

PHYSICS · JEE MAIN

# Rectilinear Motion

Chapter-wise previous year questions, with answer key

**57**

PYQS

**2020–2025**

PAPERS

**5**

TOPICS

Variable Acceleration

Motion Under Gravity

Displacement, Velocity, Acceleration

Equations of Motion

Motion Graphs

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

## Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: [prepwisar.in/learn](https://prepwisar.in/learn) · No signup needed to browse

## Variable Acceleration · 14 PYQs

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**Q1** JEE Main 2025 · 7 Apr · Shift 2

An object with mass 500 g moves along x-axis with speed  $v = 4\sqrt{x}$  m/s. The force acting on the object is :

- (A) 8 N
- (B) 4 N
- (C) 5 N
- (D) 6 N

[Step-by-step solution ► prepwiser.in/questions/HITKTD8KkG](https://www.prepwiser.in/questions/HITKTD8KkG)

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**Q2** JEE Main 2025 · 29 Jan · Shift 2

Two cars P and Q are moving on a road in the same direction. Acceleration of car P increases linearly with time whereas car Q moves with a constant acceleration. Both cars cross each other at time  $t = 0$ , for the first time. The maximum possible number of crossing(s) (including the crossing at  $t = 0$ ) is \_\_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/GWTs66OFDN](https://www.prepwiser.in/questions/GWTs66OFDN)

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**Q3** JEE Main 2024 · 6 Apr · Shift 2

A particle moves in a straight line so that its displacement  $x$  at any time  $t$  is given by  $x^2 = 1 + t^2$ . Its acceleration at any time  $t$  is  $x^{-n}$  where  $n =$  \_\_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rTqBILrzo3](https://www.prepwiser.in/questions/rTqBILrzo3)

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**Q4** JEE Main 2024 · 1 Feb · Shift 2

A particle initially at rest starts moving from reference point  $x = 0$  along  $x$ -axis, with velocity  $v$  that varies as  $v = 4\sqrt{x}$  m/s. The acceleration of the particle is \_\_\_\_\_  $\text{ms}^{-2}$ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/2jRwXseVir](https://www.prepwiser.in/questions/2jRwXseVir)

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**Q5** JEE Main 2024 · 1 Feb · Shift 1

A particle is moving in one dimension (along  $x$  axis) under the action of a variable force. It's initial position was 16m right of origin. The variation of its position ( $x$ ) with time ( $t$ ) is given as  $x = -3t^3 + 18t^2 + 16t$ , where  $x$  is in m and  $t$  is in s.

The velocity of the particle when its acceleration becomes zero is \_\_\_\_\_ m/s.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/4LTSMBJvaj](https://www.prepwiser.in/questions/4LTSMBJvaj)

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**Q6** JEE Main 2024 · 29 Jan · Shift 2

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 :

- |           |            |
|-----------|------------|
| (A) 6 m/s | (B) 10 m/s |
| (C) 8 m/s | (D) 4 m/s  |

[Step-by-step solution ► prepwiser.in/questions/Cr80jPnVYH](https://www.prepwiser.in/questions/Cr80jPnVYH)

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**Q7** JEE Main 2022 · 28 Jul · Shift 2

At time  $t = 0$  a particle starts travelling from a height  $7\hat{z}\text{cm}$  in a plane keeping  $z$  coordinate constant. At any instant of time its position along the  $\hat{x}$  and  $\hat{y}$  directions are defined as  $3t$  and  $5t^3$  respectively. At  $t = 1\text{s}$  acceleration of the particle will be

(A)  $-30\hat{y}$

(B)  $30\hat{y}$

(C)  $3\hat{x} + 15\hat{y}$

(D)  $3\hat{x} + 15\hat{y} + 7\hat{z}$

[Step-by-step solution ► prepwiser.in/questions/KIKbznvYwP](https://www.prepwiser.in/questions/KIKbznvYwP)

**Q8** JEE Main 2022 · 25 Jul · Shift 2

A particle is moving in a straight line such that its velocity is increasing at  $5\text{ ms}^{-1}$  per meter. The acceleration of the particle is \_\_\_\_\_  $\text{ms}^{-2}$  at a point where its velocity is  $20\text{ ms}^{-1}$ .

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/VWH\\_SIEp9i](https://www.prepwiser.in/questions/VWH_SIEp9i)

**Q9** JEE Main 2021 · 27 Aug · Shift 1

If the velocity of a body related to displacement  $x$  is given by  $v = \sqrt{5000 + 24x}$  m/s, then the acceleration of the body is .....  $\text{m/s}^2$ .

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/0Sq54dg\\_PL](https://www.prepwiser.in/questions/0Sq54dg_PL)

**Q10** JEE Main 2021 · 25 Jul · Shift 2

The relation between time  $t$  and distance  $x$  for a moving body is given as  $t = mx^2 + nx$ , where  $m$  and  $n$  are constants. The retardation of the motion is : (When  $v$  stands for velocity)

(A)  $2mv^3$

(B)  $2mnv^3$

(C)  $2nv^3$

(D)  $2n^2v^3$

[Step-by-step solution ► prepwiser.in/questions/DAYszyq01q](https://www.prepwiser.in/questions/DAYszyq01q)

**Q11** JEE Main 2021 · 25 Jul · Shift 2

The instantaneous velocity of a particle moving in a straight line is given as  $V = \alpha t + \beta t^2$ , where  $\alpha$  and  $\beta$  are constants. The distance travelled by the particle between 1s and 2s is :

(A)  $3\alpha + 7\beta$

(B)  $\frac{3}{2}\alpha + \frac{7}{3}\beta$

(C)  $\frac{\alpha}{2} + \frac{\beta}{3}$

(D)  $\frac{3}{2}\alpha + \frac{7}{2}\beta$

[Step-by-step solution ► prepwiser.in/questions/MZD6y6knQ2](https://www.prepwiser.in/questions/MZD6y6knQ2)

**Q12** JEE Main 2021 · 17 Mar · Shift 2

The velocity of a particle is  $v = v_0 + gt + Ft^2$ . Its position is  $x = 0$  at  $t = 0$ ; then its displacement after time ( $t = 1$ ) is :

- (A)  $v_0 + g + f$
- (B)  $v_0 + \frac{g}{2} + \frac{F}{3}$
- (C)  $v_0 + 2g + 3F$
- (D)  $v_0 + \frac{g}{2} + F$

[Step-by-step solution ► prepwiser.in/questions/0UZr\\_fjQFM](https://www.prepwiser.in/questions/0UZr_fjQFM)

**Q13** JEE Main 2021 · 24 Feb · Shift 2

A particle is projected with velocity  $v_0$  along x-axis. A damping force is acting on the particle which is proportional to the square of the distance from the origin i.e.  $ma = -\alpha x^2$ . The distance at which the particle stops :

- (A)  $\left[ \frac{3mv_0^2}{2\alpha} \right]^{\frac{1}{3}}$
- (B)  $\left( \frac{2v_0}{3\alpha} \right)^{\frac{1}{3}}$
- (C)  $\left( \frac{3v_0^2}{2\alpha} \right)^{\frac{1}{2}}$
- (D)  $\left( \frac{2v_0^2}{3\alpha} \right)^{\frac{1}{2}}$

[Step-by-step solution ► prepwiser.in/questions/SWjha-eDEJ](https://www.prepwiser.in/questions/SWjha-eDEJ)

**Q14** JEE Main 2020 · 9 Jan · Shift 1

The distance  $x$  covered by a particle in one dimensional motion varies with time  $t$  as

$x^2 = at^2 + 2bt + c$ . If the acceleration of the particle depends on  $x$  as  $x^{-n}$ , where  $n$  is an integer, the value of  $n$  is \_\_\_\_\_

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/ODOeIDIEiP](https://www.prepwiser.in/questions/ODOeIDIEiP)

## Motion Under Gravity · 16 PYQs

**Q15** JEE Main 2024 · 6 Apr · Shift 2

A body projected vertically upwards with a certain speed from the top of a tower reaches the ground in  $t_1$ . If it is projected vertically downwards from the same point with the same speed, it reaches the ground in  $t_2$ . Time required to reach the ground, if it is dropped from the top of the tower, is :

- (A)  $\sqrt{t_1 + t_2}$
- (B)  $\sqrt{t_1 t_2}$
- (C)  $\sqrt{\frac{t_1}{t_2}}$
- (D)  $\sqrt{t_1 - t_2}$

[Step-by-step solution ► prepwiser.in/questions/oQPVdcvoY6](https://www.prepwiser.in/questions/oQPVdcvoY6)

**Q16** JEE Main 2023 · 12 Apr · Shift 1

A ball is thrown vertically upward with an initial velocity of  $150\text{m/s}$ . The ratio of velocity after  $3\text{s}$  and  $5\text{s}$  is  $\frac{x+1}{x}$ . The value of  $x$  is \_\_\_\_\_.  
{ take,  $g = 10\text{m/s}^2$ }

- (A)  $-5$  (B)  $10$   
(C)  $5$  (D)  $6$

[Step-by-step solution ► prepwiser.in/questions/eGwN\\_EERck](https://www.prepwiser.in/questions/eGwN_EERck)

**Q17** JEE Main 2023 · 31 Jan · Shift 1

Spherical insulating ball and a spherical metallic ball of same size and mass are dropped from the same height. Choose the correct statement out of the following  
{Assume negligible air friction}

- (A) Metal ball will reach the earth's surface earlier than the insulating ball  
(B) Both will reach the earth's surface simultaneously.  
(C) Insulating ball will reach the earth's surface earlier than the metal ball  
(D) Time taken by them to reach the earth's surface will be independent of the properties of their materials

[Step-by-step solution ► prepwiser.in/questions/FYM-pnHQOR](https://www.prepwiser.in/questions/FYM-pnHQOR)

**Q18** JEE Main 2023 · 29 Jan · Shift 1

A  $0.4\text{ kg}$  mass takes  $8\text{s}$  to reach ground when dropped from a certain height 'P' above surface of earth. The loss of potential energy in the last second of fall is \_\_\_\_\_.  
(Take  $g = 10\text{ m/s}^2$ )

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/xThREneZhl](https://www.prepwiser.in/questions/xThREneZhl)

**Q19** JEE Main 2023 · 29 Jan · Shift 1

A tennis ball is dropped on to the floor from a height of  $9.8\text{ m}$ . It rebounds to a height  $5.0\text{ m}$ . Ball comes in contact with the floor for  $0.2\text{s}$ . The average acceleration during contact is \_\_\_\_\_  $\text{ms}^{-2}$ .  
(Given  $g = 10\text{ ms}^{-2}$ )

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/DHWMnnxHFT](https://www.prepwiser.in/questions/DHWMnnxHFT)

**Q20** JEE Main 2022 · 29 Jul · Shift 1

A ball is thrown up vertically with a certain velocity so that, it reaches a maximum height  $h$ . Find the ratio of the times in which it is at height  $\frac{h}{3}$  while going up and coming down respectively.

- (A)  $\frac{\sqrt{2}-1}{\sqrt{2}+1}$   
(B)  $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$   
(C)  $\frac{\sqrt{3}-1}{\sqrt{3}+1}$   
(D)  $\frac{1}{3}$

[Step-by-step solution ► prepwiser.in/questions/WC37w4jsJv](https://www.prepwiser.in/questions/WC37w4jsJv)

**Q21** JEE Main 2022 · 28 Jul · Shift 2

A ball is thrown vertically upwards with a velocity of  $19.6\text{ms}^{-1}$  from the top of a tower. The ball strikes the ground after 6s. The height from the ground up to which the ball can rise will be  $\left(\frac{k}{5}\right)\text{m}$ . The value of k is \_\_\_\_\_. (use  $g = 9.8\text{m/s}^2$ )

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/0qvw\\_fAVhr](https://www.prepwiser.in/questions/0qvw_fAVhr)

**Q22** JEE Main 2022 · 27 Jul · Shift 2

A block 'A' takes 2 s to slide down a frictionless incline of  $30^\circ$  and length 'l', kept inside a lift going up with uniform velocity 'v'. If the incline is changed to  $45^\circ$ , the time taken by the block, to slide down the incline, will be approximately :

- (A) 2.66 s (B) 0.83 s  
(C) 1.68 s (D) 0.70 s

[Step-by-step solution ► prepwiser.in/questions/\\_a5UTfdZA1](https://www.prepwiser.in/questions/_a5UTfdZA1)

**Q23** JEE Main 2022 · 29 Jun · Shift 1

Two balls A and B are placed at the top of 180 m tall tower. Ball A is released from the top at  $t = 0$  s. Ball B is thrown vertically down with an initial velocity 'u' at  $t = 2$  s. After a certain time, both balls meet 100 m above the ground. Find the value of 'u' in  $\text{ms}^{-1}$ . [use  $g = 10\text{ms}^{-2}$ ]:

- (A) 10 (B) 15  
(C) 20 (D) 30

[Step-by-step solution ► prepwiser.in/questions/rSAKK\\_x9zE](https://www.prepwiser.in/questions/rSAKK_x9zE)

**Q24** JEE Main 2022 · 27 Jun · Shift 2

When a ball is dropped into a lake from a height 4.9 m above the water level, it hits the water with a velocity v and then sinks to the bottom with the constant velocity v. It reaches the bottom of the lake 4.0 s after it is dropped. The approximate depth of the lake is :

- (A) 19.6 m (B) 29.4 m  
(C) 39.2 m (D) 73.5 m

[Step-by-step solution ► prepwiser.in/questions/ajo8UqbDQA](https://www.prepwiser.in/questions/ajo8UqbDQA)

**Q25** JEE Main 2022 · 26 Jun · Shift 2

A ball is projected vertically upward with an initial velocity of  $50\text{ms}^{-1}$  at  $t = 0$  s. At  $t = 2$  s, another ball is projected vertically upward with same velocity. At  $t = \underline{\hspace{2cm}}$  s, second ball will meet the first ball ( $g = 10\text{ms}^{-2}$ ).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qpV-YObOAc](https://www.prepwiser.in/questions/qpV-YObOAc)

**Q26** JEE Main 2022 · 24 Jun · Shift 1

From the top of a tower, a ball is thrown vertically upward which reaches the ground in 6 s. A second ball thrown vertically downward from the same position with the same speed reaches the ground in 1.5 s. A third ball released, from the rest from the same location, will reach the ground in \_\_\_\_\_ s.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/knCOIHptc](https://www.prepwiser.in/questions/knCOIHptc)

**Q27** JEE Main 2022 · 24 Jun · Shift 2

An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to : [Use  $g = 10 \text{ ms}^{-2}$ ].

(A) 1 : 1

(B)  $\sqrt{2} : \sqrt{3}$

(C)  $\sqrt{3} : \sqrt{2}$

(D) 2 : 3

Step-by-step solution ► [prepwiser.in/questions/EvxO3MLNq\\_](https://www.prepwiser.in/questions/EvxO3MLNq_)

**Q28** JEE Main 2021 · 27 Jul · Shift 1

A ball is thrown up with a certain velocity so that it reaches a height 'h'. Find the ratio of the two different times of the ball reaching  $\frac{h}{3}$  in both the directions.

(A)  $\frac{\sqrt{2}-1}{\sqrt{2}+1}$

(B)  $\frac{1}{3}$

(C)  $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

(D)  $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

Step-by-step solution ► [prepwiser.in/questions/R1Za1yc2Kh](https://www.prepwiser.in/questions/R1Za1yc2Kh)

**Q29** JEE Main 2021 · 25 Jul · Shift 1

Water droplets are coming from an open tap at a particular rate. The spacing between a droplet observed at 4<sup>th</sup> second after its fall to the next droplet is 34.3 m. At what rate the droplets are coming from the tap ? (Take  $g = 9.8 \text{ m/s}^2$ )

(A) 3 drops / 2 sconds

(B) 2 drops / second

(C) 1 drop / second

(D) 1 drop / 7 seconds

Step-by-step solution ► [prepwiser.in/questions/qAU4yQQqlU](https://www.prepwiser.in/questions/qAU4yQQqlU)

**Q30** JEE Main 2020 · 8 Jan · Shift 2

A ball is dropped from the top of a 100 m high tower on a planet. In the last  $\frac{1}{2} \text{ s}$  before hitting the ground, it covers a distance of 19 m. Acceleration due to gravity (in  $\text{ms}^{-2}$ ) near the surface on that planet is \_\_\_\_.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/hjMbsIFO1o](https://www.prepwiser.in/questions/hjMbsIFO1o)

**Q31** JEE Main 2025 · 3 Apr · Shift 2

A particle moves along the  $x$ -axis and has its displacement  $x$  varying with time  $t$  according to the equation:

$$x = c_0(t^2 - 2) + c(t - 2)^2$$

where  $c_0$  and  $c$  are constants of appropriate dimensions.

Then, which of the following statements is correct?

- (A) the acceleration of the particle is  $2(c + c_0)$
- (B) the acceleration of the particle is  $2c_0$
- (C) the acceleration of the particle is  $2c$
- (D) the initial velocity of the particle is  $4c$

[Step-by-step solution ► prepwisar.in/questions/fgU\\_IxpWkn](https://www.prepwisar.in/questions/fgU_IxpWkn)

**Q32** JEE Main 2025 · 2 Apr · Shift 1

A person travelling on a straight line moves with a uniform velocity  $v_1$  for a distance  $x$  and with a uniform velocity  $v_2$  for the next  $\frac{3}{2}x$  distance. The average velocity in this motion is  $\frac{50}{7}$  m/s. If  $v_1$  is 5 m/s then  $v_2 =$  \_\_\_\_\_ m/s.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/n7nYNttCfB](https://www.prepwisar.in/questions/n7nYNttCfB)

**Q33** JEE Main 2024 · 31 Jan · Shift 1

The relation between time ' $t$ ' and distance ' $x$ ' is  $t = \alpha x^2 + \beta x$ , where  $\alpha$  and  $\beta$  are constants. The relation between acceleration ( $a$ ) and velocity ( $v$ ) is :

- (A)  $a = -5\alpha v^5$
- (B)  $a = -3\alpha v^2$
- (C)  $a = -2\alpha v^3$
- (D)  $a = -4\alpha v^4$

[Step-by-step solution ► prepwisar.in/questions/jJDVu8AjQU](https://www.prepwisar.in/questions/jJDVu8AjQU)

**Q34** JEE Main 2024 · 27 Jan · Shift 1

Position of an ant ( $S$  in metres) moving in  $Y$ - $Z$  plane is given by  $S = 2t^2\hat{j} + 5t\hat{k}$  (where  $t$  is in second). The magnitude and direction of velocity of the ant at  $t = 1$  s will be :

- (A) 16 m/s in  $y$ -direction
- (B) 4 m/s in  $x$ -direction
- (C) 9 m/s in  $z$ -direction
- (D) 4 m/s in  $y$ -direction

[Step-by-step solution ► prepwisar.in/questions/op1IgsGIhb](https://www.prepwisar.in/questions/op1IgsGIhb)

**Q35** JEE Main 2023 · 15 Apr · Shift 1

The position of a particle related to time is given by  $x = (5t^2 - 4t + 5)$  m. The magnitude of velocity of the particle at  $t = 2$  s will be :

- (A)  $14\text{ms}^{-1}$
- (B)  $16\text{ms}^{-1}$
- (C)  $10\text{ms}^{-1}$
- (D)  $06\text{ms}^{-1}$

[Step-by-step solution ► prepwisar.in/questions/wTWtky11sO](https://www.prepwisar.in/questions/wTWtky11sO)

**Q36** JEE Main 2023 · 13 Apr · Shift 2

The distance travelled by an object in time  $t$  is given by  $s = (2.5)t^2$ . The instantaneous speed of the object at  $t = 5\text{s}$  will be:

- (A)  $5\text{ms}^{-1}$  (B)  $12.5\text{ms}^{-1}$   
(C)  $62.5\text{ms}^{-1}$  (D)  $25\text{ms}^{-1}$

[Step-by-step solution ► prepwisar.in/questions/0h-CqVA207](https://www.prepwisar.in/questions/0h-CqVA207)

**Q37** JEE Main 2023 · 10 Apr · Shift 2

A person travels  $x$  distance with velocity  $v_1$  and then  $x$  distance with velocity  $v_2$  in the same direction. The average velocity of the person is  $v$ , then the relation between  $v$ ,  $v_1$  and  $v_2$  will be.

- (A)  $V = V_1 + V_2$   
(B)  $V = \frac{v_1 + v_2}{2}$   
(C)  $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$   
(D)  $\frac{2}{V} = \frac{1}{v_1} + \frac{1}{v_2}$

[Step-by-step solution ► prepwisar.in/questions/8JCfR78CHf](https://www.prepwisar.in/questions/8JCfR78CHf)

**Q38** JEE Main 2023 · 30 Jan · Shift 2

A vehicle travels 4km with speed of 3km/h and another 4km with speed of 5km/h, then its average speed is

- (A) 3.75km/h (B) 4.25km/h  
(C) 3.50km/h (D) 4.00km/h

[Step-by-step solution ► prepwisar.in/questions/-IHWo9kK8a](https://www.prepwisar.in/questions/-IHWo9kK8a)

**Q39** JEE Main 2023 · 25 Jan · Shift 1

A car travels a distance of ' $x$ ' with speed  $v_1$  and then same distance ' $x$ ' with speed  $v_2$  in the same direction. The average speed of the car is :

- (A)  $\frac{v_1 v_2}{2(v_1 + v_2)}$   
(B)  $\frac{2v_1 v_2}{v_1 + v_2}$   
(C)  $\frac{2x}{v_1 + v_2}$   
(D)  $\frac{v_1 + v_2}{2}$

[Step-by-step solution ► prepwisar.in/questions/hnyEXP8N2\\_](https://www.prepwisar.in/questions/hnyEXP8N2_)

## Equations of Motion · 16 PYQs

**Q40** JEE Main 2024 · 9 Apr · Shift 1

A particle moving in a straight line covers half the distance with speed 6m/s. The other half is covered in two equal time intervals with speeds 9m/s and 15m/s respectively. The average speed of the particle during the motion is :

- (A) 9.2 m/s (B) 8.8 m/s  
(C) 10 m/s (D) 8 m/s

[Step-by-step solution ► prepwisar.in/questions/Hhaa-MwrqL](https://www.prepwisar.in/questions/Hhaa-MwrqL)

**Q41** JEE Main 2024 · 9 Apr · Shift 2

Two cars are travelling towards each other at speed of  $20\text{ms}^{-1}$  each. When the cars are  $300\text{m}$  apart, both the drivers apply brakes and the cars retard at the rate of  $2\text{ms}^{-2}$ . The distance between them when they come to rest is :

- (A) 25 m (B) 100 m  
(C) 50 m (D) 200 m

[Step-by-step solution ► prepwiser.in/questions/m3jaKcSZsV](https://www.prepwiser.in/questions/m3jaKcSZsV)

**Q42** JEE Main 2024 · 6 Apr · Shift 1

A train starting from rest first accelerates uniformly up to a speed of  $80\text{km/h}$  for time  $t$ , then it moves with a constant speed for time  $3t$ . The average speed of the train for this duration of journey will be (in  $\text{km/h}$ ) :

- (A) 70 (B) 40  
(C) 30 (D) 80

[Step-by-step solution ► prepwiser.in/questions/ADArQfYfH2](https://www.prepwiser.in/questions/ADArQfYfH2)

**Q43** JEE Main 2024 · 5 Apr · Shift 1

A body moves on a frictionless plane starting from rest. If  $S_n$  is distance moved between  $t = n - 1$  and  $t = n$  and  $S_{n-1}$  is distance moved between  $t = n - 2$  and  $t = n - 1$ , then the ratio  $\frac{S_{n-1}}{S_n}$  is  $(1 - \frac{2}{x})$  for  $n = 10$ . The value of  $x$  is \_\_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/eDtUvYqPO9](https://www.prepwiser.in/questions/eDtUvYqPO9)

**Q44** JEE Main 2024 · 4 Apr · Shift 2

A bus moving along a straight highway with speed of  $72\text{km/h}$  is brought to halt within  $4\text{s}$  after applying the brakes. The distance travelled by the bus during this time (Assume the retardation is uniform) is \_\_\_\_\_  $\text{m}$ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/4MwtWY3nxu](https://www.prepwiser.in/questions/4MwtWY3nxu)

**Q45** JEE Main 2024 · 4 Apr · Shift 1

A body travels  $102.5\text{m}$  in  $n^{\text{th}}$  second and  $115.0\text{m}$  in  $(n + 2)^{\text{th}}$  second. The acceleration is :

- (A)  $6.25\text{m/s}^2$  (B)  $5\text{m/s}^2$   
(C)  $12.5\text{m/s}^2$  (D)  $9\text{m/s}^2$

[Step-by-step solution ► prepwiser.in/questions/HbNnhXQ8uz](https://www.prepwiser.in/questions/HbNnhXQ8uz)

**Q46** JEE Main 2024 · 30 Jan · Shift 1

The displacement and the increase in the velocity of a moving particle in the time interval of  $t$  to  $(t + 1)\text{s}$  are  $125\text{m}$  and  $50\text{m/s}$ , respectively. The distance travelled by the particle in  $(t + 2)^{\text{th}}$  s is \_\_\_\_\_  $\text{m}$ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/9S8Iv2l30u](https://www.prepwiser.in/questions/9S8Iv2l30u)

**Q47** JEE Main 2024 · 29 Jan · Shift 1

A body starts moving from rest with constant acceleration covers displacement  $S_1$  in first  $(p - 1)$  seconds and  $S_2$  in first  $p$  seconds. The displacement  $S_1 + S_2$  will be made in time :

- (A)  $(2p + 1)s$  (B)  $(2p - 1)s$   
(C)  $(2p^2 - 2p + 1)s$  (D)  $\sqrt{(2p^2 - 2p + 1)}s$

**Step-by-step solution** ► [prepwiser.in/questions/4drWekPliq](https://www.prepwiser.in/questions/4drWekPliq)

**Q48** JEE Main 2024 · 27 Jan · Shift 1

A particle starts from origin at  $t = 0$  with a velocity  $5\hat{i}\text{m/s}$  and moves in  $x - y$  plane under action of a force which produces a constant acceleration of  $(3\hat{i} + 2\hat{j})\text{m/s}^2$ . If the  $x$ -coordinate of the particle at that instant is  $84\text{m}$ , then the speed of the particle at this time is  $\sqrt{\alpha}\text{m/s}$ . The value of  $\alpha$  is \_\_\_\_\_.

Numerical answer — enter the value.

**Step-by-step solution** ► [prepwiser.in/questions/hEDJDnz3vR](https://www.prepwiser.in/questions/hEDJDnz3vR)

**Q49** JEE Main 2023 · 6 Apr · Shift 2

A particle starts with an initial velocity of  $10.0\text{ms}^{-1}$  along  $x$ -direction and accelerates uniformly at the rate of  $2.0\text{ms}^{-2}$ . The time taken by the particle to reach the velocity of  $60.0\text{ms}^{-1}$  is \_\_\_\_\_.

- (A) 30s (B) 6s  
(C) 3s (D) 25s

**Step-by-step solution** ► [prepwiser.in/questions/4hHi9CK\\_ys](https://www.prepwiser.in/questions/4hHi9CK_ys)

**Q50** JEE Main 2023 · 1 Feb · Shift 2

For a train engine moving with speed of  $20\text{ms}^{-1}$ , the driver must apply brakes at a distance of 500 m before the station for the train to come to rest at the station. If the brakes were applied at half of this distance, the train engine would cross the station with speed  $\sqrt{x}\text{ms}^{-1}$ . The value of  $x$  is \_\_\_\_\_.

(Assuming same retardation is produced by brakes)

Numerical answer — enter the value.

**Step-by-step solution** ► [prepwiser.in/questions/\\_IrYIMQJRU](https://www.prepwiser.in/questions/_IrYIMQJRU)

**Q51** JEE Main 2023 · 25 Jan · Shift 2

The distance travelled by a particle is related to time  $t$  as  $x = 4t^2$ . The velocity of the particle at  $t=5\text{s}$  is :-

- (A)  $25\text{ms}^{-1}$  (B)  $20\text{ms}^{-1}$   
(C)  $8\text{ms}^{-1}$  (D)  $40\text{ms}^{-1}$

**Step-by-step solution** ► [prepwiser.in/questions/S\\_Q9uFyRig](https://www.prepwiser.in/questions/S_Q9uFyRig)

**Q52** JEE Main 2022 · 25 Jul · Shift 1

A car is moving with speed of  $150\text{km/h}$  and after applying the break it will move 27m before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling \_\_\_\_\_ m distance.

Numerical answer — enter the value.

**Step-by-step solution** ► [prepwiser.in/questions/Q7JFg1UZ6o](https://www.prepwiser.in/questions/Q7JFg1UZ6o)

**Q53** JEE Main 2022 · 29 Jun · Shift 2

A small toy starts moving from the position of rest under a constant acceleration. If it travels a distance of 10m in  $t$  s, the distance travelled by the toy in the next  $t$  s will be :

- (A) 10 m (B) 20 m  
(C) 30 m (D) 40 m

[Step-by-step solution ► prepwiser.in/questions/qCJp3jdKfd](https://www.prepwiser.in/questions/qCJp3jdKfd)

**Q54** JEE Main 2022 · 25 Jun · Shift 2

Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by  $X_P(t) = \alpha t + \beta t^2$  and  $X_Q(t) = ft - t^2$ . At what time, both the buses have same velocity?

- (A)  $\frac{\alpha-f}{1+\beta}$  (B)  $\frac{\alpha+f}{2(\beta-1)}$   
(C)  $\frac{\alpha+f}{2(1+\beta)}$  (D)  $\frac{f-\alpha}{2(1+\beta)}$

[Step-by-step solution ► prepwiser.in/questions/yeSTqVLbVZ](https://www.prepwiser.in/questions/yeSTqVLbVZ)

**Q55** JEE Main 2020 · 4 Sep · Shift 1

Starting from the origin at time  $t = 0$ , with initial velocity  $5\hat{j} \text{ ms}^{-1}$ , a particle moves in the x-y plane with a constant acceleration of  $(10\hat{i} + 4\hat{j}) \text{ ms}^{-2}$ . At time  $t$ , its coordinates are (20 m,  $y_0$  m). The values of  $t$  and  $y_0$  are, respectively:

- (A) 5s and 25 m (B) 2s and 18 m  
(C) 2s and 24 m (D) 4s and 52 m

[Step-by-step solution ► prepwiser.in/questions/iVIFEvIMQ9](https://www.prepwiser.in/questions/iVIFEvIMQ9)

## Motion Graphs · 2 PYQs

**Q56** JEE Main 2023 · 8 Apr · Shift 2

Given below are two statements

Statement I : Area under velocity- time graph gives the distance travelled by the body in a given time.

Statement II : Area under acceleration- time graph is equal to the change in velocity- in the given time.

In the light of given statements, choose the correct answer from the options given below.

- (A) Both Statement I and Statement II are False.  
(B) Both Statement I and Statement II are true.  
(C) Statement I is incorrect but Statement II is true.  
(D) Statement I is correct but Statement II is false.

[Step-by-step solution ► prepwiser.in/questions/\\_MDLcXCtIJ](https://www.prepwiser.in/questions/_MDLcXCtIJ)

**Q57** JEE Main 2023 · 30 Jan · Shift 1

A horse rider covers half the distance with 5m/s speed. The remaining part of the distance was travelled with speed 10m/s for half the time and with speed 15m/s for other half of the time. The mean speed of the rider averaged over the whole time of motion is  $\frac{x}{7}$  m/s. The value of  $x$  is \_\_\_\_\_.

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/A9N6Ra24rw](https://www.prepwiser.in/questions/A9N6Ra24rw)

## Answer key — Rectilinear Motion

Numbers match the question numbers above. For full working, open the solution link under each question.

|    |           |    |            |    |            |    |           |    |            |    |            |    |          |    |            |
|----|-----------|----|------------|----|------------|----|-----------|----|------------|----|------------|----|----------|----|------------|
| 1  | <b>B</b>  | 2  | <b>3</b>   | 3  | <b>3</b>   | 4  | <b>8</b>  | 5  | <b>52</b>  | 6  | <b>C</b>   | 7  | <b>B</b> | 8  | <b>100</b> |
| 9  | <b>12</b> | 10 | <b>A</b>   | 11 | <b>B</b>   | 12 | <b>B</b>  | 13 | <b>A</b>   | 14 | <b>3</b>   | 15 | <b>B</b> | 16 | <b>C</b>   |
| 17 | <b>C</b>  | 18 | <b>300</b> | 19 | <b>120</b> | 20 | <b>B</b>  | 21 | <b>392</b> | 22 | <b>C</b>   | 23 | <b>D</b> | 24 | <b>B</b>   |
| 25 | <b>6</b>  | 26 | <b>3</b>   | 27 | <b>B</b>   | 28 | <b>C</b>  | 29 | <b>C</b>   | 30 | <b>8</b>   | 31 | <b>A</b> | 32 | <b>10</b>  |
| 33 | <b>C</b>  | 34 | <b>D</b>   | 35 | <b>B</b>   | 36 | <b>D</b>  | 37 | <b>D</b>   | 38 | <b>A</b>   | 39 | <b>B</b> | 40 | <b>D</b>   |
| 41 | <b>B</b>  | 42 | <b>A</b>   | 43 | <b>19</b>  | 44 | <b>40</b> | 45 | <b>A</b>   | 46 | <b>225</b> | 47 | <b>D</b> | 48 | <b>673</b> |
| 49 | <b>D</b>  | 50 | <b>200</b> | 51 | <b>D</b>   | 52 | <b>3</b>  | 53 | <b>C</b>   | 54 | <b>D</b>   | 55 | <b>B</b> | 56 | <b>C</b>   |
| 57 | <b>50</b> |    |            |    |            |    |           |    |            |    |            |    |          |    |            |

### Want the next chapter?

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