YAKEEN NEET 2.0

2026

[redacted]

Motion in a Straight Line

PHYSICS (KPP -13) [redacted]

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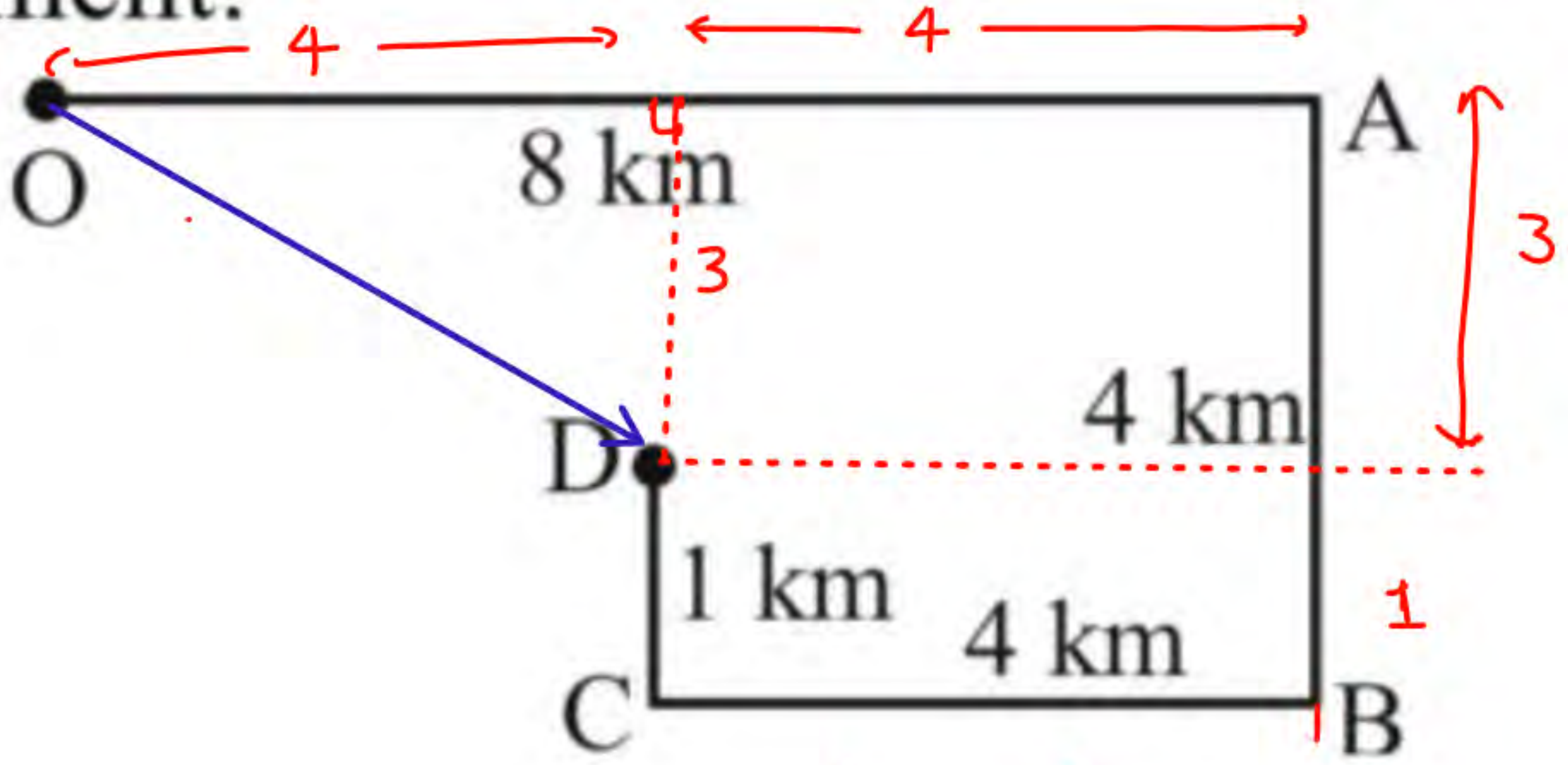
Motion in a Straight Line (KPP -13)

1. A car moves from O to D along the path $OABCD$ shown in figure. What is distance travelled and net displacement.



(1) 16, 5 (2) 17, 5

(3) 20, 4 (4) 15, 3

2

2. Which of the following statements is incorrect?

(1) Displacement is independent of the choice of origin of the axis.

(2) Displacement may or may not be equal to the distance travelled.

(3) When a particle returns to its starting point, its displacement is ~~not~~ zero.

(4) Displacement does not tell the nature of the actual motion of a particle between the points

3

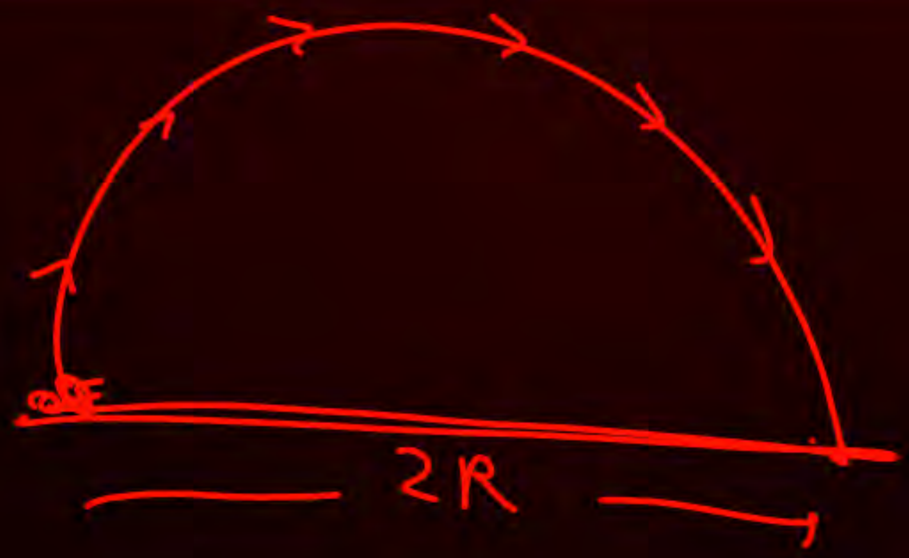
3. An old man goes for morning walk on a semi-circular track of radius 40 m; if he starts from one end of the track and reaches to other end, the distance covered by the man and his displacement will respectively be

$\pi R, 2R$

(1) 126 m, 80 m (2) 80 m, 126 m

(3) 80 m, 252 m (4) 252 m, 80 m

1



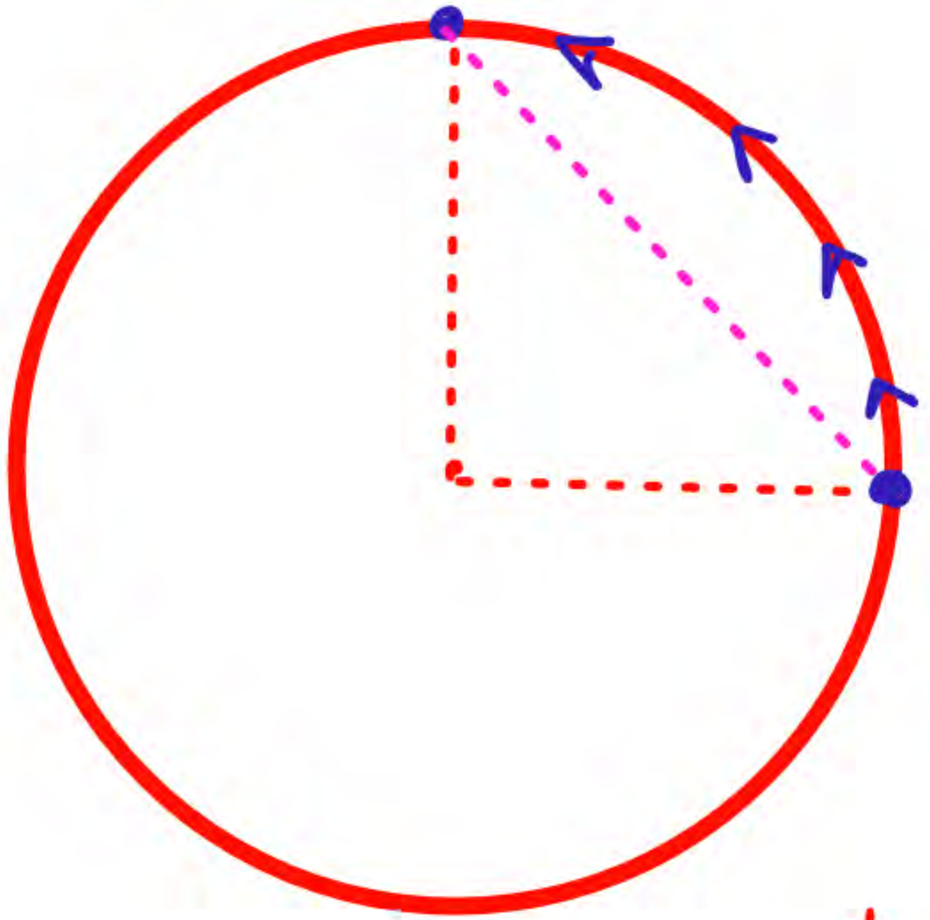
4. A body covered a distance of L m along a curved path of a quarter circle. The ratio of distance to displacement is

(1) $\frac{\pi}{2\sqrt{2}}$ $\quad \frac{2\pi R}{4} = L$

(2) $\frac{2\sqrt{2}}{\pi}$

(3) $\frac{\pi}{\sqrt{2}}$ $\quad \frac{2\pi R}{4R\sqrt{2}}$ $\quad \frac{2\pi}{4\sqrt{2}} = \frac{\pi}{2\sqrt{2}}$

(4) $\frac{\sqrt{2}}{\pi}$



1

$30\hat{j} + 20\hat{i} - 30\hat{i} - 30\hat{j} = -10\hat{i}$

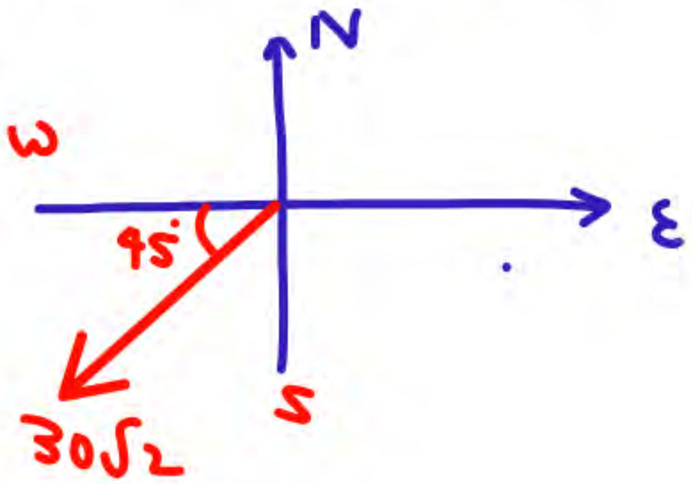
5. A person moves 30 m north and then 20 m towards east and finally $30\sqrt{2}$ m in south-west direction. The displacement of the person from the origin will be

(1) 10 m along north

(2) 10 m long south

(3) 10 m along west

(4) Zero



$-30\hat{i} - 30\hat{j}$

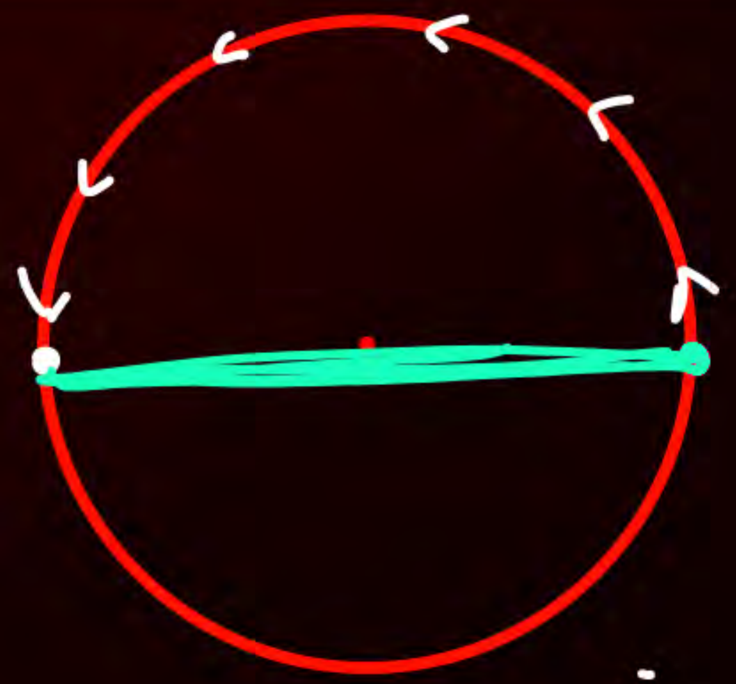
3

6. An athlete participates in a race now he is moving on a circular track of radius 80 m completes half a revolution in 20 s. Its average velocity is $= \frac{2R}{20} = \frac{R}{10}$

(1) 8 m/s (2) 16 m/s

(3) 10 m/s (4) 12 m/s

1



7. The displacement of a particle, starting from rest (at $t = 0$) is given by $s = 6t^2 - t^3$.

The time in seconds at which the particle will obtain zero velocity again is:

(1) 2 (2) 4

(3) 6 (4) 8

$v = 12t - 3t^2 = 0$

$4t - t^2 = 0$

$t(4-t) = 0$

$t = 0, \quad t = 4$

2

8. The displacement of a body along x-axis depends on time as $\sqrt{x} = 3t + 5$. Then the velocity of body:

(1) Increase with time

(2) Independent of time

(3) Decrease with time

(4) None of these

$x = (3t+5)^2$

$x = 9t^2 + 25 + 30t$

$v = 18t + 0 + 30$

$\boxed{v = 18t + 30}$

$a = 18$

1

9. A particle is moving along x-axis such that $x = 2 - 5t + 6t^2$. What is acceleration of the particle when its velocity is zero?

(1) Zero

(2) $12\ m/s^2$

(3) $-5\ m/s^2$

(4) $5/12\ m/s^2$

$v = -5 + 12t$

$a = 0 + 12 = 12$

$v = 0 - 5 + 12t = 0$

2

$t = \frac{5}{12}$

10. The displacement of a particle is given by $y = a + bt + ct^2 - dt^4$. The initial velocity and initial acceleration are respectively:

$t = 0$

(1) $b, -4d$ (2) $-b, 2d$

(3) $b, 2c$ (4) $2c, -4d$

$v = b + 2ct - 4dt^3$

$a = 2c - 12dt^2$

3

11. A particle moves along a straight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4$ metres. The velocity when the acceleration is zero is:

$v = 3t^2 - 12t + 3$

$a = 6t - 12$

(1) 3 m/s
(2) –12 m/s

$a = 0, \ t = 2$

(3) 42 m/s
(4) –9 m/s

4

12. The displacement of a particle is given by $y = a + bt + ct^2 - dt^4$. The initial velocity and acceleration are respectively:

(1) $b, -4d$

(2) $-b, 2c$

(3) $b, 2c$

(4) $2c, -4d$

3

13. A body is moving according to the equation $x = at + bt^2 - ct^3$. Then its instantaneous speed is given by: $v = a + 2bt - 3ct^2$

(1) $a + 2b + 3ct$ (2) $a + 2bt - 3ct^2$

(3) $2b - 6ct$ (4) None of these

2

14. A particle starts moving along x-axis from $t = 0$, its position varying with time as $x = 2t^3 - 3t^2 + 1$. What is the velocity when it passes through origin?

(1) $v = 0$ (2) $v = 1$

(3) $v = 5$ (4) $v = 3$

$v = 6t^2 - 6t$

$t = 1$, $v = 6 - 6 = 0$.

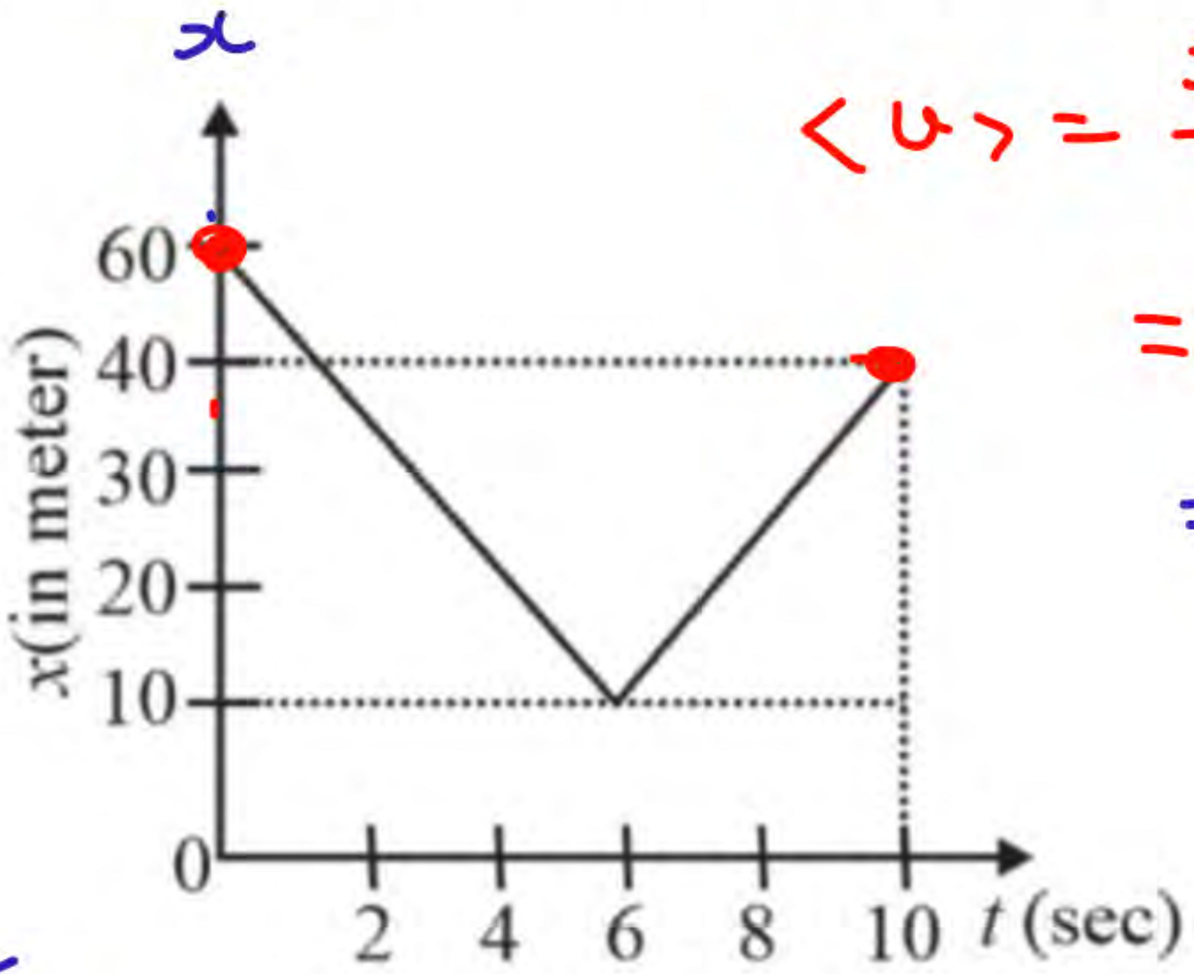
1

$x = 0$

$2t^3 - 3t^2 + 1 = 0$

$t = 1$

15. The figure shows the position time graph of a particle moving on a straight line path. What is the magnitude of average velocity of the particle over 10 second?



$$\langle v \rangle = \frac{x_f - x_i}{time}$$

$$= \frac{40-60}{10}$$

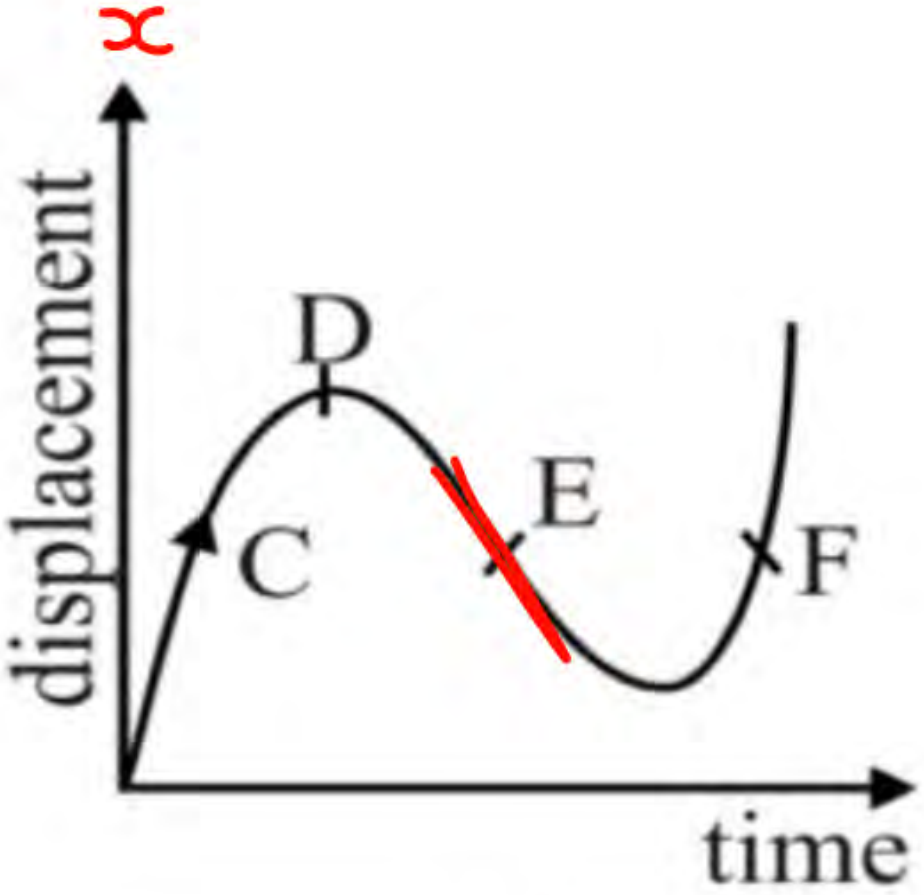
$$= -2$$

(1) 2 m/s (2) 4 m/s

(3) 6 m/s (4) 8 m/s

1

16. The displacement-time graph of a moving particle is shown. The instantaneous velocity of the particle is negative at the point:

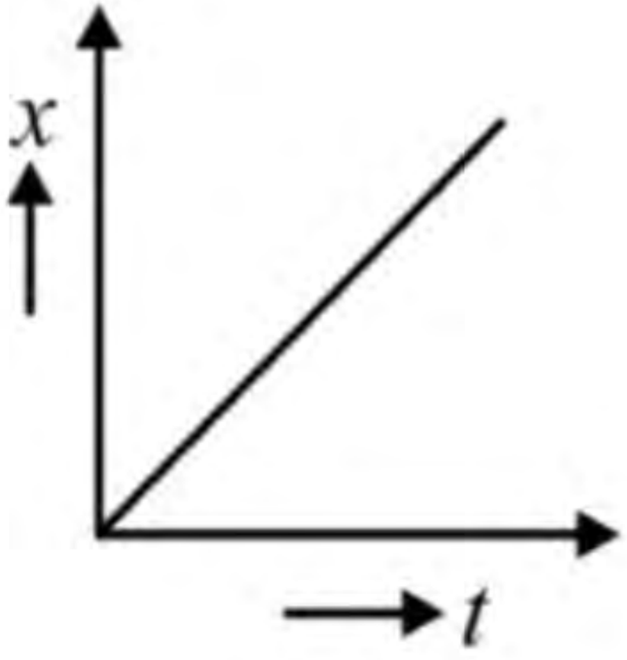


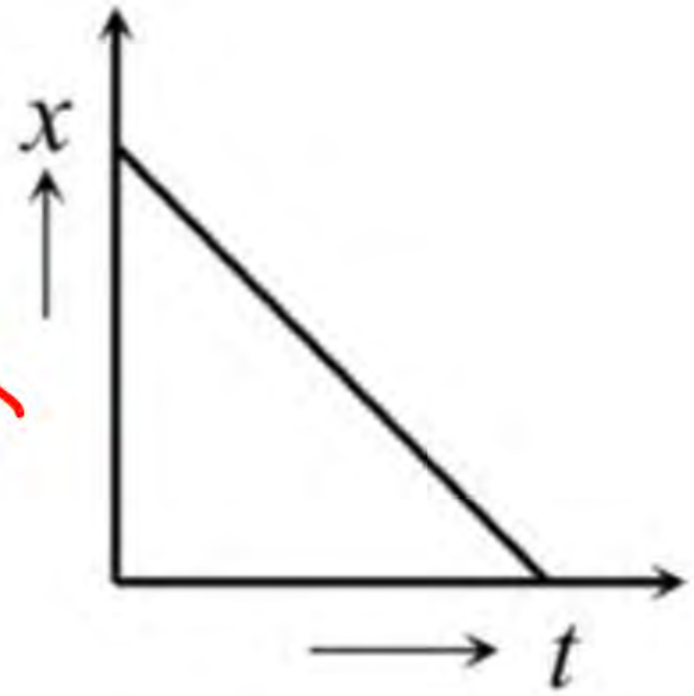
(1) D (2) F

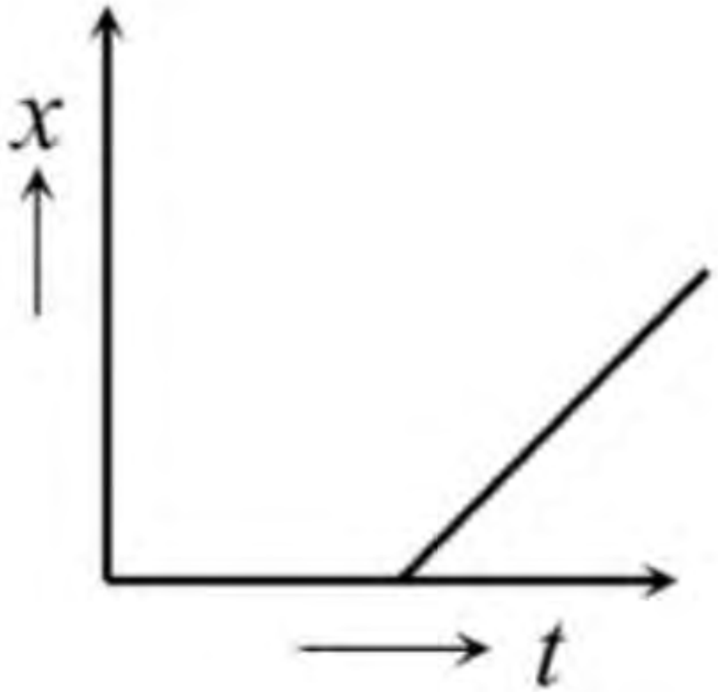
(3) C (4) E

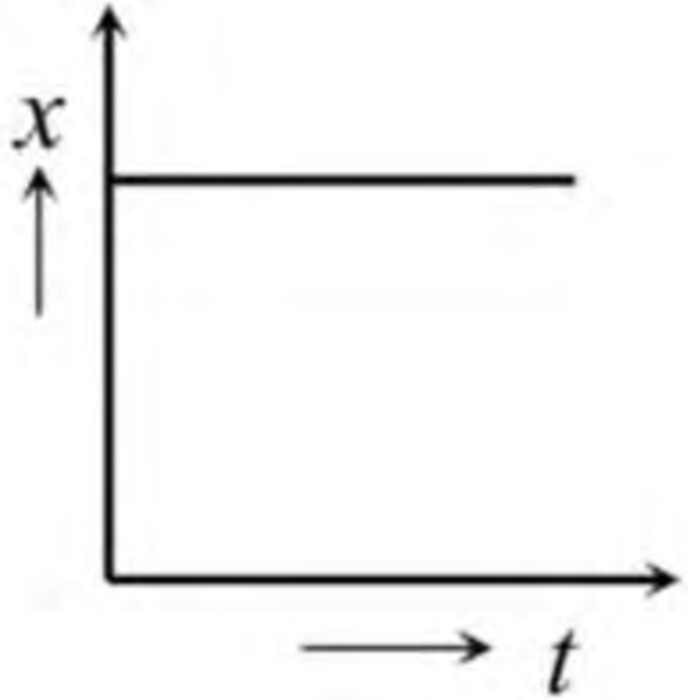
4

17. Which of the following can not be the distance time graph

(1) 

(2) 

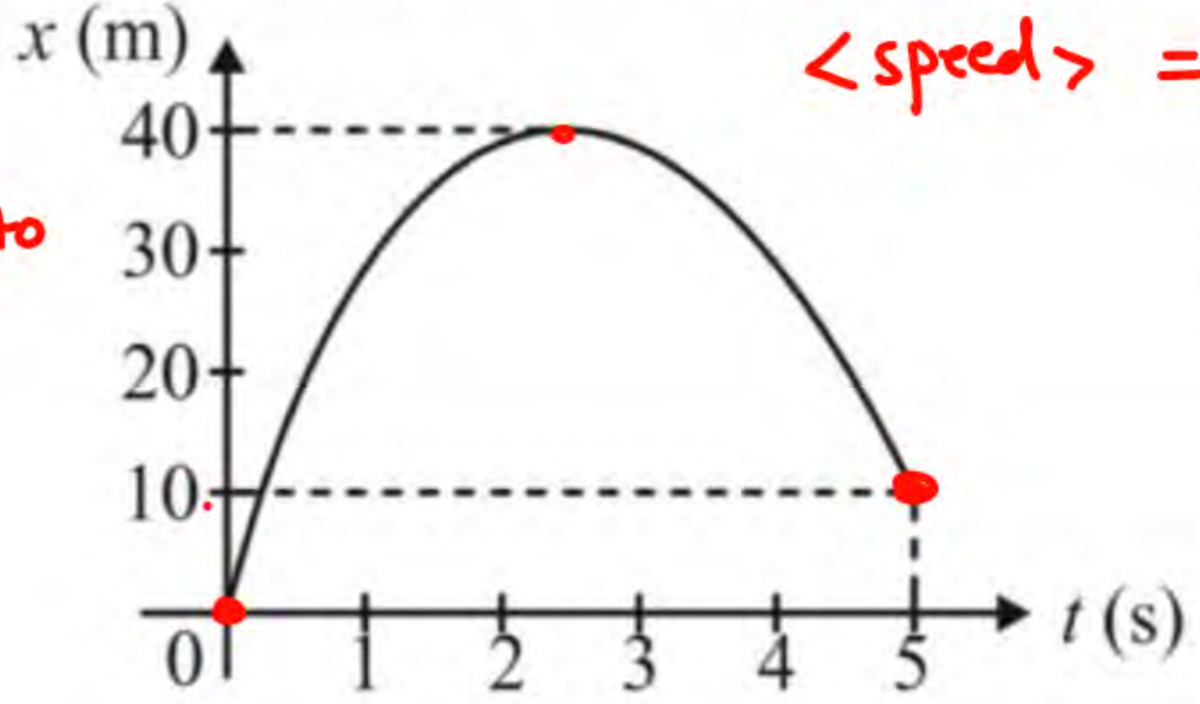
(3) 

(4) 

2

18. Displacement-time ($x - t$) graph of a particle moving along a straight-line path is shown in figure. Average speed of particle in the time interval 0 to 5 second is

$x=0$ $x=40$ $x=10$



$$\langle speed \rangle = \frac{40+30}{5} = 14$$

(1) 2 m/s

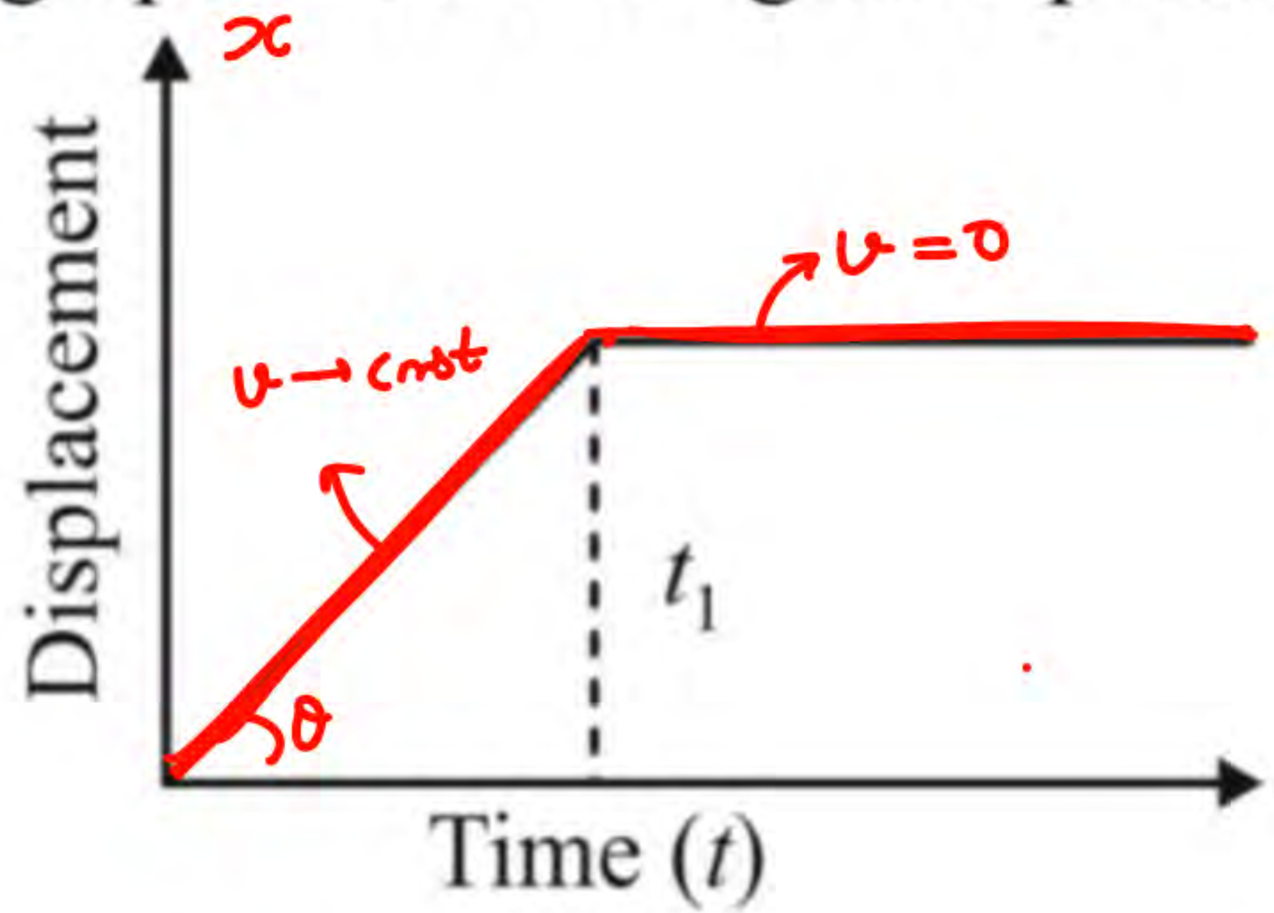
(2) 16 m/s

(3) 12 m/s

(4) 14 m/s

4

19. The x–t graph shown in figure represents



(1) Constant velocity

(2) Velocity of the body is continuously changing

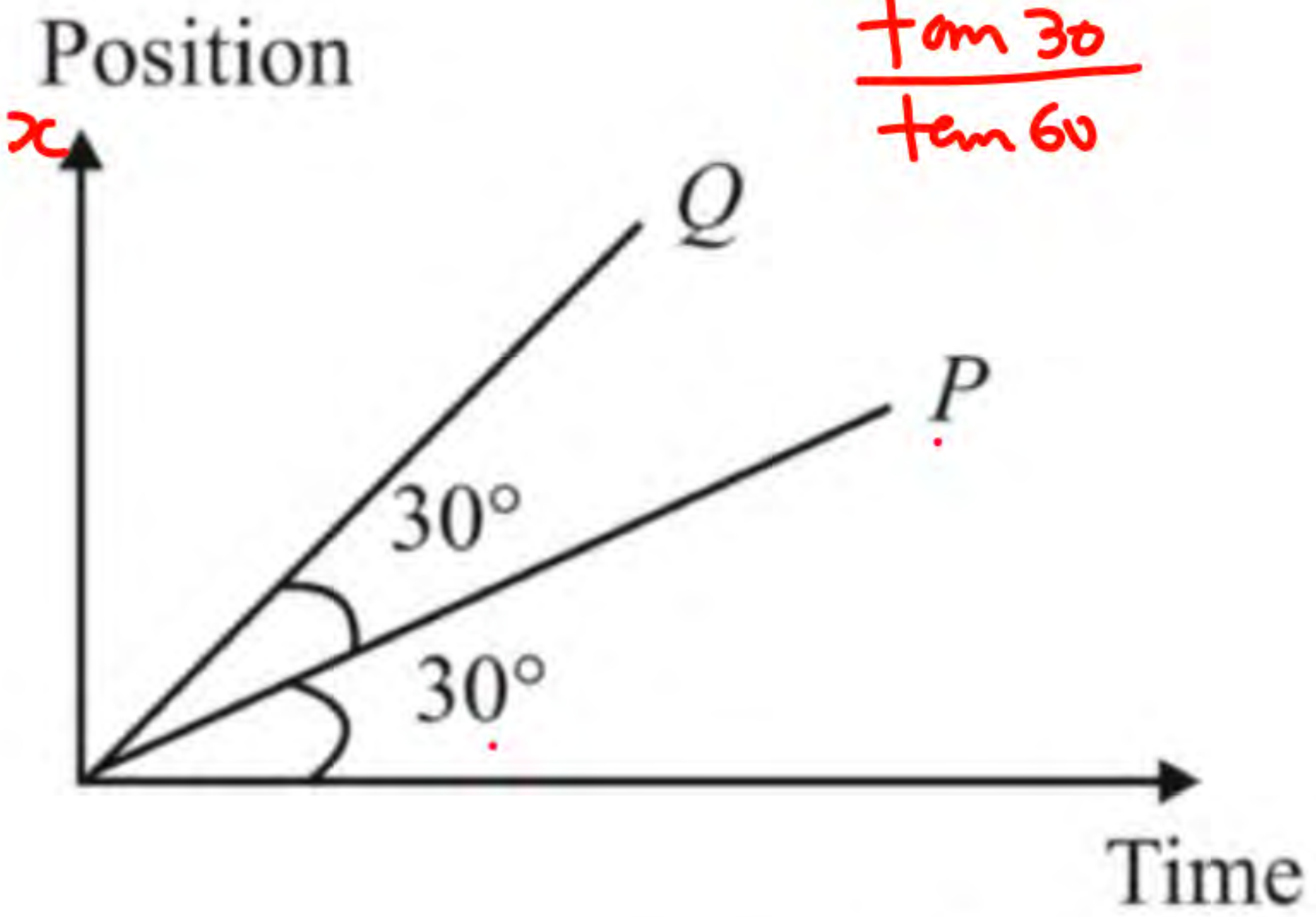
(3) Instantaneous velocity

(4) The body travels with constant speed upto time t_1 and then stops

4

20. The position-time graph of two particles P and Q are as shown in figure. The ratio of their velocities $\frac{V_P}{V_Q}$ is

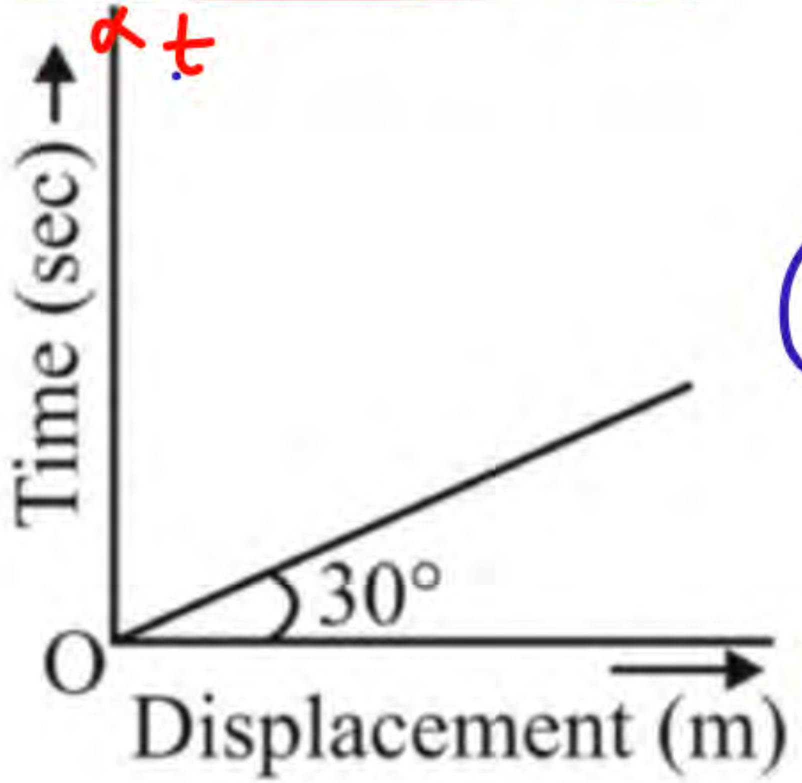
$\frac{\tan 30}{\tan 60}$



(1) 1 : 3
(2) $\sqrt{3}:1$
(3) 3 : 1
(4) $1:\sqrt{3}$

1

21. From the following displacement-time graph find out the velocity of a moving body



$\tan 60^\circ$

$y = mx$

$t = \frac{1}{\sqrt{3}} x$

$x = t\sqrt{3}$

$v = \sqrt{3}$

(1) $\frac{1}{\sqrt{3}} m/s$

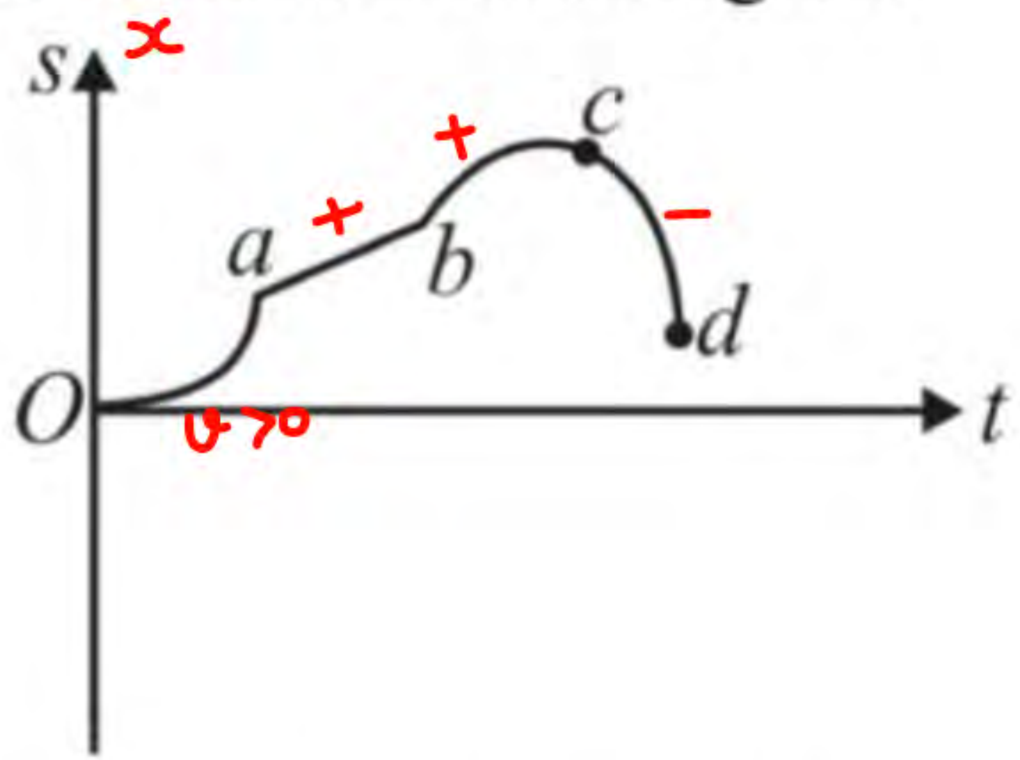
(2) $3\ m/s$

(3) $\sqrt{3}\ m/s$

(4) $1/3\ m/s$

3

22. Displacement time graph of a particle moving in a straight line is as shown in figure.



Find the sign of velocity in regions *oa*, *ab*, *bc* and *cd*

(1) Negative, positive, positive, negative

(2) Positive, positive, positive, negative

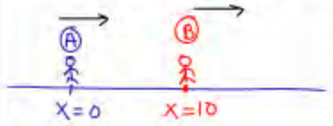
(3) Positive. negative, positive, positive

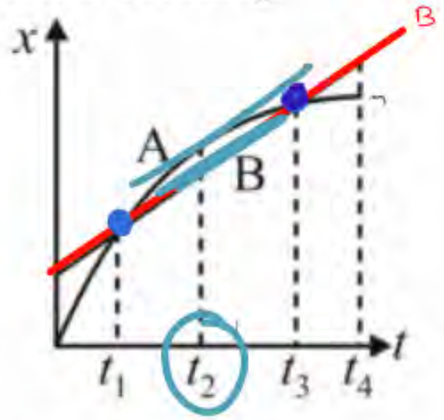
(4) Positive, positive, negative, negative

2

Paragraph for question nos. 23 to 26

The graph given shows the POSITION of two cars, A and B, as a function of time. The cars move along the x-axis on parallel but separate tracks, so that they can pass each other's position without colliding.





23. At which instant in time is car-A overtaking the car-B?

(A) t_1 (B) t_2

(C) t_3 (D) t_4

24. At time t_3, which car is moving faster? ≡ slope ↑

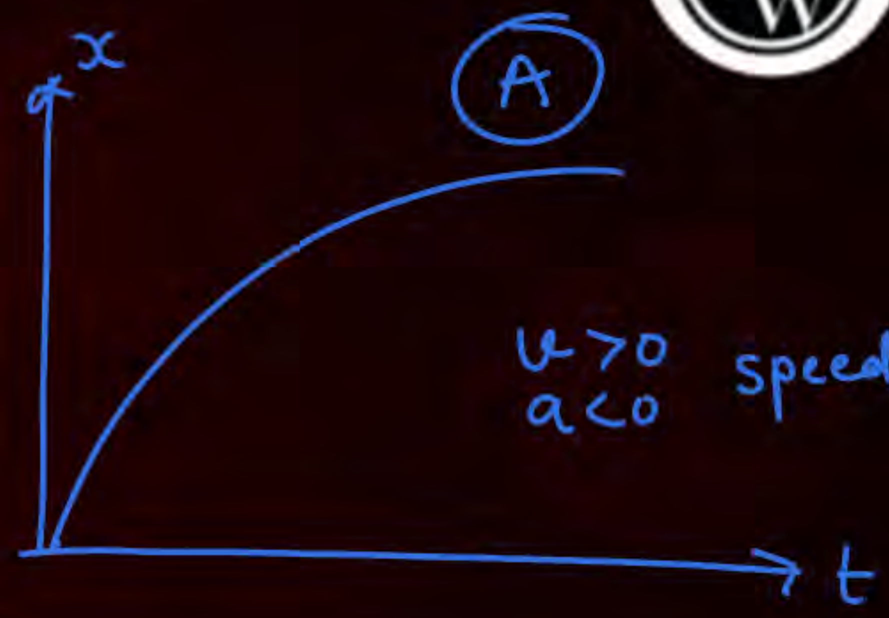
(1) car A (2) car B

(3) same speed (4) None of these

25. At which instant do the two cars have the same velocity? ≡ Slope Same.

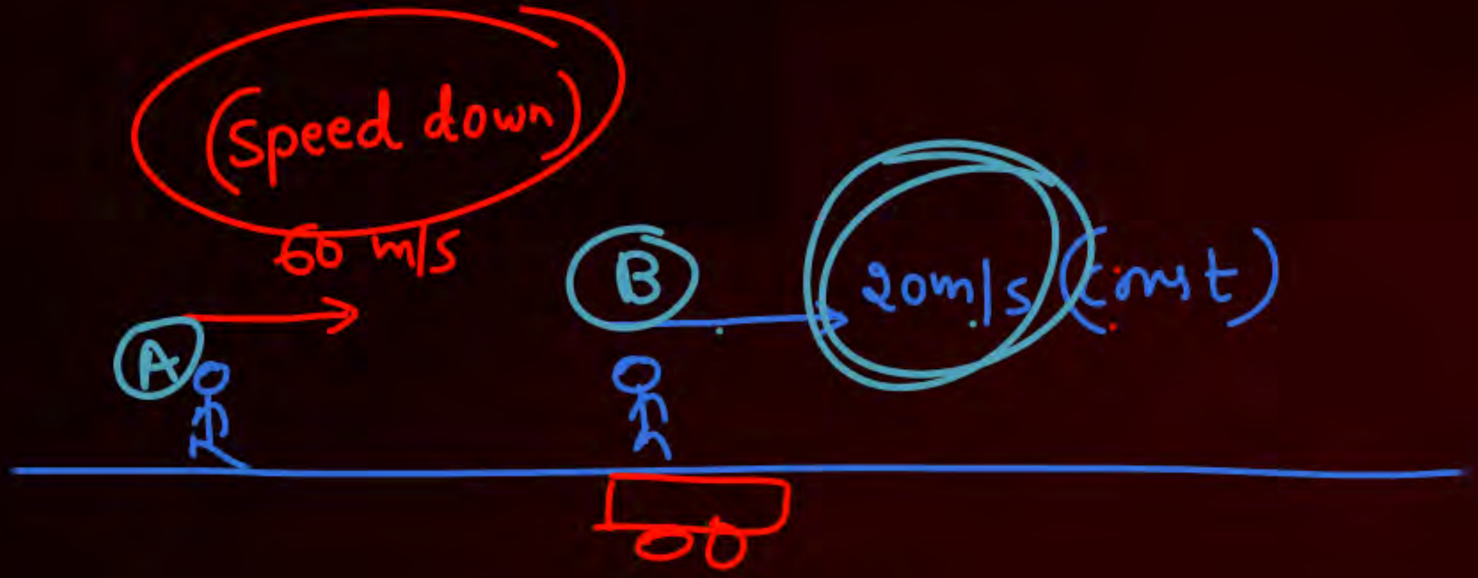
(1) t_1 (2) t_2

(3) t_3 (4) t_4



$v > 0$
$a < 0$
speed ↓

1, 2, 2



50
40
30
20

B 20

.5 .0001
.4 .0000/
.3
.2
.1

26. Which one of the following best describes the motion of car A as shown on the graphs?

(1) speeding up

(2) constant velocity

(3) slowing down

(4) first speeding up, then slowing down

3

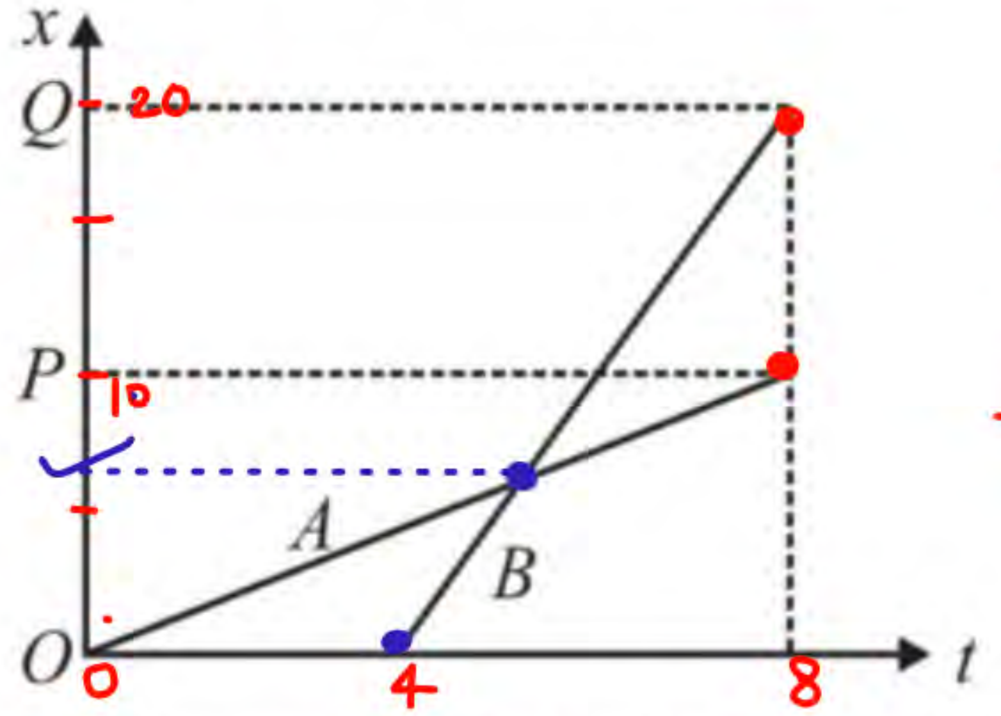
27. The position-time (x–t) graphs for two children A and B returning from their school O to their homes P and Q, respectively, are shown in figure. Choose the correct entries in the brackets below.

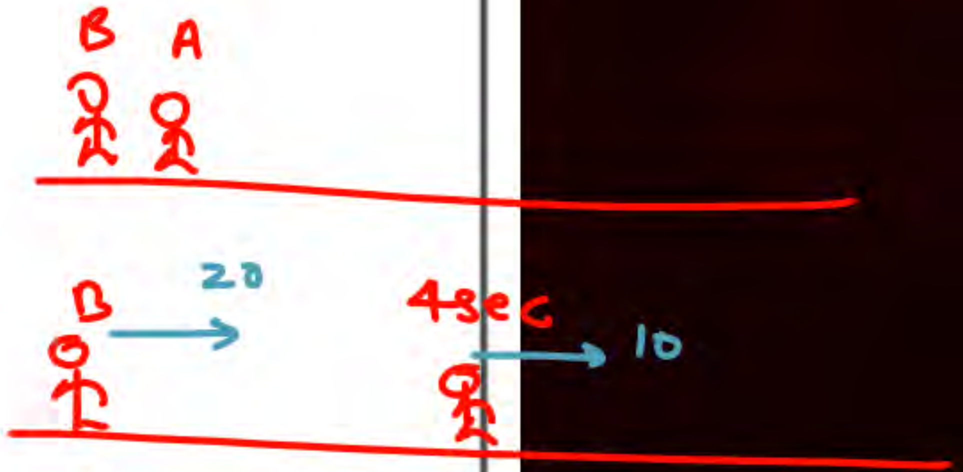
School

A ghar

B ghar

पहले A चल पड़ा =





(a) (A/B) lives closer to school than (B/A).

(b) (A/B) starts from the school earlier than (B/A).

(c) (A/B) walks faster than (B/A).

(d) A and B reach home at the (same/different) time.

(e) (A/B) overtakes on the road (once/twice).

27. (a) It is clear from the graph that OP < OQ. A lives closer to the school than B.

(b) As A starts from $t = 0$ while B starts little later. So A starts from the school earlier than B.

(c) The slope of $x - t$ for motion of B > slope of $x - t$ of A. Hence B walks faster than A.

(d) The value of t corresponding to positions P and Q of there homes is same, so A and B reach home at the same time.

(e) It is clear from the graph that B overtakes A once on the road.

28. For a particle moving along the x-axis, mark the correct statement(s).

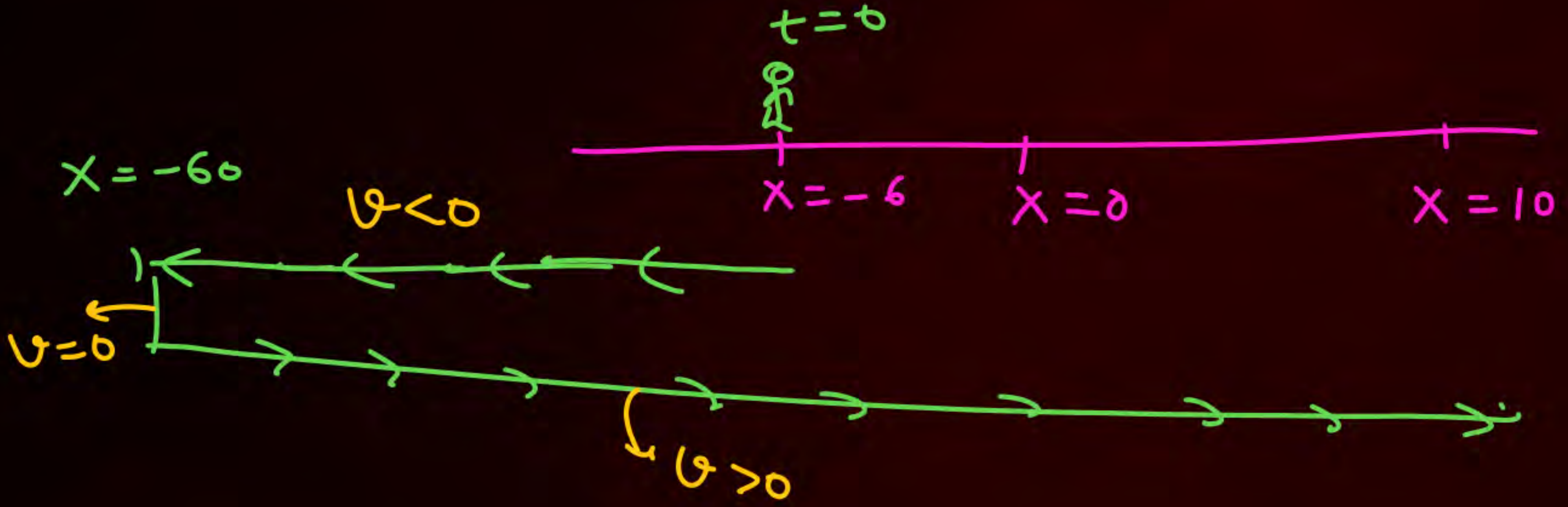
(1) If x is positive and is increasing with the time, then average velocity of the particle is positive. $\langle \vec{v} \rangle = \frac{x_f - x_i}{\text{time}}$

(2) If x is negative and becoming positive after some time, then the velocity of the particle is always positive.

(3) If x is negative and becoming less negative as time passes, then the average velocity of the particle is positive. $\frac{x_f - x_i}{\text{time}} = \frac{(-2)-(-6)}{\text{time}}$

(4) If x is positive and is increasing with time, then the velocity of the particle is always positive.

1, 3, 4


t=0
X=-60
v<0
X=-6
X=0
X=10
v=0
v>0

29. Four particles move along x-axis. Their coordinates (in meters) as functions of time (in seconds) are given by:

Particle 1: $x(t) = 3.5 - 2.7t^3$

Particle 2: $x(t) = 3.5 + 2.7t^3$

Particle 3: $x(t) = 3.5 + 2.7t^2$

Particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$

Which of these particles have constant acceleration?

(1) All four (2) Only 1 and 2

(3) Only 2 and 3 (4) Only 3 and 4

4

30. The displacement x of a particle depends on time t as

$$x = \alpha t^2 - \beta t^3$$ $\Rightarrow v = 2\alpha t - 3\beta t^2 \Rightarrow a = 2\alpha - 6\beta t$

(1) Particle will return to its starting point after time $\frac{\alpha}{\beta}$

$t = 0, x = 0$

put $x = 0$

$\alpha t^2 - \beta t^3 = 0$

$\alpha t^2 = \beta t^3$

$t = \alpha/\beta$

(4) at $t = \frac{\alpha}{3\beta}$

$a = 2\alpha - 6\beta \times \frac{\alpha}{3\beta}$

$a = 2\alpha - 2\alpha = 0$

(2) The particle will come to rest after time $\frac{2\alpha}{3\beta}$

$v = 2\alpha t - 3\beta t^2 = 0$

$a = 0$

(3) The initial velocity of the particle was zero but its initial acceleration was not zero.

$F = ma$

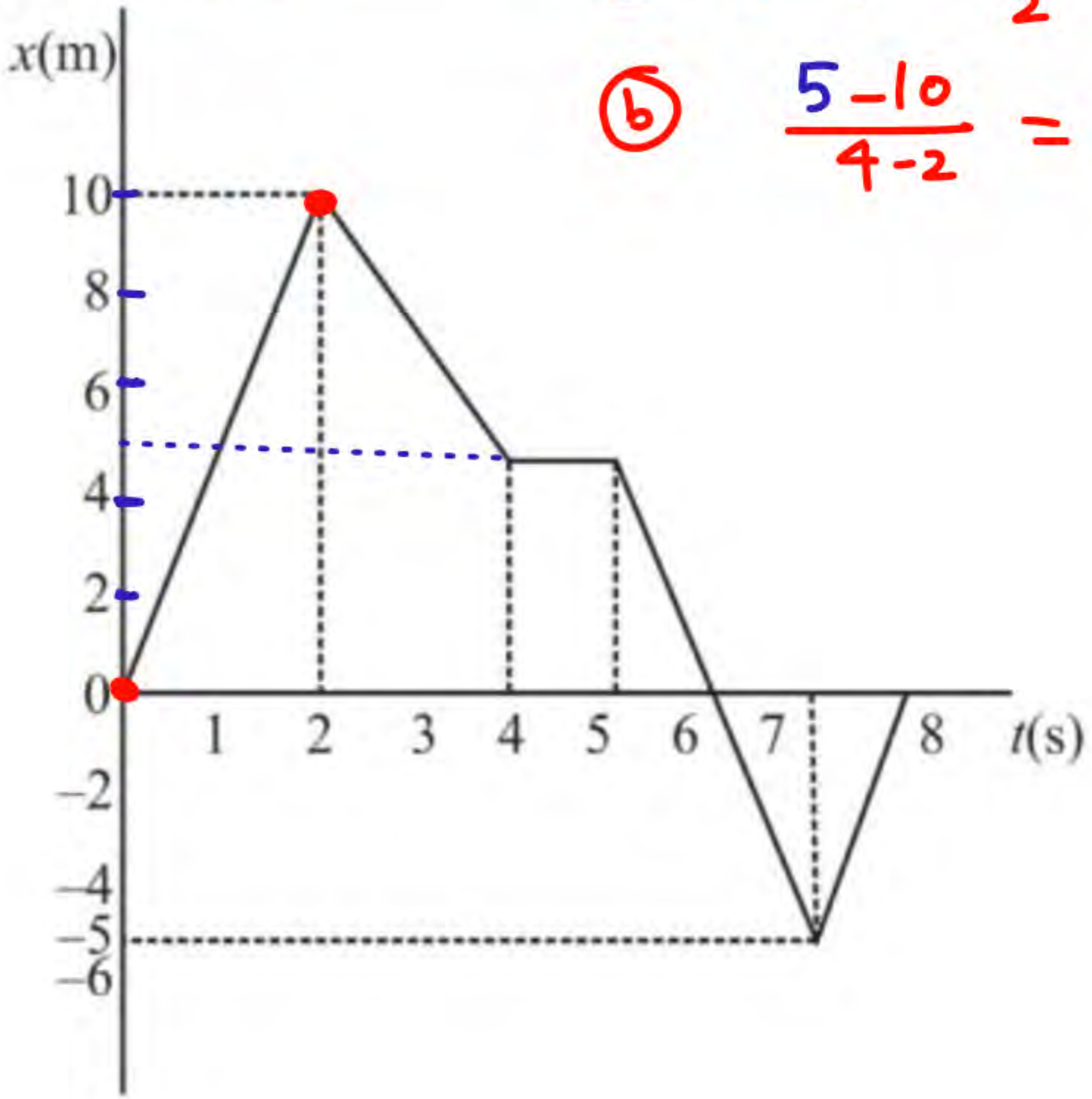
(4) No net force acts on the particle at time $\frac{\alpha}{3\beta}$

All

31. The position versus time graph for a certain particle moving along the x-axis is shown in figure. Find the average velocity in the time intervals (a) 0 to 2 s, (b) 2 s to 4 s.

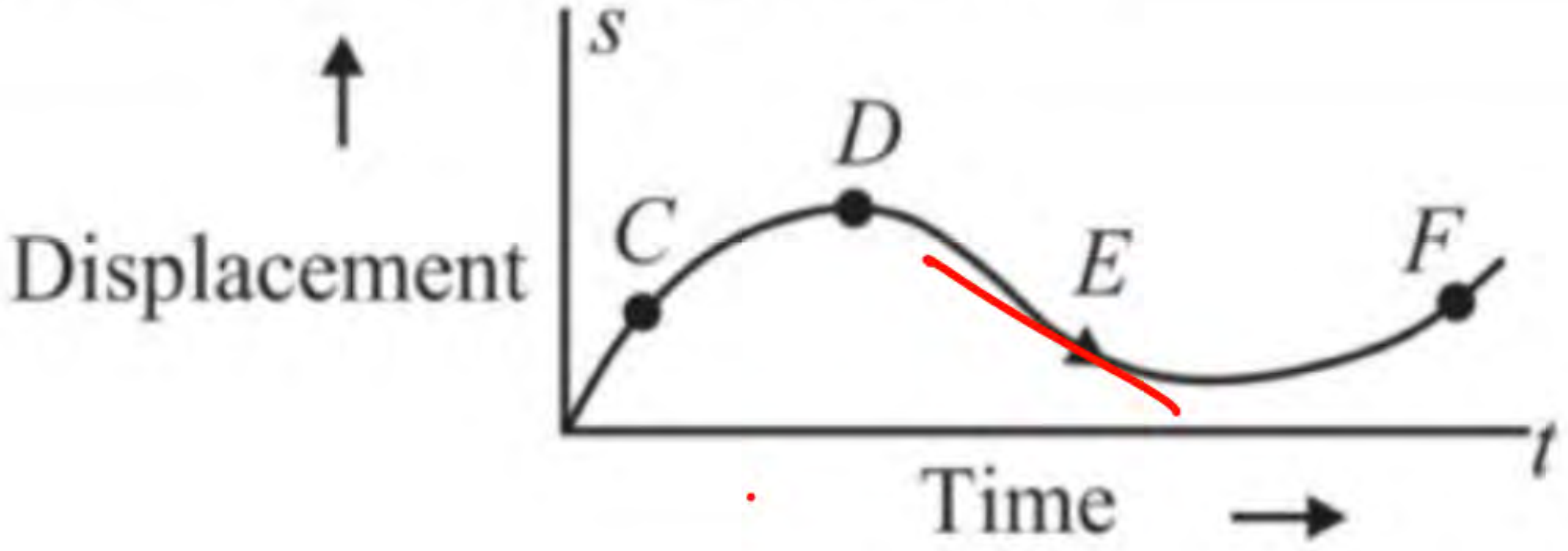
(a) $\langle v \rangle = \frac{10-0}{2}$

(b) $\frac{5-10}{4-2} = \frac{-5}{2} = -2.5$



5, −2.5

32. The displacement-time graph of moving particle is shown below. The instantaneous velocity of the particle is negative at the point.

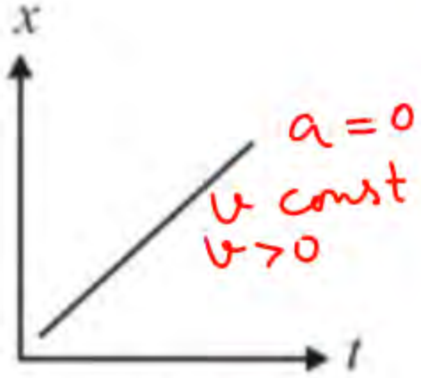


(1) D
(2) F
(3) C
(4) E

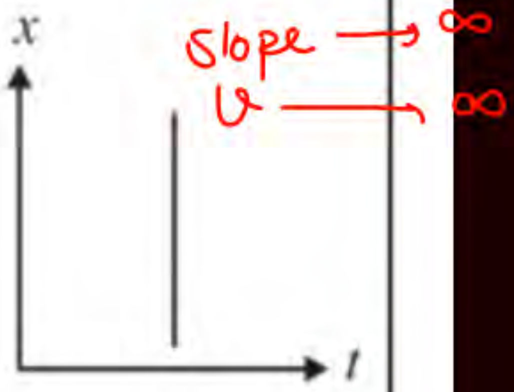
4

33. What can you say about velocity in each of the following position-time graphs?

(i)



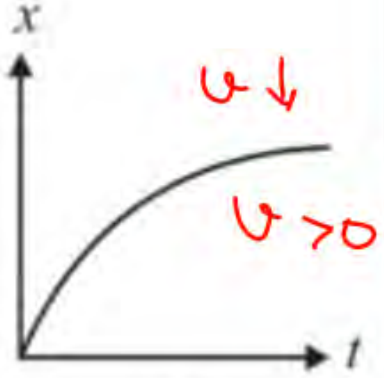
(ii)



(iii)

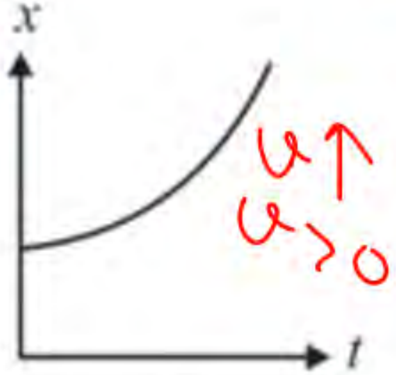
(iv)

(v)

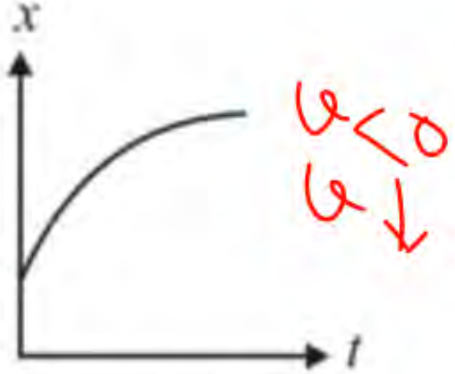


(vi)

a > 0
v > 0



(vii)



(viii)

33. (i) zero velocity.

(ii) constant positive velocity.

(iii) infinite velocity.

(iv) constant negative velocity.

(v) positive increasing velocity.

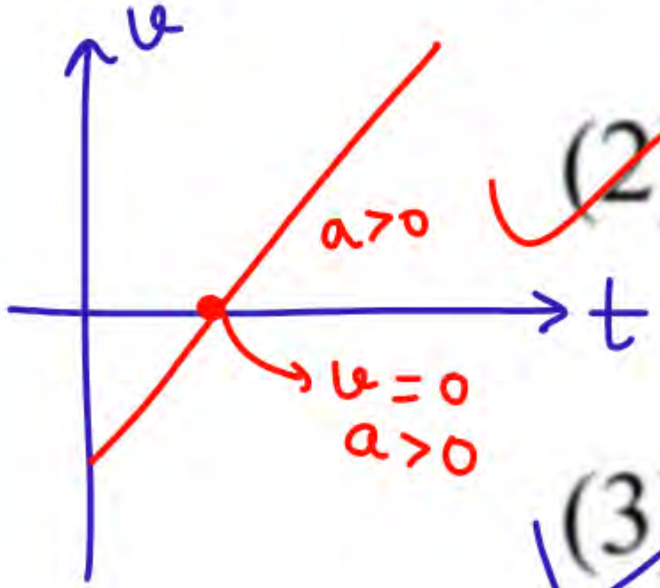
(vi) positive decreasing velocity.

(vii) positive increasing velocity.

(viii) positive decreasing velocity

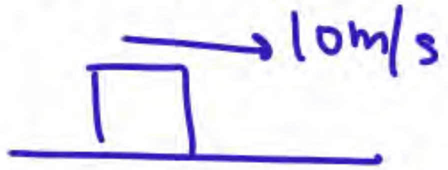
34. Mark the correct statement(s).

(1) A particle can have zero displacement and non-zero average velocity. = $\langle \vec{v} \rangle = \frac{\text{Displacement}}{\text{time}}$



(2) A particle can have zero displacement and non-zero velocity.

(3) A particle can have zero acceleration and non-zero velocity.



a = 0

(4) A particle can have zero velocity and non-zero acceleration.

2, 3, 4

35. The velocity-time graph of two bodies A and B is shown in figure. Choose correct statement.

(1) acceleration of B > acceleration of A   Slope

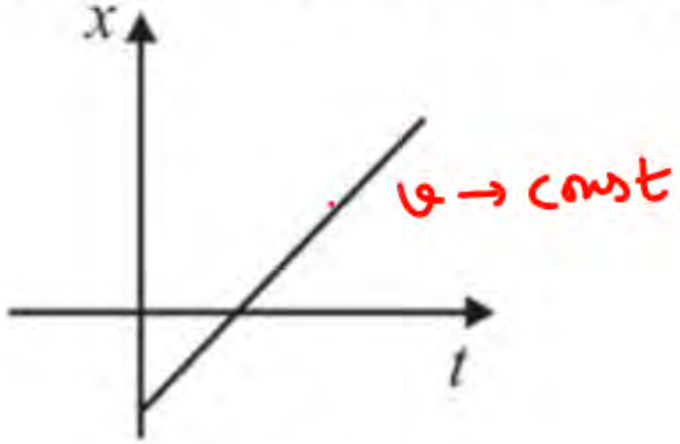
(2) acceleration of A > acceleration of B

(3) both are starting from same point

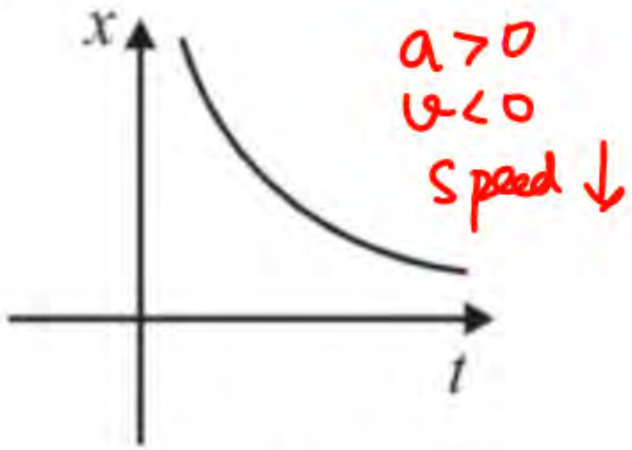
(4) A covers greater distance than B in the same time.

2, 4

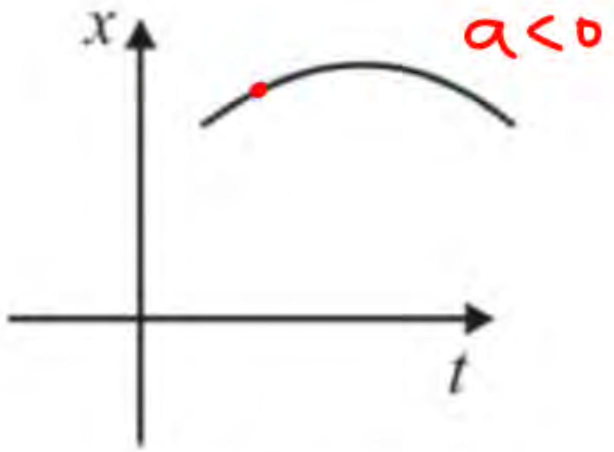
36. Study the following graphs:



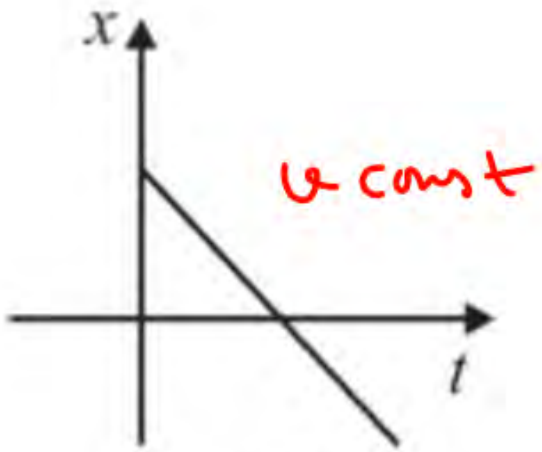
(i)



(ii)



(iii)



(iv)

The particle is moving with constant speed =

(1) In graphs (i) and (iii)

(2) In graphs (i) and (iv)

(3) In graphs (i) and (ii)

(4) In graphs (i)

2

37. A particle moves along a straight line such that its displacement S varies with time t as $S = \alpha + \beta t + \delta t^2$.

Column-I		Column-II	
i.	Acceleration at $t = 2$ s b	a.	$\beta + 5\gamma$
ii.	Average velocity during third Second	b.	2γ
iii.	Velocity at $t = 1$ s d	c.	α
iv.	Initial displacement c	d.	$\beta + 2\gamma$

$v = \beta + 2\gamma t$

$a = 2\gamma.$

b, A, d, c

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

$$= u + \frac{(2\times 3-1)a}{2}$$

$$= u + \frac{5}{\cancel{2}}\cancel{2}r$$

$$= u + 5r$$

$$= \beta + 5r$$

$u \rightarrow$ initial velocity

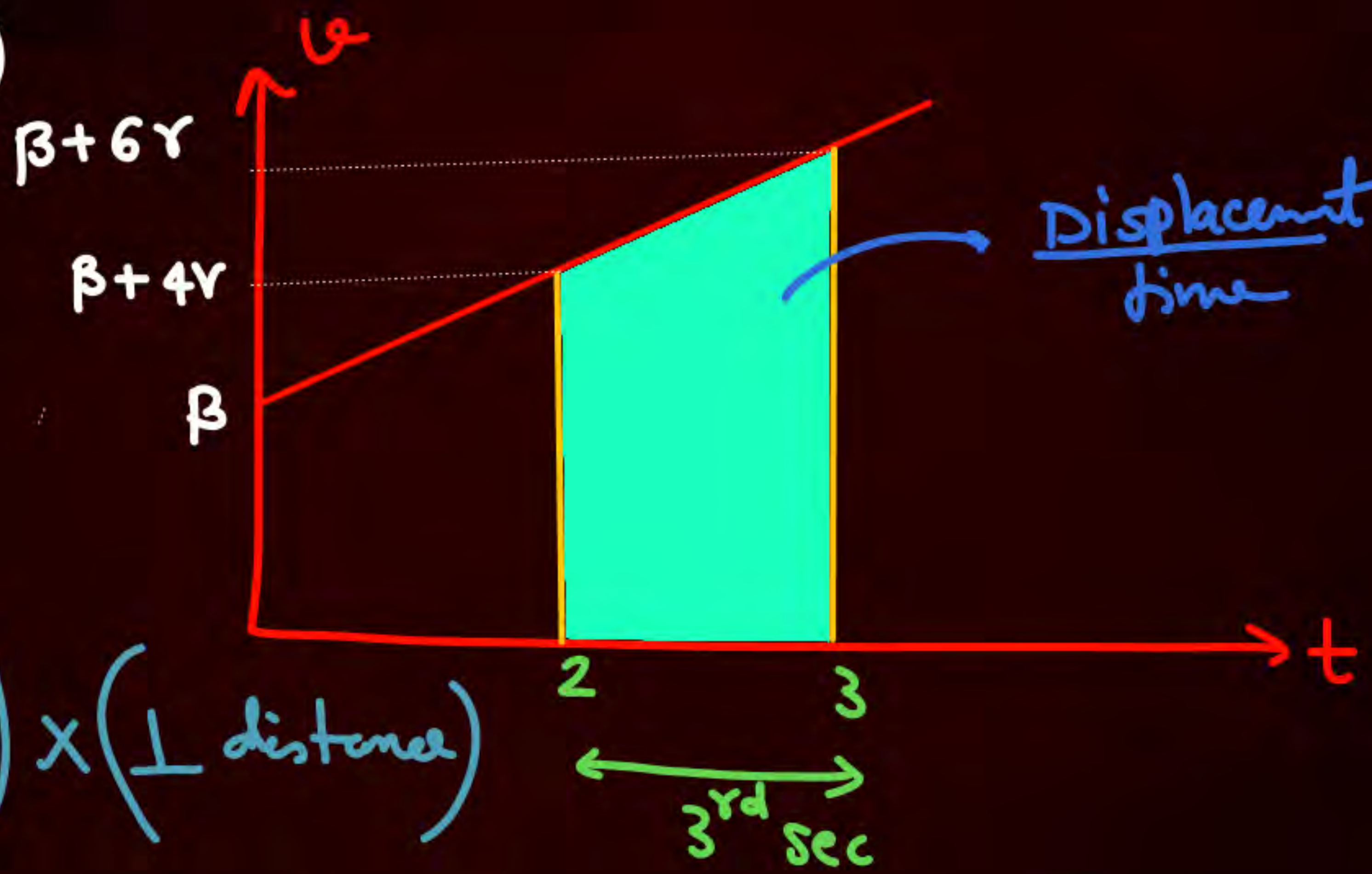
$v = \beta + 2rt$

$t = 0,\ u = \beta + 0 = \beta$

$v = \beta + 2\gamma t$

$v = 2\gamma t + \beta$

$y = mx + c$



$\frac{\text{Displacement}}{\text{time}} = \frac{\text{Area}}{\text{time}}$

$\text{Area} = \frac{1}{2}\left(\begin{matrix}\text{Sum of} \\ \parallel^{\text{rl}} \text{ side}\end{matrix}\right) \times (\perp \text{ distance})$

$= \frac{1}{2}(\beta + 4\gamma + \beta + 6\gamma) \times (3-2) = \frac{1}{2}(2\beta + 10\gamma) \times 1 = \beta + 5\gamma$

38. A particle is moving in a straight line. The variation of position 'x' as a function of time 't' is given as $x = (t^3 - 6t^2 + 20t + 15)$m. The velocity of the body when its acceleration becomes zero is:

$v = 3t^2 - 12t + 20$

$a = 6t - 12$

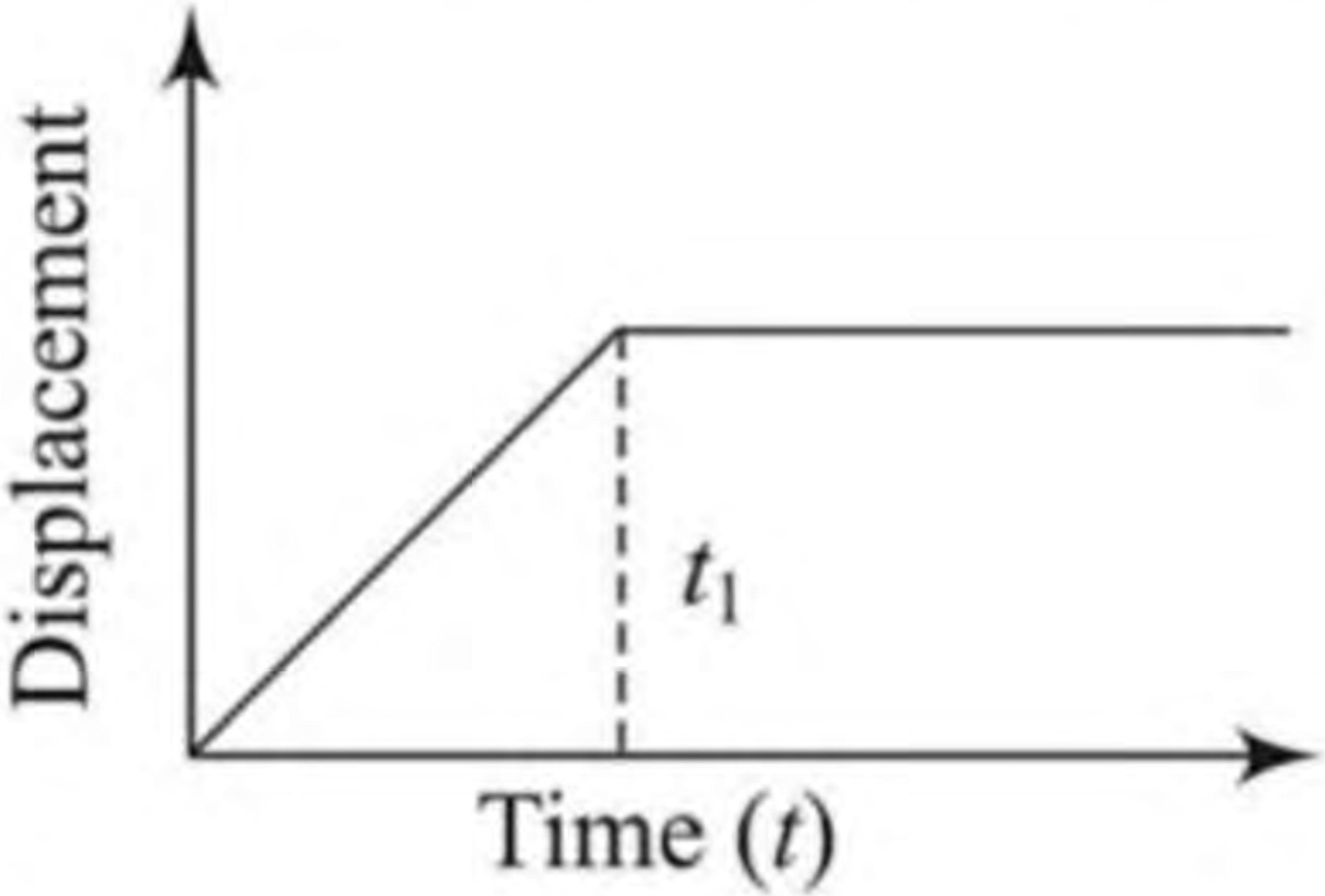
[29 Jan, 2024 (Shift-II)]

(1) 4 m/s
(2) 8 m/s
(3) 10 m/s
(4) 6 m/s

$12 - 24 + 20$

2

39. The x–t graph shown in figure represents



(1) constant velocity

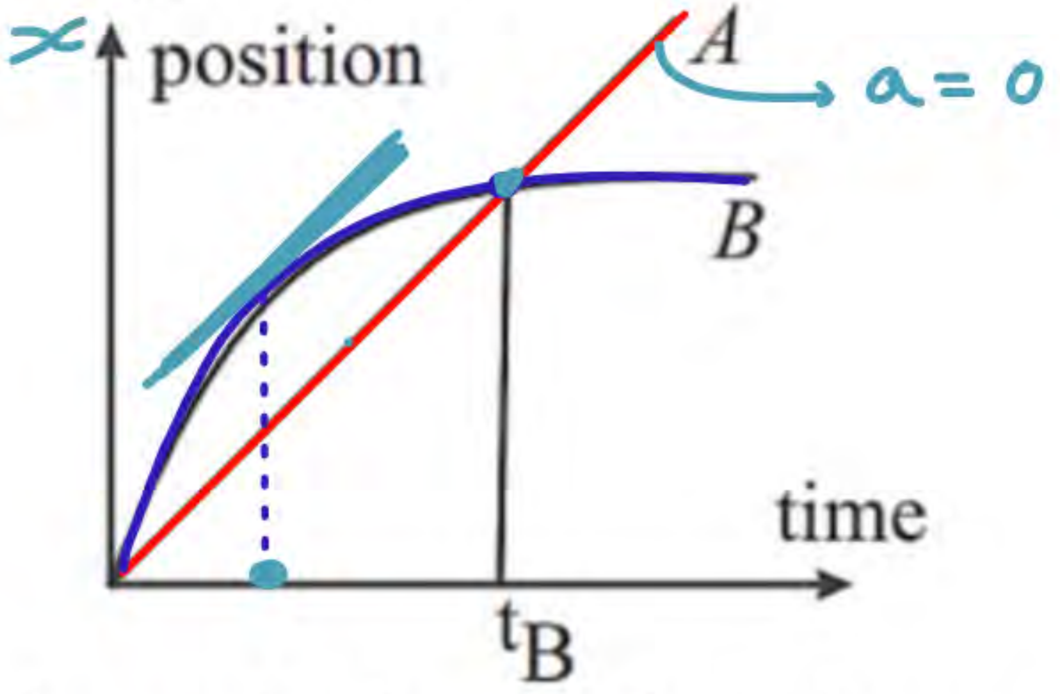
(2) velocity of the body is continuously changing

(3) instantaneous velocity

(4) the body travels with constant speed upto time t_1 and then stops.

4

40. The graph shows position as a function of time for two trains running on parallel tracks. Which one of the following statements is true?



(1) At time t_B, both trains have the same velocity

(2) Both trains have the same velocity at some time after t_B

(3) Both trains have the same velocity at some time before t_B

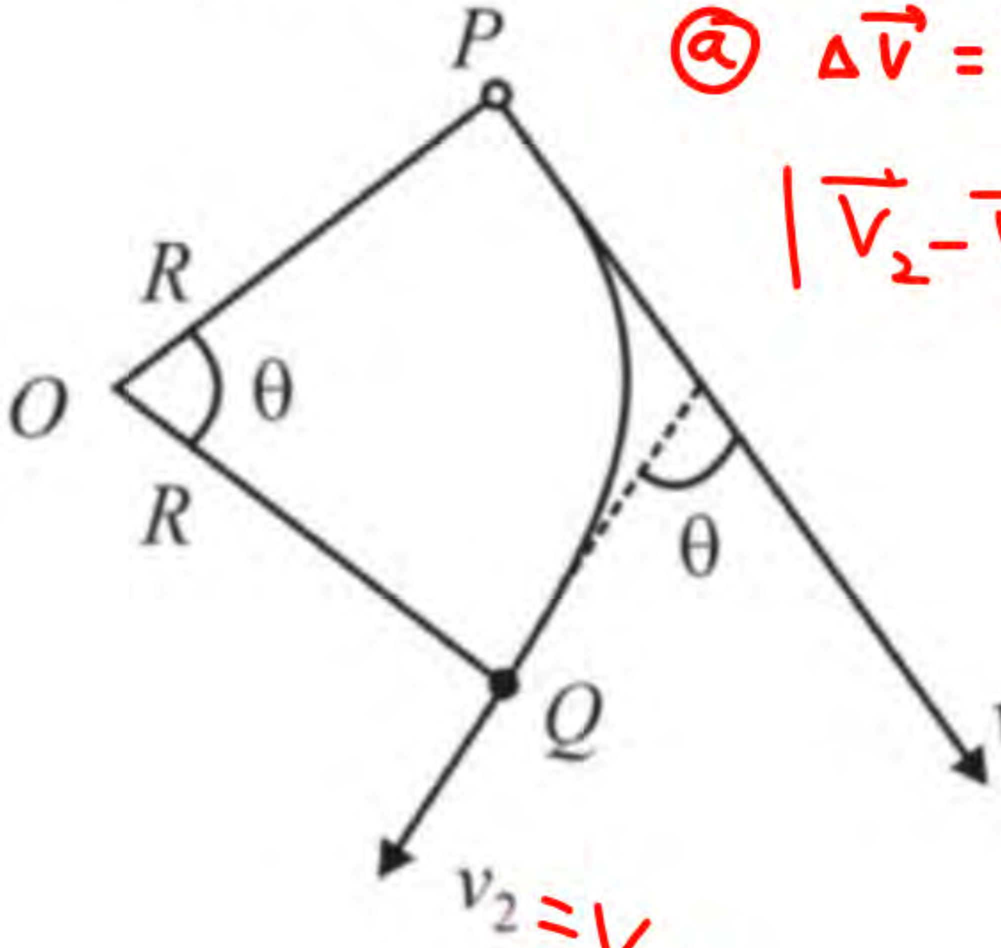
(4) Somewhere on the graph, both trains have the same acceleration

3

41. A particle describes an angle θ in a circular path with a constant speed v. Find the

(a) change in the velocity of the particle and

(b) average acceleration of the particle during the motion in the curve (circle).



(a) $\Delta\vec{v} = \vec{v}_2 - \vec{v}_1$

$|\vec{v}_2 - \vec{v}_1| = \sqrt{v_1^2 + v_2^2 - 2v_1 v_2 \cos\theta}$

$= \sqrt{2v^2 - 2v^2\cos\theta}$

$= v\sqrt{2}\sqrt{1-\cos\theta}$

$= v\sqrt{2}\sqrt{1 - 1 + 2\sin^2\theta/2}$

$= 2v\sin\theta/2$

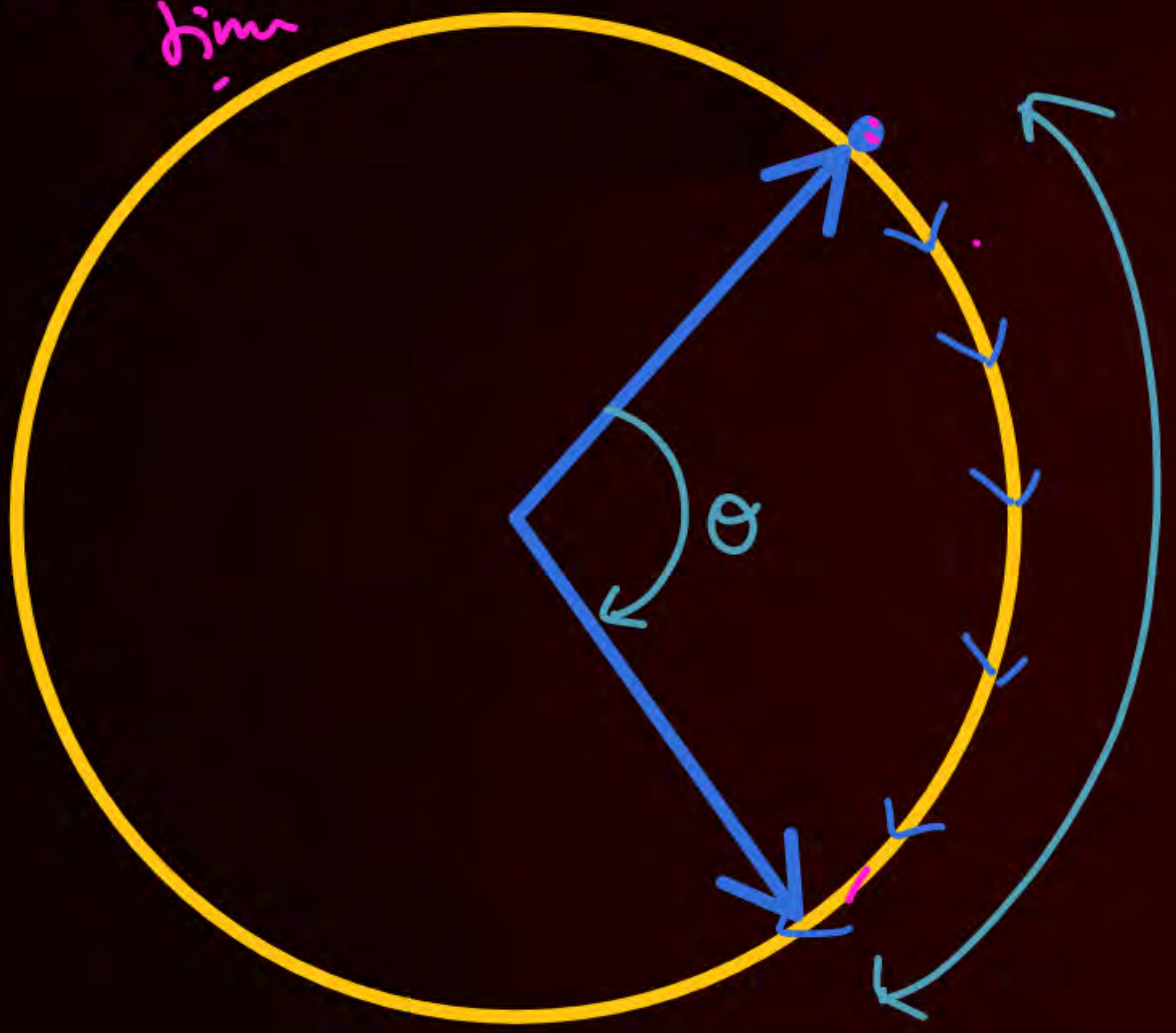
(a) $2v\sin\theta/2$

(b) $\frac{2v^2}{R\theta}\sin\theta/2$

(b) Avg acc $= \dfrac{\text{Change in velocity}}{\text{time}} = \dfrac{2v\sin\theta/2}{R\theta/v}$

$$= \frac{2v^2\sin\theta/2}{R\theta}$$

$$speed = \frac{distance}{time}$$

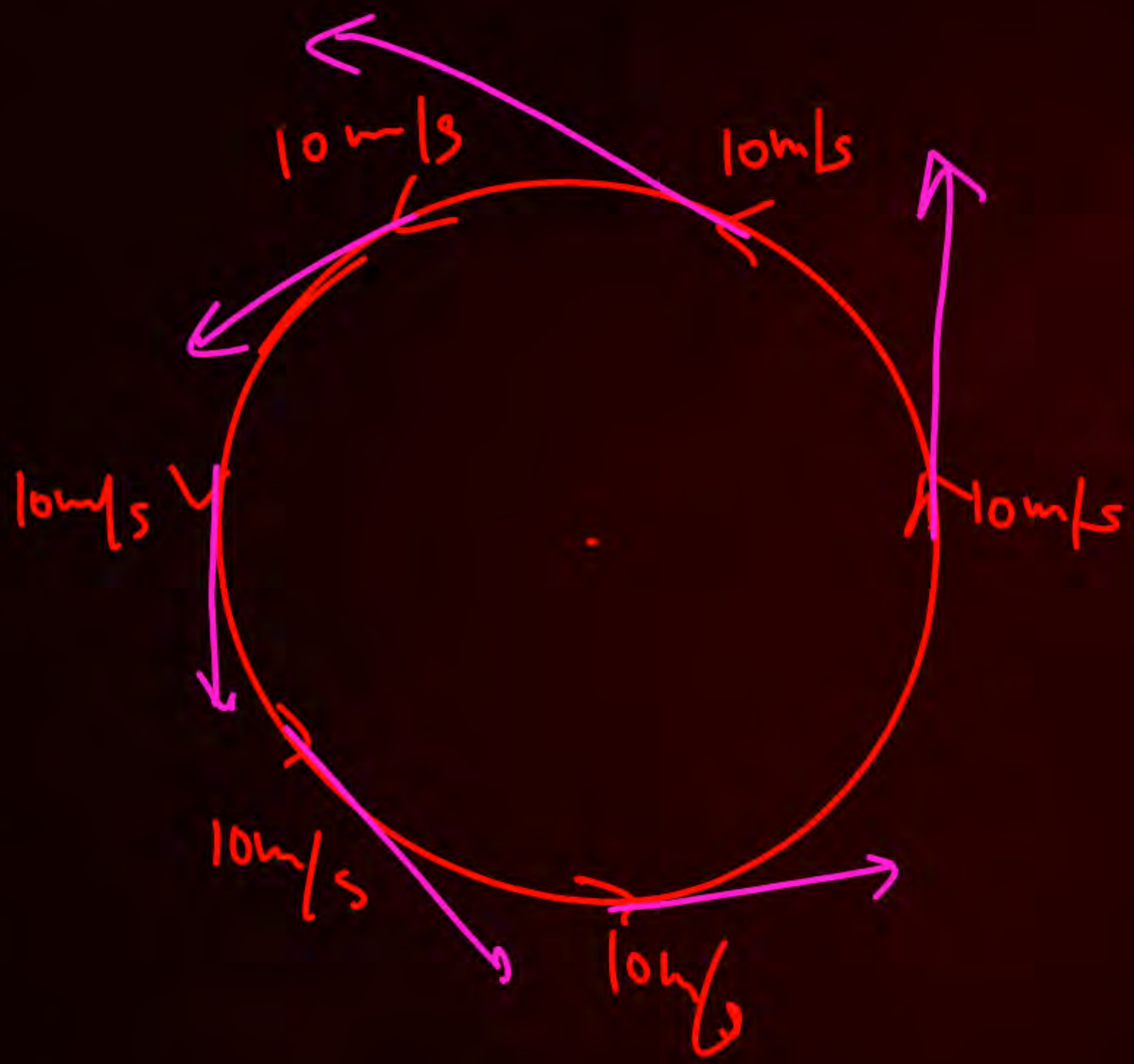


$$\theta = \frac{Arc}{R}$$

$$Arc = Distance = R\theta$$

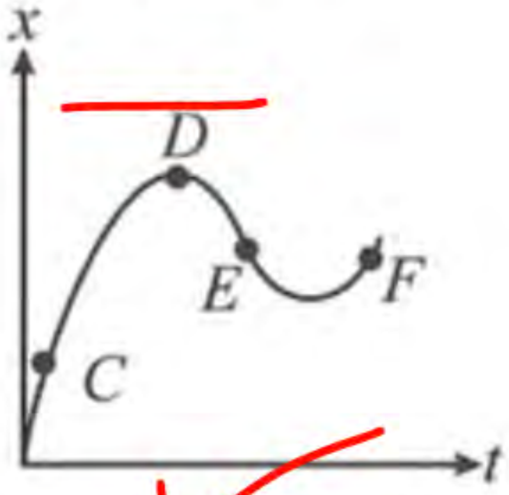
$$time = \frac{Distance}{speed}$$

$$time = \frac{R\theta}{v}$$



Velocity $\equiv$ (mag.) (Dir^n)

42. The displacement-time graph of a moving particle is shown below. The instantaneous velocity of the particle is zero at the point.



(1) C (2) D
(3) E (4) F

$t=0$

$x=0$ $x=4$

(43) $x = 4 - 27t + t^3$

$v = -27 + 3t^2$

$a = 6t$

$t=1$ $v = -24$, $a = 6$

43. A particle's position on the x axis is given by $x = 4 - 27t + t^3$, with x in meters and t in seconds.

(a) Find the particle's velocity function $v(t)$ and acceleration function $a(t)$.

(b) Is there ever a time when $v = 0$?

(c) Describe the particle's motion for $t \geq 0$.

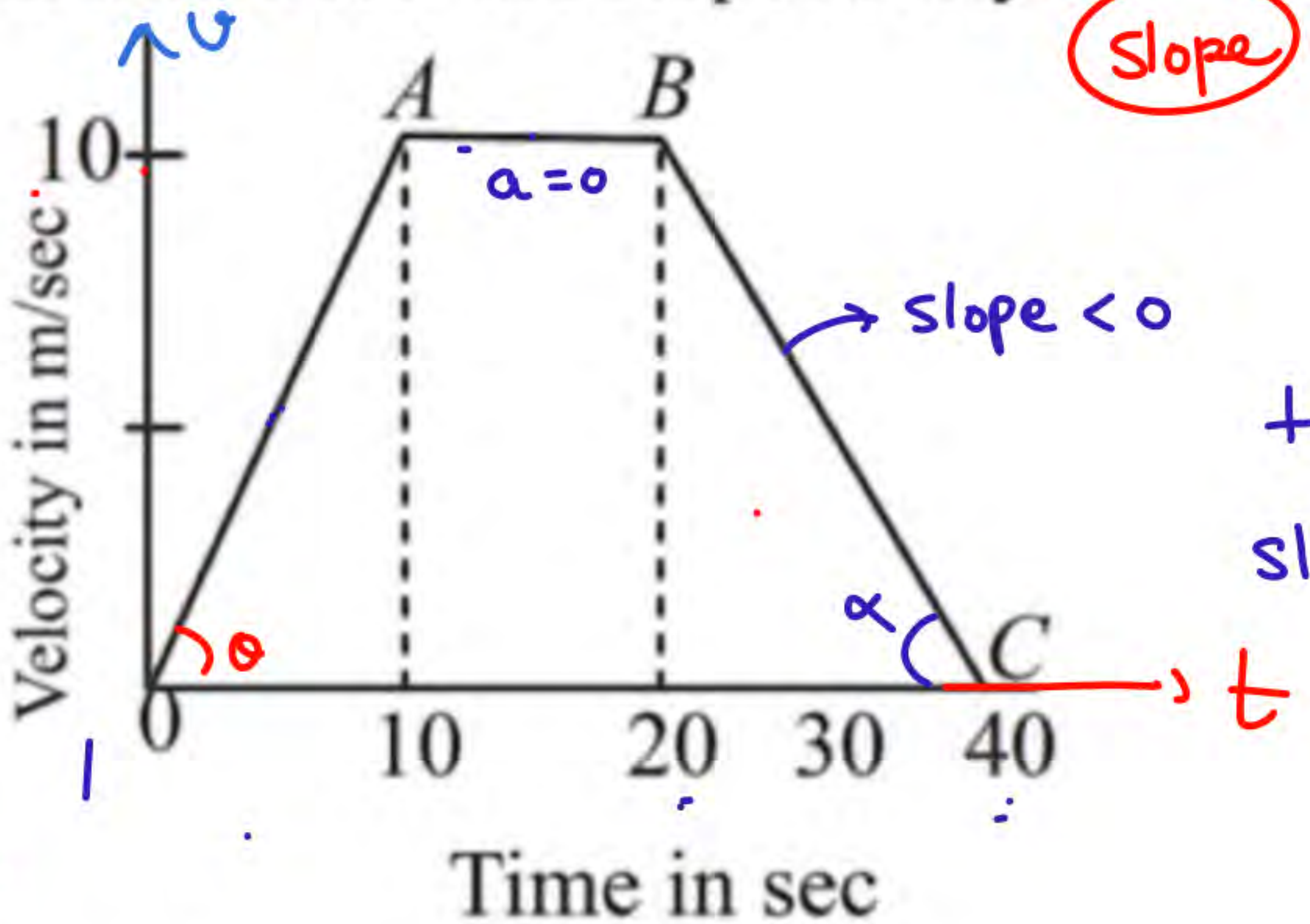
2,

44. The curve shown represents the velocity-time graph of a particle, its acceleration values along OA, AB and BC in metre/sec^2 are respectively.

Slope

O→A

$a = \tan\theta = \frac{10}{10} = 1$



$\tan\alpha = \frac{10}{20} = \frac{1}{2}$

$\text{slope} = -\frac{1}{2} = a$

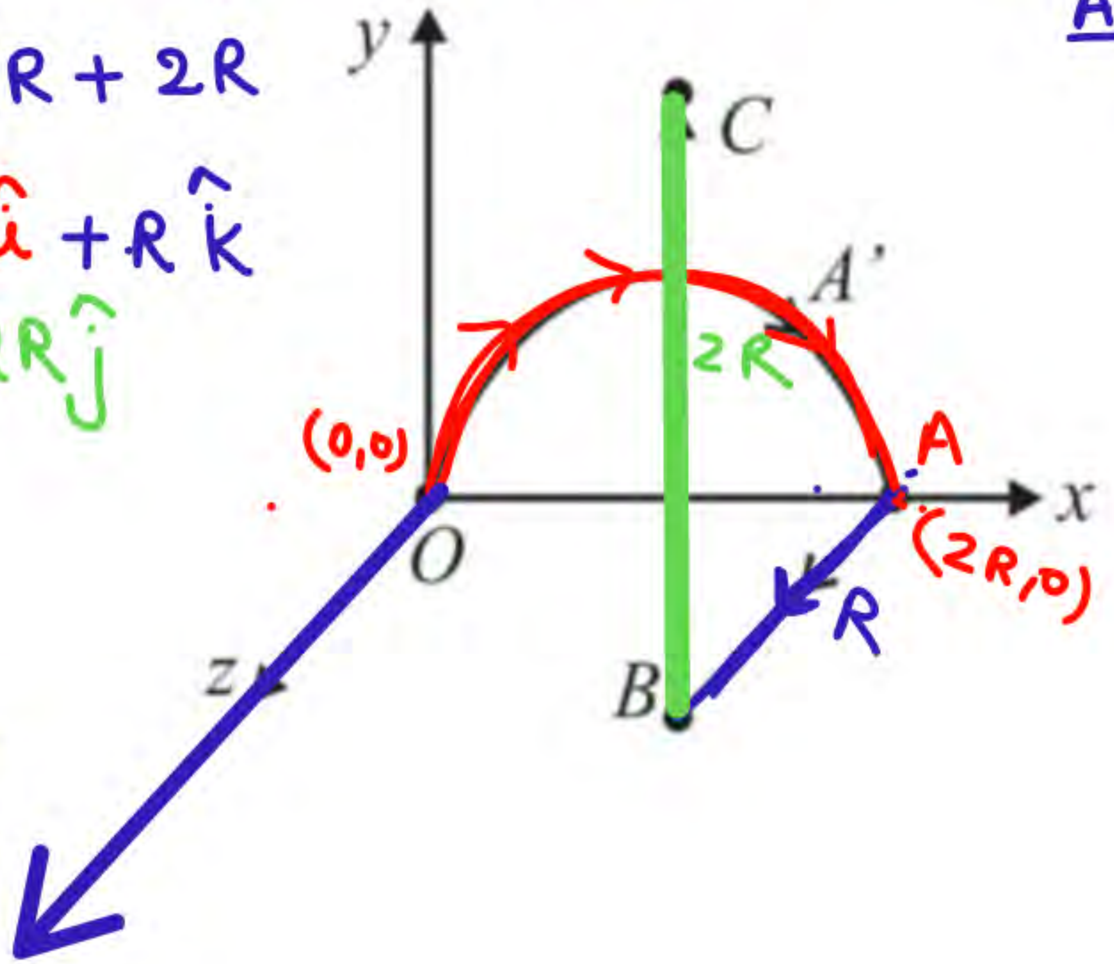
(1) 1, 0, –0.5 (2) 1, 0, 0.5

(3) 1, 1, 0.5 (4) 1, 0.5, 0

45. A particle moves in a semicircular path of radius R from O to A. Then it moves parallel to z-axis covering a distance R upto B. Finally it moves along BC parallel to y-axis through a distance 2R. Find the ratio of D/s. Displacement/Distance.

Distance $= \pi R + R + 2R$

displacement $= 2R\hat{i} + R\hat{k} + 2R\hat{j}$



Ans $= \dfrac{\sqrt{(2R)^2 + R^2 + (2R)^2}}{\pi R + R + 2R}$

$= \dfrac{3R}{\pi R + 3R} = \dfrac{3}{\pi + 3} = \dfrac{\text{Displ.}}{\text{Dist.}}$

$\dfrac{\text{Dist.}}{\text{Displ.}} = \dfrac{\pi + 3}{3}$

46. A particle moves so that its position vector varies with time as $\vec{r} = A\cos\omega t\hat{i} + A\sin\omega t\hat{j}$. Find the

(a) initial velocity of the particle,

(b) angle between the position vector and velocity of the particle at any time, and

(c) speed at any instant.

90°

(a) $A\omega\hat{j}$

(b) $\pi/2$

(c) $A\omega$

$\vec{r}\cdot\vec{v} = \cancel{-A^2\omega\cos\omega t\,\sin\omega t} + \cancel{A^2\omega\sin\omega t\,\cos\omega t} = 0$

put

(b) $t=0$, $\vec{v} = A\omega\hat{j}$

$\vec{r} = A\cos\omega t\,\hat{i} + A\sin\omega t\,\hat{j}$

$\vec{v} = \dfrac{d\vec{r}}{dt} = -A\omega\sin\omega t\,\hat{i} + A\omega\cos\omega t\,\hat{j}$

Speed $= |\vec{v}| = \sqrt{(A\omega\sin\omega t)^2 + (A\omega\cos\omega t)^2} = A\omega =$ Const

$= A\omega\sqrt{\sin^2\omega t + \cos^2\omega t}$

$\vec{r}\cdot\vec{v} = rv\cos\theta$

47. A particle starts moving rectilinearly at time $t = 0$ such that its velocity v changes with time t according to the equation $v = t^2 - t$, where t is in seconds and v in ms^{-1}. Find the time interval for which the particle retards.

speed down.

$a = 2t - 1$

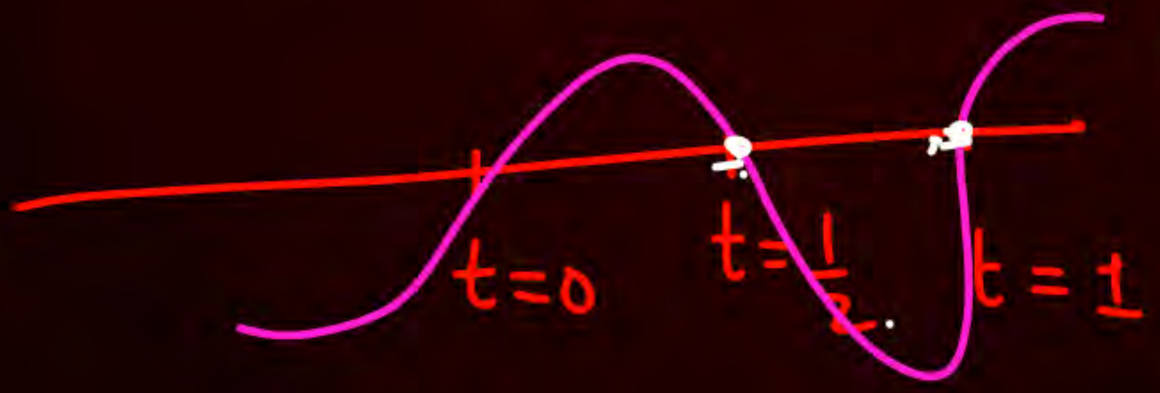
$t = 0$ par, $a < 0$
$v = 0$

$a, v \equiv$ opposite sign

$a \cdot v < 0$

$(2t-1)(t^2 - t) < 0$

$\boxed{t(2t-1)(t-1) < 0}$



$\frac{1}{2} < t < 1$

48. The position of a particle as a function of time t, is given by $x(t) = at + bt^2 - ct^3$ where a, b and c are constants. When the particle attains zero acceleration, then its velocity will be:

$a + 2bt - 3ct^2 = v$

$2b - 6ct = a$

$a = 0, \quad \frac{b}{3c} = t$

[9 April, 2019 (Shift-II)]

(1) $a + \frac{b^2}{4c}$ (2) $a + \frac{b^2}{c}$

(3) $a + \frac{b^2}{2c}$ (4) $a + \frac{b^2}{3c}$

4

49. The position of a particle moving along x-axis is related to time t as follow: $x = 2t^2 - t^3$, where x is in meters and t is in seconds.

(a) What is the maximum positive displacement of the particle along the x axis and at what instant does it attain it? 32/27

(b) Describe the motion of the particle.

(c) What is the distance covered in the first three seconds?

(d) What is its displacement in the first four seconds? $-32-0=-32$

(e) What is the particle's average speed and average velocity in the first 3 seconds?

(f) What is the particles instantaneous acceleration at the instant of its maximum positive x displacement? $t=4/3$

(g) What is the average acceleration between the interval $t = 2$s to $t = 4$s? $\frac{V_f - V_i}{4-2} = \frac{-32-(-4)}{2}$

$x = 2t^2 - t^3$

x की max value & कब.

(d) $x_f - x_i$

$t=0,\ x_i = 0$

$t=4\ \ x_f = 32-64$

$= -32$

16-48

$x = 2t^2 - t^3$

$v = 4t - 3t^2$

$a = 4 - 6t$

$a = 4 - 6 \times \frac{4}{3}$

$a = 4 - 8 = -4$

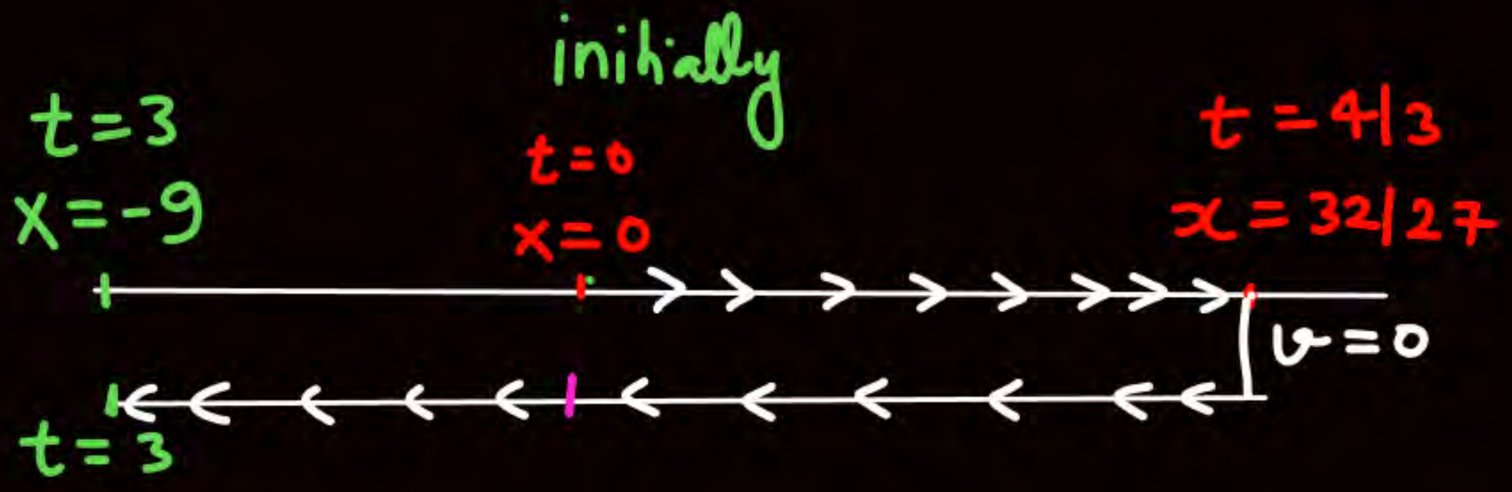
(a) $\frac{32}{27}$ (b) $\frac{4}{3}$

(c) $\frac{307}{27}$ (d) -32

(e) -3 (f) -4

(g) -14

$x = 2t^2 - t^3$



$t=0, \; x=0$

$v = 4t - 3t^2 = 0$

$t(4-3t) = 0$

$t=0, \; t = 4/3 \equiv v=0$

(turning point)

At $t = 4/3$ $\quad x = 2\left(\frac{4}{3}\right)^2 - \left(\frac{4}{3}\right)^3$

$x = \frac{32}{9} - \frac{64}{27} = \frac{96}{27} - \frac{64}{27} = \frac{32}{27}$

Distance in $t=0 \longrightarrow t=3$.

$t=3, \; x_f = 18 - 27 = -9$

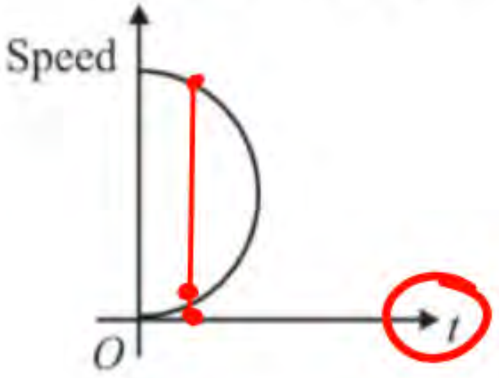
Distance $= \frac{32}{27} + \frac{32}{27} + 9$

$= \frac{64+243}{27}$

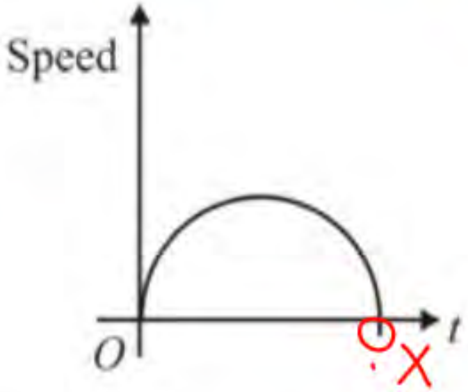
$= \frac{307}{27}$

50. Which one of the following graphs for a body moving along a straight line is possible?

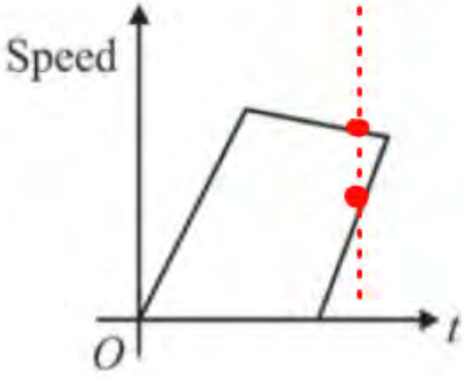
(1)



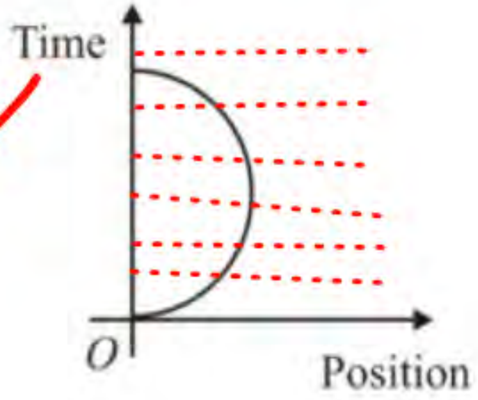
(2)



(3)



(4)



4

51. The position of a particle moving along x-axis given by $x = (-2t^3 + 3t^2 + 5)$m. The acceleration of particle at the instant its velocity becomes zero is:

(1) 12 m/s^2

(2) -12 m/s^2

(3) -6 m/s^2

(4) Zero

$v = -6t^2 + 6t$

$a = -12t + 6$

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

$-t^2 + t = 0$

$t(-t+1) = 0$

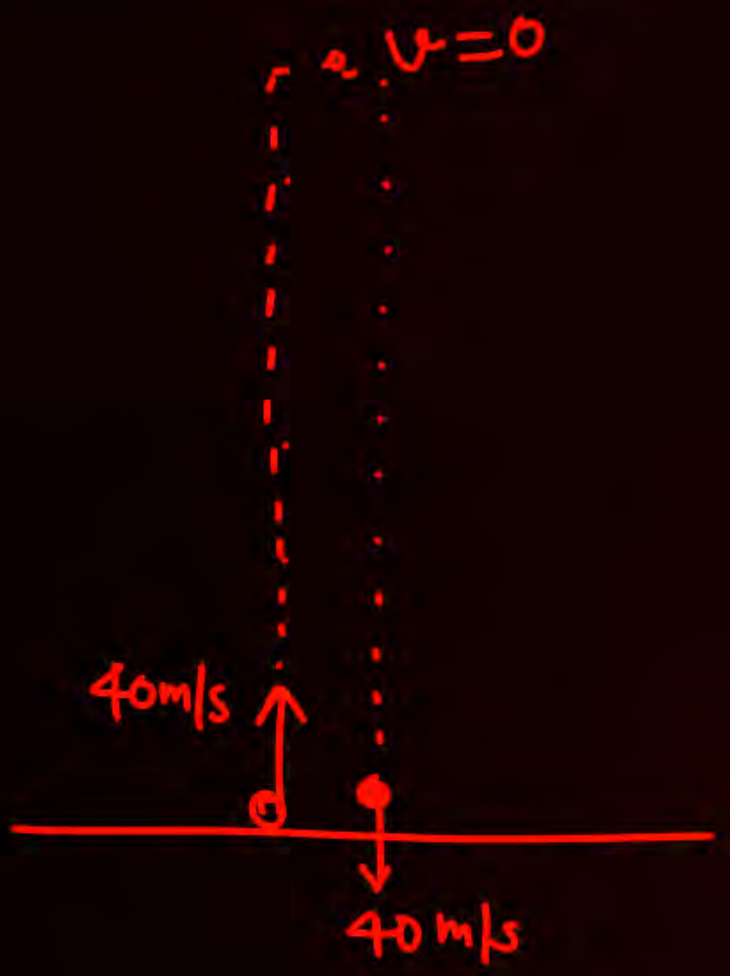
$t=0, t=1$

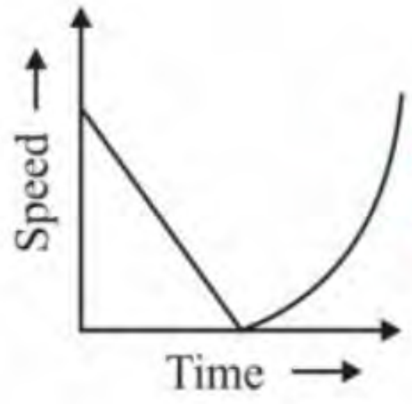
$v=0, t=1$

$t=0, v=0, a=6$

3

52. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its motion if the air resistance (constant) is not ignored?



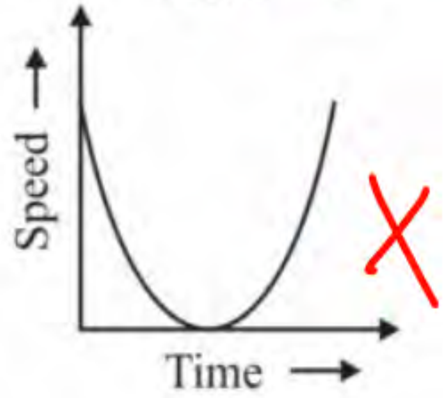
(1) 

X

(2) 

X

✓ (3) 

(4) 

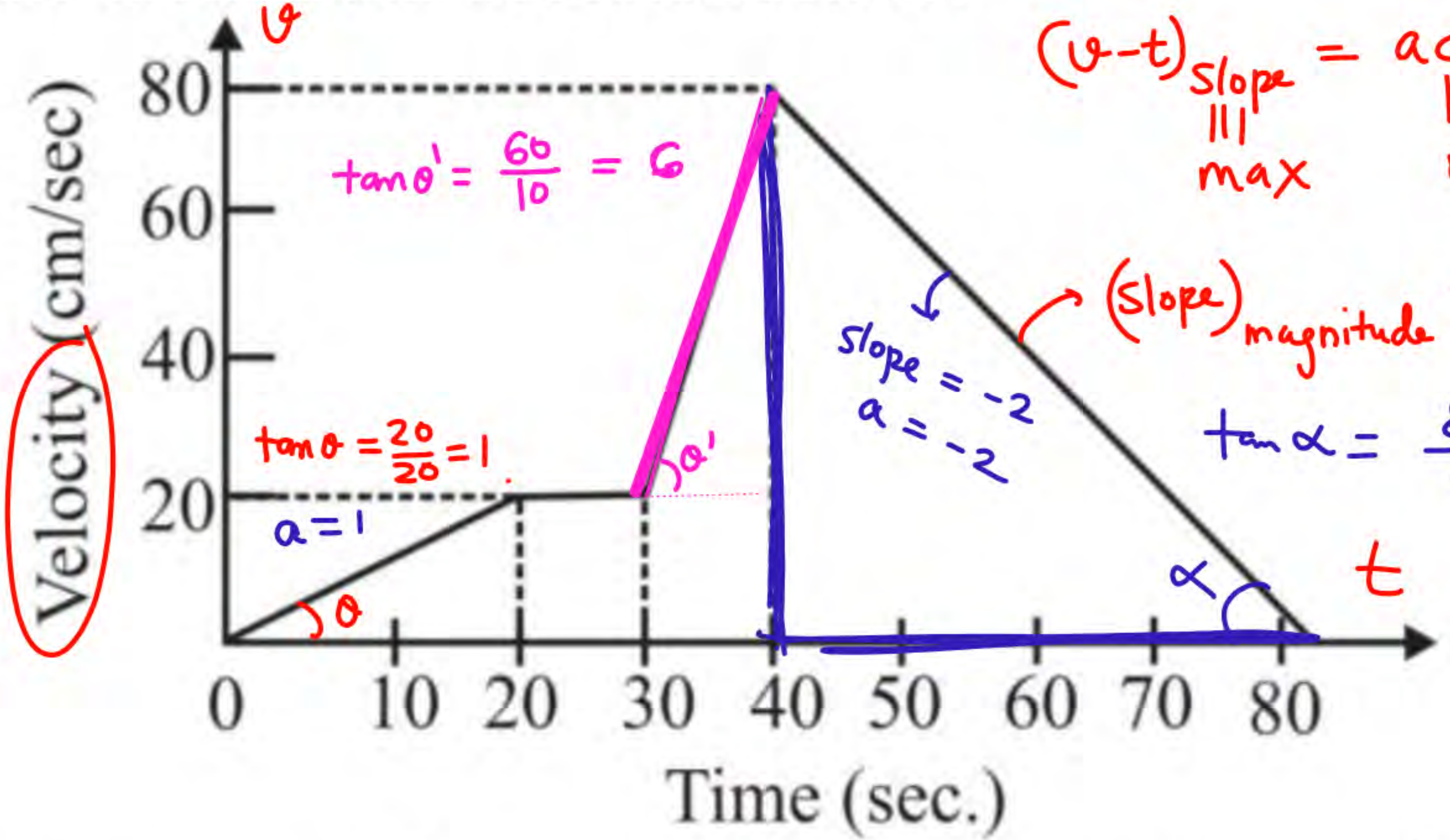
X

Agar particle
hawa me hai
uska acc ≡ g Neeche
const

acc ⟶ const
v ⟶ st. line.
(v - t)

3

53. The $v-t$ graph of a moving object is given in figure. The maximum acceleration is:



$(v-t)_{slope} = acc$

$\equiv \quad \equiv$

max $\quad$ max

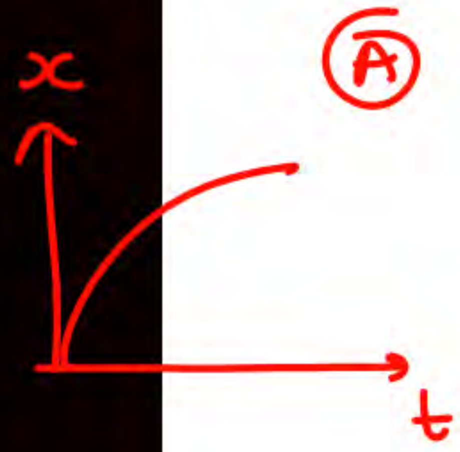
$(\text{Slope})_{\text{magnitude}} =$

$\tan\alpha = \frac{80}{40} = 2$

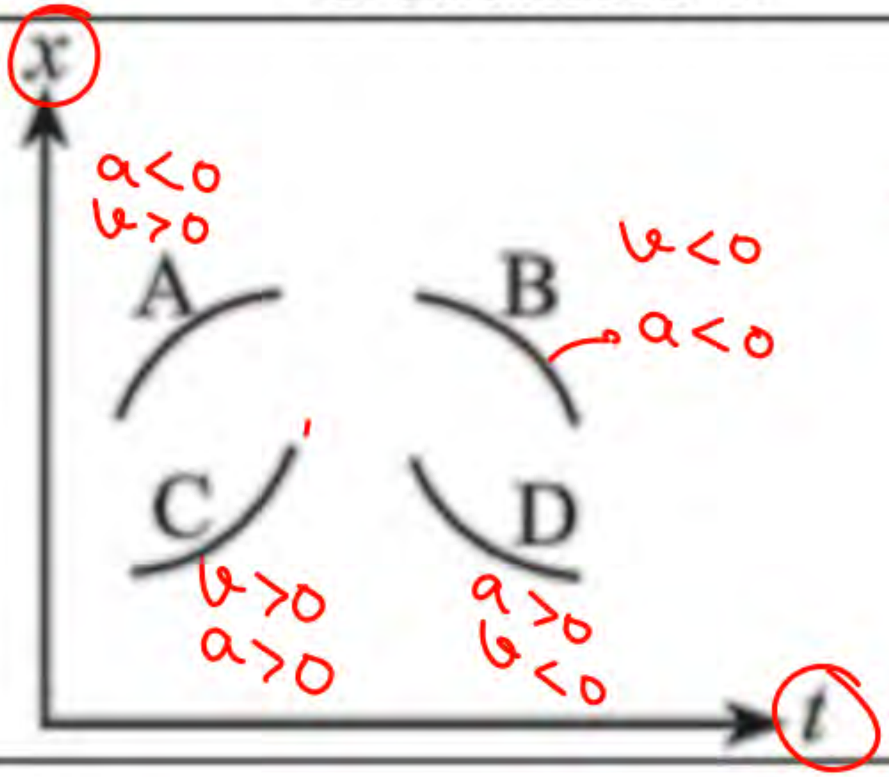
(1) 1 cm/sec^2 (2) 2 cm/sec^2

(3) 3 cm/sec^2 (4) 6 cm/sec^2 ✓

4



54. Column-I shows the position-time graph of particles moving along a straight line and column-II lists the conclusion that follow from graphs. Match column-I with column-II and choose the correct option given below the columns.

Column-I	Column-II	
	p.	Acceleration a > 0
	q.	Acceleration a < 0
	r.	Speeding up
	s.	Slowing down

2

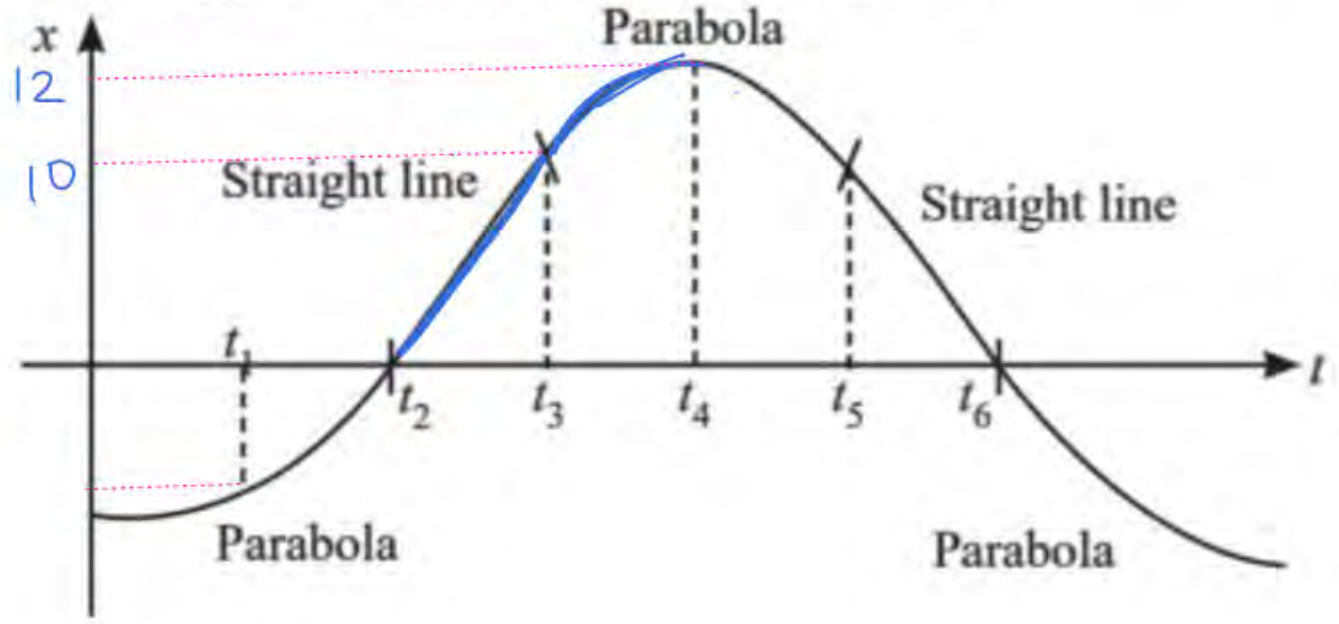
(1) A-(q,p); B-(r,p); C-(s,q); D-(r,s)

(2) A-(q,s); B-(q,r); C-(p,r); D-(p,s)

(3) A-(r,q); B-(s,r); C-(q,r); D-(p,r)

(4) A-(p,s); B-(r,s); C-(p,r); D-(p,q)

55. Figure shows a graph of position versus time graph for a particle moving along x-axis.



P → B, D

q ⇒ v const, $\underline{v > 0}$, $a = 0$
moving Away orig

Column-I		Column-II	
A.	Slowing down	p.	$t_1 \rightarrow t_2$
B.	Returning towards origin	q.	$t_2 \rightarrow t_3$
C.	Moving away from origin	r.	$t_3 \rightarrow t_4$
D.	Speeding up	s.	$t_4 \rightarrow t_5$
		t.	$t_5 \rightarrow t_6$

(1) A-(r); B-(p,s,t); C-(q,r); D-(p,s)

(2) A-(r); B-(r,t); C-(q); D-(s)

(3) A-(p,r); B-(s); C-(p,r,q); D-(r,s)

(4) A-(r); B-(p,s); C-(p,q); D-(q,r,s)

L

56. The position of a particle along x-axis is given by $x = (2t^3 - 21t^2 + 60t)m$. Then match the Column-I with Column-II. $v = 6t^2 - 42t + 60$, $a = 12t - 42$

	Column-I		Column-II
A.	Velocity of particle is zero	p.	2 sec
B.	Acceleration of particle is zero (r)	q.	3 sec
C.	Acceleration of particle is negative $12t - 42 < 0$	r.	3.5 sec
D.	Velocity of particle is towards the origin $v \cdot x < 0$	s.	4 sec
		t.	5 sec

(1) A-(p,r,t); B-(r); C-(p,q); D-(q,r,s)

(2) A-(p,t,r); B-(r,t); C-(q); D-(s)

(3) A-(p,r); B-(s); C-(p,r,q); D-(r,s)

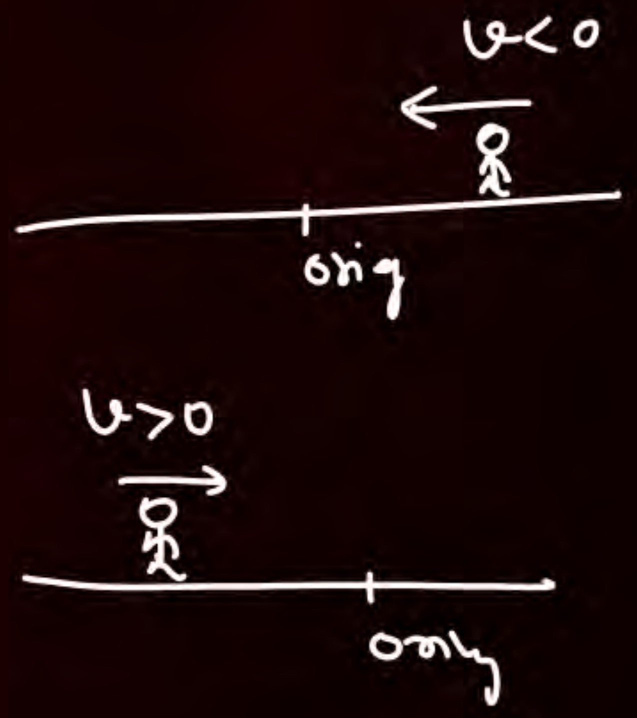
(4) A-(p,t); B-(r); C-(p,q); D-(q,r,s)

(A) $v = 0$

(B) $a = 0$

$12t = 42$

$t = \frac{42}{12} = \frac{14}{4} = \frac{7}{2} = 3.5$



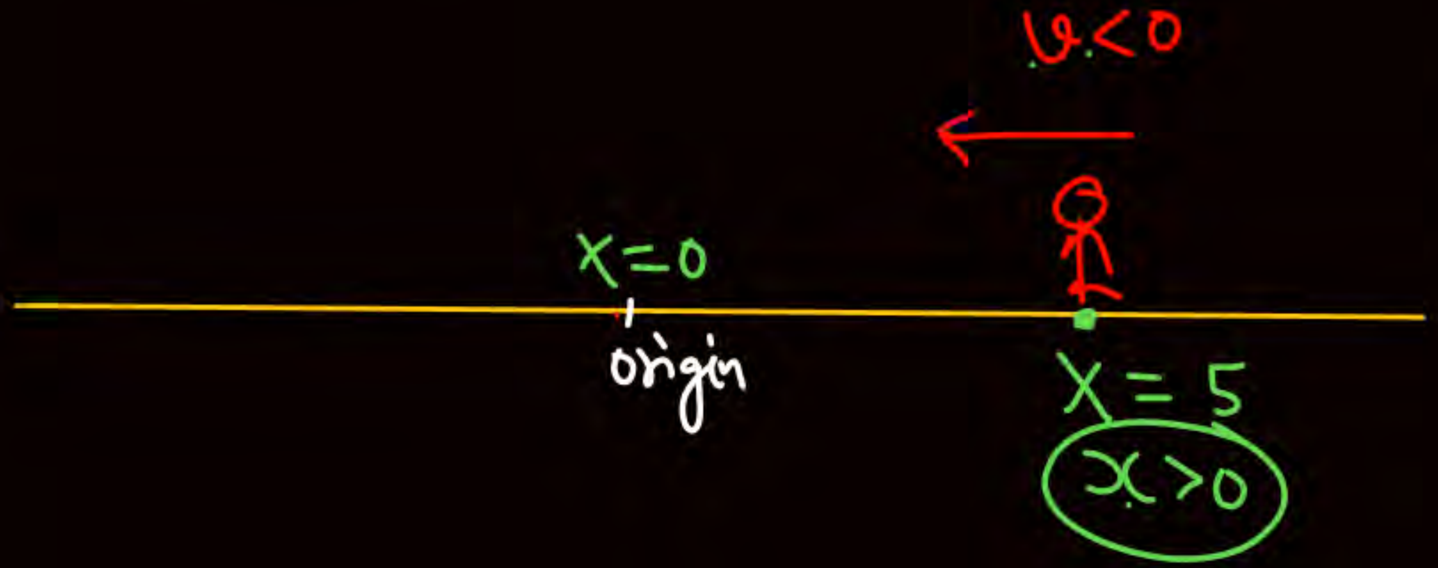
4

$v \cdot x < 0$

particle is moving towards origin.

$v > 0$ ✗

$v < 0$ ✗



$v \cdot x < 0$

$A_1 = \frac{1}{2} \times 2 \times 10 = 10$

$A_2 = \frac{1}{2} \times 4 \times 10 = 20$

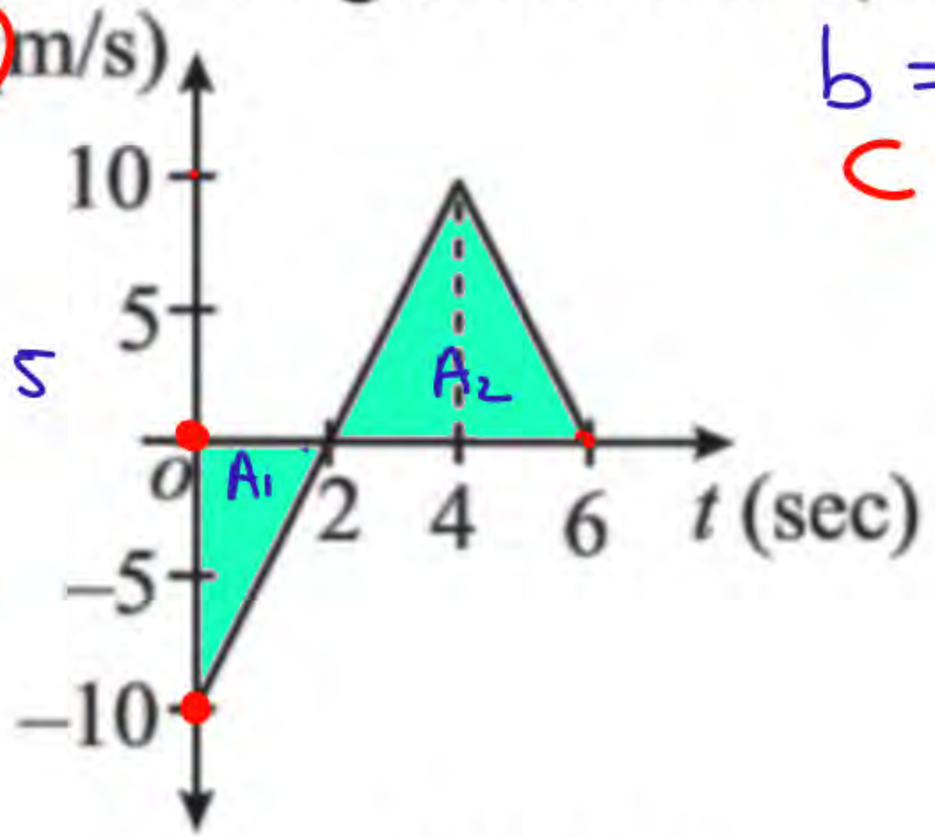
57. The figure shows the graph of velocity-time for a particle moving in a straight line. If the average speed for 6 sec is 'b' and the average acceleration from 0 sec to 4 sec is 'c' find magnitude of bc (in m^2/s^3).

$t = 0 \longrightarrow t = 6$

Avg speed $= \frac{\text{Distance}}{\text{time}}$

$= \frac{A_1 + A_2}{6} = \frac{10+20}{6} = 5$

$\langle acc \rangle = \frac{10-(-10)}{4}$

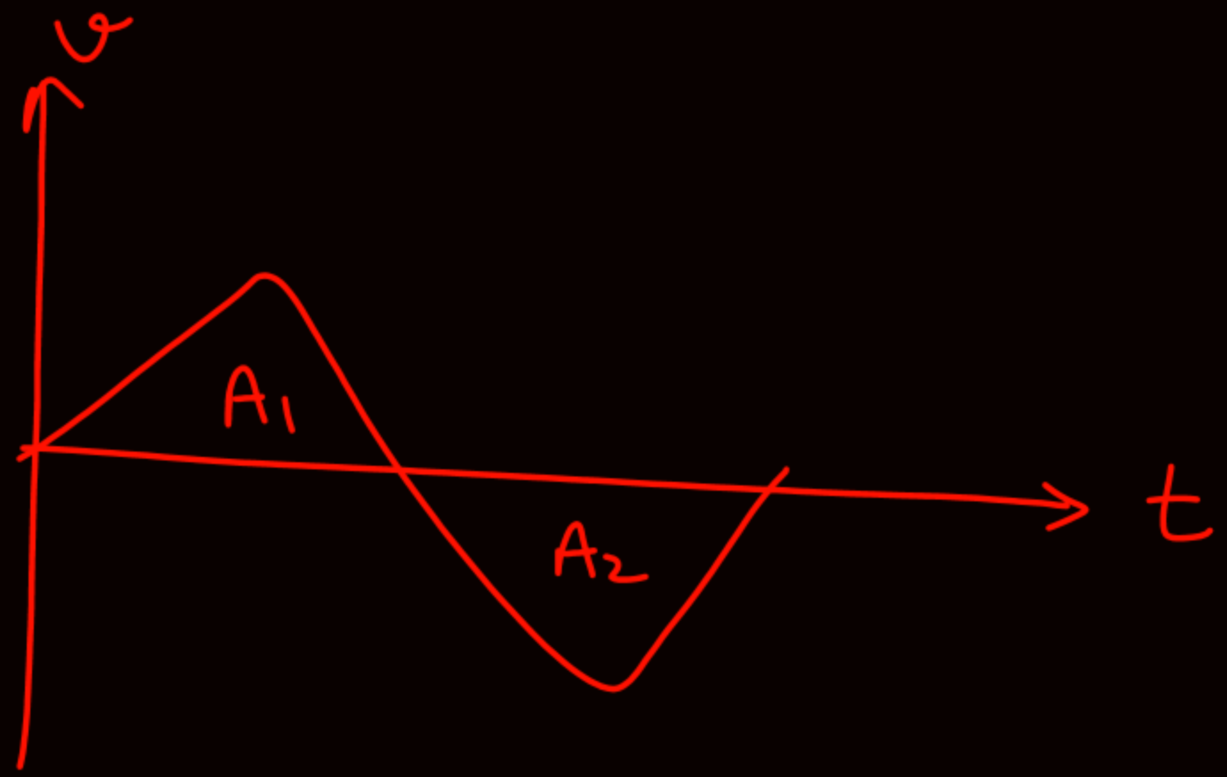


$b = 5$

$c = 5$

(1) 5
(2) 20
(3) 25
(4) 40

3

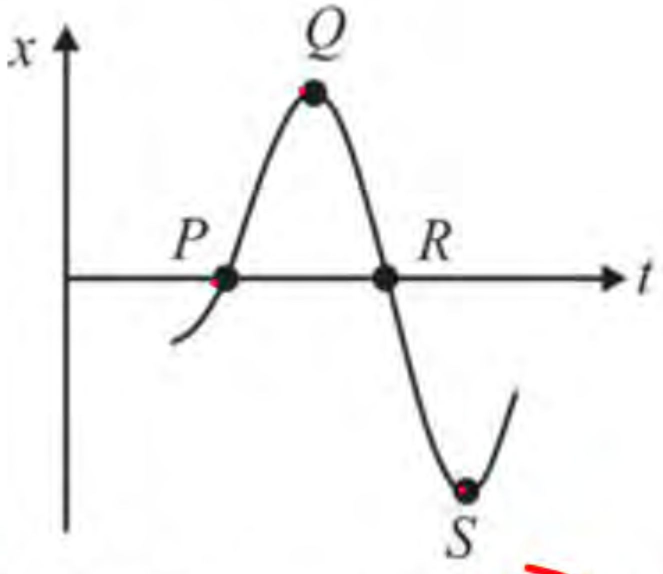


Displacement $= A_1 - A_2$

Distance $= A_1 + A_2$

a = 0, v → const
|||
(x-t) st line.

58. The given figure is an x-t graph of the motion of a particle.



(i) At which of the points P, Q, R and S is the velocity v_x positive?

(ii) At which points is the velocity negative? R

(iii) At which points is the velocity zero? Q, S

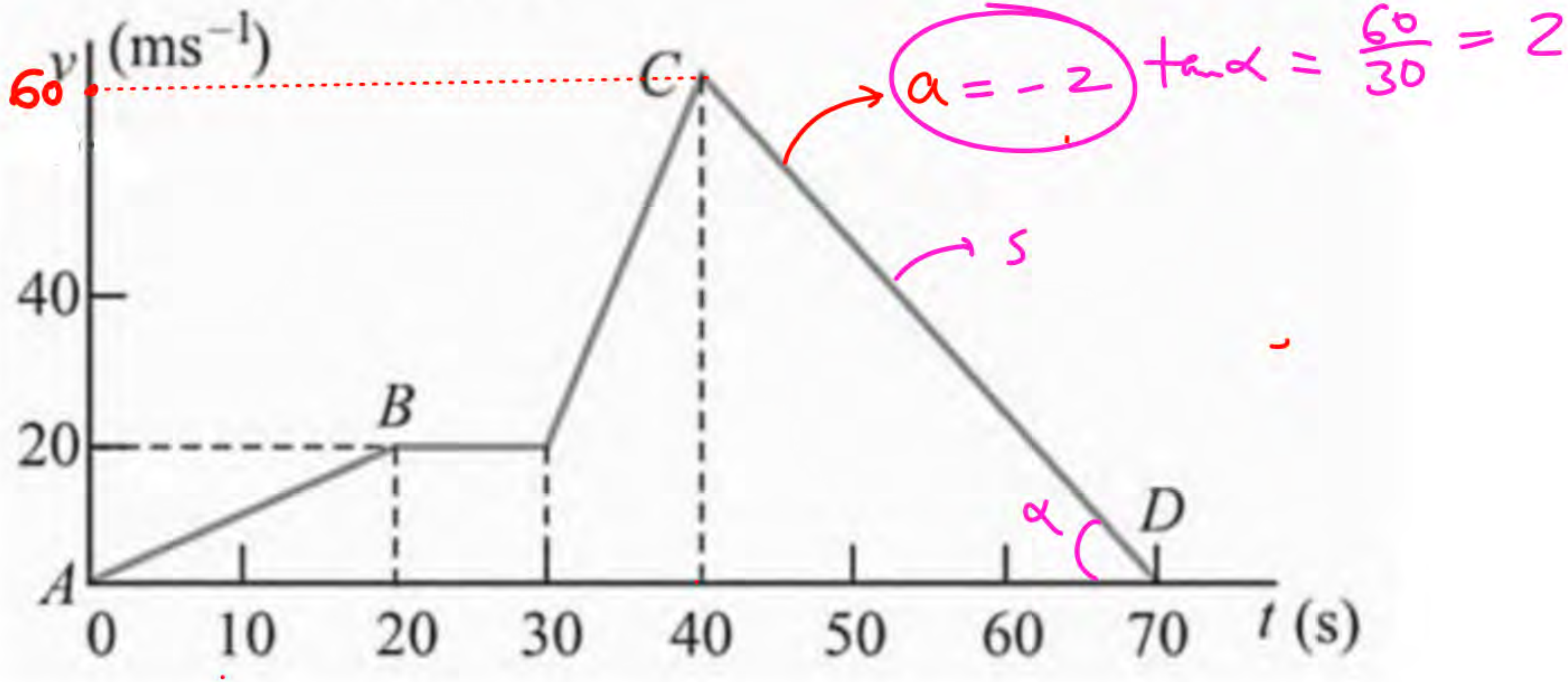
(iv) At which of the points P, Q, R, and S is the x-acceleration a_x positive? happy S

(v) At which point is the a_x negative? Q

(vi) At which points does the x-acceleration appear to be zero? R best

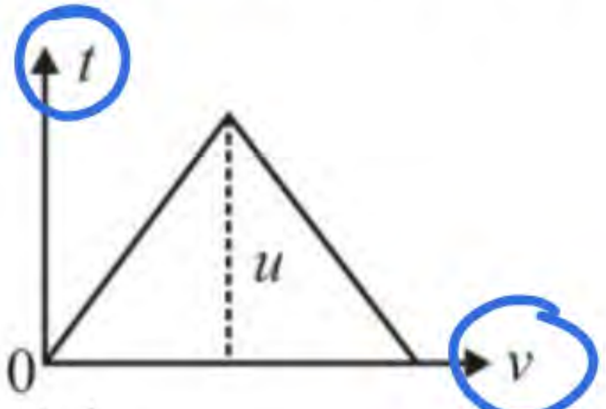
(vii) At each point, state whether the speed is increasing, decreasing, or not changing.

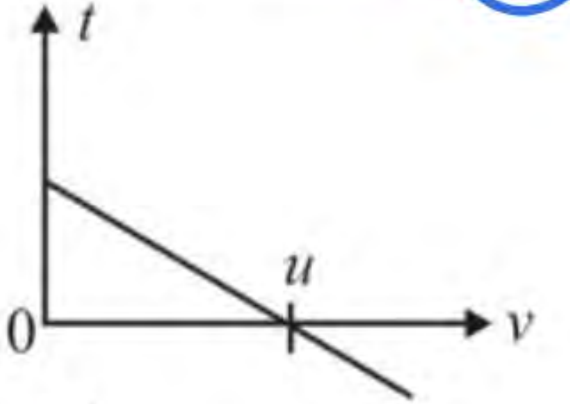
59. The velocity versus time curve of a moving point is shown in figure. Find the retardation of the particle for the portion CD.

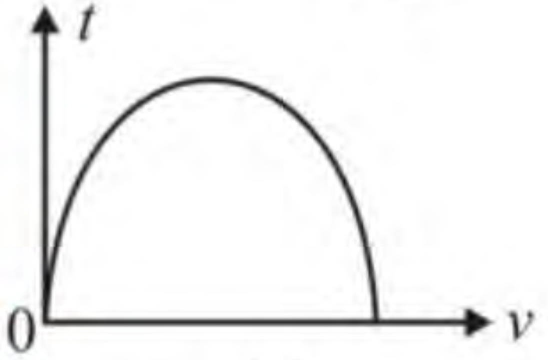


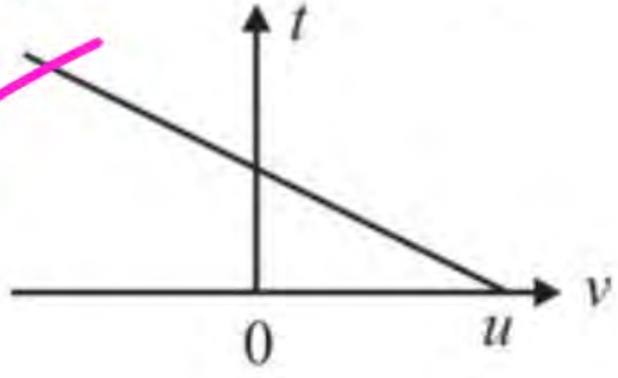
2

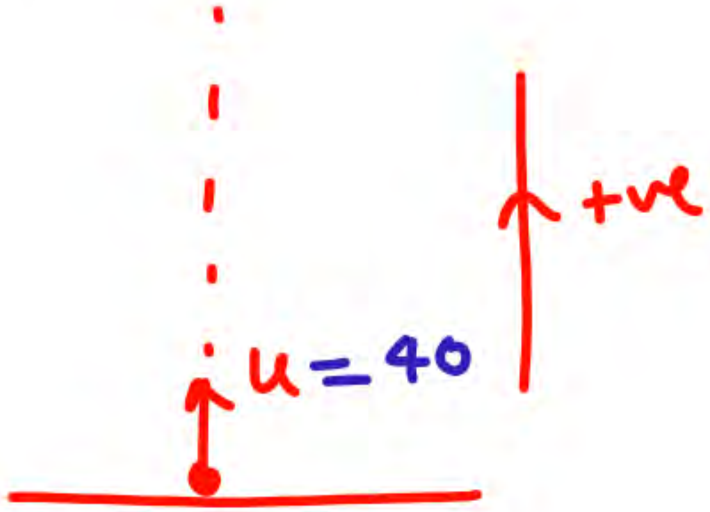
60. An object is thrown up vertically. The velocity-time graph for the motion of the particle is:

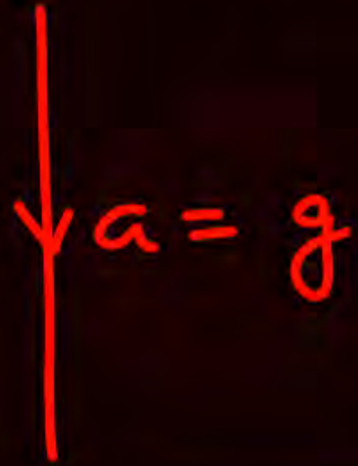
(1)


(2)


(3)


(4)






$v = u + at$

$v = u - gt$

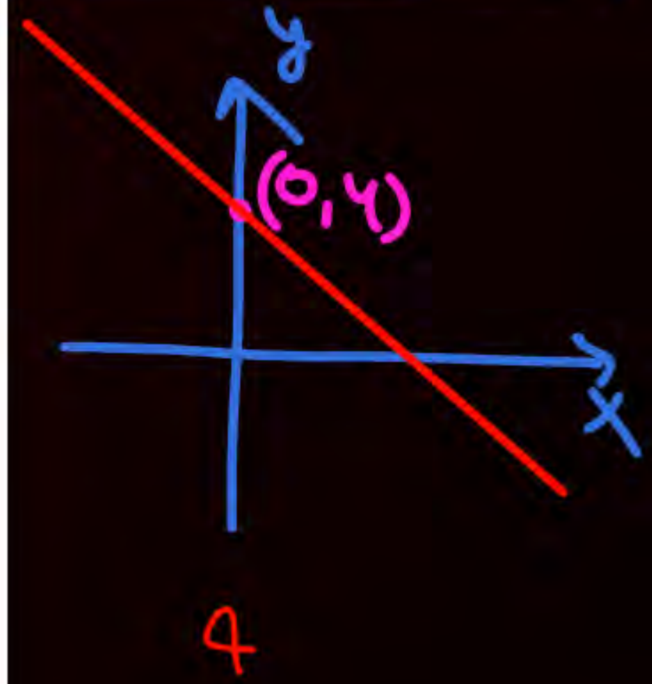
$v = 40 - 10t$

$x = 40 - 10y$

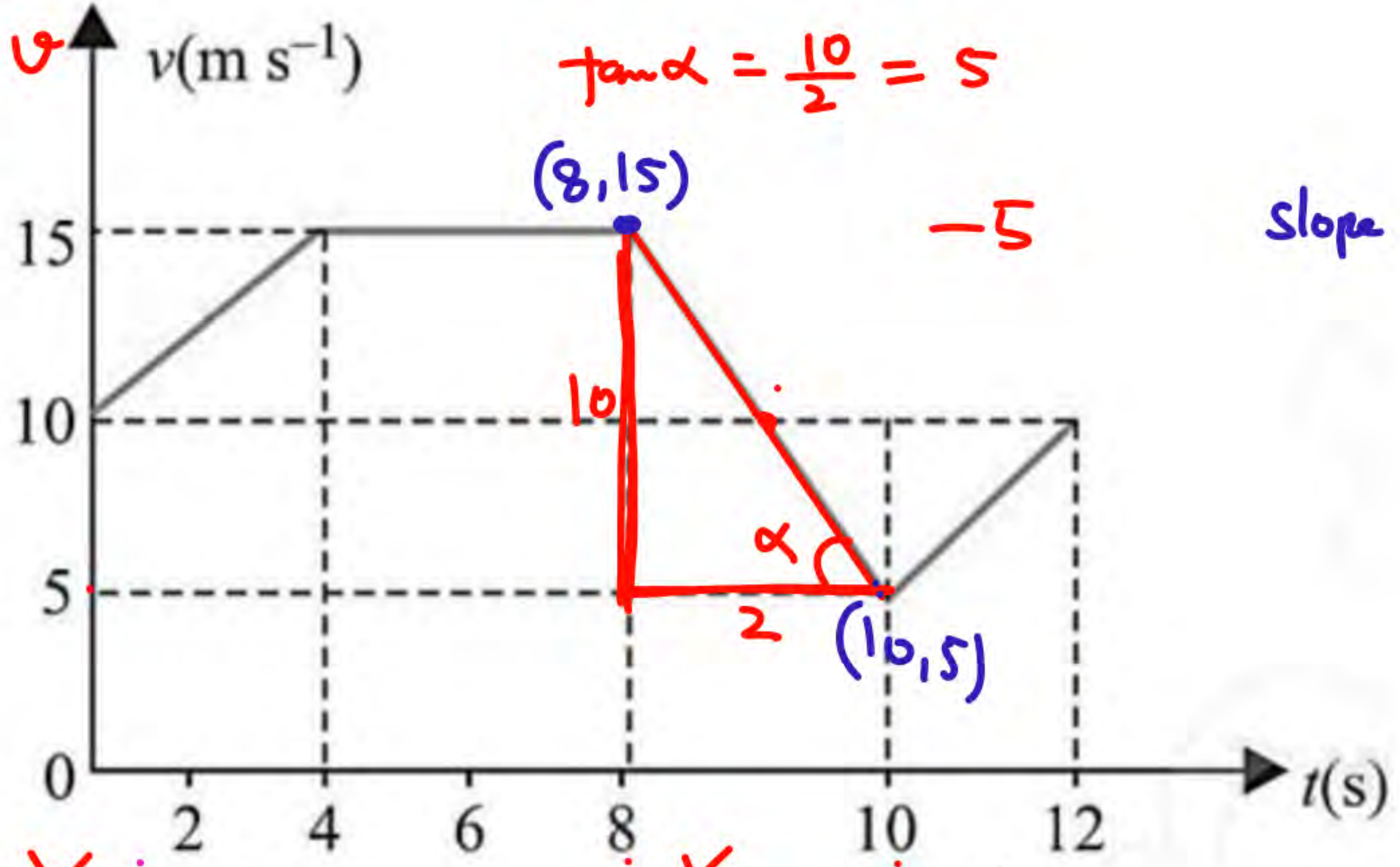
$10y + x = 40$

$10y = -x + 40$

$\boxed{y = -\frac{x}{10} + 4}$



61. The velocity-time graph of a particle moving in a straight line is shown in figure. The acceleration of the particle at $t = 9$ s is:



slope $= \frac{5-15}{10-8} = \frac{-10}{2}$

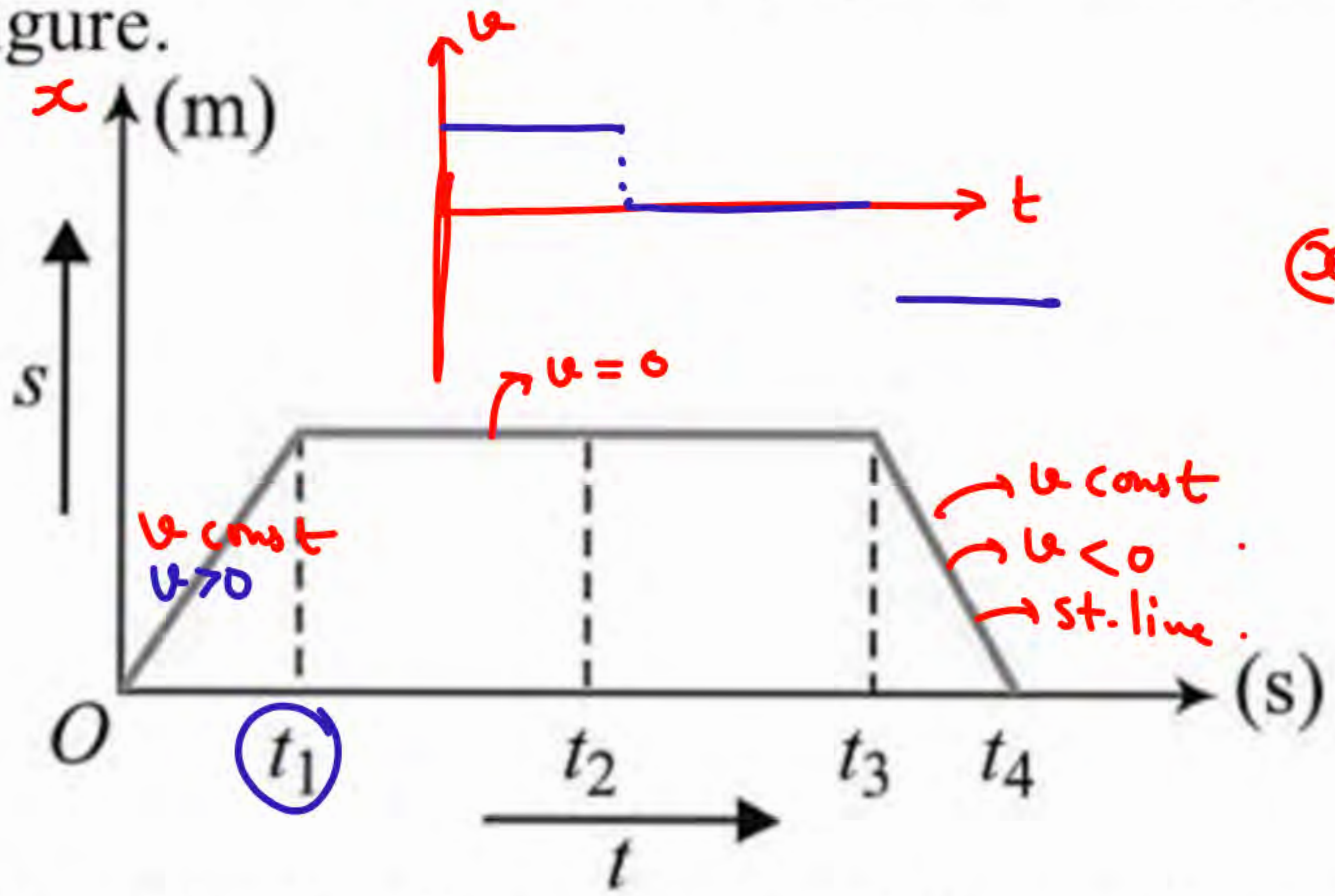
$= -5$

(1) zero (2) 5 ms^{-2}

(3) -5 ms^{-2} (4) -2 ms^{-2}

3

62. The displacement-time graph of a body is shown in figure.



(x-t) st. line

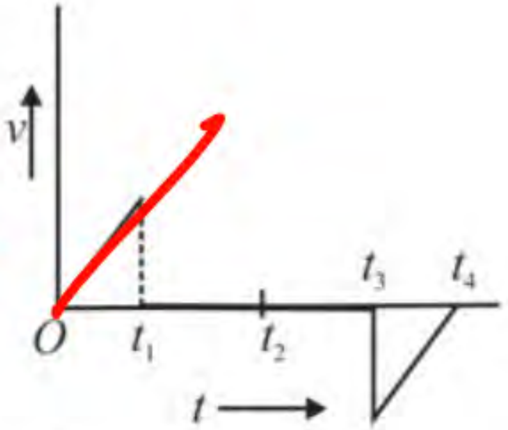
|||

v → const

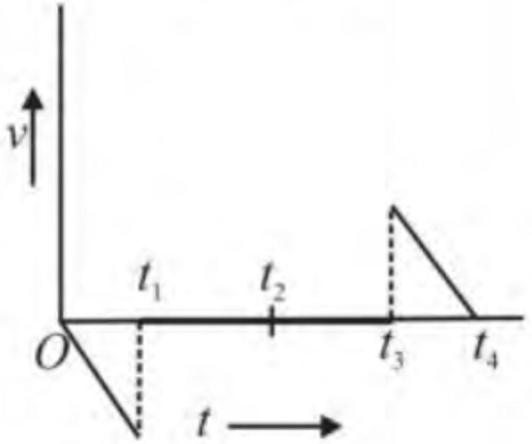
The velocity-time graph of the motion of the body will be:

4

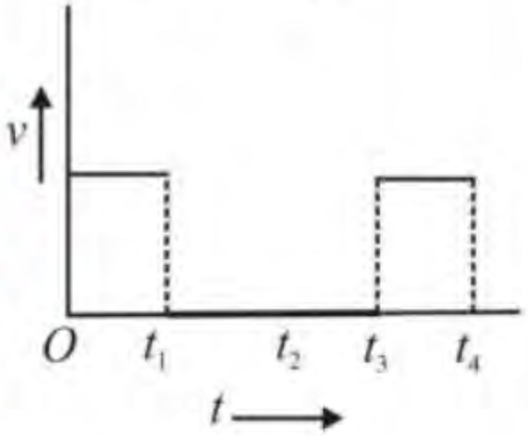
(1)



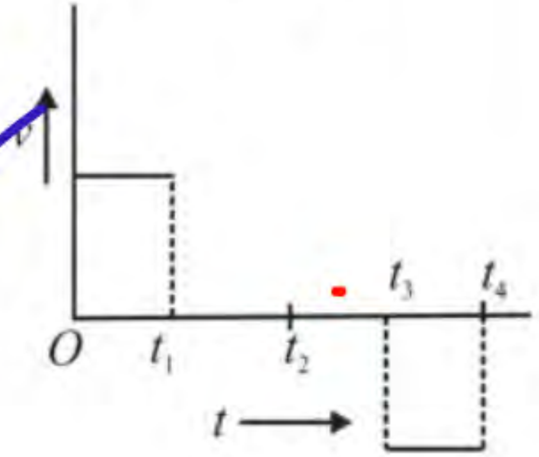
(2)



(3)

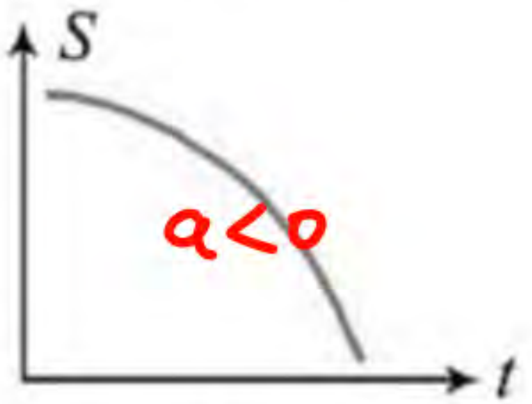


(4)

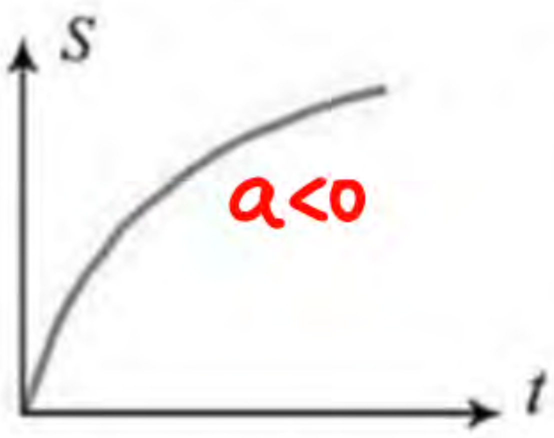


63. The acceleration will be positive in

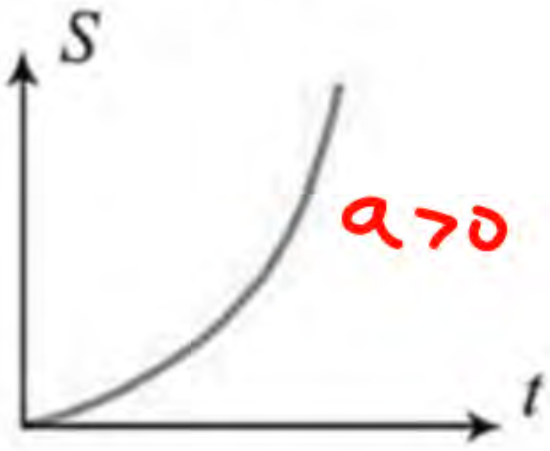
(I)



(II)



(III)



(IV)

(1) (I) and (III)

(2) (I) and (IV)

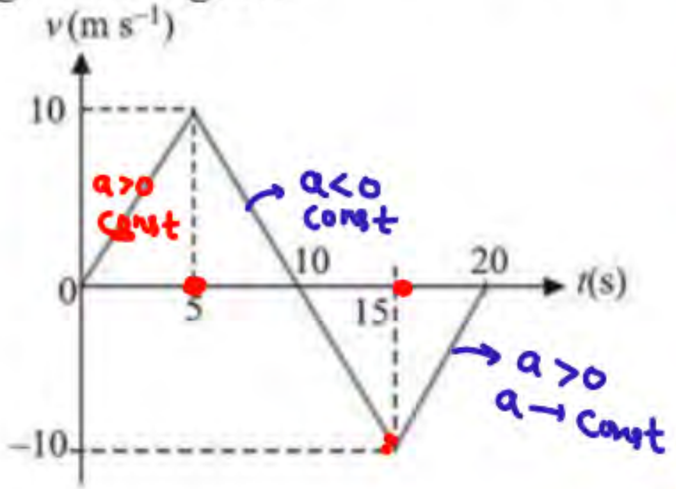
(3) (II) and (IV)

(4) None of these

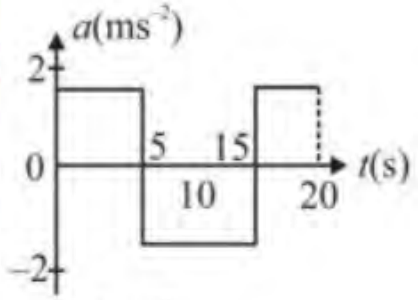
2

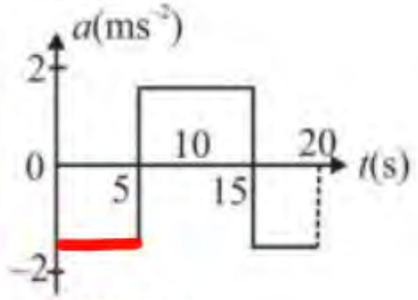
(v-t) का slope ⇒ acc देता है

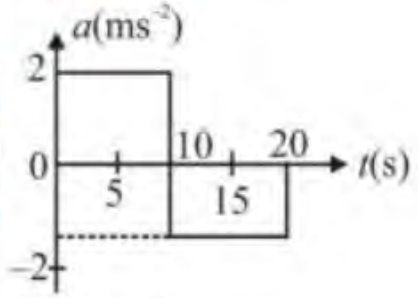
64. Plot the acceleration-time graph of the velocity-time graph given in figure.

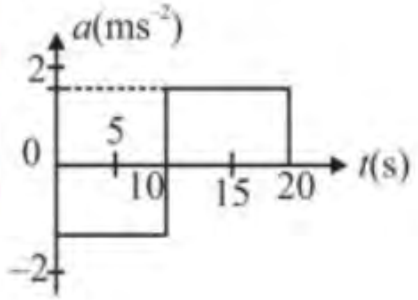


+, −, +

(1)


(2)


(3)


(4)


1

65. A particle starts moving rectilinearly at time $t = 0$ such that its velocity v changes with time t according to the equation $v = t^2 - t$, where t is in seconds and v is in ms^{-1}. The time interval for which the particle retards (i.e., magnitude of velocity decreases) is: speed down

$a \cdot v < 0$

(1) $t < 1/2$
(2) $1/2 < t < 1$
(3) $t > 1$
(4) $t < 1/2$ and $t > 1$

2

66. Check up the only correct statements in the following:

(1) ~~A body having a constant velocity still can have varying speed.~~

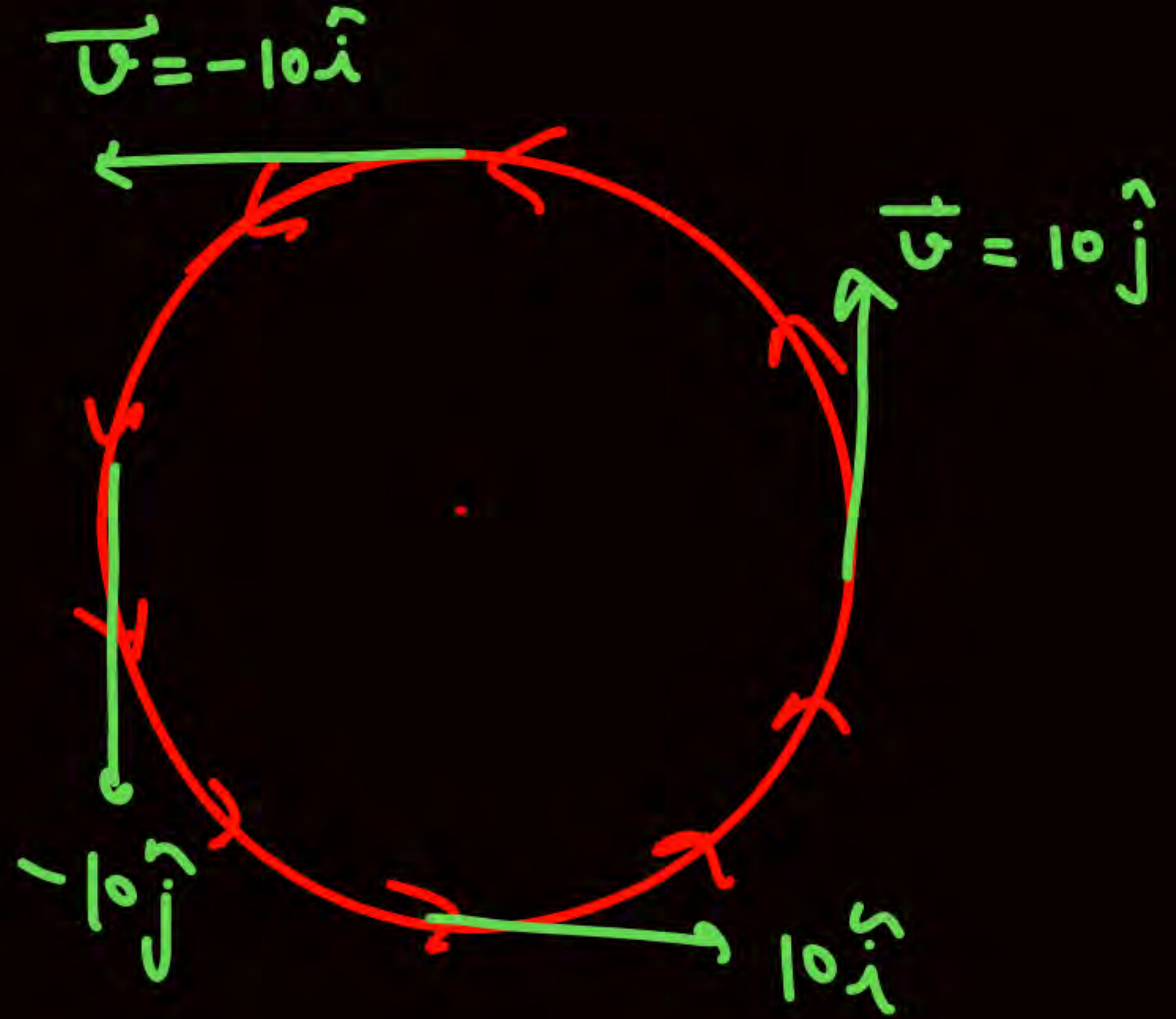
(2) A body having a constant speed can have varying velocity.

(3) A body having constant speed can have an acceleration.

(4) If velocity and acceleration are in the same direction, then distance is equal to displacement.

circular motion

2, 3, 4



$\vec{v} \longrightarrow$ change

$\vec{v} \longrightarrow$ chage

|||

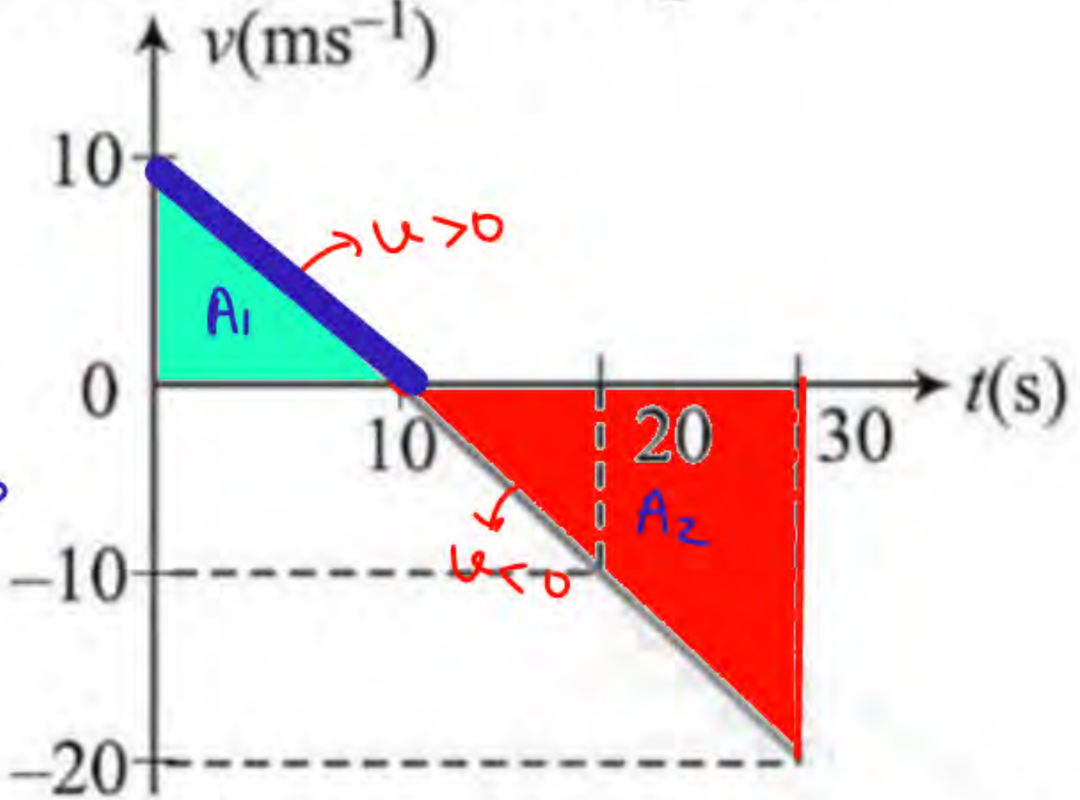
$a = \checkmark$

67. The velocity-time plot for a particle moving on a straight line is shown in figure.

Displacement $= A_1 - A_2$

$A_1 = \frac{1}{2} \times 10 \times 10 = 50$

$A_2 = \frac{1}{2} \times 20 \times 20 = 100$



(1) The particle has a constant acceleration.

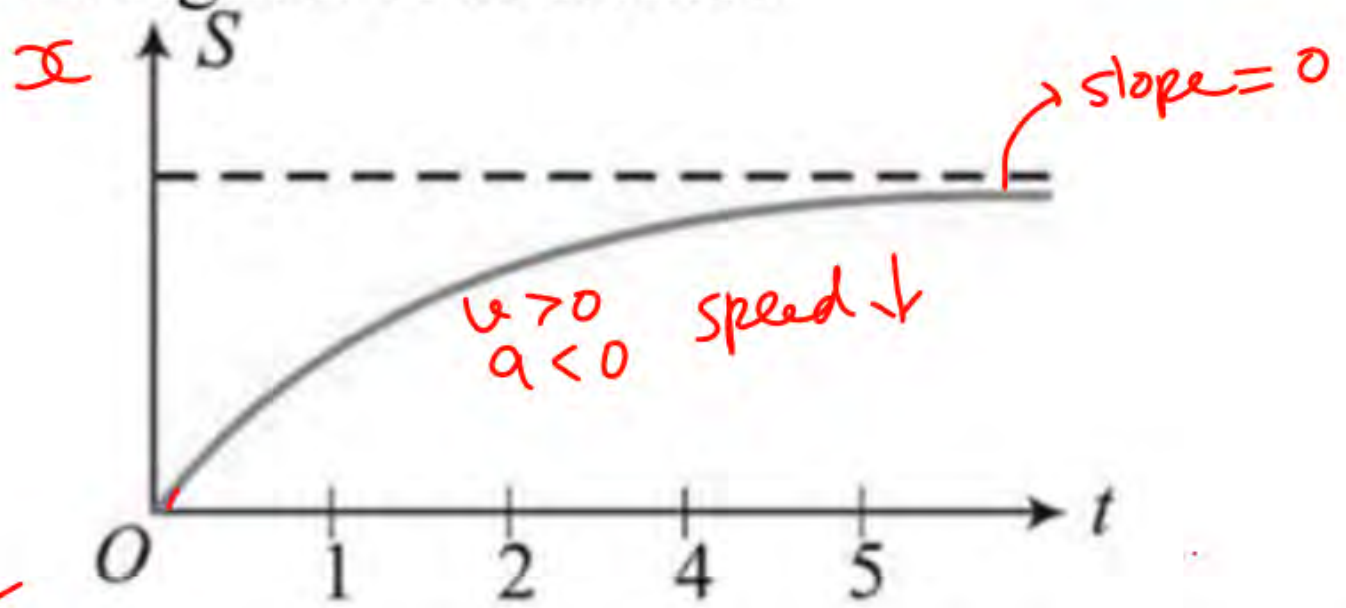
(2) The particle has never turned around.

(3) The particle has zero displacement.

(4) The average speed in the interval 0 to 10 s is the same as the average speed in the interval 10 s to 20 s.

1, 4

68. The displacement of a particle as a function of time is shown in figure. It indicates



(1) The particle starts with a certain velocity, but the motion is retarded and finally the particle stops.

(2) The velocity of the particle decreases.

(3) The acceleration of the particle is in opposite direction to the velocity.

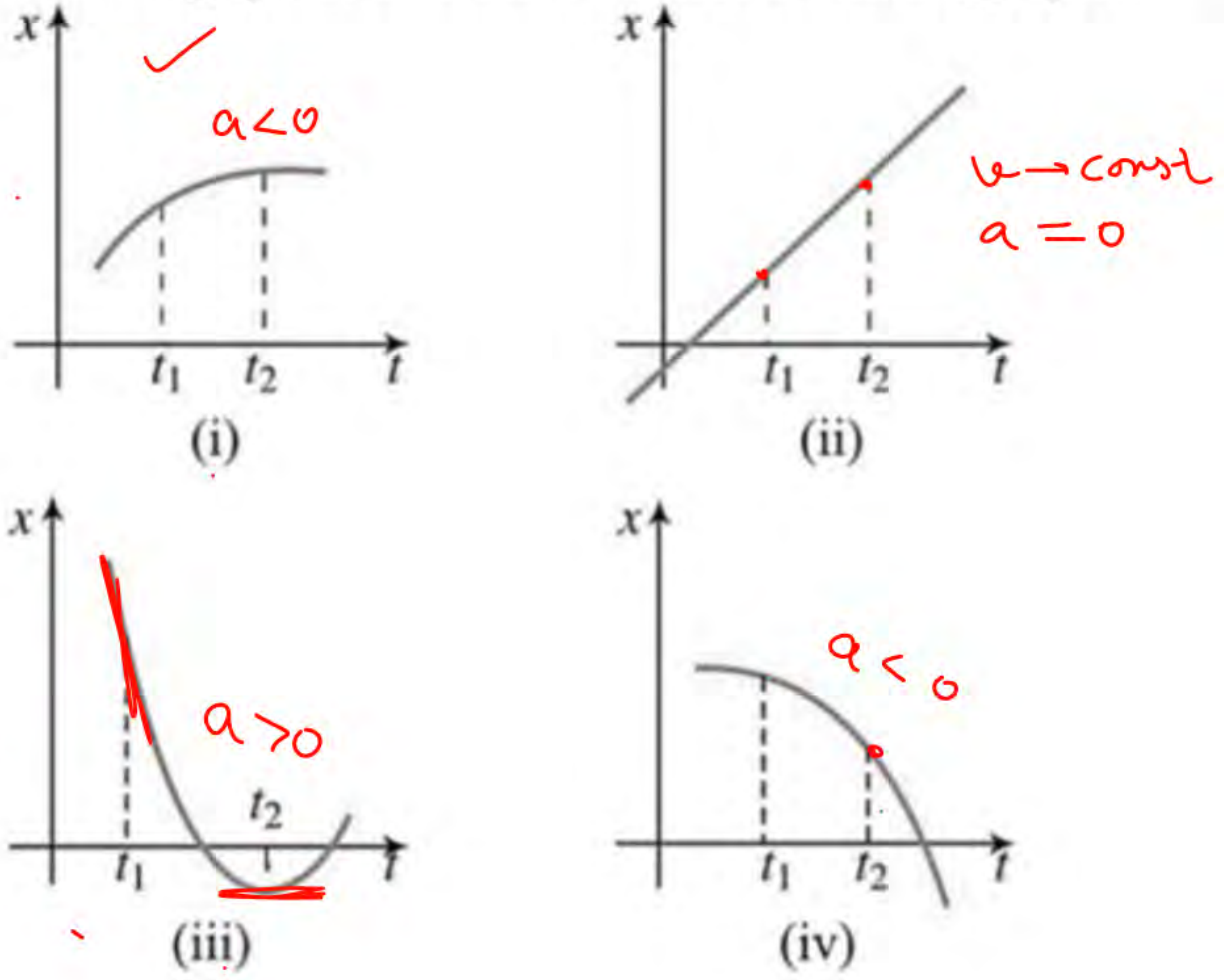
(4) The particle starts with a constant velocity, the motion is accelerated and finally the particle moves with another constant velocity.

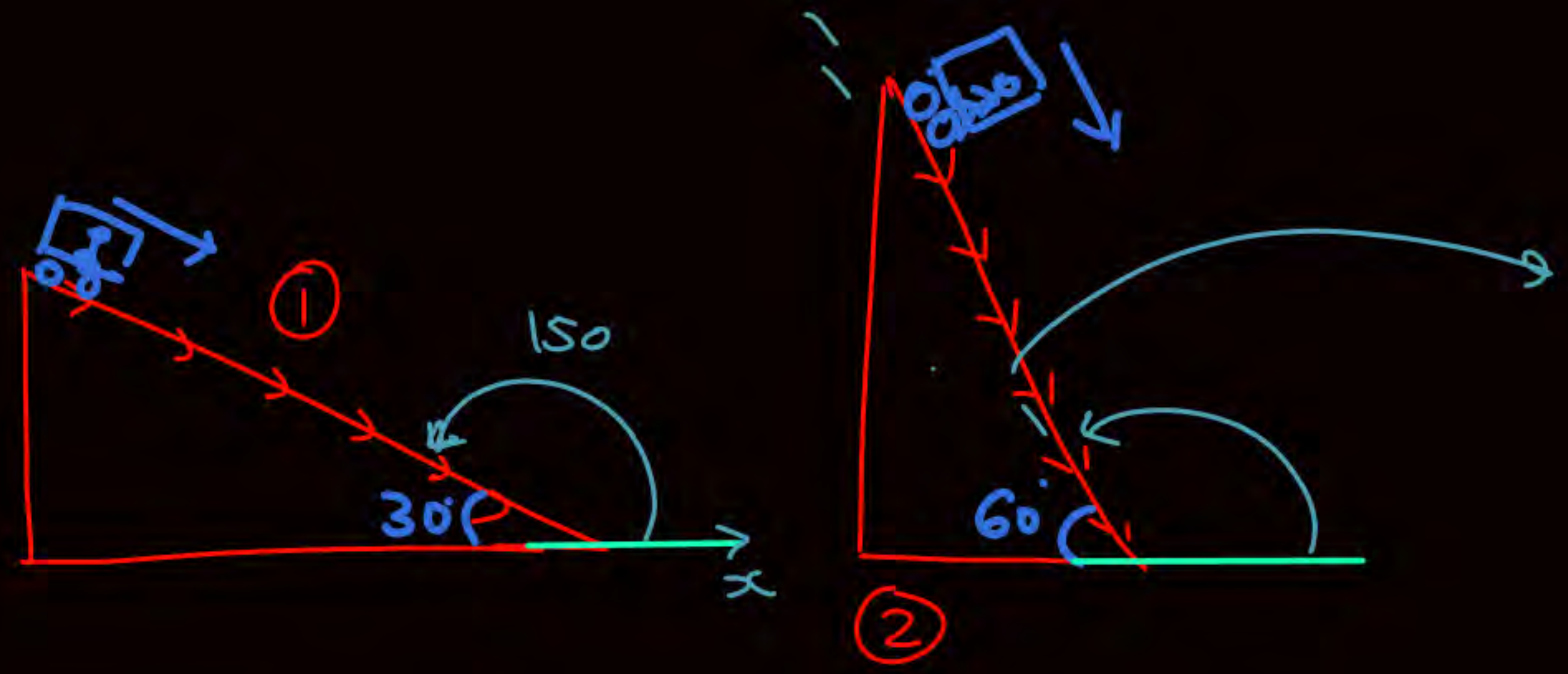
1, 2, 3

For Problems 69 and 70:

Study the four graphs given below. Answer the following questions on the basis of these graphs.

$|v_{t_1}| > |v_{t_2}|$





$$\text{slope} = \tan(120) = \tan(180-60) = -\sqrt{3}$$

magnitude of slope ⇒ $(\text{slope})_1 < (\text{slope})_2$

$$(\text{slope})_1 = \tan 150 = \tan(180-30) = -\frac{1}{\sqrt{3}}$$

$\vec{v}_A = -20\hat{i}$

$\vec{v}_B = +10\hat{i}$

$V_A > V_B$

69. In which of the graphs, the particle has more magnitude of velocity at t_1 than at t_2.

(1) (i), (iii), and (iv)

(2) (i) and (iii)

(3) (ii) and (iii)

(4) None of the above

70. Acceleration of the particle is positive

(1) In graph (i)

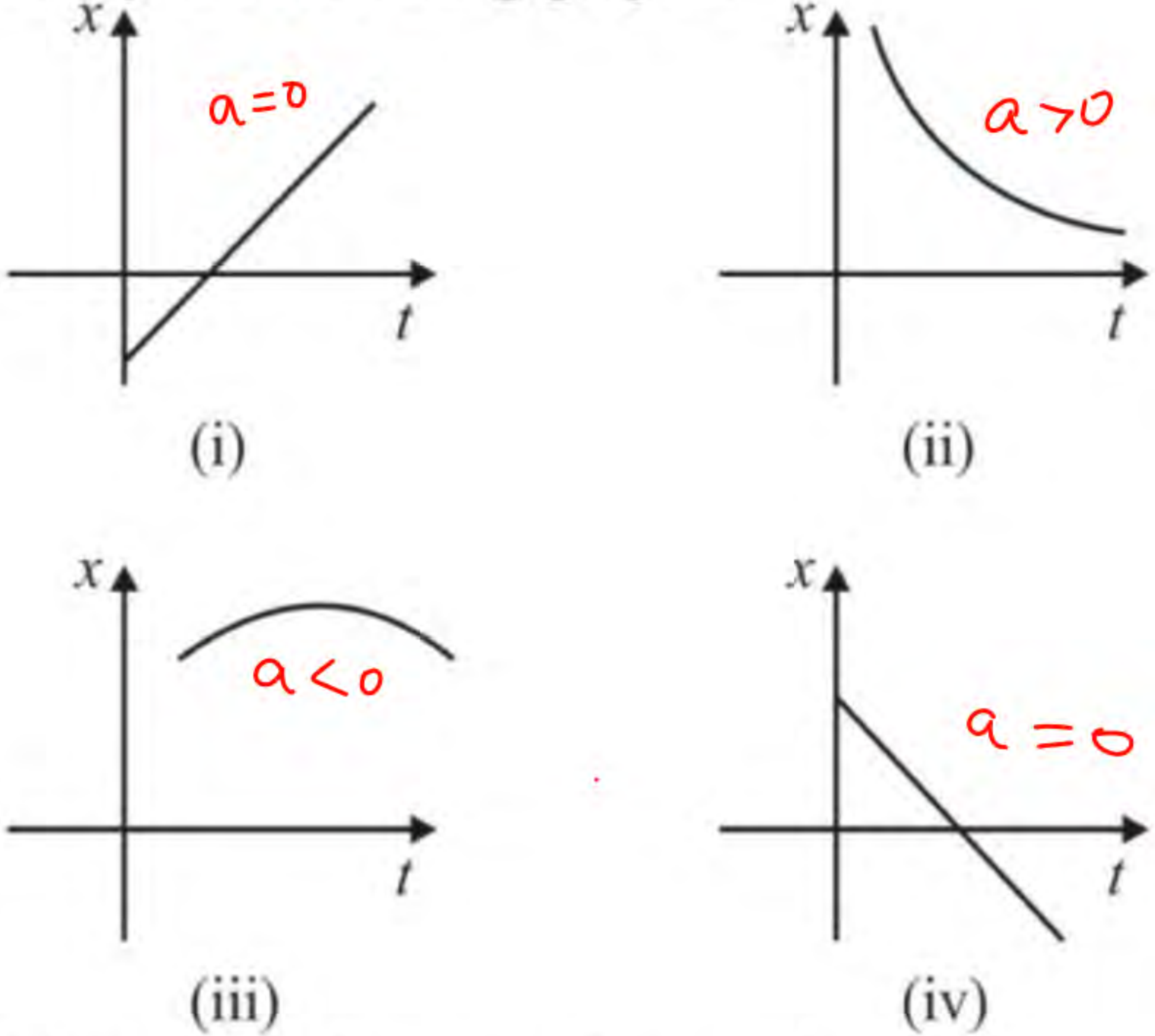
(2) In graph (ii)

(3) In graph (iii)

(4) In graph (iv)

2,3

71. Study the following graphs:



The particle has negative acceleration

(1) In graph (i)

(2) In graph (ii)

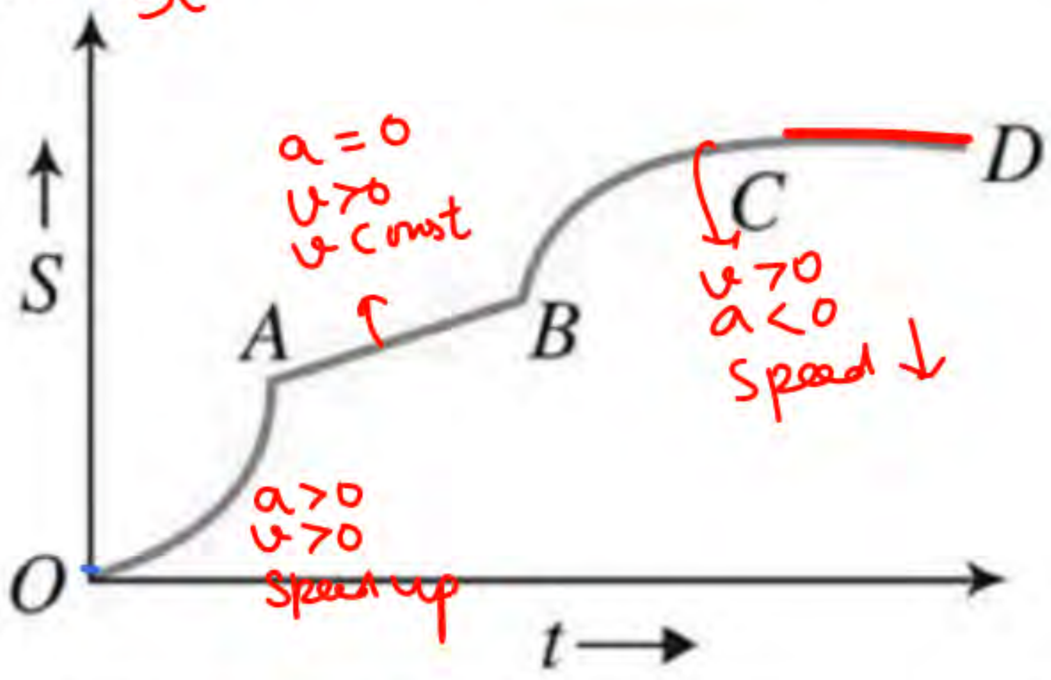
(3) In graph (iii)

(4) In graph (iv)

3

$x = t^2$
$v = 2t$
$a = 2$

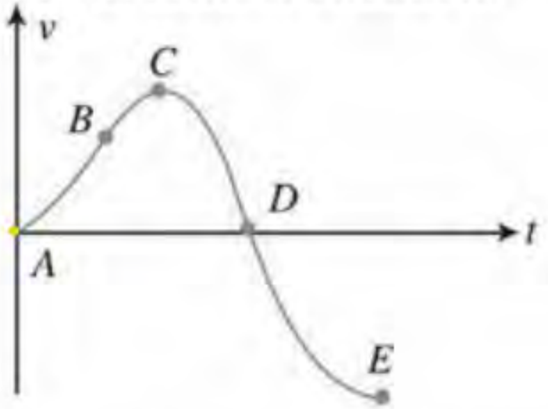
72. The displacement versus time curve is given. Sections OA and BC are parabolic. CD is parallel to the time axis.



Column-I		Column-II	
i.	OA a	a.	Velocity increases with time linearly
ii.	AB c	b.	Velocity decreases with time
iii.	BC b	c.	Velocity is independent of time
iv.	CD d	d.	Velocity is zero

a, c, b, d

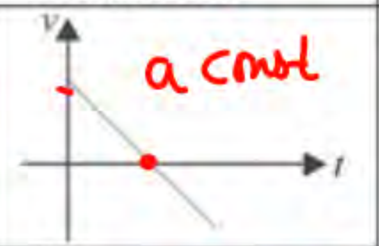
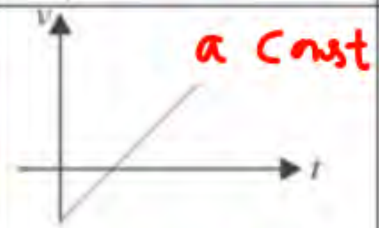
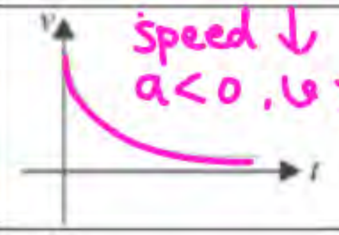
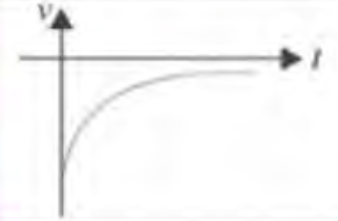
73. The velocity-time graph of a particle moving along the x-axis is shown in figure. Match the entries of Column I with entries of Colcumn II.

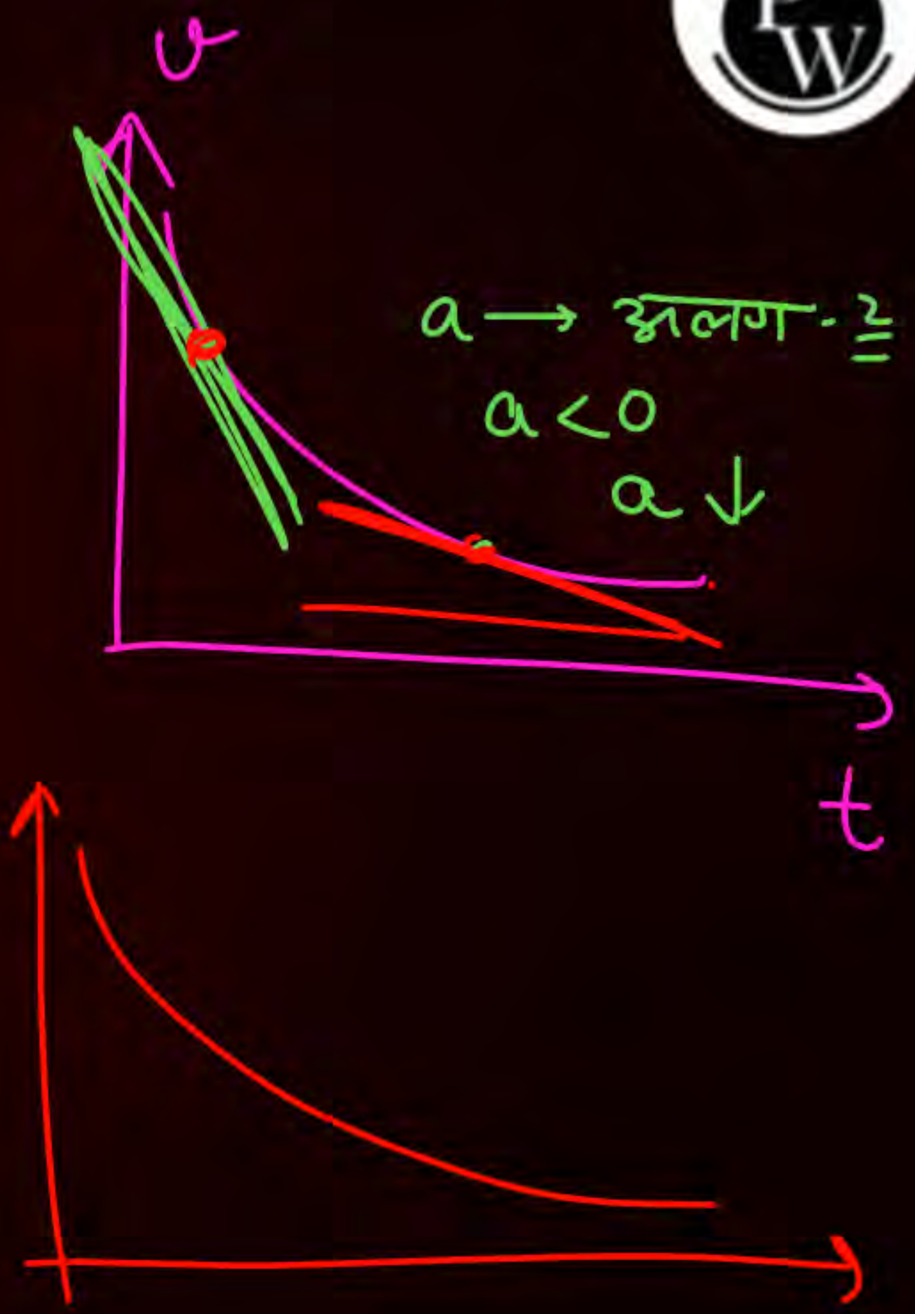


Column-I		Column-II	
i.	For AB, the particle is	a.	Moving in positive x-direction with increasing speed
ii.	For BC, the particle is	b.	Moving in positive x-direction with decreasing speed
iii.	For CD, the particle is	c.	Moving in negative x-direction with increasing speed
iv.	For DE, the particle is	d.	Moving in negative x-direction with increasing speed

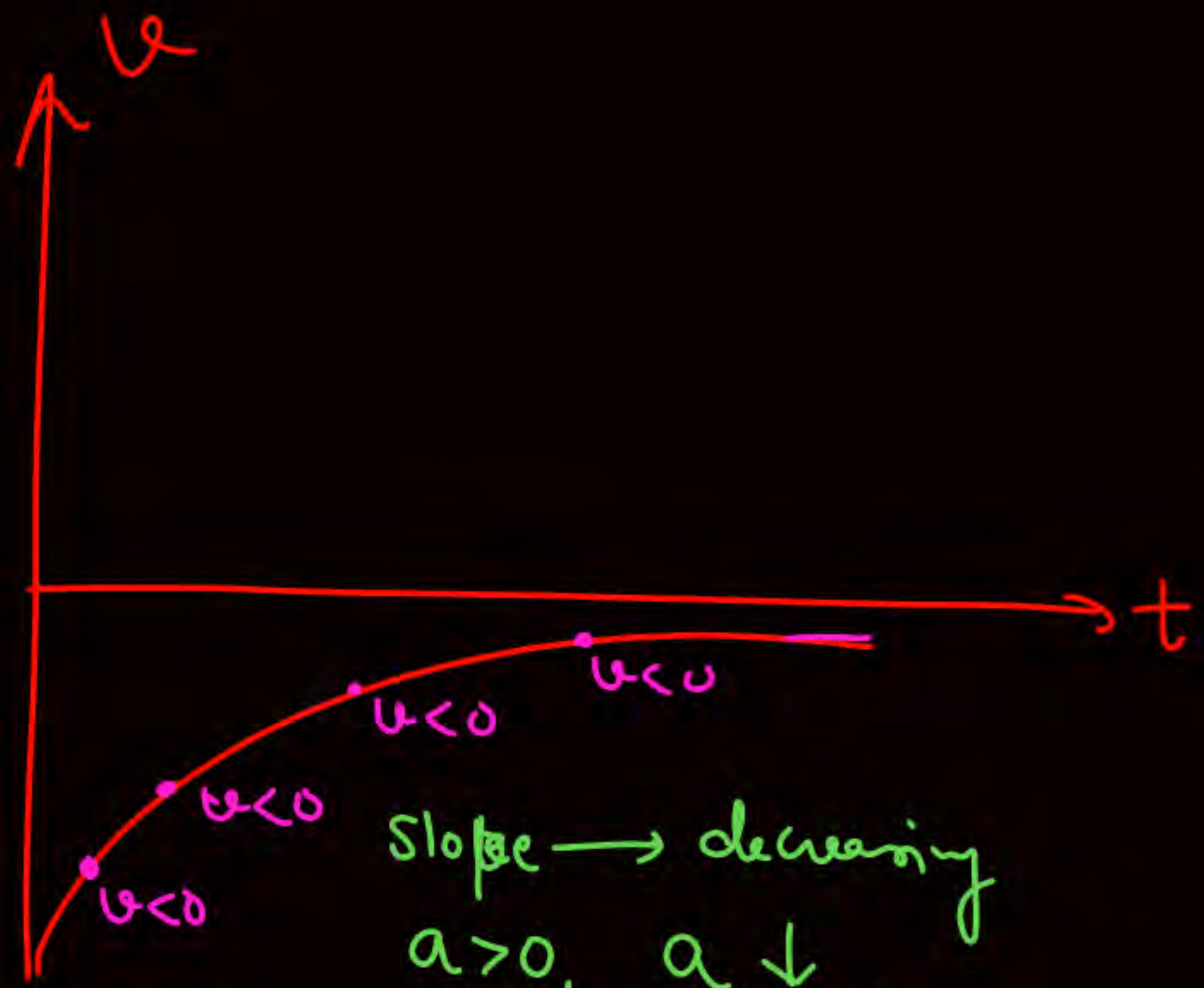
a, a, b, c

74. The velocity-time graph for a particle moving along a straight line is given in each situation of column I. In the time interval $v > t > 0$, match the graph in column I with corresponding statements in column II.

Column-I		Column-II	
i. c d		a.	Speed of particle is continuously decreasing
ii. c d		b.	Magnitude of acceleration of particle is decreasing with time
iii. a b c e		c.	Direction of acceleration of particle does not change
iv. a b c e		d.	Magnitude of acceleration of particle does not change
		e.	Particle will never come back to its initial position



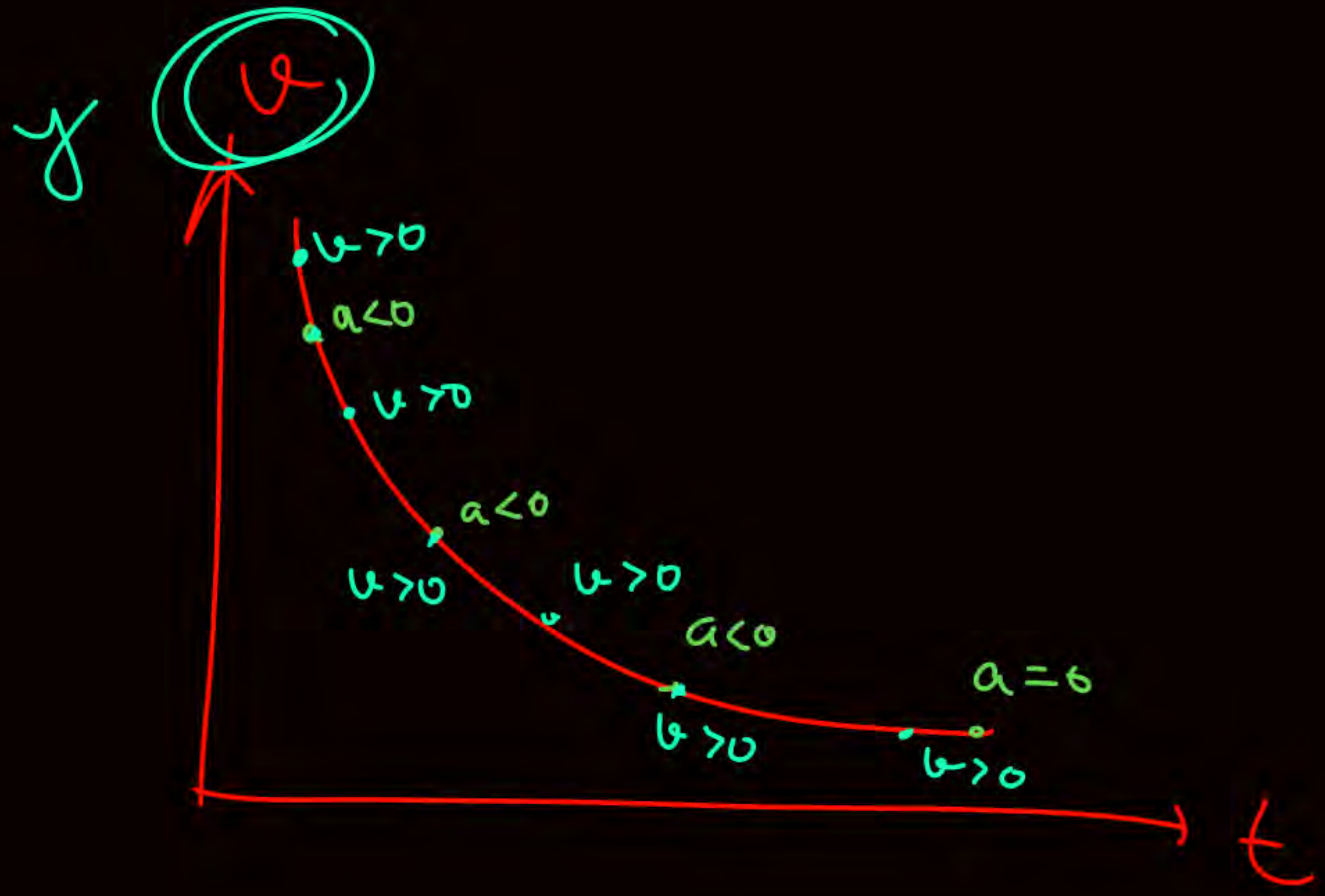
cd, cd, abce, abce



slope $\longrightarrow$ decreasing

$a>0$, $a \downarrow$,

$v<0$, speed $\downarrow$


y
v
v>0
a<0
v>0
a<0
v>0
v>0
a<0
a=0
v>0
v>0
t

Answer Key

1. (2)
2. (3)
3. (1)
4. (1)
5. (3)
6. (1)
7. (2)
8. (1)
9. (2)
10. (3)
11. (4)
12. (3)
13. (2)
14. (1)
15. (1)
16. (4)
17. (2)
18. (4)
19. (4)
20. (1)
21. (3)
22. (2)
23. (1)
24. (2)
25. (2)
26. (3)
27. (a) It is clear from the graph that OP < OQ. A lives closer to the school than B.
    (b) As A starts from $t = 0$ while B starts little later. So A starts from the school earlier than B.
    (c) The slope of $x - t$ for motion of B > slope of $x - t$ of A. Hence B walks faster than A.
    (d) The value of t corresponding to positions P and Q of there homes is same, so A and B reach home at the same time.
    (e) It is clear from the graph that B overtakes A once on the road.
28. (1, 3, 4)
29. (4)
30. (1, 2, 3, 4)
31. (a) 5 ms^{-1}, (b) –2.5 ms^{-1}
32. (4)
33. (i) zero velocity.
    (ii) constant positive velocity.
    (iii) infinite velocity.
    (iv) constant negative velocity.
    (v) positive increasing velocity.
    (vi) positive decreasing velocity.
    (vii) positive increasing velocity.
    (viii) positive decreasing velocity
34. (2, 3, 4)
35. (2, 4)
36. (2)
37. i $\rightarrow$ b; ii $\rightarrow$ a; iii $\rightarrow$ d; iv $\rightarrow$ c
38. (2)
39. (4)
40. (3)
41. (a) $= 2v\sin\frac{\theta}{2}$, (b) $\frac{2v^2}{R\theta}\sin\frac{\theta}{2}$
42. (2)
43. (a) $v = -27 + 3t^2$, $a = +6t$; (b) $t = \pm 3s$;
44. (1)
45. $\frac{\pi + 3}{3}$
46. (a) $A\omega\hat{j}$, (b) $\theta = \frac{\pi}{2}$, (c) $A\omega$
47. $\frac{1}{2}s < t < 1s$
48. (4)
49. (a) $x_{max} = \frac{32}{27}m$, $t = \frac{4}{3}s$; (c) $\frac{307}{27}m$;
    (d) –32 m; (e) –3ms^{-1}; (f) –4 ms^{-2};
    (g) –14 ms^{-2}
50. (4)
51. (3)
52. (3)
53. (4)
54. (2)
55. (1)
56. (4)
57. (3)
58. (*)
59. 2ms^{-1}

60. (4)
61. (3)
62. (4)
63. (2)
64. (1)
65. (2)
66. (2, 3, 4)
67. (1, 4)
68. (1, 2, 3)
69. (2)
70. (3)
71. (3)
72. i $\rightarrow$ a; ii $\rightarrow$ c; iii $\rightarrow$ b; iv $\rightarrow$ d
73. i $\rightarrow$ a; ii $\rightarrow$ a; iii $\rightarrow$ b; iv $\rightarrow$ c
74. i $\rightarrow$ c,d; ii $\rightarrow$ c,d; iii $\rightarrow$ a,b,c,e; iv $\rightarrow$ a,b,c,e

THANK
YOU