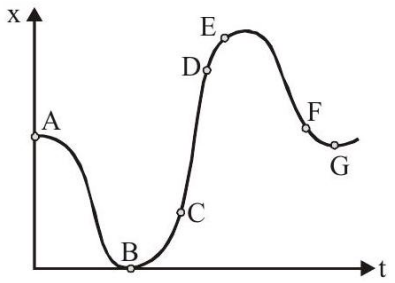
# Allen Nurture Kinematics Grand Quiz

Duration: 180 Minutes

## SECTION I - Single Correct Option

*Each question has four options. ONLY ONE of these four options is correct. Full Marks +4, Zero Marks 0 if none of the options is chosen, and Negative Marks -1 in all other cases.*

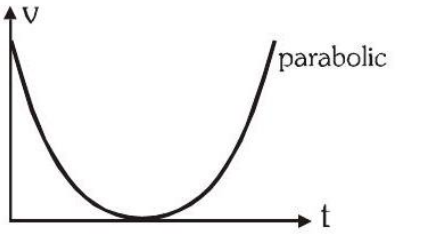
**Q1.** Consider the position-time graph showing how position of a particle moving on the x -axis of a coordinate system varies with time. Which of the following statement(s) is/are CORRECT ?



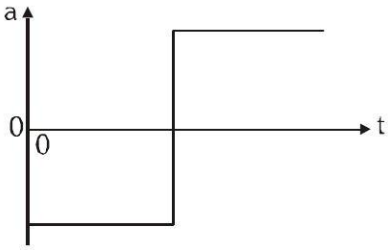

(a) Instantaneous velocity at B is close to average velocity between B and F
(b) Instantaneous velocity at E is close to average velocity between A and E
(c) Instantaneous velocity at E is close to average velocity between E and F
(d) Instantaneous velocity at F is close to average velocity between C and F

---

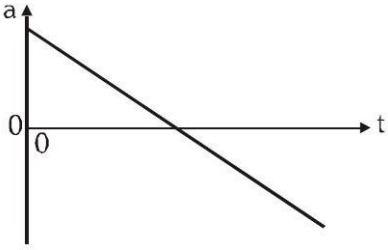
**Q2.** The graph shows the variation with time $t$ of the velocity $v$ of an object. Which one of the following graphs best represents the variation of acceleration ' a ' of the object with time t ?



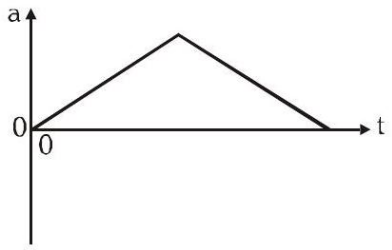

(a)



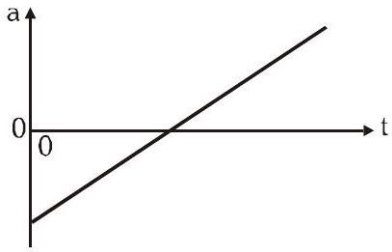

(b)



(c)



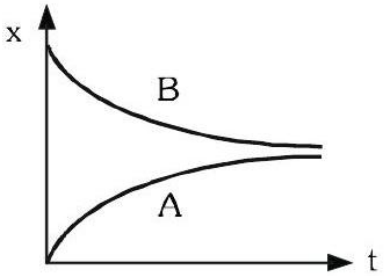

(d)



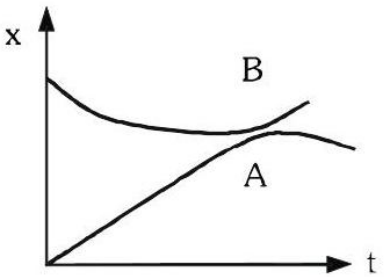

---

**Q3.** Car A and B are moving due east and west on the same straight horizontal road. At the last minute the driver of each car slams on the brakes and a head on collision is narrowly averted. Assuming the east as the positive direction and location of car A at the moment when brakes are applied to be zero, suggest which one of the following graphs best represents position ($x$)-time ($t$) relationship for each car?

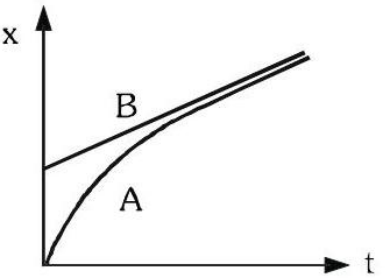
(a)



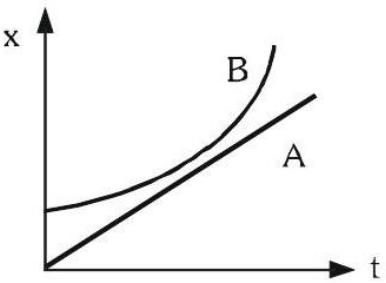

(b)




(c)



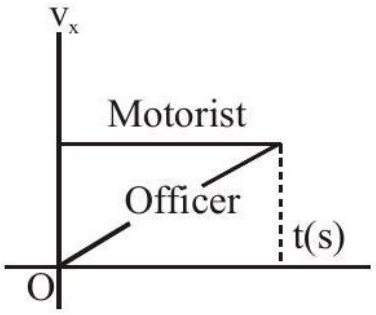

(d)

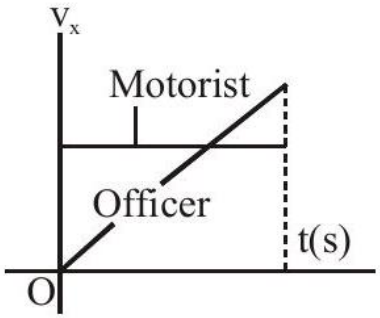


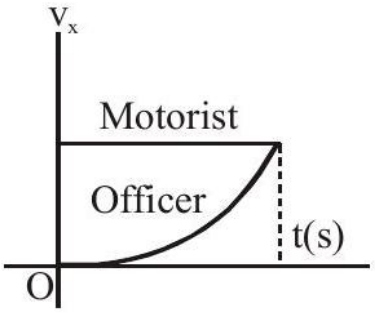
**Q4.** A train stopping at two stations 5 km apart takes 5 min on the journey from one of the station to the other. Assuming that its first accelerates with a uniform acceleration $\alpha$ and then that of uniform retardation $\beta$. if units of mass, length, and time are kg, km and min respectively then

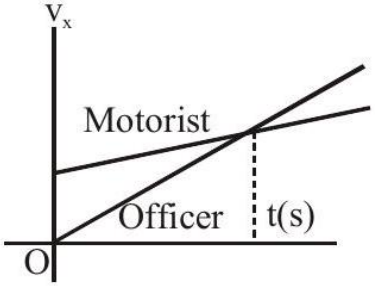
(a) $\frac{1}{\alpha}+\frac{1}{\beta}=2$
(b) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{2}{5}$
(c) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{5}{2}$
(d) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{1}{2}$

**Q5.** A motorist traveling with a constant speed passes a school-crossing corner. Just as the motorist passes, a police officer on a motorcycle standing at the corner starts off in pursuit with constant acceleration. Four possible $v_x - t$ graphs are shown for the two vehicles in example. Which graph may be correct :-

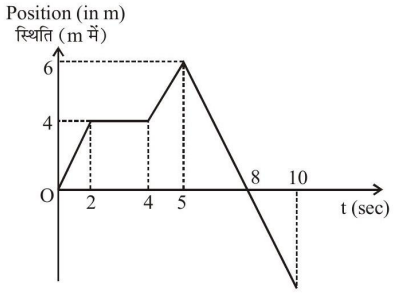
(a)



(b)



(c)



(d)


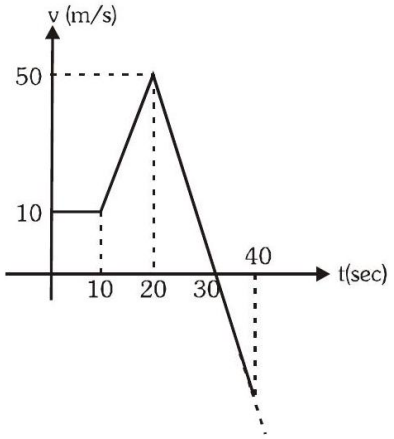
**Q6.** Position time graph of a particle is as shown, the average speed of particle in time interval 0 to 10 sec is:-




(a) 1 m/s
(b) 1.4 m/s
(c) 1.6 m/s
(d) 2.3 m/s

---

**Q7.** What is the displacement (in m ) in 40 sec ?




(a) 450
(b) 500
(c) 400
(d) 600

---

**Q8.** What is the velocity (in m/s ) at $t = 12\,\text{sec}$ ?

(a) 19
(b) 18
(c) 20
(d) 21

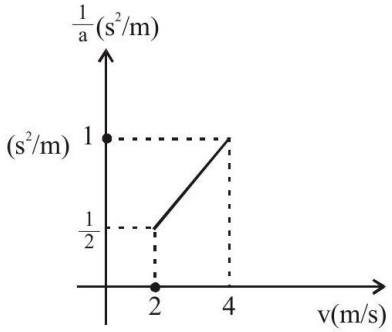
---

**Q9.** For what time in seconds ($t > 0$) the displacement of the particle is zero?

(a) $2\sqrt{60} + 30$
(b) $2\sqrt{63} + 30$
(c) $2\sqrt{67} + 30$
(d) $2\sqrt{65} + 30$

---

**Q10.** Given graph is $\frac{1}{\text{acceleration}}$ vs velocity graph. If the time interval during which velocity changes from 2 m/s to 4 m/s is given by $\Delta$t seconds. Then find the value of $2\Delta t$ : –

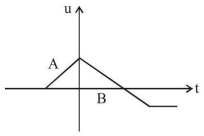



(a) 3
(b) 4
(c) 5
(d) 6

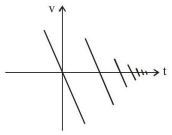
---

**Q11.** Choose the correct matching of the graph with the physical situation :-

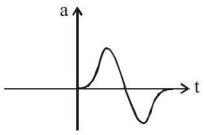
(a) A ball released from some height collides with ground and rebounds with reduced speed



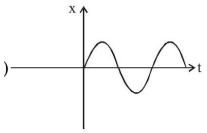

(b) A ball thrown up with some initial velocity rebounding from the floor with reduced speed after each hit.




(c) A uniformly moving cricket ball turned back by hitting it with a bat and then comes to rest



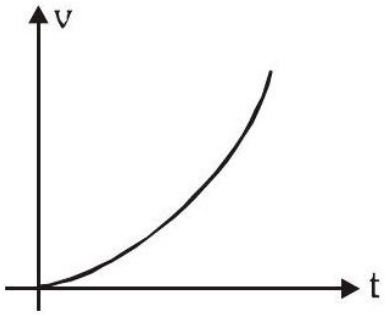

(d) Particle moving with constant speed.

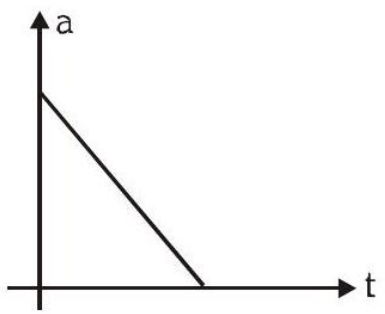



---

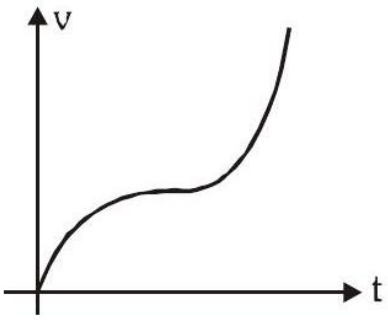
**Q12.** Which of the following pairs of graphs does not represent motion of the same particle in the same interval?

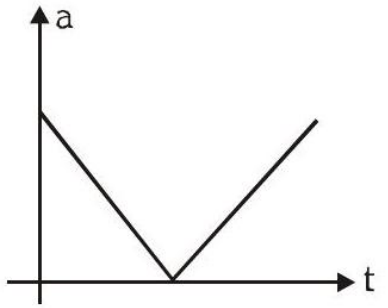
(a)



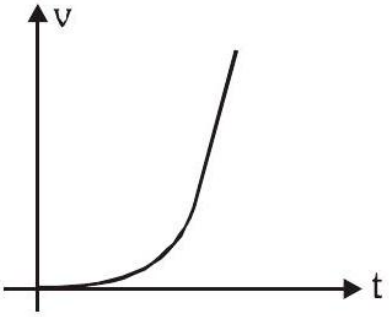



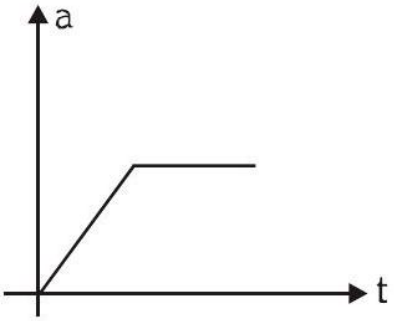
(b)



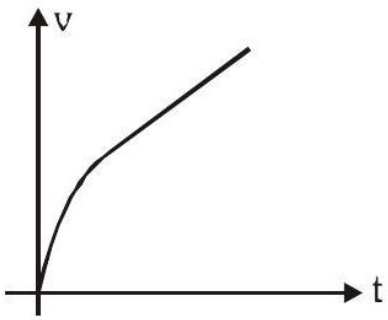



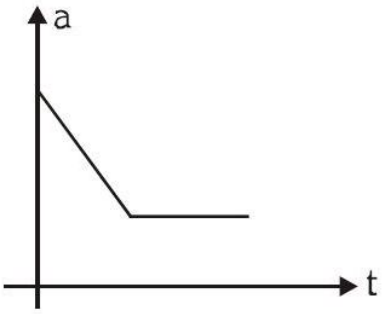

(c)



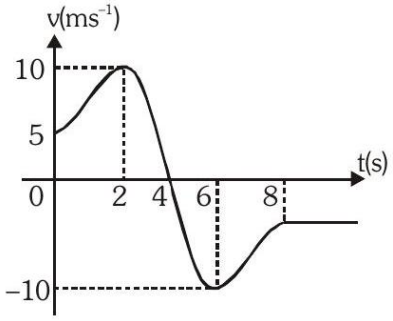

(d)






---

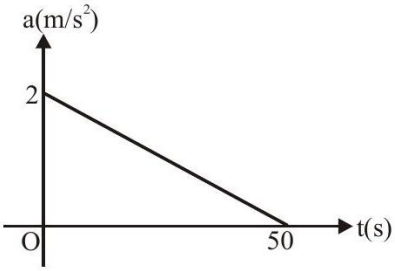
**Q13.** A particle is moving in a straight line y = 3x. Its velocity time graph is shown in figure. Its speed is minimum at t = _____




(a) 2 s
(b) 4 s
(c) 6 s
(d) 8 s

---

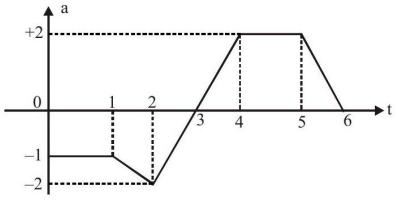
**Q14.** Referring to a-t diagram, find the velocity of the particle at t = 20 s. Assume that the particle was at the origin at t = 0 and was moving with a velocity of 10 m/s in -ve x-direction :-




(a) 20
(b) 22
(c) 18
(d) 15

---

**Q15.** If initial velocity of the particle is $2.5extm/s$, the particle will be moving along the positive direction :-



(a) 0 to 2 sec
(b) 2 to 4 sec
(c) 4 to 6 sec
(d) None of these

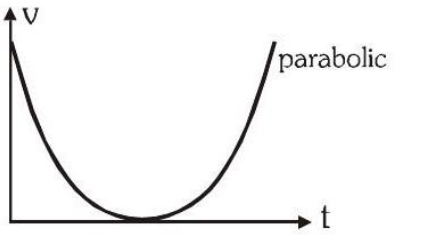
---

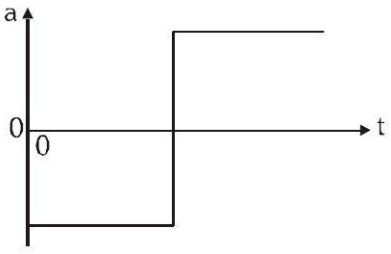
**Q16.** A particle is moving with velocity $\left(\sqrt{2}y\hat{i} + \frac{1}{\sqrt{2}}x\hat{j}\right)$. The general equation for path is

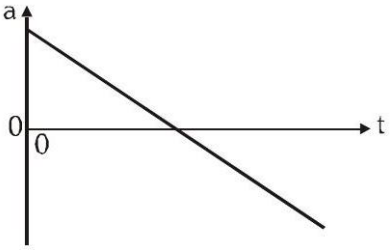
(a) $y^2 = x^2 +$ constant
(b) $x^2 = 2y^2 +$ constant
(c) $x^2 = y +$ constant
(d) $y^2 = x +$ constant

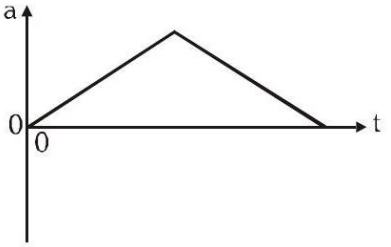
---

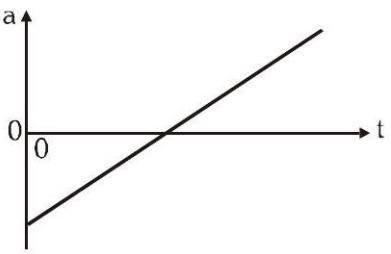
**Q17.** The graph shows the variation with time t of the velocity v of an object. Which one of the following graphs best represents the variation of acceleration ' a ' of the object with time t ?




(a)


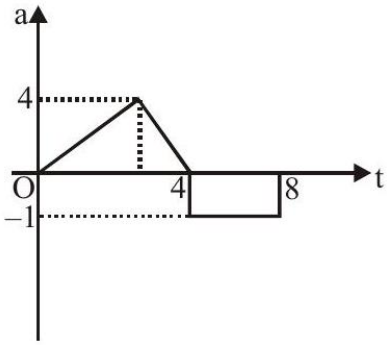

(b)



(c)



(d)



---

**Q18.** The acceleration time graph of a particle is shown in the figure. What is the velocity of particle at
t = 8 s if its initial velocity is 3 m/s ?



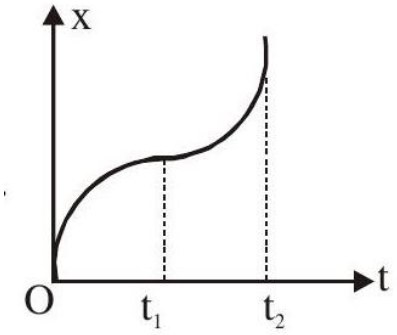

(a) 4 m/s
(b) 5 m/s
(c) 6 m/s
(d) 7 m/s

---

## SECTION II - More than One Correct Option

*Each question has four options. ONE OR MORE THAN ONE of these four option(s) is(are) correct. Full Marks +4, Partial Marks +1 for each correct option provided no incorrect option is chosen, and Negative Marks -1 in all other cases.*

**Q19.** The position versus time graph of a particle moving in a straight line along x-axis is shown in figure, from the graph it can be said that




(a) From t = 0 to t = $t_1$ particle is moving in positive x -direction.
(b) From t = 0 to t = $t_2$ particle is continuously moving towards positive x -direction.
(c) At t = $t_1$ particle has changed its direction of motion.
(d) At t = $t_2$ particle stops.

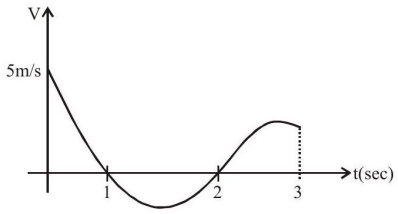
---

**Q20.** Consider the following statements and choose INCORRECT statement(s).

(a) The average velocity can never be equal to the instantaneous velocity.
(b) Direction of motion is always along the net force direction.
(c) Particle moving at constant speed in circle is in a state of equilibrium.
(d) Rate of change of speed is equal to magnitude of acceleration

---

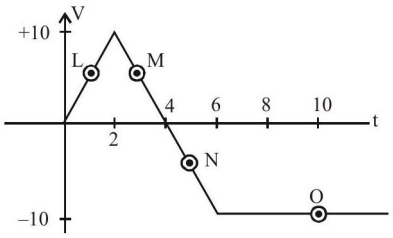
**Q21.** A particle is moving along x axis starting from x=-20. Figure shows the velocity time graph of a particle. Taking positive direction from origin towards positive x axis, which of the following statement is/are INCORRECT :-




(a) During 0 to 1 sec particle is moving towards origin
(b) During 1 to 2 sec speed is increasing continuously
(c) During 2 to 3 sec particle is slowing down
(d) During 2 to 3 sec acceleration is positive

---

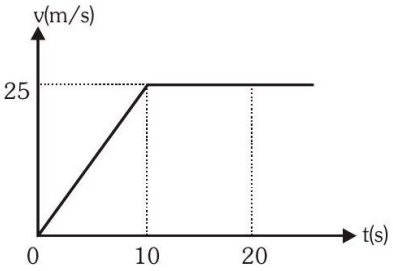
**Q22.** A particle starts from origin and moving along x-axis, whose v-t graph is as shown. Choose the CORRECT statement(s) :




(a) At point L particle is speeding up.
(b) At point M particle is moving in positive x -direction.
(c) At point N particle is slowing down.
(d) At point O particle is rest.

---

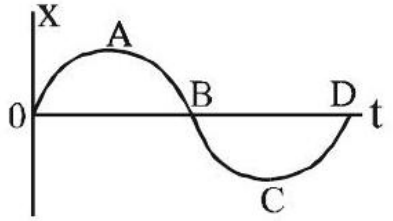
**Q23.** The velocity of a car increases linearly from zero to 25 m/s in 10s and then remains constant (see figure). Select correct alternative(s)




(a) The distance travelled by the car in 10 s is 125 m
(b) The distance travelled by the car in 20 s is 250 m
(c) The distance travelled by the car in 5 s is 62.5 m
(d) The distance travelled by the car in 15 s is 250 m

---

**Q24.** A particle has a rectilinear motion and the figure gives its displacement as a function of time. Which of the following statements are true with respect to the motion



(a) in the motion between O and A the velocity is positive and acceleration is negative
(b) between A and B the velocity and acceleration are positive
(c) between B and C the velocity is negative and acceleration is positive
(d) between C and D the acceleration is positive

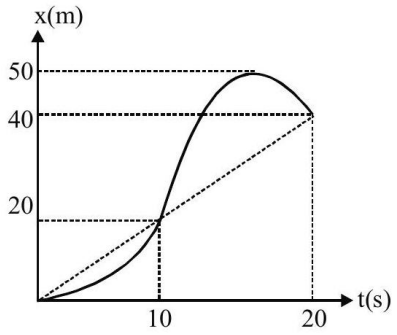
---

**Q25.** A man in a lift ascending with an upward acceleration ' $a$ ' throws a ball vertically upwards with velocity ' $v$ ' and catches it after $t_1$ second. Afterwards, when the lift is descending with the same acceleration ' $a$ ' acting downwards, the man again throws the ball vertically upwards with the same velocity and catches it after $t_2$ second. Which of the following statement(s) are correct ?

(a) The velocity of the ball is $g\left(t_1 + t_2\right)/t_1 t_2$
(b) The velocity of the ball is $gt_1 t_2/\left(t_1 + t_2\right)$
(c) The acceleration of the lift is $\frac{g(t_2 - t_1)}{(t_2 + t_1)}$
(d) The acceleration of the lift is $g\left(\frac{t_1}{t_2} + \frac{t_2}{t_1}\right)$

---

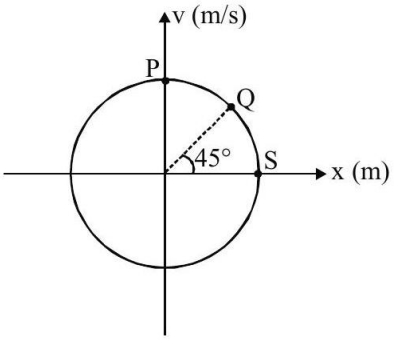
**Q26.** A position-time graph of a car moving on a straight road is shown below. The CORRECT statement(s) is/are :




(a) Distance travelled in the interval t = 0 to t = 20 s is 60 m .
(b) Average velocity in the interval t = 0 to t = 20 s is equal to that in the interval t = 0 to t = 10 s.
(c) Acceleration of the car changed its direction twice.
(d) Average acceleration in the interval t = 0 to t = 20 s is negative in direction.

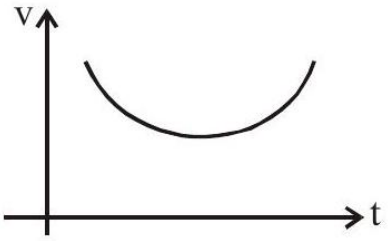
---

**Q27.** A particle is in motion on the x -axis. The variation of its velocity with position is as shown. The graph is circle and its equation is $x^2 + v^2 = 1$, where $x$ is in $m$ and $v$ in $m/s$. The CORRECT statement(s) is/are




(a) When x is positive, acceleration is negative.
(b) When x is negative, acceleration is positive.
(c) At Q, acceleration has magnitude $\frac{1}{\sqrt{2}}$ m/s$^2$
(d) At S, acceleration is infinite.

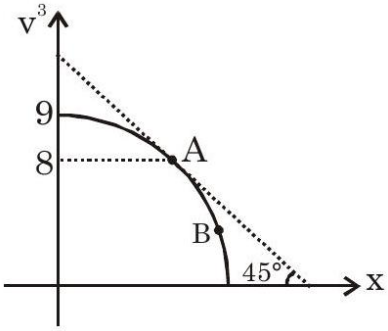
**Q28.** Velocity-time graph for a particle moving along a straight-line is shown. It can be concluded that:




(a) Particle has positive acceleration in initial and negative in later part of motion.
(b) Particle is continuously moving away from its initial position.
(c) Particle has positive acceleration during whole course of motion.
(d) Particle has negative acceleration in initial and positive in later part of motion.

---

**Q29.** Particle is moving on x -axis. Cube of it velocity versus position graph is a shown. Select the correct statement:




(a) Magnitude of acceleration at point 'A' is given by $\frac{1}{6}$ m/s$^2$
(b) Magnitude of acceleration at point 'A' is given by $\frac{1}{12}$ m/s$^2$
(c) B is the final point of the journey.
(d) Velocity is maximum when a particle is at origin.

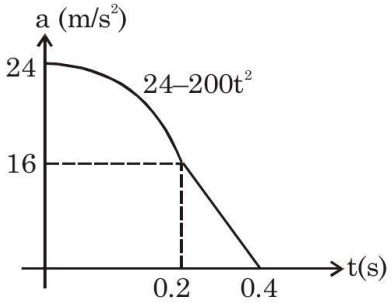
---

**Q30.** A balloon starts rising up from earth's surface with constant vertical speed $v_0$. Due to air resistance balloon will get horizontal velocity which is directly proportional to the height (h) ascend by the balloon ($v_x = kh$) then choose CORRECT statement(s) :-

(a) Horizontal displacement of balloon is given by $\frac{kh^2}{2v_0}$ when balloon is at height h .
(b) Horizontal displacement of balloon is given by $\frac{kh^2}{2}$ when balloon is at height h .
(c) Equation of trajectory of balloon is $x = \frac{ky^2}{2v_0}$
(d) Speed of balloon will be minimum at point of release of balloon on the earth surface.

---

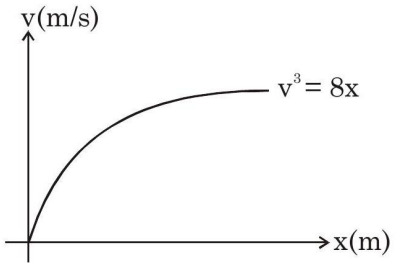
**Q31.** An accelerometer record for the motion of the given part of mechanism is approximated by an arc of a parabola for 0.2 sec and an straight line for next 0.2 sec as shown the diagram. Given that $v = 0$ when $t = 0$ and $x = 0.8$ m when $t = 0.4$sec.




(a) Acceleration of particle at t = 0.3sec is 8 m/s$^2$.
(b) Velocity of particle at t = 0.1 sec is $\left(\frac{7}{3}\right)$ m/s.
(c) Velocity of particle at t = 0.3sec is 6 m/s.
(d) Position of particle at t = 0.2sec is 0.9 m

---

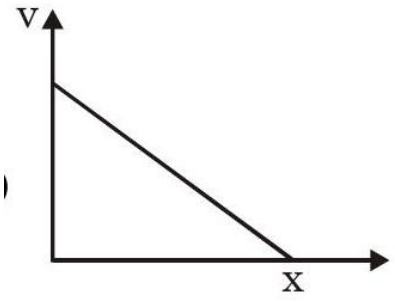
**Q32.** The v - x curve for an object moving along the x -axis shown in the diagram :



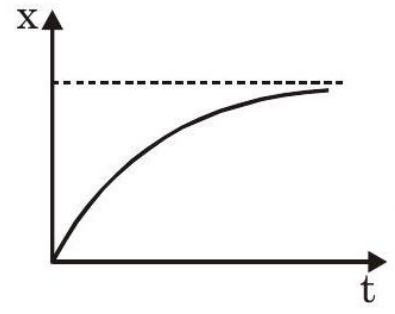

(a) The acceleration of particle when x = 1 m is $\left(\frac{4}{3}\right)$ m/s$^2$
(b) The acceleration of particle when x = 8 m is $\left(\frac{2}{3}\right)$ m/s$^2$
(c) The acceleration of particle when v = 2 m/s is $\left(\frac{8}{3}\right)$ m/s$^2$
(d) The acceleration of particle when v = 8 m/s is $\left(\frac{1}{3}\right)$ m/s$^2$

---

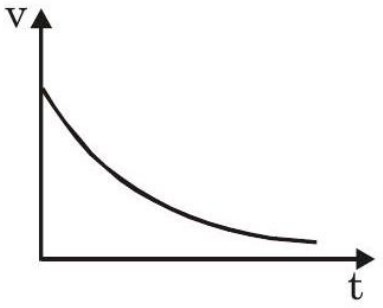
**Q33.** A bird is approaching a pole along a straight line path such that in each second, it travells half of the remaining distance from pole. If distance travelled in time t is x , its instantaneous speed v and magnitude of its instantaneous acceleration is a. Then which of the following graph(s) is/are CORRECT :-



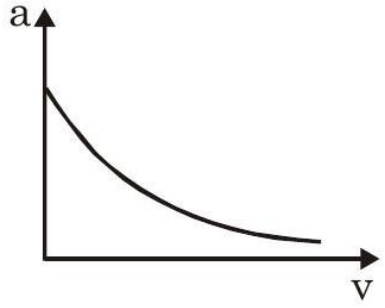

(a)




(b)



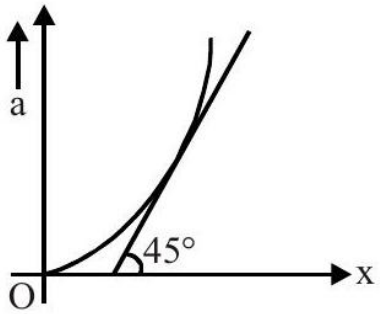

(c)




(d)

---

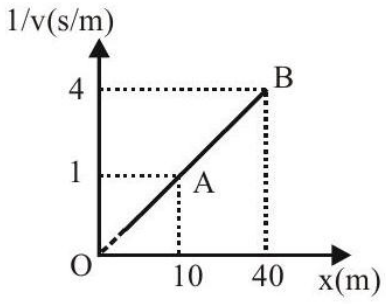
**Q34.** A particle starts moving with initial velocity 3 m/s along $x$-axis from origin. Its acceleration is varying with $x$ in parabolic nature as shown in figure. At $x = 1$ m tangent to the graph makes an angle 45° with positive x -axis as shown in diagram. Then at $x = 3$ m : –




(a) velocity of the particle is $3\sqrt{2}$ m/s
(b) velocity of the particle is $3\sqrt{3}$ m/s
(c) acceleration of the particle is 4.5 m/s$^2$
(d) acceleration of the particle is 9 m/s$^2$

---

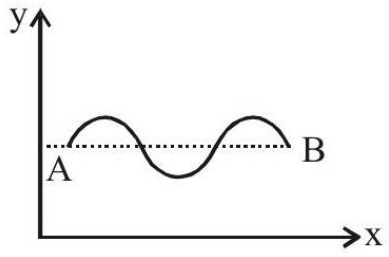
**Q35.** A particle is moving along a straight line along the positive x -axis such that its speed is inversely proportional to the distance from origin $\left[\text{v} \propto \frac{1}{\text{x}} \Rightarrow \text{v} = \frac{\text{k}}{\text{x}}\right.$, where k is the proportionality constant ]. At t = 0, the particle is at point A and moving along the positive x -axis. The graph of motion of the particle for $\frac{1}{\text{v}}$ versus x (distance from origin) is shown in the figure during motion of particle from A to B :-



(a) The time interval of motion from point A to point B is 50 sec .
(b) The time interval of motion from point A to point B is 75 sec .
(c) The proportionally constant k is 10 $m^2/s$
(d) Acceleration of the particle at $x = 10$ m is $-0.1$ $m/s^2$

---

**Q36.** A graph between x-y coordinates is given for a particle moving in x-y plane from point A to point B . Which of the following option(s) are INCORRECT :




(a) This graph represents path of the particle.
(b) Particle does not change it's direction during the motion.
(c) Average velocity from A to B is zero.
(d) Particle travels in a straight line.

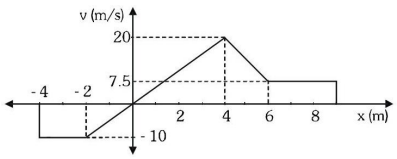
---

**Q37.** A particle is moving with a position vector, $\vec{r} = \left[a_0 \sin(2\pi t)\hat{i} + a_0 \cos(2\pi t)\hat{j} + a_0 t\hat{k}\right]$. Then-

(a) Magnitude of displacement of the particle between time $t = 4$ sec and $t = 6$ sec is $2a_0$
(b) Distance travelled by the particle in 1 sec is $\sqrt{(2\pi a_0)^2 + a_0^2}$
(c) The speed of particle in the whole motion is constant and equal to $\sqrt{(2\pi a_0)^2 + a_0^2}$.
(d) None of these

---

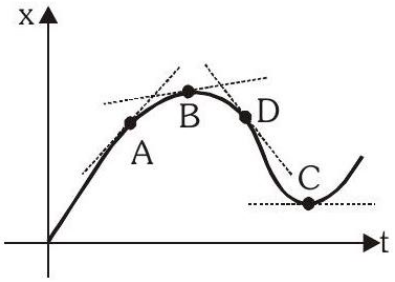
**Q38.** Velocity-position graph of a particle moving along the x -axis is shown in the figure. Which of the following function most suits the graph?




(a) v = $-10$ m/s in position interval $[-4$ m, $-2$ m$]$
(b) v = 5xm/s in position interval $[-2$ m, 4 m$]$
(c) v = 7.5 m/s in position interval [6 m, 9 m]
(d) v = 7.5 m/s at x = 5 m

---

**Q39.** A particle is moving along a straight line y $- 2 = 0$. Its displacement-time graph is shown in figure. Point A, B, C and D are marked on graph at four different instants. Select the correct alternative ( s ). [Given velocity v = dx/dt] (A) Magnitude of velocity at A is greater than magnitude of velocity at B . (B) Magnitude of velocity at B is greater than magnitude of velocity at C .

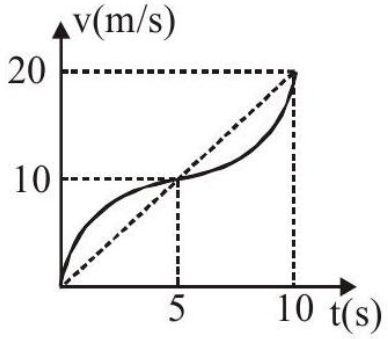



(C) Magnitude of velocity at C is greater than magnitude of velocity at D . (D) Magnitude of velocity at D is greater than magnitude of velocity at C .

(a) Magnitude of velocity at A is greater than magnitude of velocity at B .
(b) Magnitude of velocity at B is greater than magnitude of velocity at C .
(c) Magnitude of velocity at C is greater than magnitude of velocity at D .
(d) Magnitude of velocity at D is greater than magnitude of velocity at C .

---

**Q40.** A velocity-time graph of a car moving on a straight road is shown below. The correct statement(s) is/are:- (A) Acceleration is negative in interval t = 0 to t = 5 s (B) Velocity is zero at t = 5 s (C) Car never changes its direction (D) Displacement in interval t = 0 to t = 5 is greater than 25 m .




(a) Acceleration is negative in interval t = 0 to t = 5 s
(b) Velocity is zero at t = 5 s
(c) Car never changes its direction
(d) Displacement in interval t = 0 to t = 5 is greater than 25 m .

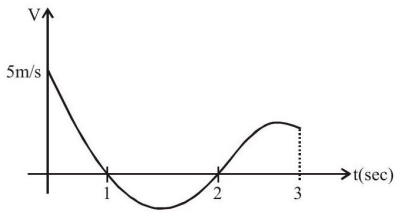
---

**Q41.** A particle is moving with a position vector, $\vec{r} = \left[a_0 \sin(2\pi t)\hat{i} + a_0 \cos(2\pi t)\hat{j} + a_0 t\hat{k}\right]$. Then-

(a) Magnitude of displacement of the particle between time $t = 4\,\text{sec}$ and $t = 6\,\text{sec}$ is $2a_0$
(b) Distance travelled by the particle in 1 sec is $\sqrt{(2\pi a_0)^2 + a_0^2}$
(c) The speed of particle in the whole motion is constant and equal to $\sqrt{(2\pi a_0)^2 + a_0^2}$.
(d) None of these

---

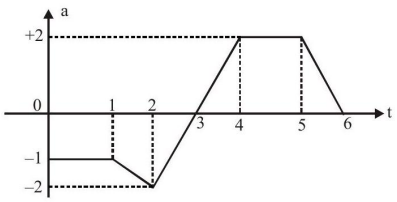
**Q42.** A particle is moving along x axis starting from x = -20. Figure shows the velocity time graph of a particle. Taking positive direction from origin towards positive x axis, which of the following statement is/are INCORRECT :-



(a) During 0 to 1 sec particle is moving towards origin
(b) During 1 to 2 sec speed is increasing continuously
(c) During 2 to 3 sec particle is slowing down
(d) During 2 to 3 sec acceleration is positive

---

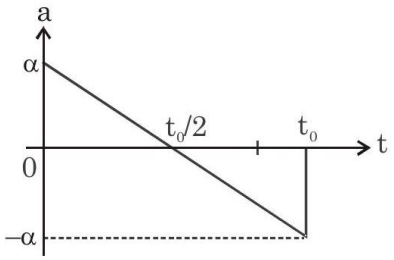
**Q43.** If initial velocity of the particle is 2.5 m/s, the particle will be moving along the positive direction :-




(a) 0 to 2 sec
(b) 2 to 4 sec
(c) 4 to 6 sec
(d) None of these

---

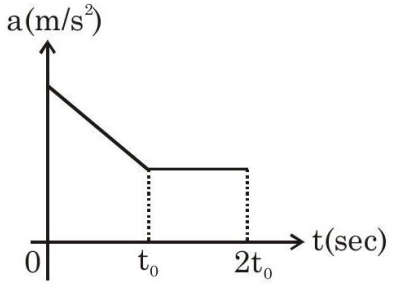
**Q44.** A person stands in an elevator. Starting at rest at t = 0 the elevator moves upward, coming to rest again at time t = $t_0$. The acceleration of the elevator during this period is shown graphically below. Which of the following statement(s) is/are CORRECT?




(a) The maximum speed of the elevator is $\frac{\alpha t_0}{4}$
(b) The total distance traveled by the elevator is $\frac{\alpha t_0^2}{6}$
(c) Acceleration does not change sign during motion
(d) Magnitude of acceleration continuously decreases

---

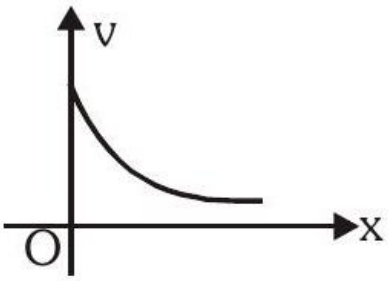
**Q45.** The acceleration-time graph of a particle moving along the x -axis is given below. Initial velocity of particle is along the positive x -axis. Mark the CORRECT statement(s) :



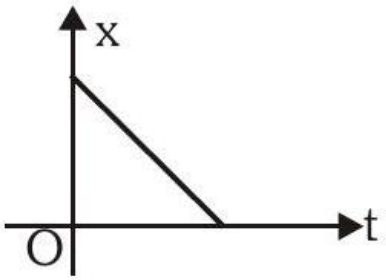

(a) Velocity of particle is decreasing in time interval t = 0 to t = $t_0$.
(b) Velocity of particle is increasing in time interval t = 0 to t = $t_0$.
(c) Velocity of particle is constant in time interval t = $t_0$ to t = $2t_0$.
(d) Velocity of particle is increasing in time interval t = $t_0$ to t = $2t_0$.

**Q46.** A motor car moves in a straight track with a retardation $kv^2$ where k is positive constant. Its initial velocity is $v_0$ at origin. Then, which of the following graphs is/are correct?

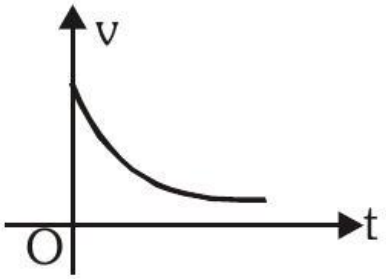
(a)



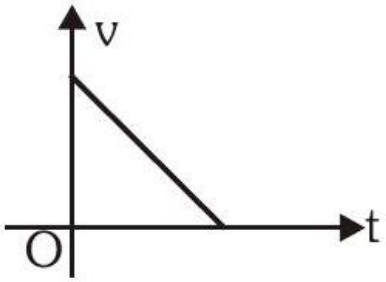

(b)




(c)



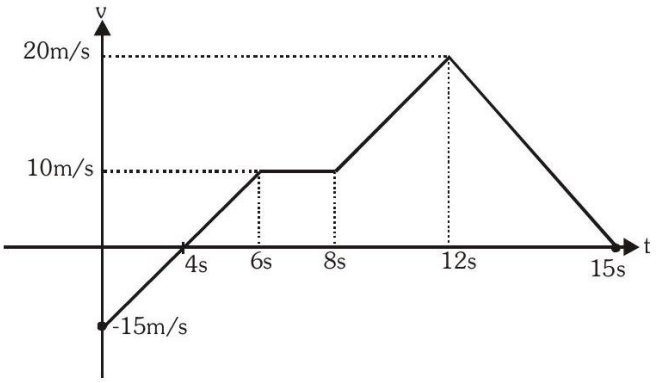

(d)




## SECTION I - Single Correct Option

*Each question has four options. ONLY ONE of these four options is correct. Full Marks +4, Zero Marks 0 if none of the options is chosen, and Negative Marks -1 in all other cases.*

**Passage: Passage for Q47-Q49** A moving particle is acted upon by three forces at different times to bring it to rest. Its velocity versus time graph is given below




**Q47.** The average speed for the first 6 s is :-

(a) zero
(b) $\frac{5}{3}$ $ms^{-1}$
(c) $\frac{10}{3}$ $ms^{-1}$
(d) $\frac{20}{3}$ $ms^{-1}$

---

**Q48.** The average velocity for the first 12 s is :-

(a) zero
(b) 5 m/s
(c) $\frac{10}{3}$ m/s
(d) 10 m/s

---

**Q49.** The average acceleration from $t = 5$ s to $t = 15$ s is :-

(a) zero
(b) $-0.5$ $m/s^2$
(c) $+0.5$ $m/s^2$
(d) 1 $m/s^2$

---

**Passage: Passage for Q50-Q52** In mathematics and physics, a phase space is a space in which all possible states of a system are represented, with each possible state of the system corresponding to one unique point in the phase space. For mechanical systems, the phase space usually consists of all possible values of position and momentum variable on a plane. The phase space diagram is position $x(t)$ vs momentum $p(t)$ curve in this plane. For example, the phase space

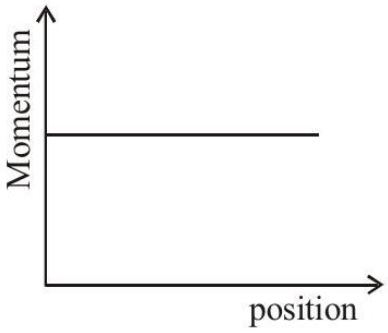
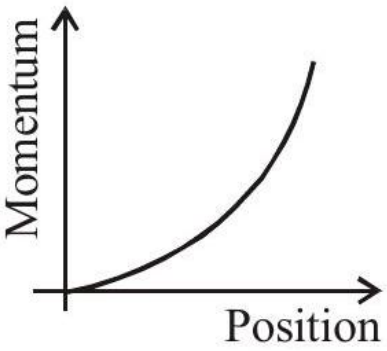


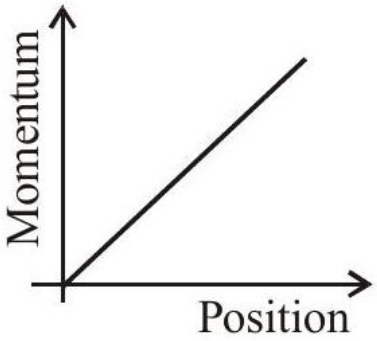

diagram for a particle moving with constant velocity is shown in the diagram, which is a straight line. We use the sign convention in which position or momentum downwards is positive and upward as negative. (Momentum, $\overrightarrow{p} = m\overrightarrow{v}$)

**Q50.** A particle is dropped from some height. Its phase space diagram is :

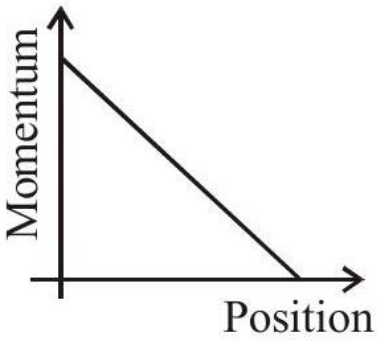
(a)



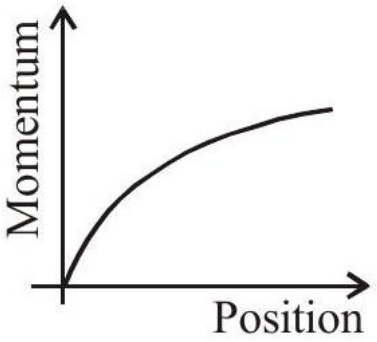

(b)




(c)




(d)



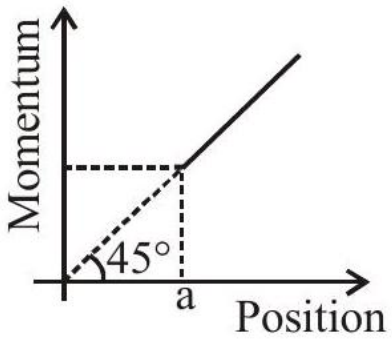

---

**Q51.** A particle starts from rest with constant acceleration towards positive direction. In its phase space diagram, momentum is taken on y -axis and position is the on x -axis, then slope of its tangent will be proportional to ('t' is time) :

(a) $t^2$
(b) t
(c) $\frac{1}{t}$
(d) None

---

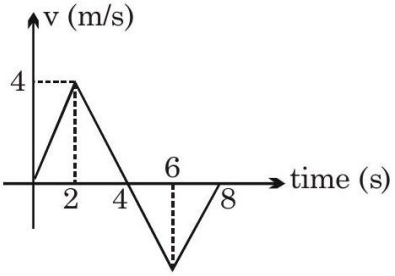
**Q52.** A phase-space diagram is shown for a particle moving along a straight line. Its position ($x$) as a function of time will be given by [at $t = 0, x = a$]



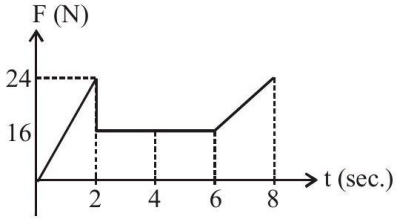

(a) $x = t$
(b) $x = ae^{t/m}$
(c) $x = at$
(d) $x = ae^{-t/m}$

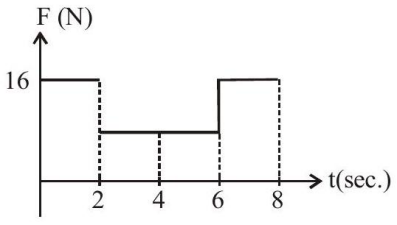
---

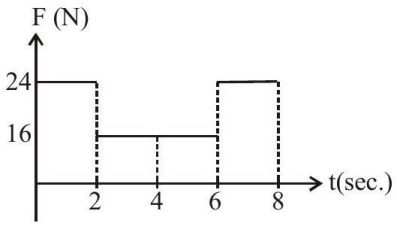
**Passage: Passage for Q53-Q54** In a certain building, a lift moves with a constant magnitude of acceleration. The v-t graph (upward velocity being taken positive) shows the lift's motion between the ground floor and the first floor. The lift starts at $t = 0$ from ground floor and comes back to the ground again after reaching upto the first floor.



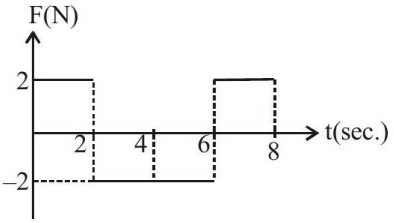

**Q53.** A spring balance is attached to the ceiling of the lift. Plot a graph for the reading of the spring balance (in Newtons) with respect to time if a 2 kg mass is hung from it ( $g = 10\ m/s^2$ ) Ignore any fluctuation in reading during change in acceleration of lift.

(a)



(b)



(c)


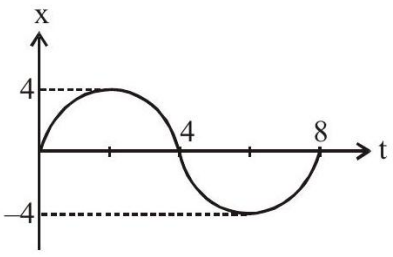
(d)



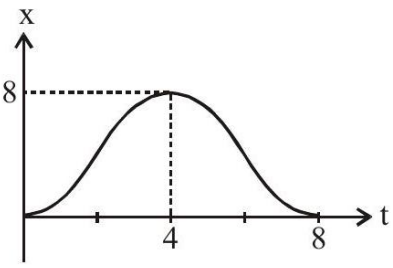

---

**Q54.** Draw the x -t graph for the motion taking x = 0 at ground level and upward direction as positive.

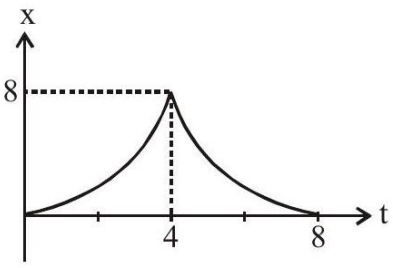
(a)



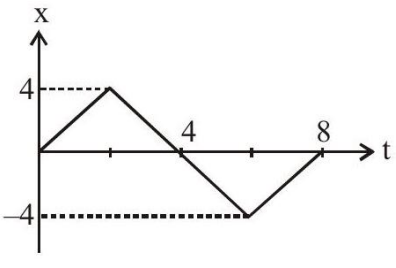

(b)




(c)

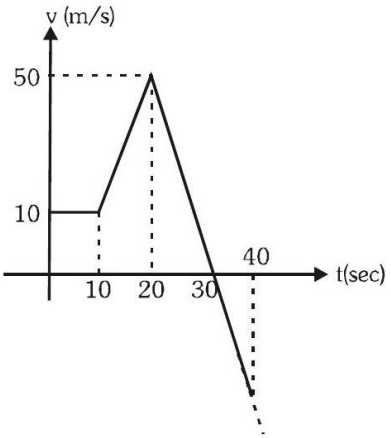



(d)




---

**Passage: Passage for Q55-Q57**



**Q55.** For what time in seconds (t > 0) the displacement of the particle is zero?

(a) $2\sqrt{60}+30$
(b) $2\sqrt{63}+30$
(c) $2\sqrt{67}+30$
(d) $2\sqrt{65}+30$

---

**Q56.** What is the velocity (in m/s ) at t=12 sec ?

(a) 19
(b) 18
(c) 20
(d) 21

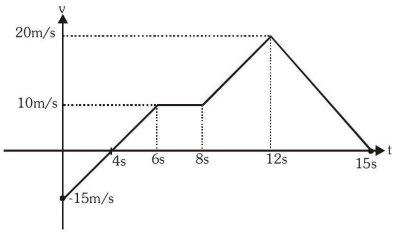
---

**Q57.** For what time in seconds ( t>0 ) the displacement of the particle is zero?

(a) $2\sqrt{60}+30$
(b) $2\sqrt{63}+30$
(c) $2\sqrt{67}+30$
(d) $2\sqrt{65}+30$

---

**Passage: Passage for Q58** A moving particle is acted upon by three forces at different times to bring it to rest. Its velocity versus time graph is given below

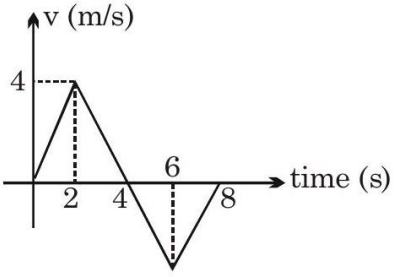



**Q58.** The average acceleration from $t = 5$ s to $t = 15$ s is :-

(a) zero
(b) $-0.5$ m/s$^2$
(c) $+0.5$ m/s$^2$
(d) 1 m/s$^2$

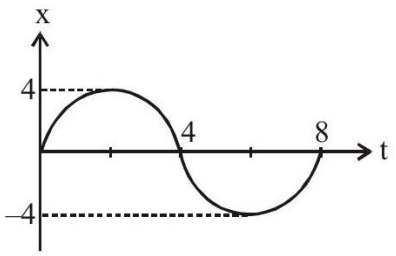
---

**Passage: Passage for Q59** In a certain building, a lift moves with a constant magnitude of acceleration. The v-t graph (upward velocity being taken positive) shows the lift's motion between the ground floor and the first floor. The lift starts at t=0 from ground floor and comes back to the ground again after reaching upto the first floor.

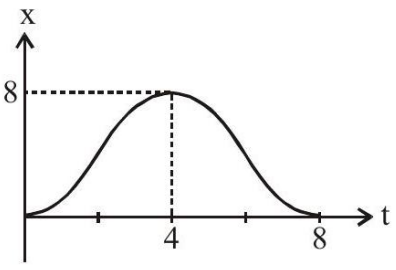



**Q59.** Draw the x -t graph for the motion taking x=0 at ground level and upward direction as positive.

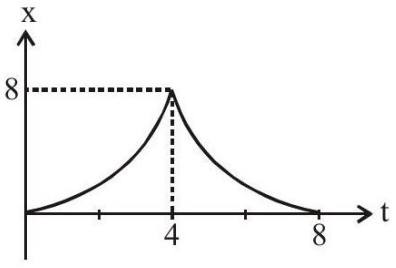
(a)



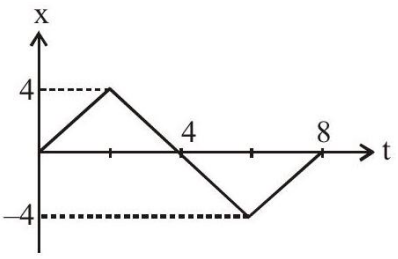

(b)




(c)

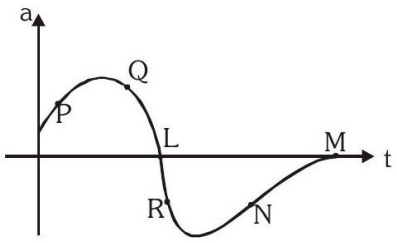



(d)




---

**Passage: Passage for Q60-Q61** Acceleration-time graph of a moving particle is shown in figure




**Q60.** Does particle speeding up just before reaching at L ?

Information I: Velocity of particle at L is in positive direction Information II : Velocity of particle at L is in negative direction

(a) Question can be solved by using information I only
(b) Question can be solved by using information II only
(c) Question can be solved by using either information I or information II
(d) Question can't be solved by using either information I or information II

---

**Q61.** Does speed of particle at M is less than speed at L ?

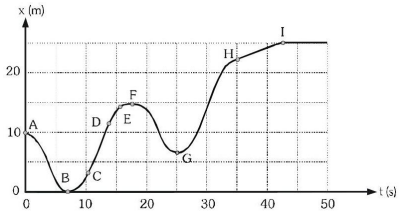
Information I: Velocity of particle at L is in positive direction Information II : Velocity of particle at L is in negative direction

(a) Question can be solved by using information I only
(b) Question can be solved by using information II only

(c) Question can be solved by using either information I or information II
(d) Question can't be solved by using either information I or information II

---

**Passage: Passage for Q62-Q64** An observer records positions of a particle moving on a straight-line path at various instants of time. He starts his stopwatch when the particle is passing the point x = 10 m. With the help of these data he prepares the following graph, where position x is shown on the ordinate in meters and time $t$ on the abscissa in seconds.




**Q62.** At the instant t = 0,

(a) the particle was moving in the negative x -direction and the observer started his stopwatch.
(b) the particle was moving in the positive x -direction and the observer started his stopwatch.
(c) the particle started its motion with a negative velocity and the observer started his stopwatch.
(d) the particle started its motion with a positive velocity and the observer started his stopwatch.

---

**Q63.** Speed of the particle

(a) first increases then decreases in time interval between points B and F
(b) first increases then decreases in time interval between points D and F
(c) always increases between points H and I .
(d) always decreases between points F and G .

---

**Q64.** The particle is changing its direction of motion at the instant corresponding to points

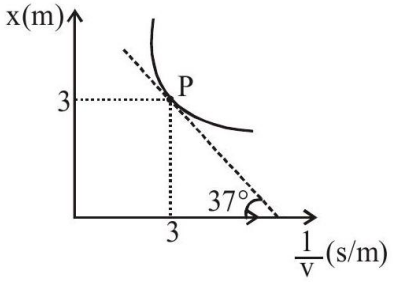
(a) A and E only.
(b) B, F and G only.
(c) C, D, E and H only.
(d) C, D, E, H and I only.

---

## SECTION III - Numerical Type

*The answer to each question is a NUMERICAL VALUE. Full Marks +4, and Zero Marks 0 in all other cases.*

**Q65.** From the graph shown, if magnitude of acceleration is $\frac{4}{n^2} m/s^2$. Then the value of $n$ is.

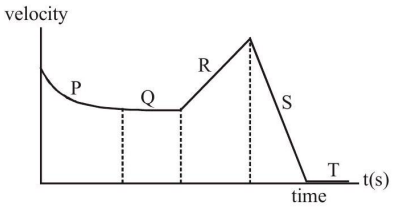



---

## SECTION IV - Matrix Match Type

*Each question has two columns. MATCH Column I with Column II. Full Marks +4 (awarded proportionally per correctly matched row). No Negative Marks.*

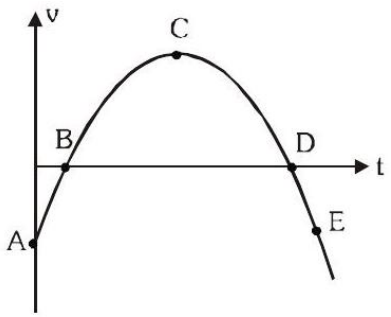
**Q66.** Study the velocity-time graph pictured below and match each segment of the graph with the description of this motion at that time.




| Column I | Column II |
|---|---|
| (A) The object is motionless in | (P) Segment |
| (B) The object is moving with constant velocity in | (Q) Segment |
| (C) The object is having acceleration in | (R) Segment |
| (D) The object is travelling in north but accelerating in south in | (S) Segment<br>(T) Segment |

---

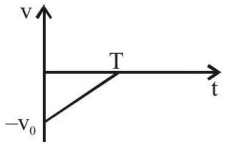
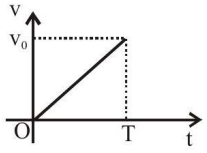
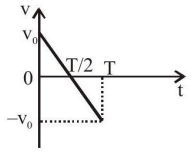
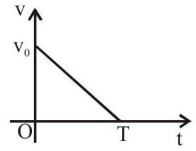
**Q67.** A particle moves along a straight line such that its velocity (v) varies with time (t) parabolically (see figure).



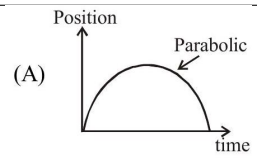
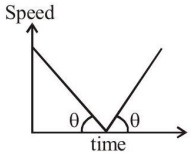
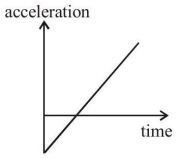

| Column I | Column II |
|---|---|
| (A) AB | (P) Particle is moving in +x direction |
| (B) BC | (Q) Particle is moving in -x direction |
| (C) CD | (R) Speeding up |
| (D) DE | (S) Speeding down |
| | (T) Velocity is negative and acceleration is positive. |

---

**Q68.** Study the following v-t graphs in column-I carefully and match appropriately with the statements given in column-II. Assume that motion takes place from time 0 to T.

| Column I | Column II |
|---|---|
| (A)   | (P) Net displacement is positive, but not zero |
| (B)   | (Q) Net displacement is negative, but not zero |
| (C)   | (R) Particle returns to its initial position again |
| (D)   | (S) Acceleration is positive<br>(T) Acceleration is negative |

**Q69.** Match the graphs/scenarios in Column-I with the descriptions of motion in Column-II.

| Column I | Column II |
|---|---|
| (A)   | (P) Particle must change its direction during the subsequent motion |
| (B)   | (Q) Particle may return to its initial position during subsequent motion |
| (C)   | (R) Acceleration vector of a particle must be constant throughout the motion |
| (D) Distance time | (S) Particle come to rest at least once during its motion<br>(T) Initial velocity of particle is zero. |