A particle is projected upwards with a velocity of 100 m/s at an angle of 60° with the vertical. Find the time when the particle will move perpendicular to its initial direction, taking $g = 10 \text{ m/s}^2$.

एक कण को ऊर्ध्वाधर से 60° कोण पर 100 m/s वेग से ऊपर की ओर प्रक्षेपित किया जाता है। वह समय ज्ञात कीजिए जब कण अपनी प्रारम्भिक दिशा के लम्बवत् गति करेगा। ($g = 10 \text{ m/s}^2$)

Ans. 20 s



$$\vec{u} = 50\sqrt{3}\hat{i} + 50\hat{j}$$

$$\vec{v} = 50\sqrt{3}\hat{i} + (50 - 10t)\hat{j}$$

$$\vec{u} \cdot \vec{v} = 0$$

$$7500 + 2500 - 500t = 0$$

$$t = 20$$

Air Resistance वाला सवाल.



Q A particle is projected upward from ground 120 m/s . If air resistance is consider due to which it gives extra acc of 2 m/s^2 . find.

① h_{max}

② Time of flight

③ a_{upward}

④ a_{down}

⑤ $T_{\text{jane wala}} = T_{\text{up}}$

⑥ $T_{\text{aane wala}} = T_{\text{down}}$

\textcircled{Rm} & $\textcircled{7}$

$$\frac{T_{\text{जाने}}}{T_{\text{आने}}} = \frac{T_{\text{up}}}{T_{\text{down}}} = ?$$

Solⁿ

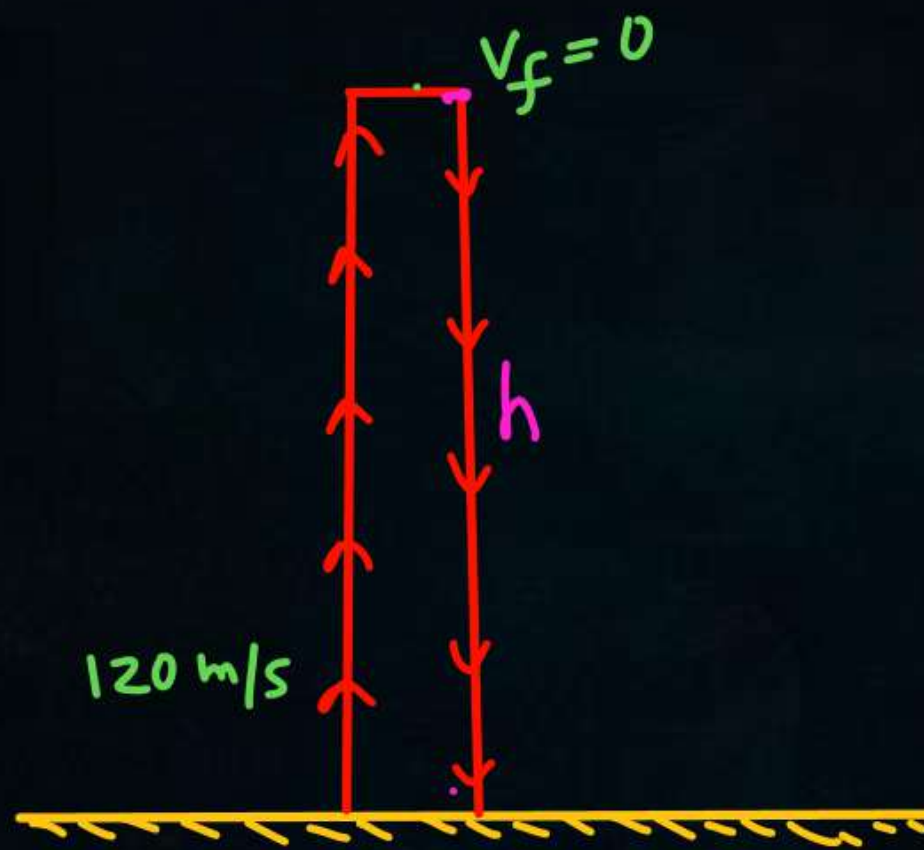
Upward journey

$$a = 10 + 2 = 12 \text{ (Downward)}$$

$$h_{\max} = \frac{(120)^2}{2 \times 12} = 600 \text{ m}$$

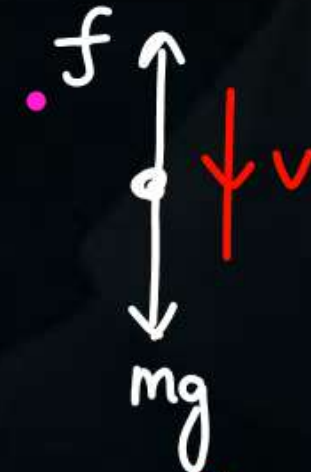
$$T_{\text{up}} = \frac{120}{12} = 10 = T_{\text{जाने}}$$

$$T_{\text{जाने}} < T_{\text{आने}}$$



Downward journey

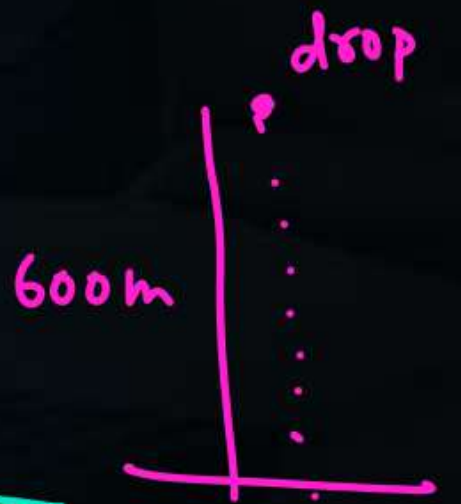
$$a = 10 - 2 = 8 \text{ (down)}$$



$$600 = 0 + \frac{1}{2} \times 8 \times t^2$$

$$t = \sqrt{\frac{1200}{8}} = \sqrt{150} = T_{\text{down}}$$

= T_{आने वाला}

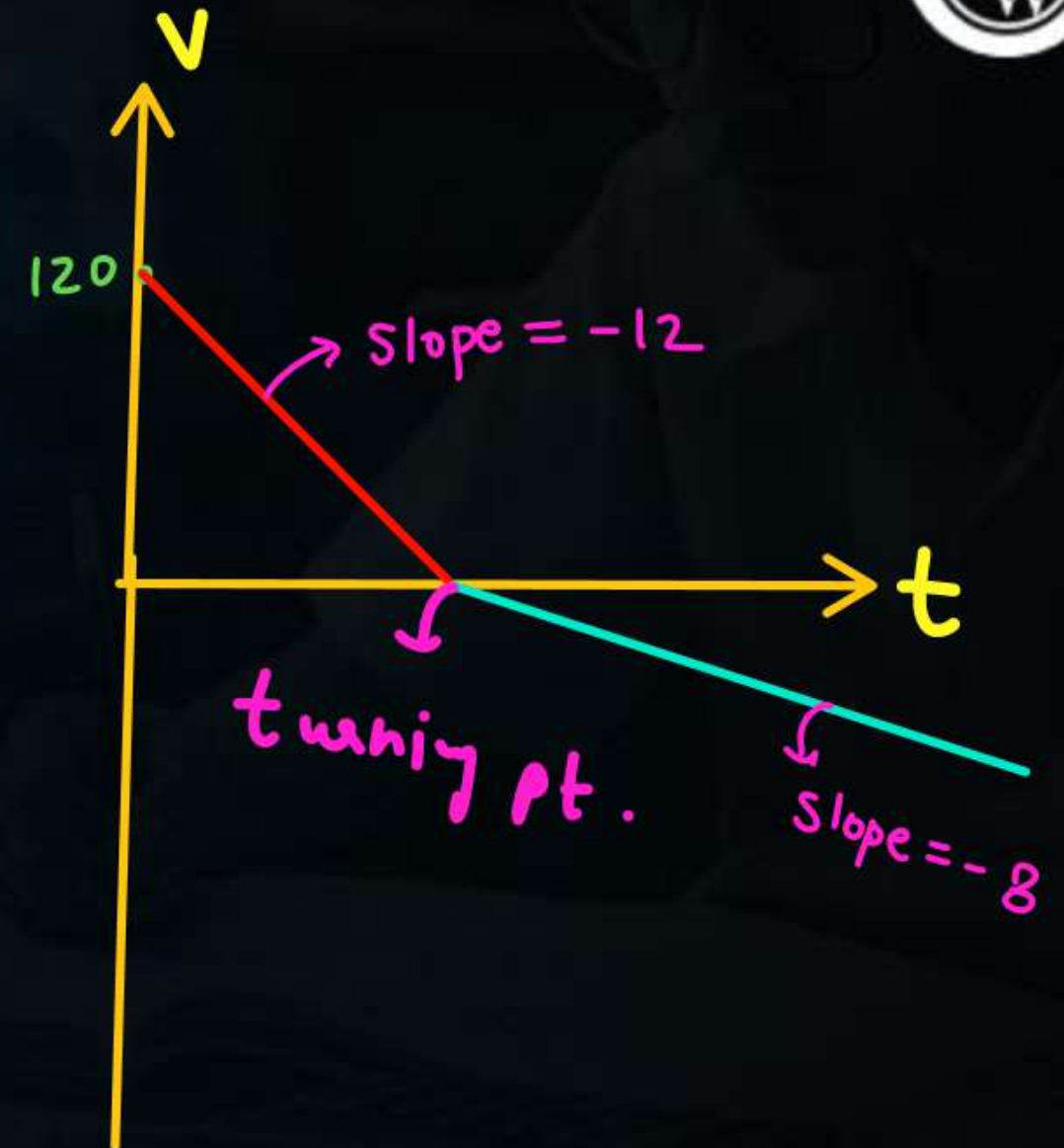


$$\text{Time of flight} = T_{\text{जाने}} + T_{\text{आने}} = 10 + \sqrt{150}$$

EXP 24 ET
* *

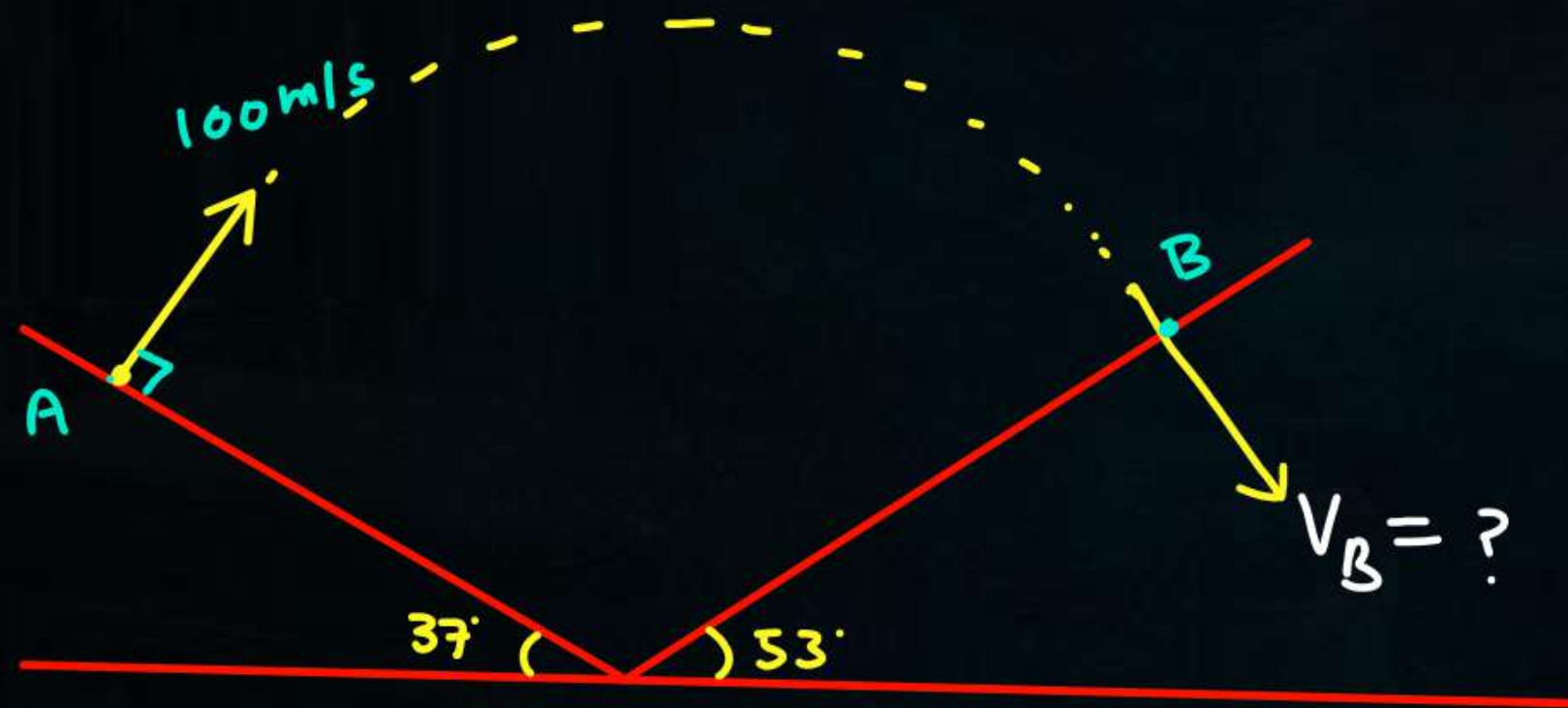
$$\frac{T_{up}}{T_{down}} = \frac{10}{\sqrt{150}} = \sqrt{\frac{100}{150}} = \sqrt{\frac{2}{3}}$$

$$\frac{T_{down}}{T_{up}} = \frac{\sqrt{3}}{\sqrt{2}}$$



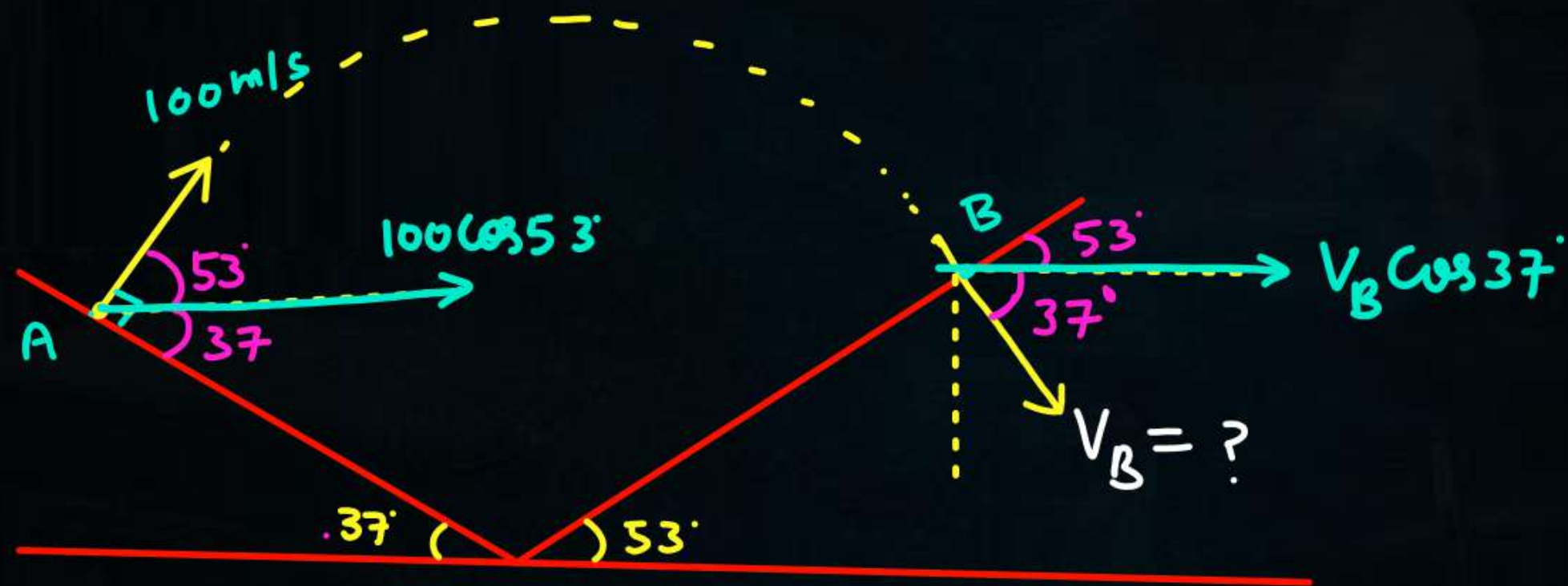
§ Repeat the above prob if $u = 240 \text{ m/s}$.

Q



A particle is projected with velocity 100 m/s perpendicularly from an inclined plane s.t it strikes another inclined plane perpendicularly at 'B' as shown in diagram. find V_B

Q

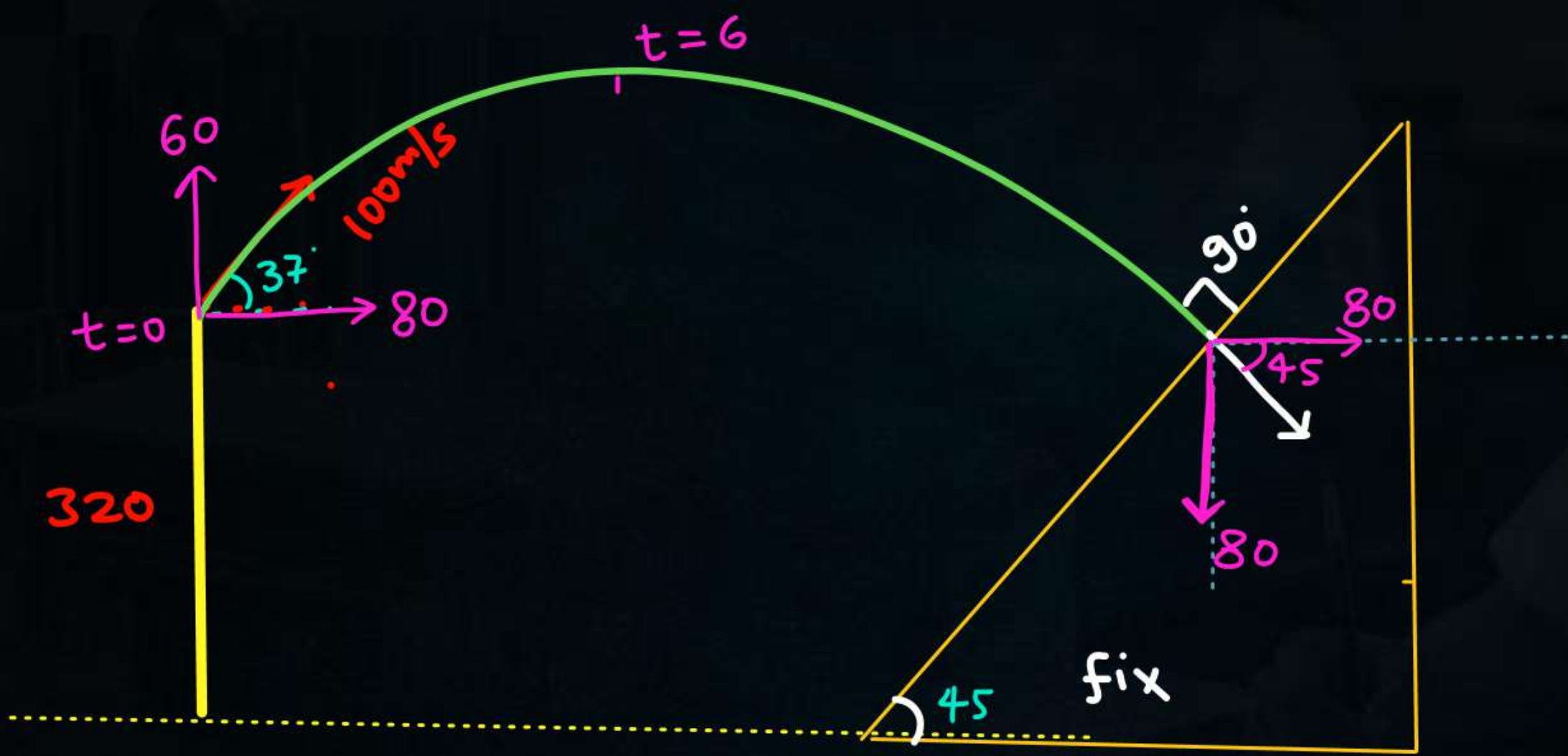


$$100 \cos 53 = V_B \cos 37.$$

$$100 \times \frac{3}{5} = V_B \times \frac{4}{5}$$

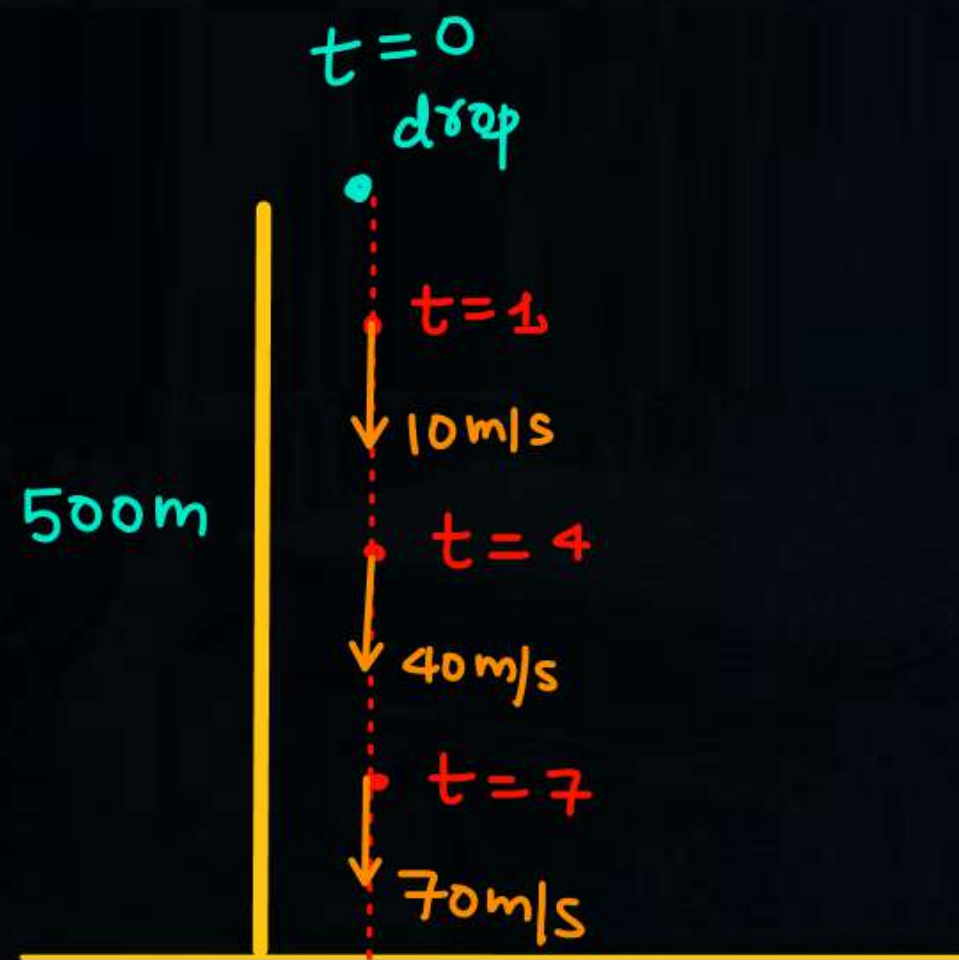
$$\boxed{V_B = 75}$$

SSSA
2



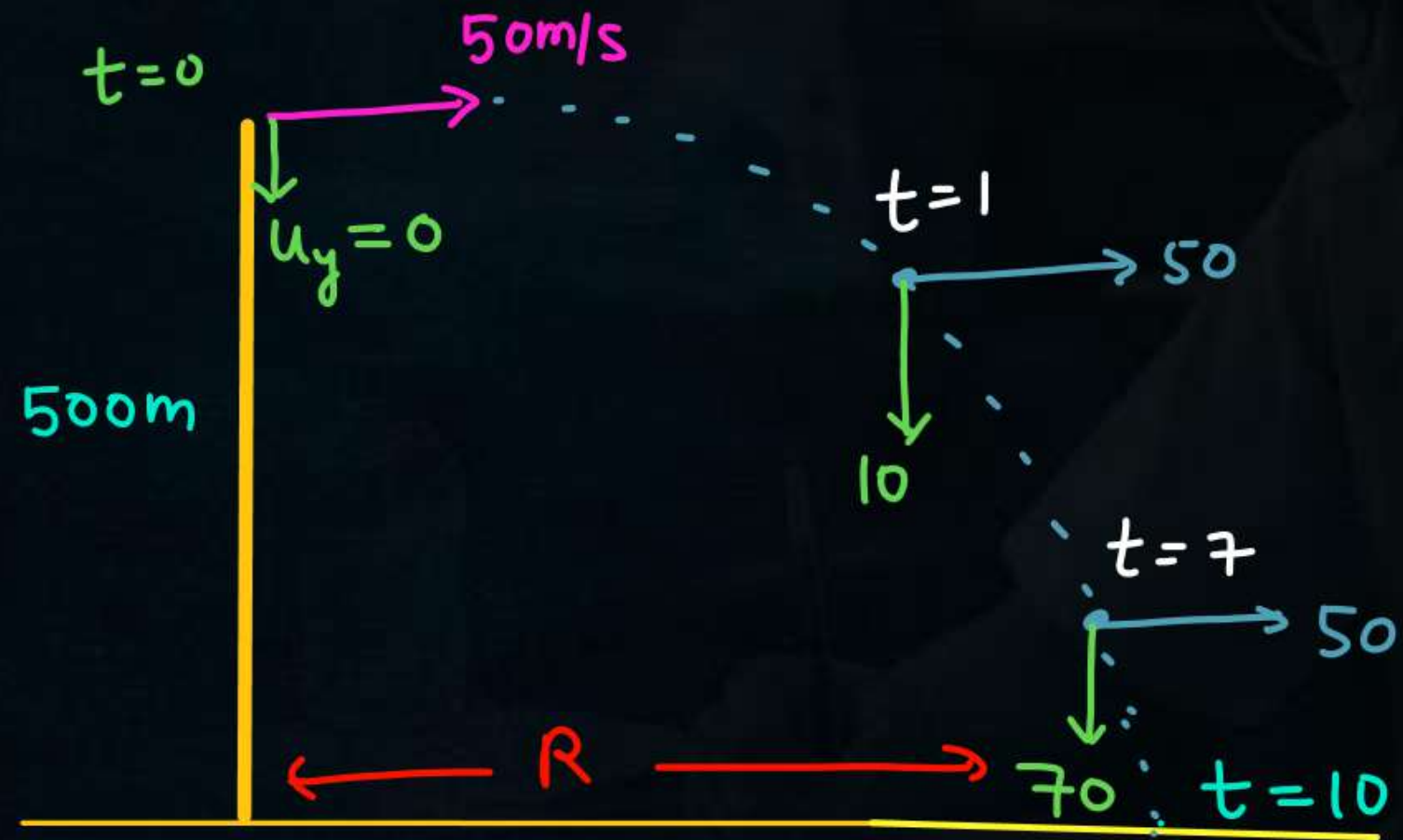
$$T = 6 + 8 = 14$$

Q



$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 500}{10}} = 10$$

Q



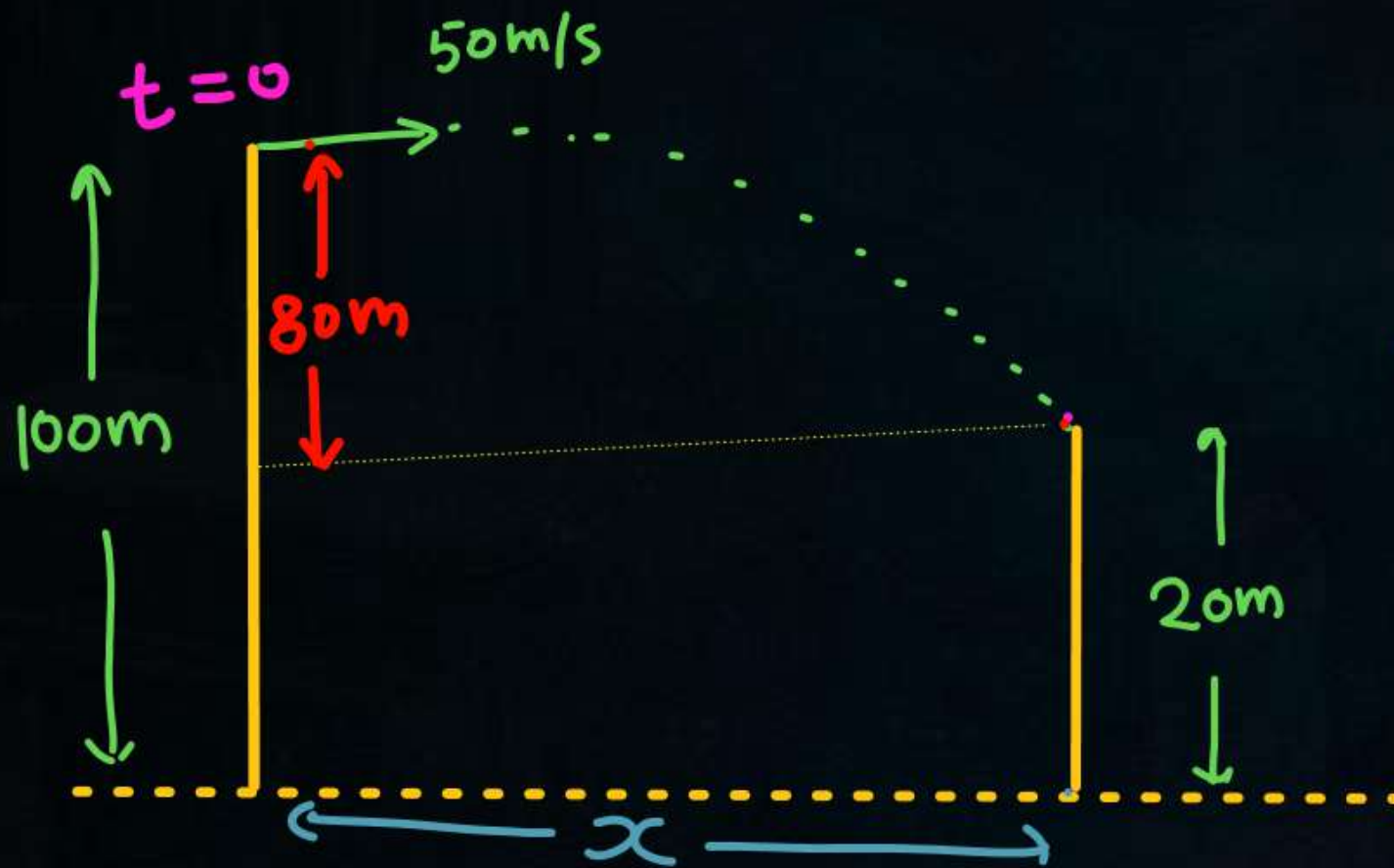
$$a_x = 0$$

$$t=1, \vec{v} = 50\hat{i} - 10\hat{j}$$

$$t=7, \vec{v} = 50\hat{i} - 70\hat{j}$$

$$T = \sqrt{\frac{2h}{g}} = 10, \quad R = 50 \times 10 = 500$$

Q



$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 80}{10}} = 4$$

$$x = 50 \times 4 = 200$$

^{****}
SKC

(jab x ke sadh ho y ko bhool jao)
aur " y " " to x " " ')

Air Resistance वाला सवाल. H.W



Q A particle is projected upward from ground 240 m/s . If air resistance is consider due to which it gives extra acc of 2 m/s^2 . find.

① h_{max}

② Time of flight

③ a_{upward}

④ a_{down}

⑤ $T_{\text{jane wala}} = T_{\text{up}}$

⑥ $T_{\text{aane wala}} = T_{\text{down}}$

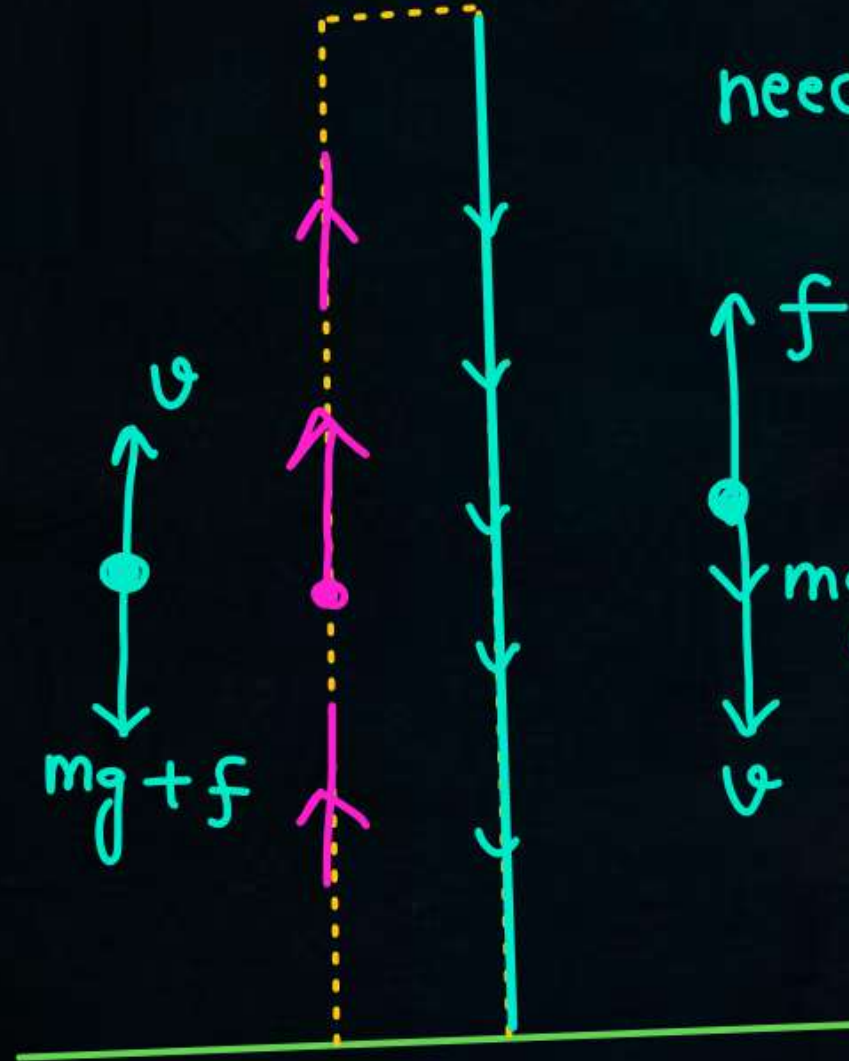
⑦ R^m

$$\frac{T_{\text{जाने}}}{T_{\text{आने}}} = \frac{T_{\text{up}}}{T_{\text{down}}} = ?$$

SKC Agar kuch na bola jaye to air resist. ki wajah se force hum velocity ke opposite mange.

Uper jate wakt

$$a = 10 + 2 = 12$$



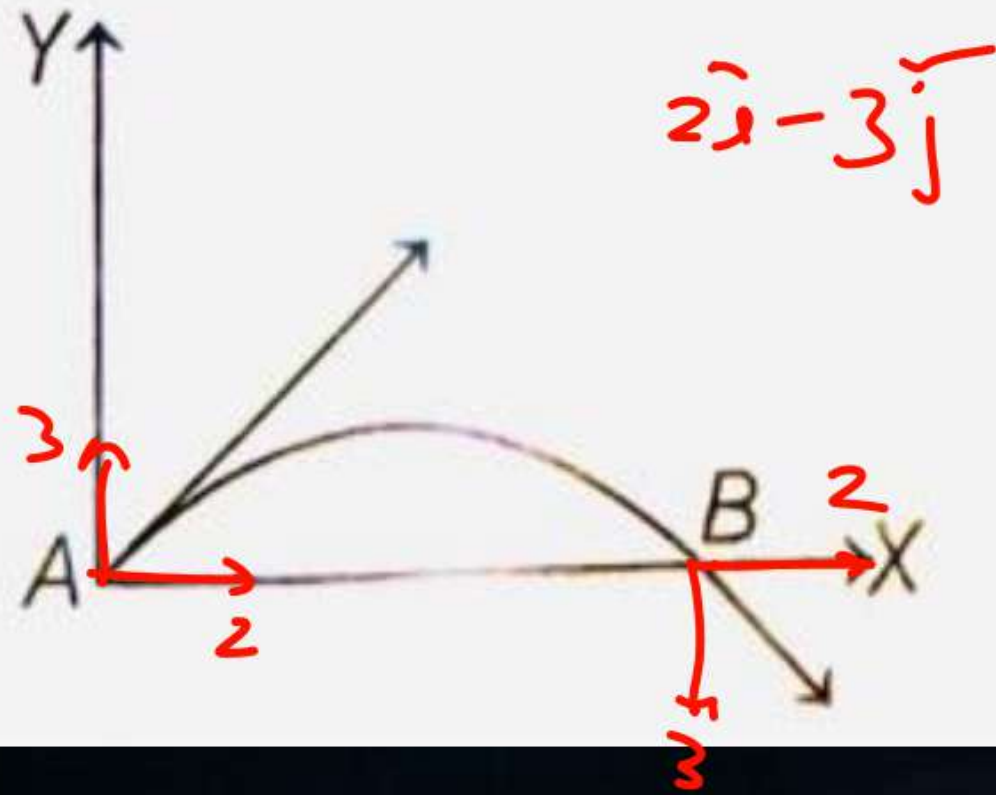
neeche jate wakt



$$a_{\text{नीचे}} = 10 - 2 = 8$$

06 The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. Its velocity (in m/s) at point B is

[NEET 2013]



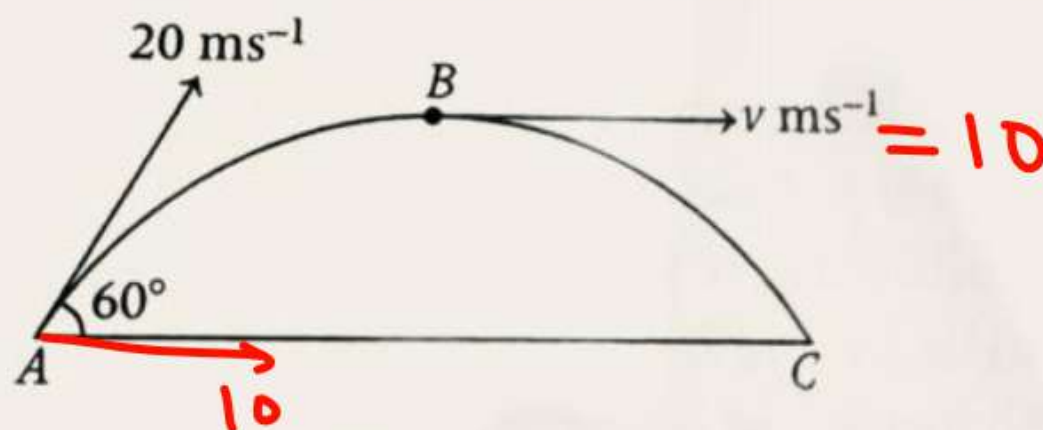
01 A bullet is fired from a gun at the speed of 280 m s^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is ($g = 9.8 \text{ m s}^{-2}$, $\sin 30^\circ = 0.5$)

- (a) 2000 m (b) 1000 m (c) 3000 m (d) 2800 m

[NCERT (New) Pg. 39, NEET 2023]

02 A ball is projected from point A with velocity 20 ms^{-1} at an angle 60° to the horizontal direction. At the highest point B of the path (as shown in figure), the velocity $v \text{ ms}^{-1}$ of the ball will be

[NCERT (New) Pg. 38, NEET 2023 Manipur]



- (a) 20 (b) $10\sqrt{3}$ (c) Zero (d) 10

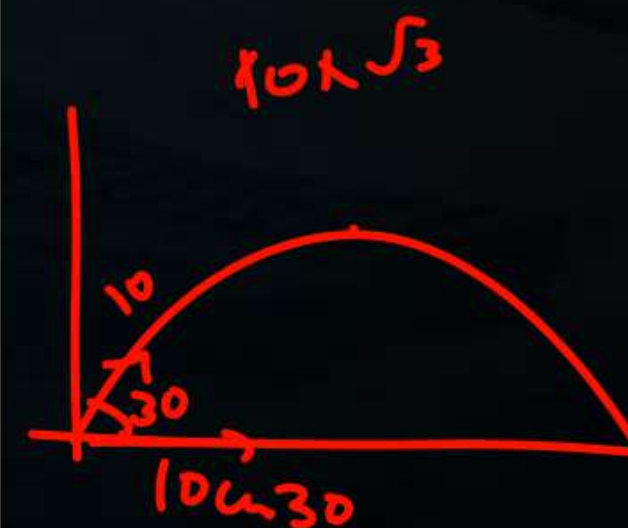
03 A ball is projected with a velocity, 10 ms^{-1} at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be

[NCERT (New), Pg 38 NEET 2022 Re]

- (a) 10 ms^{-1} (b) Zero (c) $5\sqrt{3} \text{ ms}^{-1}$ (d) 5 ms^{-1}



$$\frac{(140)^2}{2g}$$



sssq

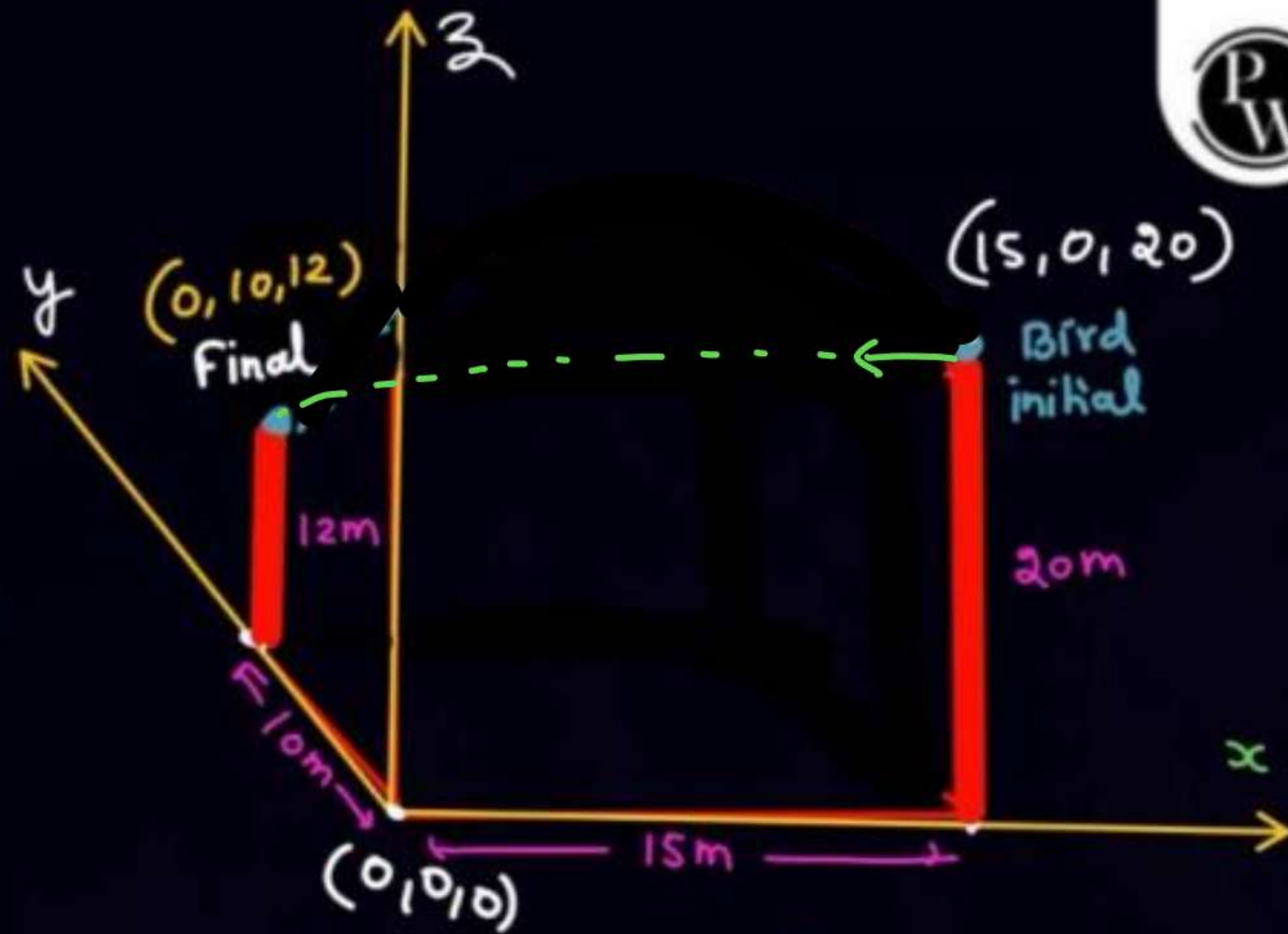
$$t = \sqrt{\frac{2 \times 8}{10}}$$

L1

$$\vec{d} = -15\hat{i} + 10\hat{j} - 8\hat{k}$$

-15, 10, -8

2110121



Sol. Displacement = 6 (mag)

$$\text{Average velocity} = \frac{6}{10}$$

$$\text{Distance} = 10 + 4 = 14$$

$$\text{Average speed} = \frac{14}{10}$$

Q. $x = 0$ $t = 0$ $x = 10$ $t = 5 \text{ sec}$

Sol. Distance = 10

$$\text{Average speed} = \frac{10}{5}$$

$$\text{Displacement} = 10 \text{ (Magnitude)}$$

$$\text{Average velocity} = \frac{10}{5} \text{ (Magnitude)}$$

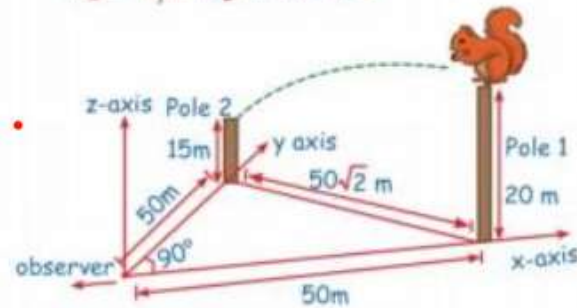
★ Agar particle ne apni direction nahi badli

★ distance = |displacement|

★ Avg speed = |Avg velocity|



Q. A small squirrel jumps from pole 1 to pole 2 and took 3 sec. What is average velocity vector of squirrel? If average velocity vector is expressed as $v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$, express your answer as sum of magnitudes of its components $|v_x| + |v_y| + |v_z|$ in unit m/s.



Sol. Initial coordinate is (50, 0, 20)

Final coordinate is (0, 50, 15)

$$\text{Displacement} = -50\hat{i} + 50\hat{j} - 5\hat{k}$$

$$\text{Average velocity} = \frac{-50\hat{i} + 50\hat{j} - 5\hat{k}}{3}$$

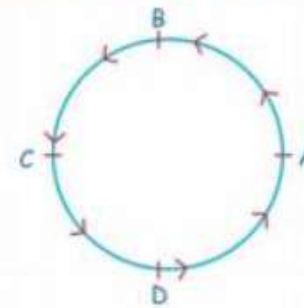
$$= -\frac{50}{3}\hat{i} + \frac{50}{3}\hat{j} - \frac{5}{3}\hat{k}$$

$$\frac{50}{3} + \frac{50}{3} + \frac{5}{3} = \frac{105}{3} = 35 \text{ m/s}$$

मुझे पता है कुछ google boys ने google पर search करके answer 105 निकाला होगा..... अबे सवाल रीक से पढ़ लिया करो



Q. A particle is performing uniform circular motion with constant speed v_1 having time period T Anticlockwise. Find avg velocity and avg speed.



Sol.

	Avg Speed	Avg Velocity
A → B	$\frac{2\pi R / 4}{T / 4} = \frac{2\pi R}{T}$	$\frac{R\sqrt{2}}{T / 4}$
A → B → C	$\frac{\pi R}{T / 2} = \frac{2\pi R}{T}$	$\frac{2R}{T / 2}$
A → B → C → D	$\frac{(3/4)2\pi R}{3T / 4} = \frac{2\pi R}{T}$	$\frac{R\sqrt{2}}{3T / 4}$
A → B → C → D → A	$\frac{2\pi R}{T}$	0

Q. A car is moving along x-axis, in 1st four hour it travel with speed 50 km/hr, in next 2 hours it move with 70 km/hr and in last part of journey it travel for 5 hour with 80 km/hr. Find avg speed.

Sol. Avg speed = $\frac{\text{total distance}}{\text{Time}}$

$$= \frac{d_1 + d_2 + d_3}{t_1 + t_2 + t_3} = \frac{50 \times 4 + 70 \times 2 + 80 \times 5}{4 + 2 + 5}$$

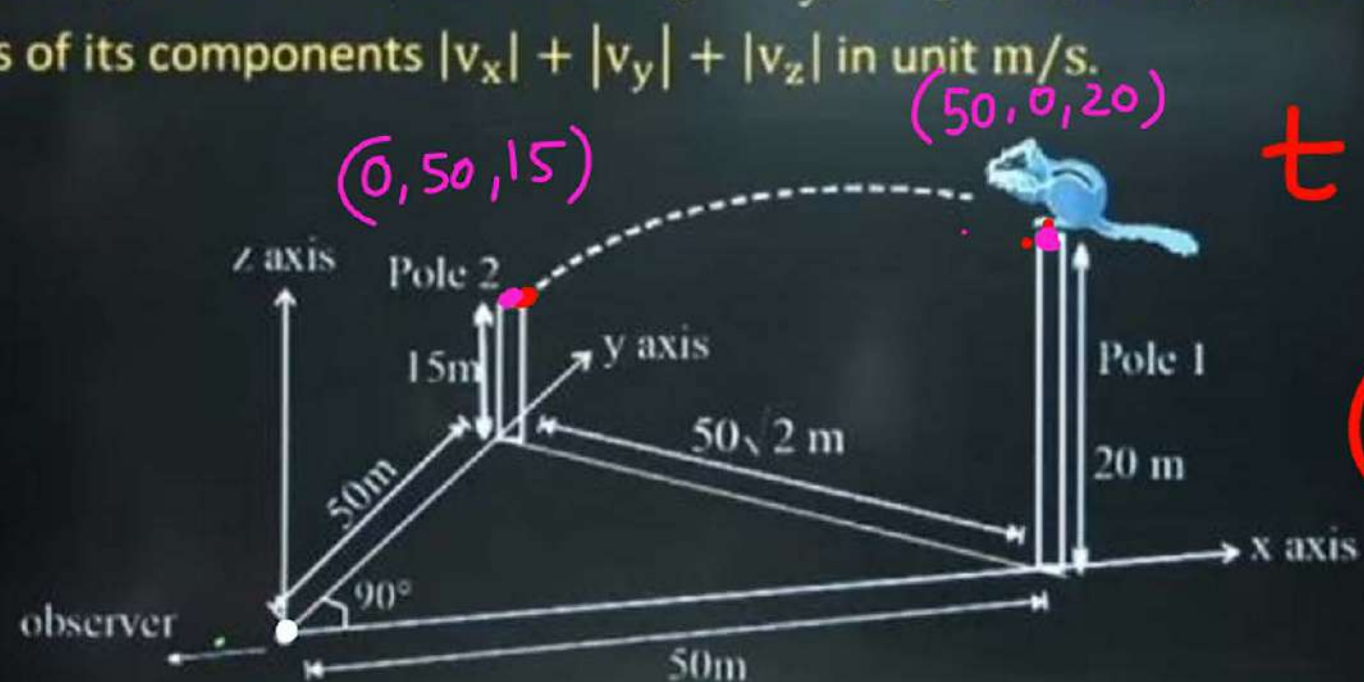
M/w

Question -18

$$\vec{d} = -50\hat{i} + 50\hat{j} - 5\hat{j} \quad \langle \vec{v} \rangle = -50\hat{i} + 50\hat{j} - 5\hat{j}$$



A small squirrel jumps from pole 1 to pole 2 in horizontal direction. Squirrels is observed by a very small observer at origin. What is average velocity vector of squirrel average velocity vector is expressed as $v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$, express your answer as sum magnitudes of its components $|v_x| + |v_y| + |v_z|$ in unit m/s.



$$t = \sqrt{\frac{2 \times 5}{10}}$$

$t = 1$

$$\frac{50}{50} \frac{50}{5} = 105$$

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Home work

- Solve all ques of today class
- KPP-16 (will be uploaded today even)
- module → will start from tomorrow.



@SALEEMSIR_PW



THANK
YOU