

Q1. JEE Main 2026 (28 January Shift 2)

A particle starts moving from time $t = 0$ and its coordinate is given as $x(t) = 4t^3 - 3t$

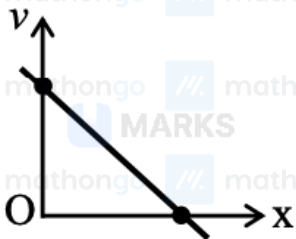
- A. The particle returns to its original position (origin) 0.866 units later
- B. The particle is 1 unit away from origin at its turning point
- C. Acceleration of the particle is non-negative
- D. The particle is 0.5 units away from origin at its turning point
- E. Particle never turns back as acceleration is non-negative

Choose the correct answer from the options given below :

- (1) A, B, C Only
- (2) C, E Only
- (3) A, C Only
- (4) A, C, D Only

Q2. JEE Main 2026 (24 January Shift 2)

The velocity (v) - Distance (x) graph is shown in figure. Which graph represents acceleration (a) versus distance (x) variation of this system?



- (1) (2)
(3) (4)

Q3. JEE Main 2026 (23 January Shift 2)

A paratrooper jumps from an aeroplane and opens a parachute after 2 s of free fall and starts deaccelerating with 3 m/s^2 . At 10 m height from ground, while descending with the help of parachute, the speed of paratrooper is 5 m/s . The initial height of the airplane is ____ m.

($g = 10 \text{ m/s}^2$)

- (1) 82.5
- (2) 20
- (3) 62.5
- (4) 92.5

Q4. JEE Main 2026 (28 January Shift 1)

Water drops fall from a tap on the floor, 5 m below, at regular intervals of time, the first drop strikes the floor when the sixth drop begins to fall. The height at which the fourth drop will be from ground, at the instant when the first drop strikes the ground is ____ m.

$(g = 10 \text{ m/s}^2)$

(1) 4.2

(2) 2.5

(3) 4.0

(4) 3.8

ANSWERS AND SOLUTIONS

1. (1) 2. (1) 3. (4) 4. (1)

1. (1) Given $x(t) = 4t^3 - 3t$, we find $v(t) = 12t^2 - 3$ and $a(t) = 24t$.

Statement A: Setting $x(t) = 0$ gives $4t^3 - 3t = 0 \Rightarrow t(4t^2 - 3) = 0$, so $t = 0$ or $t = \sqrt{3/4} = 0.866$. The particle returns to origin at $t = 0.866$ units. TRUE.

Statement B: Turning points occur at $v(t) = 0 \Rightarrow 12t^2 - 3 = 0 \Rightarrow t = \pm 0.5$. At $t = 0.5$:
 $x = 4(0.125) - 1.5 = -1$; distance = 1 unit. At $t = -0.5$: $x = 1$; distance = 1 unit. TRUE.

Statement C: For $t \geq 0$ (particle starts at $t = 0$), $a(t) = 24t \geq 0$. TRUE.

Statement D: At turning points, distance is 1 unit, not 0.5. FALSE.

Statement E: False because acceleration is non-negative only for $t \geq 0$, and particle does turn back at $t = 0.5$. FALSE.

Correct statements: A, B, C Only.

2. (1) The v-x graph shows velocity decreasing linearly with distance. Using kinematic equation $v^2 = v_0^2 + 2ax$, we can establish the relationship between acceleration and position.

From the linear v-x relationship, differentiating using $a = v \frac{dv}{dx}$ yields acceleration that is linearly proportional to distance from the origin.

The a-x graph shows a straight line passing through the origin with positive slope, indicating that acceleration increases linearly with distance while remaining positive throughout the motion.

3. (4) During the first 2 s of free fall, the paratrooper starts from rest ($u = 0$).

Velocity after 2 s is $v_1 = u + gt = 0 + 10 \times 2 = 20$ m/s.

Distance covered during free fall is $h_1 = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times 2^2 = 20$ m.

After opening the parachute, the paratrooper decelerates at $a = -3$ m/s².

At a height of 10 m from the ground, the final velocity is $v_2 = 5$ m/s.

Let h_2 be the distance covered during deceleration until reaching 10 m height.

Using $v_2^2 = v_1^2 + 2ah_2$:

$$5^2 = 20^2 + 2(-3)h_2$$

$$25 = 400 - 6h_2$$

$$6h_2 = 375$$

$$h_2 = 62.5 \text{ m.}$$

The total height of the airplane is the sum of the free fall distance, the deceleration distance, and the remaining height from the ground.

$$H = h_1 + h_2 + 10 = 20 + 62.5 + 10 = 92.5 \text{ m.}$$

4. (1) Time for first drop to fall 5 m:

$$5 = \frac{1}{2} \times 10 \times t^2 \text{ gives } t = 1 \text{ s.}$$

Since the first drop strikes when the sixth begins, there are 5 intervals: each interval $T = \frac{1}{5} = 0.2$ s.

When drop 1 hits the ground (at $t = 1$ s), drop 4 has been falling for $t_4 = 1 - 3 \times 0.2 = 0.4$ s.

Distance fallen by drop 4: $s_4 = \frac{1}{2} \times 10 \times (0.4)^2 = 0.8$ m.

Height of drop 4 above ground: $5 - 0.8 = 4.2$ m.