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PHYSICS · JEE MAIN

Kinematics

Previous Year Questions with answers

339 questions · **184** papers · **2002–2026** · newest paper first

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What is in this PDF: every Kinematics question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

Step-by-step solutions for every question are free in the EdLoop JEE app (Google Play) and on app.edloop.in. More chapters: pyq.edloop.in/free-pdfs/

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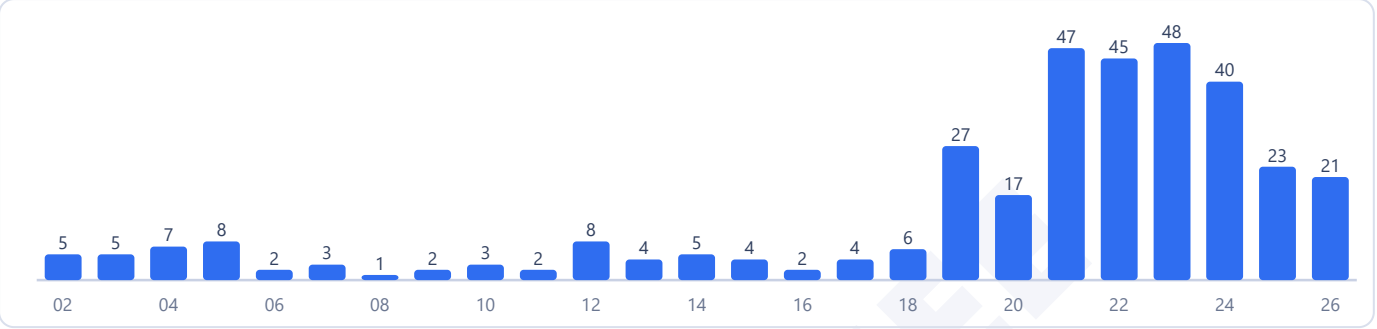
Chapter at a glance

5.9%	339	150 of 162	271 / 68
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

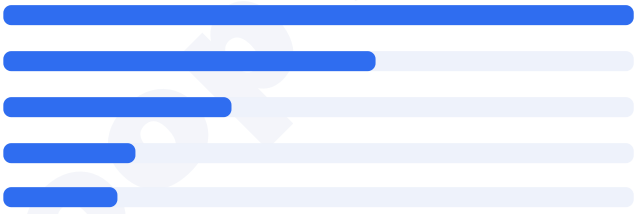
Trend. Steady: 1.4 questions per paper in 2024–2026 against 1.8 in 2019–2023.

Questions per year



Counts are the questions we hold: 339 in 184 papers. 2 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Kinematics forms the mechanical backbone of JEE Main Physics, appearing in the vast majority of test sessions. In the papers we hold from 2019 to 2026, the chapter yielded **268 questions in 162 papers**, which corresponds to **1.7 questions per paper**, and was present in 150 of those 162 papers. This places it **2nd of 29 Physics chapters** by volume over that eight-year period, representing 5.9% of all Physics questions asked.

The chapter's weighting has stayed about the same when compared to the older entrance exam format. From 2002 to 2018, it took a 5.3% share of the Physics section; across the recent 2024 to 2026 cycle, it stood at 5.4%, yielding 84 questions in 58 papers. Its peak activity in our records occurred in 2021, with 48 questions across 26 papers. Since 2019 there has been no year without it, featuring in 150 of the 162 papers we hold.

The material corresponds to Unit 2: Kinematics in NTA's Class 11 curriculum. Because trajectory analysis, coordinate decomposition, and relative velocity appear repeatedly in Newton's laws and electromagnetism, early confidence here pays steady dividends.

Most-asked topics

Across 2019 to 2026, the chapter divided into six distinct topic buckets:

- **Motion in a Straight Line**: 104 questions. The primary area, including variable acceleration calculus, multi-interval braking, and vertical throws under gravity.
- **Projectile Motion**: 63 questions. Trajectories on horizontal ground and inclined surfaces, trajectory equations, and instantaneous velocity directions.

- **Vectors**: 43 questions. Scalar and cross products, orthogonal resolution, directional cosines, and axial versus polar classifications.
- **Relative Motion**: 21 questions. Classic river-boat crossing problems, rain-umbrella angles, and closing velocities between two bodies.
- **Graphs of Motion**: 19 questions. Slope interpretation of displacement curves and area integration under acceleration-time or velocity-time plots.
- **Circular Motion (Kinematics)**: 18 questions. Tangential and radial acceleration splits, angular displacement polynomials, and banked turns.

Every single topic among these six appeared in the 2026 exam cycle, so skipping any branch leaves marks on the table.

What the questions look like

Straight-line motion problems regularly feature bodies undergoing two consecutive phases of movement. For example, a falling skydiver drops freely for a measured time interval before opening a parachute that provides uniform upward deceleration, and you must calculate the drop altitude. Another standard format provides position or velocity as a polynomial function of time, requiring differentiation to determine when acceleration vanishes or integration to find net displacement over an interval.

Projectile motion questions often test velocities at intermediate points along the path rather than standard peak height or range formulas. A representative problem specifies the speed when the velocity vector makes a 45° angle with the ground and asks for the launch velocity knowing the initial projection angle was 60°. You solve these efficiently by exploiting the constancy of the horizontal velocity component throughout free flight.

Relative motion questions generally involve two dimensions. A swimmer aims perpendicular to river banks to minimize crossing duration while drifting downstream, or two vehicles approach an intersection along perpendicular roads. Graph-based problems present piecewise linear velocity profiles where students compute total distance traveled from enclosed area while evaluating displacement from algebraic area sums.

A substantial share of kinematics appears in non-multiple-choice format: 68 of the 268 questions from 2019 to 2026 were numerical-response items, meaning students must arrive at exact answers without relying on candidate choices.

How to practise it

Begin by establishing clear sign conventions for one-dimensional kinematics. Treat displacement, velocity, and acceleration as algebraic scalars with explicit positive and negative signs rather than juggling separate formulas for upward and downward motion. Always verify whether acceleration is constant before applying standard kinematic equations; if acceleration depends on position or time, switch immediately to calculus.

When practicing projectile motion, decompose all vector quantities along orthogonal axes at the outset. Avoid relying exclusively on memorized formulas for range and time of flight, which fail whenever the landing point sits on an incline or elevation differs from the launch height. Instead, write separate equations for horizontal and vertical coordinates parameterized by time.

For relative velocity, draw vector addition triangles and write down the governing vector subtraction relationship before taking components. Pay close attention to unit conversions between kilometers per hour and meters per second, which frequently trip students up in numerical answer inputs.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

A gas balloon is going up with a constant velocity of 10 m/s. When this balloon reached a height of 75 m, a stone is dropped from it and balloon keeps moving up with the same velocity. The height of the balloon when the stone hits the ground is _____ m. (Take $g = 10$ m/s^2)

(A) 85
(B) 150
(C) 129
(D) 125

Answer: (D) 125 · Official NTA final key

Q2 JEE Main 2026 · 8 Apr · Shift 2 MCQ

Two identical bodies, projected with the same speed at two different angles cover the same horizontal range R. If the time of flight of these bodies are 5 s and 10 s, respectively, then the value of R is _____ m. (Take $g = 10$ m/s^2)

(A) 250
(B) 25
(C) 500
(D) 125

Answer: (A) 250 · Official NTA final key

Q3 JEE Main 2026 · 8 Apr · Shift 2 Numerical

Two masses of 3.4 kg and 2.5 kg are accelerated from an initial speed of 5 m/s and 12 m/s, respectively. The distances traversed by the masses in the 5th second are 104 m and 129 m, respectively. The ratio of their momenta after 10 s is $\frac{x}{8}$. The value of x is _____.

Numerical value type: the answer is a number.

Answer: 9. · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 1 Numerical

From 18 m height above the ground a ball is dropped from rest . The height above the ground at which the magnitude of velocity equal to the magnitude of acceleration (in the same set of units) due to gravity is _____ m.
(Take $g = 10$ m/s^2 and neglect the air resistance)

Numerical value type: the answer is a number.

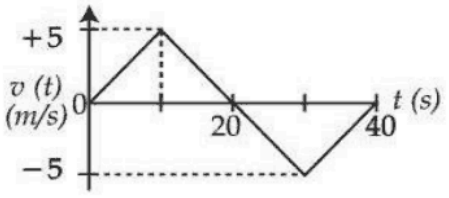
Answer: 13. · Official NTA final key

Q5 JEE Main 2026 · 5 Apr · Shift 2 MCQ

The velocity (v) versus time (t) plot of a particle is shown in the figure, for a time interval of 40 s. The total distance travelled by the particle and the average velocity during this period are, respectively _____.

(see the figure above)

The velocity (v) versus time (t) plot of a particle is shown in the figure, for a time interval of 40 s. The total distance travelled by the particle and the average velocity during this period are, respectively _____.



Options :

6911211628. 25 m and zero

6911211629. 50 m and zero

6911211630. 100 m and zero

6911211631. 100 m and 2.5 m/s

(A) 25 m and zero
(B) 50 m and zero
(C) 100 m and zero
(D) 100 m and 2.5 m/s

Answer: (C) 100 m and zero · Official NTA final key

Q6 JEE Main 2026 · 4 Apr · Shift 1 MCQ

The two projectiles are projected with the same initial velocities at the 15° and 30° with respect to the horizontal. The ratio of their ranges is $1{:}x$. The value of x is

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

Answer: (B) $\sqrt{3}$ · Official NTA final key

Q7 JEE Main 2026 · 4 Apr · Shift 2 MCQ

Two cars A and B are moving in the same direction along a straight line with speeds 100 km/h and 80 km/h, respectively such that car A is moving ahead of car B. A person in car B throws a stone with a speed v so that it hits the car A with a speed of 5 m/s. The value of v is _____ km/h.

(A) 18
(B) 28
(C) 38
(D) 48

Answer: (C) 38 · Official NTA final key

Q8 JEE Main 2026 · 4 Apr · Shift 2 MCQ

If x and y coordinates of a projectile as a function of time (t) are given as $24t$ and $43.6t - 4.9t^2$, respectively, then the angle (in degrees) made by the projectile with horizontal when $t = 2$ s is _____.

(A) 60
(B) 45
(C) 30
(D) 75

Answer: (B) 45 · Official NTA final key

Q9 JEE Main 2026 · 4 Apr · Shift 2 Numerical

A gun mounted on the ground fires bullets in all directions with same speed. The farthest distance the bullets could reach is 6.4 m. The speed of the bullets from the gun is _____ m/s.

(take g = 10 m/s^2)

Numerical value type: the answer is a number.

Answer: 8. · Official NTA final key

Q10 JEE Main 2026 · 2 Apr · Shift 1 MCQ

The velocity of a particle is given as $\vec{v} = -x\hat{i} + 2y\hat{j} - z\hat{k}$ m/s. The magnitude of acceleration at point (1, 2, 4) is _____ m/s^2.

(A) $\sqrt{6}$
(B) 9
(C) $\sqrt{33}$
(D) 0

Answer: (B) 9 · Official NTA final key

Q11 JEE Main 2026 · 2 Apr · Shift 1 MCQ

A particle is rotating in a circular path and at any instant its motion can be described as $\theta = \frac{5t^4}{40} - \frac{t^3}{3}$. The angular acceleration of the particle after 10 seconds is _____ rad/s^2.

(A) 150
(B) 120
(C) 130
(D) 170

Answer: (C) 130 · Official NTA final key

Q12 JEE Main 2026 · 28 Jan · Shift 1 MCQ

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 m/s^2)

(A) 4.0
(B) 3.8
(C) 4.2
(D) 2.5

Answer: (C) 4.2 · Official NTA final key

Q13 JEE Main 2026 · 28 Jan · Shift 1 MCQ

A particle of mass m falls from rest through a resistive medium having resistive force, $F = -kv$, where v is the velocity of the particle and k is a constant. Which of the following graphs represents velocity (v) versus time (t)?

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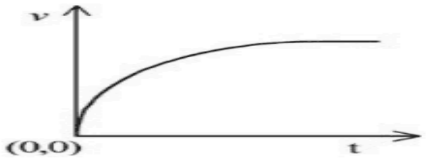
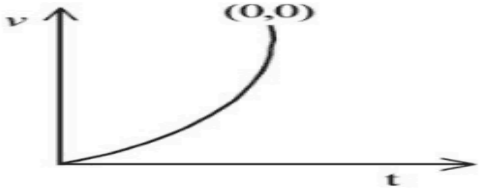
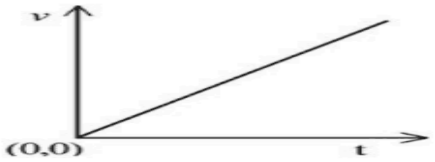
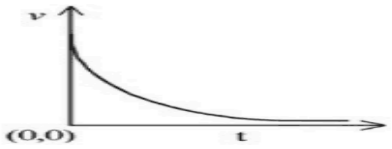
Q.40 A particle of mass m falls from rest through a resistive medium having resistive force, $F = -kv$, where v is the velocity of the particle and k is a constant. Which of the following graphs represents velocity (v) versus time (t)?

Options

1.


2.


3.


4.


(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Official NTA final key

Q14 JEE Main 2026 · 28 Jan · Shift 2 MCQ

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 :

(A) C, E Only

(B) A, B, C Only

(C) A, C, D Only

(D) A, C Only

Answer: (B) A, B, C Only · Official NTA final key

Q15 JEE Main 2026 · 28 Jan · Shift 2 MCQ

When the position vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ changes sign as $-\vec{r}$, which one of the following vector will not flip under sign change ?

(A) Linear momentum
(B) Angular momentum
(C) Velocity
(D) Acceleration

Answer: (B) Angular momentum · Official NTA final key

Q16 JEE Main 2026 · 24 Jan · Shift 1 MCQ

A boy throws a ball into air at 45° from the horizontal to land it on a roof of a building of height H. If the ball attains maximum height in 2 s and lands on the building in 3 s after launch, then value of H is _____ m.

($g = 10$ m/s^2)

(A) 25
(B) 10
(C) 15
(D) 20

Answer: (C) 15 · Official NTA final key

Q17 JEE Main 2026 · 24 Jan · Shift 2 MCQ

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

(see the figure above)

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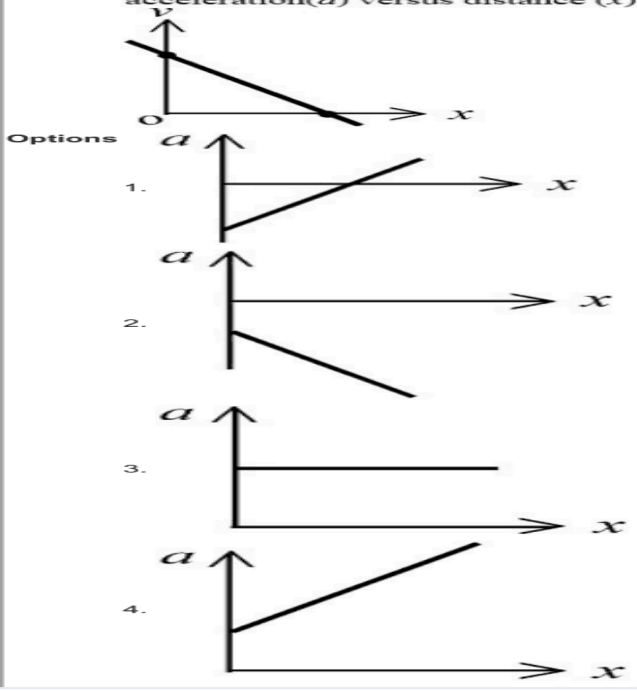
Q.27 The velocity (v) – Distance (x) graph is shown in figure. Which graph represents acceleration(a) versus distance (x) variation of this system?



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Official NTA final key

Q18 JEE Main 2026 · 23 Jan · Shift 1 MCQ

An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction is :

(see the figure above)

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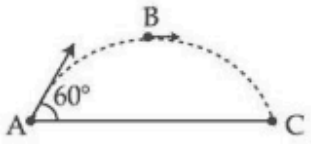
Q.37 An object is projected with kinetic energy K from a point A at an angle $60°$ with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction is :



Options

1. $2:3$
2. $1:2$
3. $3:4$
4. $1:4$

(A) $2:3$
(B) $1:2$
(C) $3:4$
(D) $1:4$

Answer: (C) $3:4$ · Official NTA final key

Q19 JEE Main 2026 · 23 Jan · Shift 2 MCQ

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.

($g = 10$ m/s^2)

(A) 82.5
(B) 92.5
(C) 62.5
(D) 20

Answer: (B) 92.5 · Official NTA final key

Q20 JEE Main 2026 · 22 Jan · Shift 1 MCQ

A projectile is thrown upward at an angle 60° with the horizontal. The speed of the projectile is 20 m/s when its direction of motion is 45° with the horizontal. The initial speed of the projectile is _____ m/s.

(A) $20\sqrt{2}$
(B) 40
(C) $20\sqrt{3}$
(D) $40\sqrt{2}$

Answer: (A) $20\sqrt{2}$ · Official NTA final key

Q21 JEE Main 2026 · 21 Jan · Shift 2 MCQ

A river of width 200 m is flowing from west to east with a speed of 18 km/h. A boat, moving with speed of 36 km/h in still water, is made to travel one-round trip (bank to bank of the river). Minimum time taken by the boat for this journey and also the displacement along the river bank are _____ and _____ respectively.

(A) 20 s and 100 m
(B) 40 s and 100 m
(C) 40 s and 0 m
(D) 40 s and 200 m

Answer: (D) 40 s and 200 m · Official NTA final key

Q22 JEE Main 2025 · 8 Apr · Shift 2 MCQ

Two balls with same mass and initial velocity, are projected at different angles in such a way that maximum height reached by first ball is 8 times higher than that of the second ball. T_1 and T_2 are the total flying times of first and second ball, respectively, then the ratio of T_1 and T_2 is

(A) 2 : 1
(B) $\sqrt{2} : 1$
(C) $2\sqrt{2} : 1$
(D) 4 : 1

Answer: (C) $2\sqrt{2} : 1$ · Key from source paper

Q23 JEE Main 2025 · 7 Apr · Shift 1 MCQ

Two projectiles are fired from ground with same initial speeds from same point at angles $(45^\circ + \alpha)$ and $(45^\circ - \alpha)$ with horizontal direction. The ratio of their times of flights is

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

Answer: (A) $\frac{1+\tan\alpha}{1-\tan\alpha}$ · Key from source paper

Q24 JEE Main 2025 · 7 Apr · Shift 2 MCQ

A helicopter flying horizontally with a speed of 360 km/h at an altitude of 2 km, drops an object at an instant. The object hits the ground at a point O, 20s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is : (use acceleration due to gravity $g = 10m/s^2$ and neglect air resistance)

(A) $2\sqrt{5}$ km
(B) 7.2 km
(C) 4 km
(D) $2\sqrt{2}$ km

Answer: (D) $2\sqrt{2}$ km · Key from source paper

Q25 JEE Main 2025 · 7 Apr · Shift 2 MCQ

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) 6 N
(D) 5 N

Answer: (B) 4 N · Key from source paper

Q26 JEE Main 2025 · 4 Apr · Shift 1 MCQ

If L and P represent the angular momentum and linear momentum respectively of a particle of mass 'm' having position vector as $\vec{r} = a(\hat{i}\cos\omega t + \hat{j}\sin\omega t)$. The direction of force is

(A) Opposite to the direction of $\vec{r}$
(B) Opposite to the direction of $\vec{P}$
(C) Opposite to the direction of $\vec{L} \times \vec{P}$
(D) Opposite to the direction of $\vec{L}$

Answer: (A) Opposite to the direction of $\vec{r}$ · Key from source paper

Q27 JEE Main 2025 · 4 Apr · Shift 2 MCQ

The displacement x versus time graph is shown below.

(see the figure above)

(A) The average velocity during 0 to 3 s is $10m/s$

(B) The average velocity during 3 to 5 s is $0m/s$

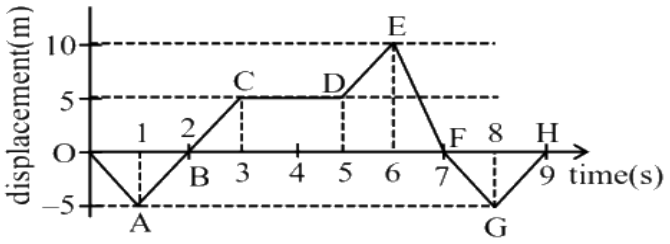
(C) The instantaneous velocity at $t = 2s$ is $5m/s$

(D) The average velocity during 5 to 7 s and instantaneous velocity at $t = 6.5s$ are equal

(E) The average velocity from $t = 0$ to $t = 9s$ is zero

Choose the correct answer from the options given below :

12. The displacement x versus time graph is shown below.



(A) The average velocity during 0 to 3 s is $10\,\mathrm{m/s}$

(B) The average velocity during 3 to 5 s is $0\,\mathrm{m/s}$

(C) The instantaneous velocity at $\mathrm{t} = 2\mathrm{s}$ is $5\,\mathrm{m/s}$

(D) The average velocity during 5 to 7 s and instantaneous velocity at $\mathrm{t} = 6.5\mathrm{s}$ are equal

(E) The average velocity from $\mathrm{t} = 0$ to $\mathrm{t} = 9\mathrm{s}$ is zero

Choose the correct answer from the options given below :

(1) (B), (C), (E) only

(2) (A), (D), (E) only

(3) (B), (D), (E) only

(4) (B), (C), (D) only

(A) (B), (C), (E) only

(B) (A), (D), (E) only

(C) (B), (D), (E) only

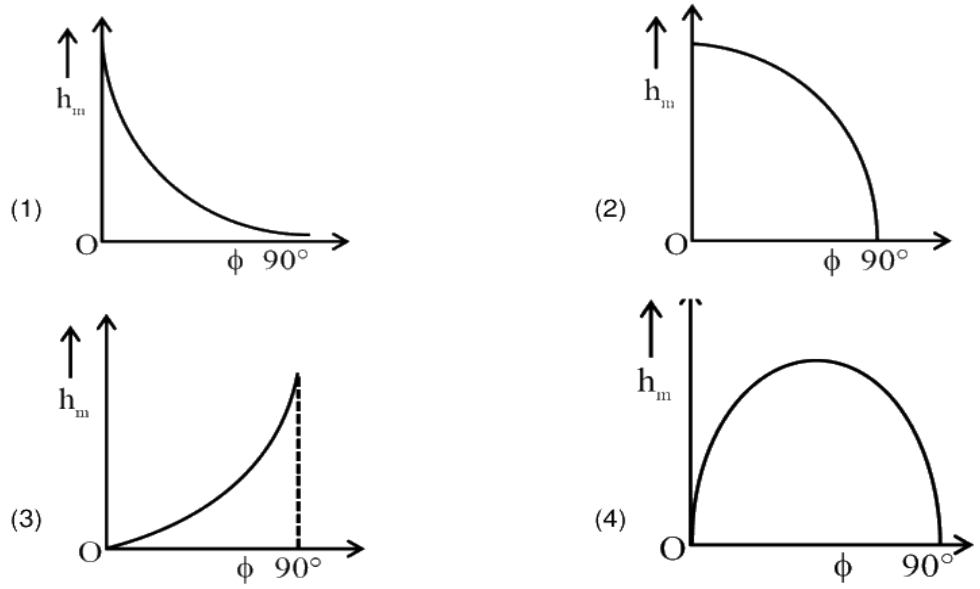
(D) (B), (C), (D) only

Answer: (A) (B), (C), (E) only · Key from source paper

Q28 JEE Main 2025 · 3 Apr · Shift 1 MCQ

The angle of projection of a particle is measured from the vertical axis as ϕ and the maximum height reached by the particle is h_m. Here h_m as function of ϕ can be presented as

9. The angle of projection of a particle is measured from the vertical axis as ϕ and the maximum height reached by the particle is h_m. Here h_m as function of ϕ can be presented as



A *see figure*

B *see figure*

C *see figure*

D *see figure*

Answer: (B) · Key from source paper

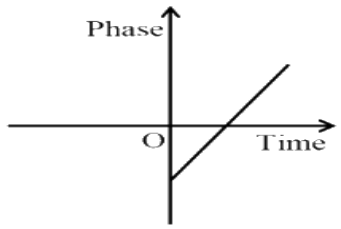
Q29 JEE Main 2025 · 3 Apr · Shift 1 MCQ

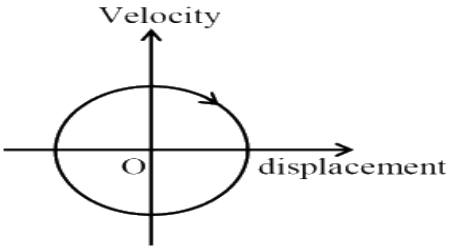
Which of the following curves possibly represent one-dimensional motion of a particle?

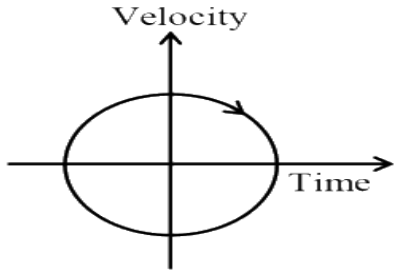
(see the figure above)

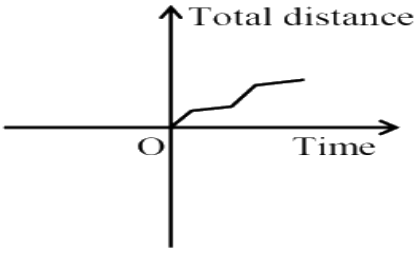
Choose the correct answer from the options given below:

20. Which of the following curves possibly represent one-dimensional motion of a particle?

(A) 

(B) 

(C) 

(D) 

Choose the correct answer from the options given below:

(1) A, B and D only
(2) A, B and C only
(3) A and B only
(4) A, C and D only

SECTION-B

A. A, B and D only
B. A, B and C only
C. A and B only
D. A, C and D only

Answer: (A) A, B and D only · Key from source paper

Q30 JEE Main 2025 · 3 Apr · Shift 2 MCQ

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

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

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 initial velocity of the particle is 4 c
C. the acceleration of the particle is $2c_0$
D. the acceleration of the particle is 2c

Answer: (A) the acceleration of the particle is $2(c + c_0)$ · Key from source paper

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Q31 JEE Main 2025 · 3 Apr · Shift 2 MCQ

A particle is projected with velocity u so that its horizontal range is three times the maximum height attained by it. The horizontal range of the projectile is given as $\frac{mu^2}{25g}$, where value of n is: (Given, 'g' is the acceleration due to gravity.)

(A) 12
(B) 18
(C) 24
(D) 6

Answer: (C) 24 · Key from source paper

Q32 JEE Main 2025 · 2 Apr · Shift 1 MCQ

A river is flowing from west to east direction with speed of $9kmh^{-1}$. If a boat capable of moving at a maximum speed of $27kmh^{-1}$ in still water, crosses the river in half a minute, while moving with maximum speed at an angle of 150° to direction of river flow, then the width of the river is :

(A) 75 m
(B) 300 m
(C) 112.5 m
(D) $112.5 \times \sqrt{3}m$

Answer: (C) 112.5 m · Key from source paper

Q33 JEE Main 2025 · 2 Apr · Shift 1 Numerical

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 $5m/s$ then $v_2 =$ _____ m/s.

Numerical value type: the answer is a number.

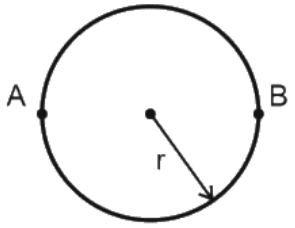
Answer: 10. · Key from source paper

Q34 JEE Main 2025 · 2 Apr · Shift 2 MCQ

A sportsman runs around a circular track of radius r such that he traverses the path ABAB. The distance travelled and displacement, respectively, are

(see the figure above)

13. A sportsman runs around a circular track of radius r such that he traverses the path ABAB. The distance travelled and displacement, respectively, are



(1) $3\pi r, 2r$ (2) $\pi r, 3r$ (3) $2r, 3\pi r$ (4) $3\pi r, \pi r$

(A) $3\pi r, 2r$

(B) $\pi r, 3r$

(C) $2r, 3\pi r$

(D) $3\pi r, \pi r$

Answer: (A) $3\pi r, 2r$ · Key from source paper

Q35 JEE Main 2025 · 29 Jan · Shift 1 MCQ

Two projectiles are fired with same initial speed from same point on ground at angles of $(45^\circ - \alpha)$ and $(45^\circ + \alpha)$, respectively, with the horizontal direction. The ratio of their maximum heights attained is :

(A) $\frac{1-\tan\alpha}{1+\tan\alpha}$

(B) $\frac{1-\sin 2\alpha}{1+\sin 2\alpha}$

(C) $\frac{1+\sin 2\alpha}{1-\sin 2\alpha}$

(D) $\frac{1+\sin\alpha}{1-\sin\alpha}$

Answer: (B) $\frac{1-\sin 2\alpha}{1+\sin 2\alpha}$ · Key from source paper

Q36 JEE Main 2025 · 29 Jan · Shift 1 Numerical

The maximum speed of a boat in still water is 27 km/h. Now this boat is moving downstream in a river flowing at 9 km/h. A man in the boat throws a ball vertically upwards with speed of 10 m/s. Range of the ball as observed by an observer at rest on the river bank, is _____ cm. (Take g = 10 $\mathrm{m/s^2}$)

Numerical value type: the answer is a number.

Answer: 2000. · Key from source paper

Q37 JEE Main 2025 · 29 Jan · Shift 2 Numerical

Two cars P and Q are moving on a road in the same direction. Accleration of car P increases linearly with time whereas car Q moves with a constant accleration. 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 value type: the answer is a number.

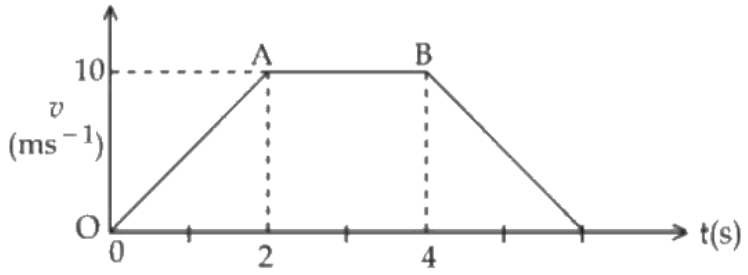
Answer: 3. · Key from source paper

Q38 JEE Main 2025 · 28 Jan · Shift 2 MCQ

The velocity-time graph of an object moving along a straight line is shown in figure. What is the distance covered by the object between $t = 0$ to $t = 4$ s ?

(see the figure above)

Q28. The velocity-time graph of an object moving along a straight line is shown in figure. What is the distance covered by the object between $t = 0$ to $t = 4$ s ?



(1) 30 m
(2) 11 m
(3) 10 m
(4) 13 m

(A) 30 m
(B) 11 m
(C) 10 m
(D) 13 m

Answer: (A) 30 m · Key from source paper

Q39 JEE Main 2025 · 24 Jan · Shift 2 MCQ

The position vector of a moving body at any instant of time is given as $\vec{r} = \left(5t^2\hat{i} - 5t\hat{j}\right)$ m. The magnitude and direction of velocity at $t = 2$ s is,

(A) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis
(B) $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
(C) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with + ve X axis
(D) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis

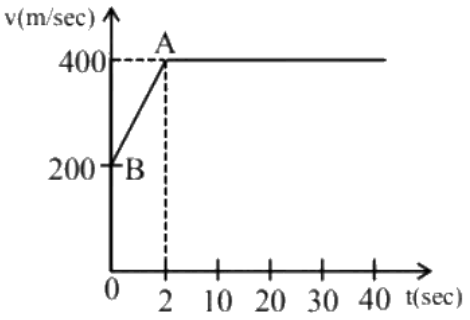
Answer: (D) $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with - ve Y axis · Key from source paper

Q40 JEE Main 2025 · 23 Jan · Shift 1 MCQ

The motion of an airplane is represented by velocity-time graph as shown below. The distance covered by airplane in the first 30.5 second is _____ km .

(see the figure above)

Q43. The motion of an airplane is represented by velocity-time graph as shown below. The distance covered by



airplane in the first 30.5 second is _____ km .

(1) 12
(2) 3
(3) 6
(4) 9

(A) 12
(B) 3
(C) 6
(D) 9

Answer: (A) 12 · Key from source paper

Q41 JEE Main 2025 · 23 Jan · Shift 1 Numerical

Two particles are located at equal distance from origin. The position vectors of those are represented by $\bar{A} = 2\hat{i} + 3n\hat{j} + 2\hat{k}$ and $\bar{B} = 2\hat{i} - 2\hat{j} + 4p\hat{k}$, respectively. If both the vectors are at right angle to each other, the value of n^{-1} is _____ .

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q42 JEE Main 2025 · 23 Jan · Shift 2 MCQ

A ball having kinetic energy KE, is projected at an angle of 60° from the horizontal. What will be the kinetic energy of ball at the highest point of its flight ?

(A) $\frac{(KE)}{8}$
(B) $\frac{(KE)}{2}$
(C) $\frac{(KE)}{16}$
(D) $\frac{(KE)}{4}$

Answer: (D) $\frac{(KE)}{4}$ · Key from source paper

Q43 JEE Main 2025 · 22 Jan · Shift 1 Numerical

A particle is projected at an angle of 30° from horizontal at a speed of 60 m/s. The height traversed by the particle in the first second is h_0 and height traversed in the last second, before it reaches the maximum height, is h_1. The ratio $h_0 : h_1$ is _____ [Take, g = 10 m/s^2]

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q44 JEE Main 2025 · 22 Jan · Shift 2 MCQ

A ball of mass 100 g is projected with velocity 20 m/s at 60° with horizontal. The decrease in kinetic energy of the ball during the motion from point of projection to highest point is

(A) 5 J
(B) 15 J
(C) 20 J
(D) zero

Answer: (B) 15 J · Key from source paper

Q45 JEE Main 2024 · 9 Apr · Shift 1 MCQ

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

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

Answer: (B) 8 m/s · Key from source paper

Q46 JEE Main 2024 · 9 Apr · Shift 1 Numerical

If $\vec{a}$ and $\vec{b}$ makes an angle $\cos^{-1}\left(\frac{5}{9}\right)$ with each other, then $|\vec{a}+\vec{b}| = \sqrt{2}|\vec{a}-\vec{b}|$ for $|\vec{a}| = n|\vec{b}|$ The integer value of n is _____

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q47 JEE Main 2024 · 9 Apr · Shift 2 MCQ

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

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

Answer: (B) 100 m · Key from source paper

Q48 JEE Main 2024 · 9 Apr · Shift 2 Numerical

The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is _____ °.

Numerical value type: the answer is a number.

Answer: 150. · Key from source paper

Q49 JEE Main 2024 · 8 Apr · Shift 1 MCQ

A clock has 75 cm, 60 cm long second hand and minute hand respectively. In 30 minutes duration the tip of second hand will travel x distance more than the tip of minute hand. The value of x in meter is nearly (Take $\pi = 3.14$) :

(A) 140.5
(B) 118.9
(C) 139.4
(D) 220.0

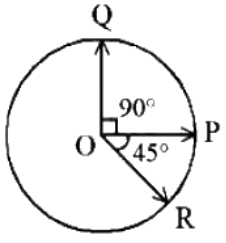
Answer: (C) 139.4 · Key from source paper

Q50 JEE Main 2024 · 8 Apr · Shift 1 Numerical

Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____ .

(see the figure above)

Q21. Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____ .



Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q51 JEE Main 2024 · 8 Apr · Shift 2 MCQ

The angle of projection for a projectile to have same horizontal range and maximum height is :

(A) $\tan^{-1}(4)$
(B) $\tan^{-1}\left(\frac{1}{4}\right)$
(C) $\tan^{-1}\left(\frac{1}{2}\right)$
(D) $\tan^{-1}(2)$

Answer: (A) $\tan^{-1}(4)$ · Key from source paper

Q52 JEE Main 2024 · 8 Apr · Shift 2 Numerical

A body of mass M thrown horizontally with velocity v from the top of the tower of height H touches the ground at a distance of 100 m from the foot of the tower. A body of mass 2M thrown at a velocity $\frac{v}{2}$ from the top of the tower of height 4H will touch the ground at a distance of _____ m.

Numerical value type: the answer is a number.

Answer: 100. · Key from source paper

Q53 JEE Main 2024 · 6 Apr · Shift 1 MCQ

A train starting from rest first accelerates uniformly up to a speed of 80 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 km/h) :

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

Answer: (D) 70 · Key from source paper

Q54 JEE Main 2024 · 6 Apr · Shift 1 Numerical

For three vectors $\vec{A} = (-x\hat{i} - 6\hat{j} - 2\hat{k})$, $\vec{B} = (-\hat{i} + 4\hat{j} + 3\hat{k})$ and $\vec{C} = (-8\hat{i} - \hat{j} + 3\hat{k})$, if $\vec{A} \cdot (\vec{B} \times \vec{C}) = 0$, then value of x is _____

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q55 JEE Main 2024 · 6 Apr · Shift 2 MCQ

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) $\sqrt{t_1 - t_2}$
(D) $\sqrt{\frac{t_1}{t_2}}$

Answer: (A) $\sqrt{t_1 t_2}$ · Key from source paper

Q56 JEE Main 2024 · 6 Apr · Shift 2 · Numerical

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 value type: the answer is a number.

Answer: 3. · Key from source paper

Q57 JEE Main 2024 · 5 Apr · Shift 1 · MCQ

The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is :

(A) $\tan^{-1} \frac{(2\vec{Q}-2\vec{P})}{2\vec{Q}+2\vec{P}}$
(B) 0°
(C) $\tan^{-1}(P/Q)$
(D) $\tan^{-1}(2Q/P)$

Answer: (B) 0° · Key from source paper

Q58 JEE Main 2024 · 5 Apr · Shift 1 · Numerical

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 $\left(1 - \frac{2}{x}\right)$ for n = 10. The value of x is _____ .

Numerical value type: the answer is a number.

Answer: 19. · Key from source paper

Q59 JEE Main 2024 · 5 Apr · Shift 2 · MCQ

A man carrying a monkey on his shoulder does cycling smoothly on a circular track of radius 9 m and completes 120 resolutions in 3 minutes. The magnitude of centripetal acceleration of monkey is (in m/s^2) :

(A) $57600\pi^2\ \mathrm{ms}^{-2}$
(B) Zero
(C) $4\pi^2\ \mathrm{ms}^{-2}$
(D) $16\pi^2\ \mathrm{ms}^{-2}$

Answer: (D) $16\pi^2\ \mathrm{ms}^{-2}$ · Key from source paper

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Q60 JEE Main 2024 · 5 Apr · Shift 2 Numerical

The maximum height reached by a projectile is 64 m. If the initial velocity is halved, the new maximum height of the projectile is _____ m.

Numerical value type: the answer is a number.

Answer: 16. · Key from source paper

Q61 JEE Main 2024 · 4 Apr · Shift 1 MCQ

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

(A) 6.25 m/s^2
(B) 12.5 m/s^2
(C) 9 m/s^2
(D) 5 m/s^2

Answer: (A) 6.25 m/s^2 · Key from source paper

Q62 JEE Main 2024 · 4 Apr · Shift 1 MCQ

The co-ordinates of a particle moving in $x-y$ plane are given by : $x=2+4t, y=3t+8t^2$. The motion of the particle is :

(A) uniformly accelerated having motion along a parabolic path.
(B) uniform motion along a straight line.
(C) uniformly accelerated having motion along a straight line.
(D) non-uniformly accelerated.

Answer: (A) uniformly accelerated having motion along a parabolic path. · Key from source paper

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Q63 JEE Main 2024 · 4 Apr · Shift 1 Numerical

Two forces F_1 and F_2 are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between $\vec{F}_1$ and $\vec{F}_2$ is $\cos^{-1}\left(\frac{1}{n}\right)$. The value of $|n|$ is _____.

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

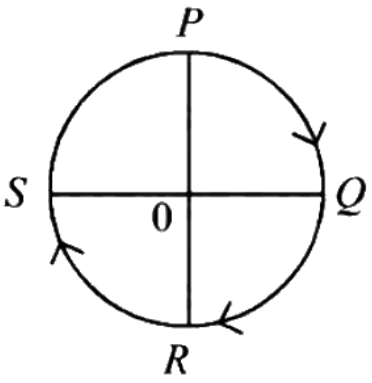
Q64 JEE Main 2024 · 4 Apr · Shift 2 MCQ

A cyclist starts from the point P of a circular ground of radius 2 km and travels along its circumference to the

(see the figure above)

point S. The displacement of a cyclist is:

Q2. A cyclist starts from the point P of a circular ground of radius 2 km and travels along its circumference to the



point S. The displacement of a cyclist is:

(1) $\sqrt{8}$ km (2) 8 km

(3) 6 km (4) 4 km

(A) $\sqrt{8}$ km

(B) 8 km

(C) 6 km

(D) 4 km

Answer: (A) $\sqrt{8}$ km · Key from source paper

Q65 JEE Main 2024 · 4 Apr · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 40. · Key from source paper

Q66 JEE Main 2024 · 1 Feb · Shift 1 MCQ

A particle moving in a circle of radius R with uniform speed takes time T to complete one revolution. If this particle is projected with the same speed at an angle θ to the horizontal, the maximum height attained by it is equal to $4R$. The angle of projection θ is then given by :

(A) $\sin^{-1}\left(\frac{2gT^2}{\pi^2 R}\right)^{\frac{1}{2}}$

(B) $\sin^{-1}\left(\frac{\pi^2 R}{2gT^2}\right)^{\frac{1}{2}}$

(C) $\cos^{-1}\left(\frac{2gT^2}{\pi^2 R}\right)^{\frac{1}{2}}$

(D) $\cos^{-1}\left(\frac{\pi R}{2gT^2}\right)^{\frac{1}{2}}$

Answer: (A) $\sin^{-1}\left(\frac{2gT^2}{\pi^2 R}\right)^{\frac{1}{2}}$ · Key from source paper

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Q67 JEE Main 2024 · 1 Feb · Shift 1 Numerical

A particle is moving in one dimension (along x axis) under the action of a variable force. It's initial position was 16 m 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 _____ $\mathrm{m\ s^{-1}}$.

Numerical value type: the answer is a number.

Answer: 52. · Key from source paper

Q68 JEE Main 2024 · 1 Feb · Shift 2 MCQ

Train A is moving along two parallel rail tracks towards north with 72 $\mathrm{km\ h^{-1}}$ and train B is moving towards south with speed 108 $\mathrm{km\ h^{-1}}$. Velocity of train B with respect to A and velocity of ground with respect to B are (in $\mathrm{m\ s^{-1}}$):

(A) -30 and 50

(B) -50 and -30

(C) -50 and 30

(D) 50 and -30

Answer: (C) -50 and 30 · Key from source paper

Q69 JEE Main 2024 · 1 Feb · Shift 2 Numerical

A particle initially at rest starts moving from reference point $x = 0$ along x-axis, with velocity v that varies as $v = 4\sqrt{x}\ \mathrm{m\ s^{-1}}$. The acceleration of the particle is _____ $\mathrm{m\ s^{-2}}$.

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q70 JEE Main 2024 · 31 Jan · Shift 1 MCQ

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

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

Answer: (A) $a = -2\alpha v^3$ · Key from source paper

Q71 JEE Main 2024 · 31 Jan · Shift 1 Numerical

A body starts falling freely from height H hits an inclined plane in its path at height h. As a result of this perfectly elastic impact, the direction of the velocity of the body becomes horizontal. The value of $\frac{H}{h}$ for which the body will take the maximum time to reach the ground is _____.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q72 JEE Main 2024 · 31 Jan · Shift 2 MCQ

If two vectors $\vec{A}$ and $\vec{B}$ having equal magnitude R are inclined at an angle θ, then

(A) $\vec{A} - \vec{B} = \sqrt{2}\,R \sin\frac{\theta}{2}$
(B) $\vec{A} + \vec{B} = 2R \sin\frac{\theta}{2}$
(C) $\vec{A} + \vec{B} = 2R \cos\frac{\theta}{2}$
(D) $\vec{A} - \vec{B} = 2R \cos\frac{\theta}{2}$

Answer: (C) $\vec{A} + \vec{B} = 2R \cos\frac{\theta}{2}$ · Key from source paper

Q73 JEE Main 2024 · 30 Jan · Shift 1 Numerical

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

Numerical value type: the answer is a number.

Answer: 175. · Key from source paper

Q74 JEE Main 2024 · 30 Jan · Shift 2 MCQ

Projectiles A and B are thrown at angles of 45° and 60° with vertical respectively from top of a 400 m high tower. If their times of flight are same, the ratio of their speeds of projection $v_A : v_B$ is:

(A) $1 : \sqrt{3}$
(B) $\sqrt{2} : 1$
(C) $1 : 2$
(D) $1 : \sqrt{2}$

Answer: (D) $1 : \sqrt{2}$ · Key from source paper

Q75 JEE Main 2024 · 30 Jan · Shift 2 Numerical

A vector has magnitude same as that of $\vec{A} = 3\hat{j} + 4\hat{j}$ and is parallel to $\vec{B} = 4\hat{i} + 3\hat{j}$. The x and y components of this vector in first quadrant are x and 3 respectively where x = _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q76 JEE Main 2024 · 29 Jan · Shift 1 MCQ

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

Answer: (B) $\sqrt{(2p^2 - 2p + 1)}$ s · Key from source paper

Q77 JEE Main 2024 · 29 Jan · Shift 1 Numerical

A ball rolls off the top of a stairway with horizontal velocity u. The steps are 0.1 m high and 0.1 m wide. The minimum velocity u with which that ball just hits the step 5 of the stairway will be $\sqrt{x}$ m s^{-1}, where $x =$ _____ [use $g = 10$ m s^{-2}].

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q78 JEE Main 2024 · 29 Jan · Shift 2 MCQ

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) 4 m s^{-1}
(B) 8 m s^{-1}
(C) 10 m s^{-1}
(D) 6 m s^{-1}

Answer: (B) 8 m s^{-1} · Key from source paper

Q79 JEE Main 2024 · 29 Jan · Shift 2 Numerical

A particle is moving in a circle of radius 50 cm in such a way that at any instant the normal and tangential components of its acceleration are equal. If its speed at t = 0 is 4 m s^{-1}, the time taken to complete the first revolution will be $\frac{1}{\alpha}\left[1 - e^{-2\pi}\right]$ s, where $\alpha =$ _____.

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q80 JEE Main 2024 · 27 Jan · Shift 1 MCQ

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

(A) 16 m s^{-1} in y-direction
(B) 4 m s^{-1} in x-direction
(C) 9 m s^{-1} in z-direction
(D) 4 m s^{-1} in y-direction

Answer: (D) 4 m s^{-1} in y-direction · Key from source paper

Q81 JEE Main 2024 · 27 Jan · Shift 1 Numerical

A particle starts from origin at t = 0 with a velocity $5\hat{i}$ m s^{-1} and moves in x $-$ y plane under action of a force which produces a constant acceleration of $\left(3\hat{i} + 2\hat{j}\right)$ m s^{-2}. If the x-coordinate of the particle at that instant is 84 m, then the speed of the particle at this time is $\sqrt{\alpha}$ m s^{-1}. The value of α is _____.

Numerical value type: the answer is a number.

Answer: 673. · Key from source paper

Q82 JEE Main 2024 · 27 Jan · Shift 2 MCQ

A bullet is fired into a fixed target looses one third of its velocity after travelling 4 cm. It penetrates further $D \times 10^{-3}$ m before coming to rest. The value of D is :

(A) 32
(B) 5
(C) 3
(D) 4

Answer: (A) 32 · Key from source paper

Q83 JEE Main 2024 · 27 Jan · Shift 2 MCQ

Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The angular speed of the moon in its orbit about the earth is more than the angular speed of the earth in its orbit about the sun.

Reason (R): The moon takes less time to move around the earth than the time taken by the earth to move around the sun.

In the light of the above statements, choose the most appropriate answer from the options given below :

(A) (A) is correct but (R) is not correct

(B) Both (A) and (R) are correct and (R) is the correct explanation of A.

(C) Both (A) and (R) are correct but (R) is not the correct explanation of A.

(D) (A) is not correct but (R) is correct

Answer: (B) Both (A) and (R) are correct and (R) is the correct explanation of A. · Key from source paper

Q84 JEE Main 2024 · 27 Jan · Shift 2 Numerical

A body falling under gravity covers two points A and B separated by 80 m in 2 s. The distance of upper point A from the starting point is _____ m. Use g = 10 m s^{-2}

Numerical value type: the answer is a number.

Answer: 45. · Key from source paper

Q85 JEE Main 2023 · 15 Apr · Shift 1 MCQ

A vector in $x - y$ plane makes an angle of 30° with y-axis. The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be :

(A) $\frac{1}{\sqrt{3}}$

(B) 6

(C) 2

(D) $\sqrt{3}$

Answer: (C) 2 · Key from source paper

Q86 JEE Main 2023 · 15 Apr · Shift 1 MCQ

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

(A) 06 m s^{-1}

(B) 14 m s^{-1}

(C) 10 m s^{-1}

(D) 16 m s^{-1}

Answer: (D) 16 m s^{-1} · Key from source paper

Q87 JEE Main 2023 · 15 Apr · Shift 1 MCQ

The position vector of a particle related to time t is given by $\vec{r} = \left(10t\hat{i} + 15t^2\hat{j} + 7\hat{k}\right)$ m. The direction of net force experienced by the particle is :

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(A) Positive x-axis
(B) In $x - y$ plane
(C) Positive y-axis
(D) Positive z-axis

Answer: (C) Positive y-axis · Key from source paper

Q88 JEE Main 2023 · 13 Apr · Shift 1 MCQ

Two trains A and B of length l and $4l$ are travelling into a tunnel of length L in parallel tracks from opposite directions with velocities 108 km h^{-1} and 72 km h^{-1}, respectively. If train A take 35 s less time than train B to cross the tunnel then, length L of tunnel is:
(Given $L = 60\,l$)

(A) 1200 m
(B) 900 m
(C) 1800 m
(D) 2700 m

Answer: (C) 1800 m · Key from source paper

Q89 JEE Main 2023 · 13 Apr · Shift 2 MCQ

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

(A) 25 m s^{-1}
(B) 5 m s^{-1}
(C) 62.5 m s^{-1}
(D) 12.5 m s^{-1}

Answer: (A) 25 m s^{-1} · Key from source paper

Q90 JEE Main 2023 · 13 Apr · Shift 2 MCQ

A passenger sitting in a train A moving at 90 km h^{-1} observes another train B moving in the opposite direction for 8 s. If the velocity of the train B is 54 km h^{-1}, then length of train B is:

(A) 120 m
(B) 320 m
(C) 80 m
(D) 200 m

Answer: (B) 320 m · Key from source paper

Q91 JEE Main 2023 · 12 Apr · Shift 1 MCQ

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

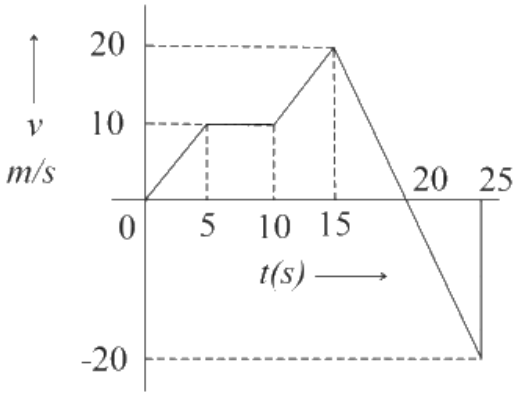
(A) 10
(B) -5
(C) 6
(D) 5

Answer: (D) 5 · Key from source paper

Q92 JEE Main 2023 · 11 Apr · Shift 1 MCQ

Form the v - t graph shown, the ratio of distance to displacement in 25 s of motion is:
(see the figure above)

Q2. Form the v - t graph shown, the ratio of distance to displacement in 25 s of motion is:



(1) 1
(2) $\frac{1}{2}$
(3) $\frac{5}{3}$
(4) $\frac{3}{5}$

(A) 1
(B) $\frac{1}{2}$
(C) $\frac{5}{3}$
(D) $\frac{3}{5}$

Answer: (C) $\frac{5}{3}$ · Key from source paper

Q93 JEE Main 2023 · 11 Apr · Shift 1 Numerical

A projectile fired at 30° to the ground is observed to be at same height at time 3 s and 5 s after projection, during its flight. The speed of projection of the projectile is $\mathrm{m\ s^{-1}}$.
(Given $g = 10\ \mathrm{m\ s^{-2}}$)

Numerical value type: the answer is a number.

Answer: 80. · Key from source paper

Q94 JEE Main 2023 · 11 Apr · Shift 2 MCQ

When vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$, it gives a vector equal to $2\hat{j}$. Then the magnitude of vector $\vec{B}$ will be:

(A) $\sqrt{5}$
(B) 3
(C) $\sqrt{6}$
(D) $\sqrt{33}$

Answer: (D) $\sqrt{33}$ · Key from source paper

Q95 JEE Main 2023 · 11 Apr · Shift 2 MCQ

A projectile is projected at 30° from horizontal with initial velocity $40\ \mathrm{m\ s^{-1}}$. The velocity of the projectile at $t = 2$ s from the start will be:

(A) $40\sqrt{3}\ \mathrm{m\ s^{-1}}$
(B) Zero
(C) $20\ \mathrm{m\ s^{-1}}$
(D) $20\sqrt{3}\ \mathrm{m\ s^{-1}}$

Answer: (D) $20\sqrt{3}\ \mathrm{m\ s^{-1}}$ · Key from source paper

Q96 JEE Main 2023 · 11 Apr · Shift 2 MCQ

A body of mass 500 g moves along x-axis such that it's velocity varies with displacement x according to the relation $v = 10\sqrt{x}\ \mathrm{m\ s^{-1}}$ the force acting on the body is:

(A) 125 N
(B) 25 N
(C) 166 N
(D) 5 N

Answer: (B) 25 N · Key from source paper

Q97 JEE Main 2023 · 10 Apr · Shift 1 MCQ

The position-time graphs for two students A and B returning from the school to their homes are shown in figure.

(see the figure above)

(A) A lives closer to the school
(B) B lives closer to the school
(C) A takes lesser time to reach home
(D) A travels faster than B
(E) B travels faster than A

Choose the correct answer from the options given below

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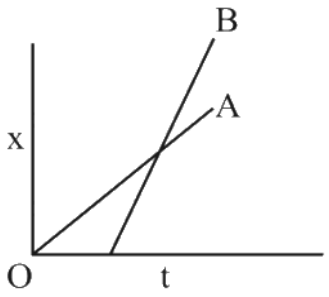
Q2. The position-time graphs for two students A and B returning from the school to their homes are shown in figure.



(A) A lives closer to the school
(B) B lives closer to the school
(C) A takes lesser time to reach home
(D) A travels faster than B
(E) B travels faster than A
Choose the correct answer from the options given below
(1) A, C and D only
(2) A, C and E only
(3) B and E only
(4) A and E only

(A) A, C and D only
(B) A, C and E only
(C) B and E only
(D) A and E only

Answer: (D) A and E only · Key from source paper

Q98 JEE Main 2023 · 10 Apr · Shift 1 MCQ

The range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be

(A) 100 m
(B) $100\sqrt{2}$ m
(C) $50\sqrt{2}$ m
(D) 50 m

Answer: (A) 100 m · Key from source paper

Q99 JEE Main 2023 · 10 Apr · Shift 2 MCQ

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) $v = \frac{v_1+v_2}{2}$
(B) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$
(C) $v = v_1 + v_2$
(D) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Answer: (D) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$ · Key from source paper

Q100 JEE Main 2023 · 10 Apr · Shift 2 MCQ

Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:

(A) $\sqrt{3} : 1$
(B) $1 : \sqrt{3}$
(C) $2 : \sqrt{3}$
(D) $1 : 3$

Answer: (D) $1 : 3$ · Key from source paper

Q101 JEE Main 2023 · 8 Apr · Shift 1 MCQ

Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:

(A) $\frac{\sqrt{5}A}{4}$
(B) $\frac{\sqrt{5}A}{2}$
(C) $\frac{5A}{2}$
(D) $\frac{\sqrt{5}A^2}{2}$

Answer: (B) $\frac{\sqrt{5}A}{2}$ · Key from source paper

Q102 JEE Main 2023 · 8 Apr · Shift 1 MCQ

Two projectiles A and B are thrown with initial velocities of $40\ \mathrm{m\,s^{-1}}$ and $60\ \mathrm{m\,s^{-1}}$ at angles 30° and 60° with the horizontal respectively. The ratio of their ranges respectively is ($\mathrm{g} = 10\ \mathrm{m\,s^{-2}}$)

(A) $4 : 9$
(B) $2 : \sqrt{3}$
(C) $\sqrt{3} : 2$
(D) $1 : 1$

Answer: (A) $4 : 9$ · Key from source paper

Q103 JEE Main 2023 · 8 Apr · Shift 2 MCQ

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

Answer: (D) Statement I is incorrect but Statement II is true · Key from source paper

Q104 JEE Main 2023 · 8 Apr · Shift 2 MCQ

The trajectory of projectile, projected from the ground is given by $y = x - \frac{x^2}{20}$. Where x and y are measured in meter. The maximum height attained by the projectile will be.

(A) $200\ \text{m}$
(B) $10\ \text{m}$
(C) $5\ \text{m}$
(D) $10\sqrt{2}\ \text{m}$

Answer: (C) $5\ \text{m}$ · Key from source paper

Q105 JEE Main 2023 · 6 Apr · Shift 1 MCQ

A particle is moving with constant speed in a circular path. When the particle turns by an angle 90°, the ratio of instantaneous velocity to its average velocity is $\pi : x\sqrt{2}$. The value of x will be

(A) 2
(B) 5
(C) 1
(D) 7

Answer: (A) 2 · Key from source paper

Q106 JEE Main 2023 · 6 Apr · Shift 1 MCQ

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: When a body is projected at an angle 45°, its range is maximum.

Reason R: For maximum range, the value of $\sin 2\theta$ should be equal to one.

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

(A) A is false but R is true
(B) A is true but R is false
(C) Both A and R are correct and R is the correct explanation of A
(D) Both A and R are correct but R is NOT the correct explanation of A

Answer: (C) Both A and R are correct and R is the correct explanation of A · Key from source paper

Q107 JEE Main 2023 · 6 Apr · Shift 2 MCQ

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

(A) $25\ \mathrm{s}$
(B) $3\ \mathrm{s}$
(C) $6\ \mathrm{s}$
(D) $30\ \mathrm{s}$

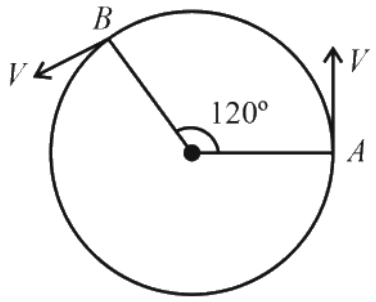
Answer: (A) $25\ \mathrm{s}$ · Key from source paper

Q108 JEE Main 2023 · 6 Apr · Shift 2 MCQ

As shown in the figure, a particle is moving with constant speed $\pi\ \mathrm{m\,s}^{-1}$. Considering its motion from A to B, the magnitude of the average velocity is:

(see the figure above)

Q2. As shown in the figure, a particle is moving with constant speed $\pi\ \mathrm{m\,s}^{-1}$. Considering its motion from A to B, the magnitude of the average velocity is:



(1) $\sqrt{3}\ \mathrm{m\,s}^{-1}$
(2) $\pi\ \mathrm{m\,s}^{-1}$
(3) $1.5\sqrt{3}\ \mathrm{m\,s}^{-1}$
(4) $2\sqrt{3}\ \mathrm{m\,s}^{-1}$

(A) $\sqrt{3}\ \mathrm{m\,s}^{-1}$
(B) $\pi\ \mathrm{m\,s}^{-1}$
(C) $1.5\sqrt{3}\ \mathrm{m\,s}^{-1}$
(D) $2\sqrt{3}\ \mathrm{m\,s}^{-1}$

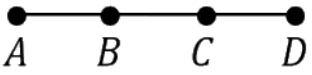
Answer: (C) $1.5\sqrt{3}\ \mathrm{m\,s}^{-1}$ · Key from source paper

Q109 JEE Main 2023 · 1 Feb · Shift 1 MCQ

An object moves with speed v_1, v_2 and v_3 along a line segment AB, BC and CD respectively as shown in figure. Where $AB = BC$ and $AD = 3\ AB$, then average speed of the object will be :

(see the figure above)

Q2. An object moves with speed v_1, v_2 and v_3 along a line segment AB, BC and CD respectively as shown in figure. Where $AB = BC$ and $AD = 3\ AB$, then average speed of the object will be :



(1) $\frac{v_1+v_2+v_3}{3}$

(2) $\frac{v_1v_2v_3}{3v_1v_2+v_2v_3+v_3v_1}$

(3) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$

(4) $\frac{v_1+v_2+v_3}{3v_1v_2v_3}$

(A) $\frac{v_1+v_2+v_3}{3}$

(B) $\frac{v_1v_2v_3}{3v_1v_2+v_2v_3+v_3v_1}$

(C) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$

(D) $\frac{v_1+v_2+v_3}{3v_1v_2v_3}$

Answer: (C) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$ · Key from source paper

Q110 JEE Main 2023 · 1 Feb · Shift 1 MCQ

A child stands on the edge of the cliff 10 m above the ground and throws a stone horizontally with an initial speed of 5 $\mathrm{m\ s^{-1}}$. Neglecting the air resistance, the speed with which the stone hits the ground will be _____ $\mathrm{m\ s^{-1}}$ (given, g = 10 $\mathrm{m\ s^{-2}}$).

(A) 20

(B) 15

(C) 30

(D) 25

Answer: (B) 15 · Key from source paper

Q111 JEE Main 2023 · 1 Feb · Shift 2 Numerical

For a train engine moving with speed of 20 $\mathrm{ms^{-1}}$, 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 $\sqrt{x}\ \mathrm{ms^{-1}}$. The value of x is _____. (Assuming same retardation is produced by brakes)

Numerical value type: the answer is a number.

Answer: 200. · Key from source paper

Q112 JEE Main 2023 · 1 Feb · Shift 2 MCQ

For a body projected at an angle with the horizontal from the ground, choose the correct statement

(A) Gravitational potential energy is maximum at the highest point.
(B) The horizontal component of velocity is zero at highest point.
(C) The vertical component of momentum is maximum at the highest point.
(D) The kinetic energy (K.E.) is zero at the highest point of projectile motion.

Answer: (A) Gravitational potential energy is maximum at the highest point. · Key from source paper

Q113 JEE Main 2023 · 31 Jan · Shift 1 MCQ

The initial speed of a projectile fired from ground is u. At the highest point during its motion, the speed of projectile is $\frac{\sqrt{3}}{2}u$. The time of flight of the projectile is:

(A) $\frac{u}{2g}$
(B) $\frac{u}{g}$
(C) $\frac{2u}{g}$
(D) $\frac{\sqrt{3}u}{g}$

Answer: (B) $\frac{u}{g}$ · Key from source paper

Q114 JEE Main 2023 · 31 Jan · Shift 1 Numerical

The speed of a swimmer is 4 $\mathrm{km\ h^{-1}}$ in still water. If the swimmer makes his strokes normal to the flow of river of width 1 km, he reaches a point 750 m down the stream on the opposite bank. The speed of the river water is _____ $\mathrm{km\ h^{-1}}$.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q115 JEE Main 2023 · 31 Jan · Shift 2 MCQ

A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of $3rd$ second, the displacement of body (in m) from its starting point is:

(A) 30
(B) 15 π
(C) 5 π
(D) $10\sqrt{2}$

Answer: (D) $10\sqrt{2}$ · Key from source paper

Q116 JEE Main 2023 · 31 Jan · Shift 2 Numerical

Two bodies are projected from ground with same speeds 40 m s^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60°, with horizontal then sum of the maximum heights, attained by the two projectiles, is _____ m. (Given g = 10 m s^{-2})

Numerical value type: the answer is a number.

Answer: 80. · Key from source paper

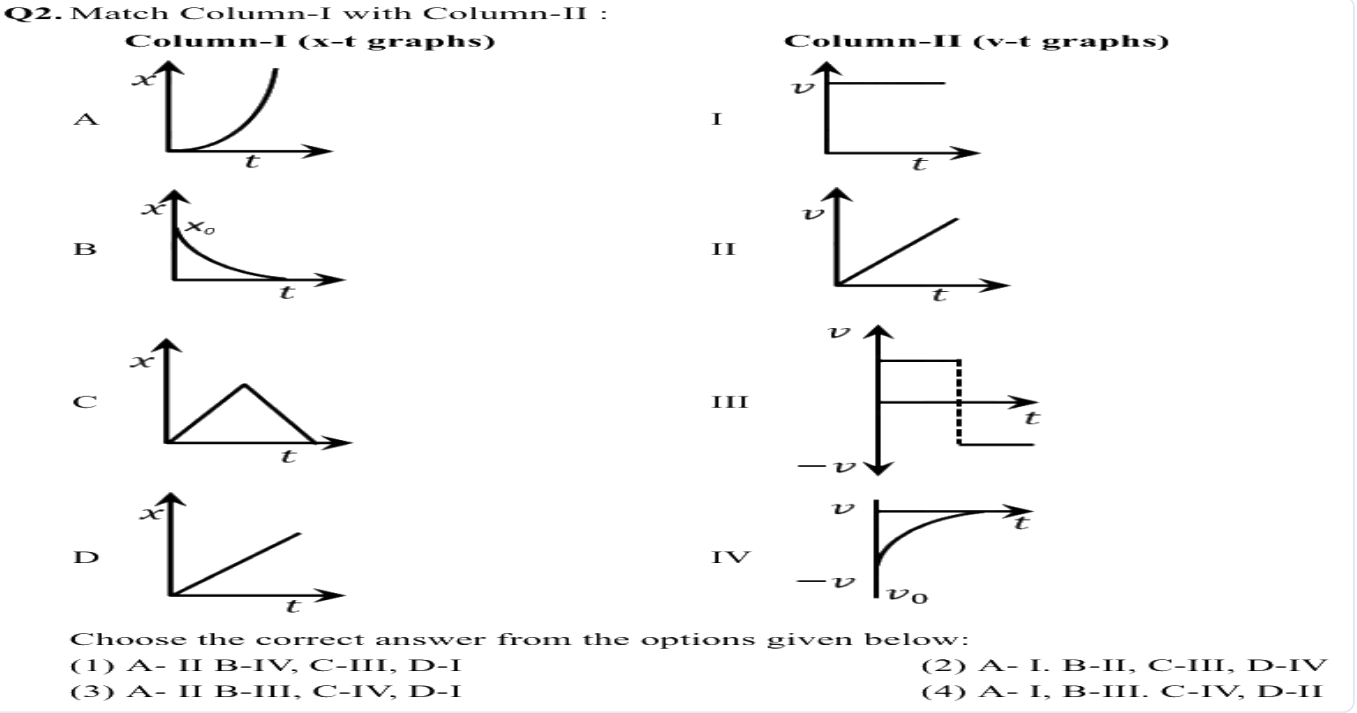
Q117 JEE Main 2023 · 30 Jan · Shift 1 MCQ

Match Column-I with Column-II :

Column-I (x-t graphs)
A *(see the figure above)*
B *(see the figure above)*
C *(see the figure above)*
D *(see the figure above)*

Column-II (v-t graphs)
I *(see the figure above)*
II *(see the figure above)*
III *(see the figure above)*
IV *(see the figure above)*

Choose the correct answer from the options given below:



(A) A- II B-IV, C-III, D-I
(B) A- I. B-II, C-III, D-IV
(C) A- II B-III, C-IV, D-I
(D) A- I, B-III. C-IV, D-II

Answer: (A) A- II B-IV, C-III, D-I · Key from source paper

Q118 JEE Main 2023 · 30 Jan · Shift 1 Numerical

A horse rider covers half the distance with 5 m s^{-1} speed. The remaining part of the distance was travelled with speed 10 m s^{-1} for half the time and with speed 15 m s^{-1} 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^{-1}. The value of x is _____.

Numerical value type: the answer is a number.

Answer: 50. · Key from source paper

Q119 JEE Main 2023 · 30 Jan · Shift 2 MCQ

A vehicle travels 4 km with speed of 3 km h^{-1} and another 4 km with speed of 5 km h^{-1}, then its average speed is :

(A) 4.25 km h^{-1}
(B) 3.50 km h^{-1}
(C) 4.00 km h^{-1}
(D) 3.75 km h^{-1}

Answer: (D) 3.75 km h^{-1} · Key from source paper

Q120 JEE Main 2023 · 30 Jan · Shift 2 Numerical

A stone tied to 180 cm long string at its end is making 28 revolutions in horizontal circle in every minute. The magnitude of acceleration of stone is $\frac{1936}{x}$ m s^{-2}. The value of x _____.
[Take $\pi = \frac{22}{7}$]

Numerical value type: the answer is a number.

Answer: 125. · Key from source paper

Q121 JEE Main 2023 · 29 Jan · Shift 1 MCQ

A stone is projected at angle 30° to the horizontal. The ratio of kinetic energy of the stone at point of projection to its kinetic energy at the highest point of flight will be :

(A) $1:2$
(B) $1:4$
(C) $4:1$
(D) $4:3$

Answer: (D) $4:3$ · Key from source paper

Q122 JEE Main 2023 · 29 Jan · Shift 1 Numerical

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 _____ J. [Take $g = 10\ \text{m s}^{-2}$]

Numerical value type: the answer is a number.

Answer: 300. · Key from source paper

Q123 JEE Main 2023 · 29 Jan · Shift 2 MCQ

An object moves at a constant speed along a circular path in a horizontal plane with centre at the origin. When the object is at $x = +2$ m, its velocity is $-4\hat{\text{j}}\ \text{m s}^{-1}$. The object's velocity (v) and acceleration (a) at $x = -2$ m will be

(A) $v = 4\hat{\text{i}}\ \text{m s}^{-1}$, $a = 8\hat{\text{j}}\ \text{m s}^{-2}$
(B) $v = 4\hat{\text{j}}\ \text{m s}^{-1}$, $a = 8\hat{\text{i}}\ \text{m s}^{-2}$
(C) $v = -4\hat{\text{j}}\ \text{m s}^{-1}$, $a = 8\hat{\text{i}}\ \text{m s}^{-2}$
(D) $\text{v} = -4\hat{\text{i}}\ \text{m s}^{-1}$, $\text{a} = -8\hat{\text{j}}\ \text{m s}^{-2}$

Answer: (B) $v = 4\hat{\text{j}}\ \text{m s}^{-1}$, $a = 8\hat{\text{i}}\ \text{m s}^{-2}$ · Key from source paper

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Q124 JEE Main 2023 · 29 Jan · Shift 2 Numerical

A car is moving on a circular path of radius 600 m such that the magnitudes of the tangential acceleration and centripetal acceleration are equal. The time taken by the car to complete first quarter of revolution, if it is moving with an initial speed of $54\ \text{km h}^{-1}$ is $t\left(1 - e^{-\frac{\pi}{2}}\right)$ s. The value of t is _____.

Numerical value type: the answer is a number.

Answer: 40. · Key from source paper

Q125 JEE Main 2023 · 25 Jan · Shift 1 Numerical

If $\vec{P} = 3\hat{i} + \sqrt{3}\hat{j} + 2\hat{k}$ and $\vec{Q} = 4\hat{i} + \sqrt{3}\hat{j} + 2.5\hat{k}$ then, the unit vector in the direction of $\vec{P} \times \vec{Q}$ is $\frac{1}{x}\left(\sqrt{3}\hat{i} + \hat{j} - 2\sqrt{3}\hat{k}\right)$. The value of x is

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q126 JEE Main 2023 · 25 Jan · Shift 1 MCQ

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

Answer: (D) $\frac{2v_1 v_2}{v_1+v_2}$ · Key from source paper

Q127 JEE Main 2023 · 25 Jan · Shift 2 MCQ

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

(A) $40\ \mathrm{m\,s^{-1}}$
(B) $25\ \mathrm{m\,s^{-1}}$
(C) $20\ \mathrm{m\,s^{-1}}$
(D) $8\ \mathrm{m\,s^{-1}}$

Answer: (A) $40\ \mathrm{m\,s^{-1}}$ · Key from source paper

Q128 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Two objects are projected with same velocity u however at different angles α and β with the horizontal. If $\alpha + \beta = 90^\circ$, the ratio of horizontal range of the first object to the 2nd object will be :

(A) $4 : 1$
(B) $2 : 1$
(C) $1 : 2$
(D) $1 : 1$

Answer: (D) $1 : 1$ · Key from source paper

Q129 JEE Main 2023 · 24 Jan · Shift 1 MCQ

The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is

(A) 192 m
(B) 136 m
(C) 272 m
(D) 68 m

Answer: (C) 272 m · Key from source paper

EdLoop JEE

Q130 JEE Main 2023 · 24 Jan · Shift 1 · Numerical

Vectors $a\hat{i}+b\hat{j}+\hat{k}$ and $2\hat{i}-3\hat{j}+4\hat{k}$ are perpendicular to each other when $3a+2b=7$, the ratio of a to b is $\frac{x}{2}$. The value of x is _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q131 JEE Main 2023 · 24 Jan · Shift 2 · MCQ

If two vectors $\vec{P}=\hat{i}+2m\hat{j}+m\hat{k}$ and $\vec{Q}=4\hat{i}-2\hat{j}+m\hat{k}$ are perpendicular to each other. Then, the value of m will be

(A) -1
(B) 2
(C) 3
(D) 1

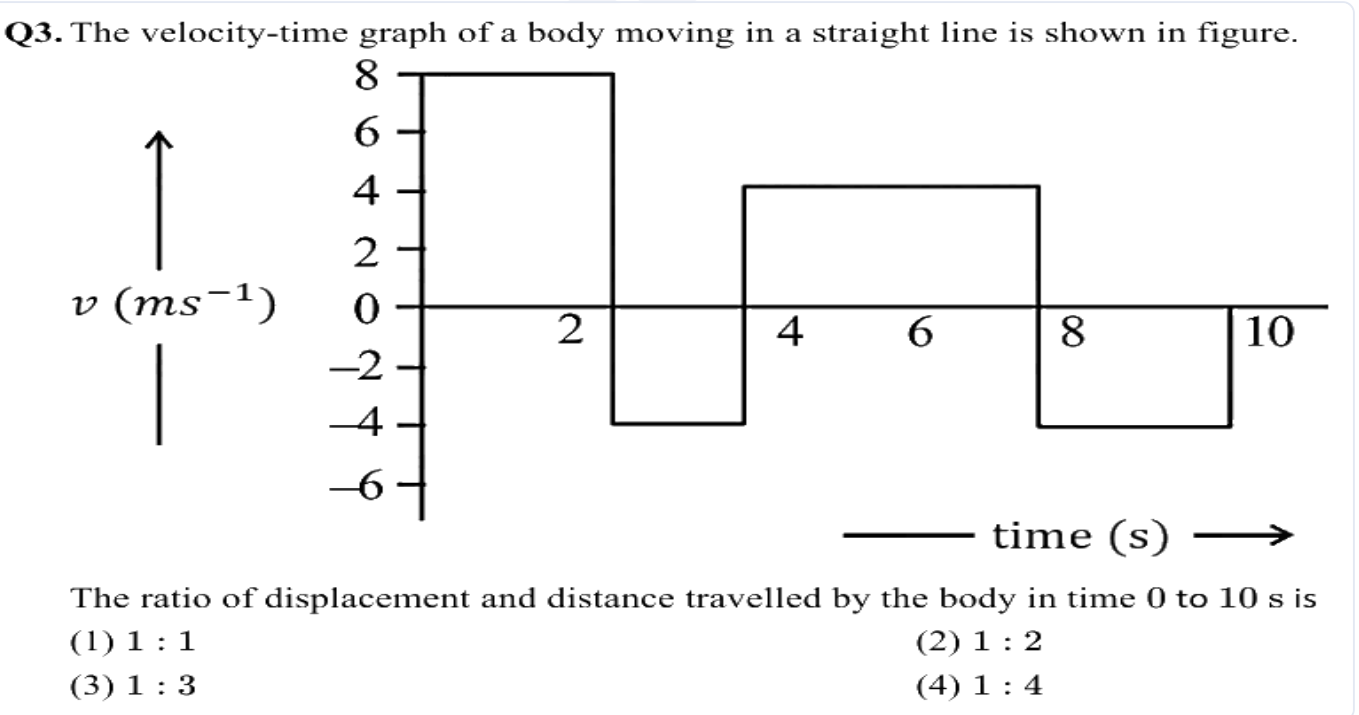
Answer: (B) 2 · Key from source paper

Q132 JEE Main 2023 · 24 Jan · Shift 2 · MCQ

The velocity-time graph of a body moving in a straight line is shown in figure.

(see the figure above)

The ratio of displacement and distance travelled by the body in time 0 to 10 s is



(A) $1:1$
(B) $1:2$
(C) $1:3$
(D) $1:4$

Answer: (C) $1:3$ · Key from source paper

Q133 JEE Main 2022 · 29 Jul · Shift 1 MCQ

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) $\frac{1}{3}$

Answer: (B) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ · Key from source paper

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Q134 JEE Main 2022 · 29 Jul · Shift 1 MCQ

If $t=\sqrt{x}+4$, then $\left(\frac{dx}{dt}\right)_{t=4}$ is:

(A) 4
(B) Zero
(C) 8
(D) 16

Answer: (B) Zero · Key from source paper

Q135 JEE Main 2022 · 29 Jul · Shift 1 MCQ

A ball is projected with kinetic energy E, at an angle of 60° to the horizontal. The kinetic energy of this ball at the highest point of its flight will become :

(A) Zero
(B) $\frac{E}{2}$
(C) $\frac{E}{4}$
(D) E

Answer: (C) $\frac{E}{4}$ · Key from source paper

Q136 JEE Main 2022 · 29 Jul · Shift 1 Numerical

An object is projected in the air with initial velocity u at an angle θ. The projectile motion is such that the horizontal range R, is maximum. Another object is projected in the air with a horizontal range half

of the range of first object. The initial velocity remains same in both the case. The value of the angle of projection, at which the second object is projected, will be _____ degree.

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q137 JEE Main 2022 · 29 Jul · Shift 2 MCQ

A juggler throws balls vertically upwards with same initial velocity in air. When the first ball reaches its highest position, he throws the next ball. Assuming the juggler throws n balls per second, the maximum height the balls can reach is

(A) $\frac{g}{2n}$
(B) $\frac{g}{n}$
(C) $2gn$
(D) $\frac{g}{2n^2}$

Answer: (D) $\frac{g}{2n^2}$ · Key from source paper

Q138 JEE Main 2022 · 29 Jul · Shift 2 MCQ

A ball is released from a height h. If t_1 and t_2 be the time required to complete first half and second half of the distance respectively. Then, choose the correct relation between t_1 and t_2.

(A) $t_1 = \sqrt{2}\,t_2$
(B) $t_1 = (\sqrt{2}-1)t_2$
(C) $t_2 = (\sqrt{2}+1)t_1$
(D) $t_2 = (\sqrt{2}-1)t_1$

Answer: (D) $t_2 = (\sqrt{2}-1)t_1$ · Key from source paper

Q139 JEE Main 2022 · 28 Jul · Shift 1 MCQ

A NCC parade is going at a uniform speed of $9\ \mathrm{km\ h^{-1}}$ under a mango tree on which a monkey is sitting at a height of $19.6\ \mathrm{m}$. At any particular instant, the monkey drops a mango. A cadet will receive the mango whose distance from the tree at time of drop is :
(Given $g = 9.8\ \mathrm{m\ s^{-2}}$)

(A) $5\ \mathrm{m}$
(B) $10\ \mathrm{m}$
(C) $19.8\ \mathrm{m}$
(D) $24.5\ \mathrm{m}$

Answer: (A) $5\ \mathrm{m}$ · Key from source paper

Q140 JEE Main 2022 · 28 Jul · Shift 1 Numerical

If the projection of $2\hat{i}+4\hat{j}-2\hat{k}$ on $\hat{i}+2\hat{j}+\alpha\hat{k}$ is zero. Then, the value of α will be

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q141 JEE Main 2022 · 28 Jul · Shift 2 MCQ

At time $t = 0$ a particle starts travelling from a height $7\hat{z}$ cm in a plane keeping z coordinate constant. At any instant of time, it's position along the x and y directions are defined as $3t$ and $5t^3$ respectively. At $t = 1$ s acceleration of the particle will be

(A) $-30y$

(B) $30y$

(C) $3x + 15y$

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

Answer: (B) $30y$ · Key from source paper

Q142 JEE Main 2022 · 28 Jul · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 392. · Key from source paper

Q143 JEE Main 2022 · 27 Jul · Shift 1 MCQ

A bullet is shot vertically downwards with an initial velocity of 100 $\mathrm{m\ s^{-1}}$ from a certain height. Within 10 s, the bullet reaches the ground and instantaneously comes to rest due to the perfectly inelastic collision. The velocity-time curve for total time t = 20 s will be : (Take g = 10 $\mathrm{m\ s^{-2}}$)

(see the figure above)

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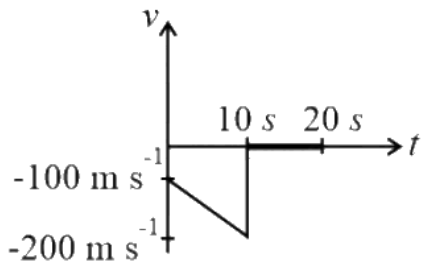
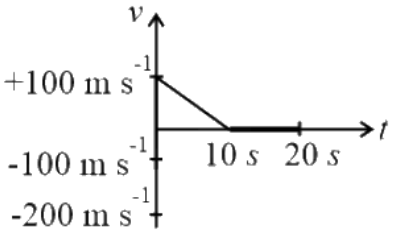
Q2. A bullet is shot vertically downwards with an initial velocity of 100 m s^{-1} from a certain height. Within 10 s, the bullet reaches the ground and instantaneously comes to rest due to the perfectly inelastic collision. The velocity-time curve for total time t = 20 s will be : (Take $g = 10$ m s^{-2})

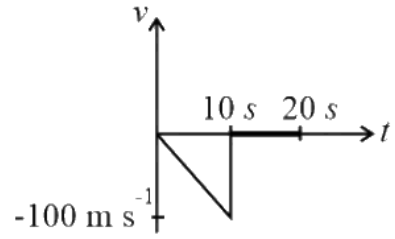
(1)



(2)



(3)



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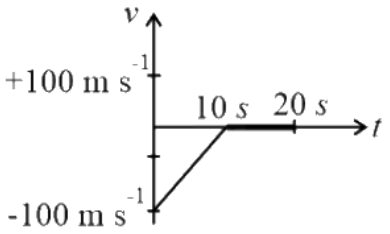

(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Key from source paper

Q144 JEE Main 2022 · 27 Jul · Shift 1 Numerical

A ball of mass m is thrown vertically upward. Another ball of mass 2 m is thrown an angle θ with the vertical. Both the balls stay in air for the same period of time. The ratio of the heights attained by the two balls respectively is $\frac{1}{x}$. The value of x is _____ .

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q145 JEE Main 2022 · 27 Jul · Shift 2 MCQ

The velocity of the bullet becomes one third after it penetrates 4 cm in a wooden block. Assuming that bullet is facing a constant resistance during its motion in the block. The bullet stops completely after travelling at $(4 + x)$ cm inside the block. The value of x is

(A) 2.0

(B) 1.0

(C) 0.5

(D) 1.5

Answer: (C) 0.5 · Key from source paper

Q146 JEE Main 2022 · 27 Jul · Shift 2 MCQ

A body of mass 10 kg is projected at an angle of 45° with the horizontal. The trajectory of the body is observed to pass through a point (20, 10). If T is the time of flight, then its momentum vector, at time $t = \frac{T}{\sqrt{2}}$, is _____ .
[Take $g = 10\ \mathrm{m\ s^{-2}}$]

(A) $100\hat{i} + \left(100\sqrt{2} - 200\right)\hat{j}$ N s
(B) $100\sqrt{2}\hat{i} + \left(100 - 200\sqrt{2}\right)\hat{j}$ N s
(C) $100\hat{i} + \left(100 - 200\sqrt{2}\right)\hat{j}$ N s
(D) $100\sqrt{2}\hat{i} + \left(100\sqrt{2} - 200\right)\hat{j}$ N s

Answer: (D) $100\sqrt{2}\hat{i} + \left(100\sqrt{2} - 200\right)\hat{j}$ N s · Key from source paper

Q147 JEE Main 2022 · 26 Jul · Shift 1 MCQ

Two projectile thrown at 30° and 45° with the horizontal respectively, reach the maximum height in same time. The ratio of their initial velocities is

(A) $1 : \sqrt{2}$
(B) $2 : 1$
(C) $\sqrt{2} : 1$
(D) $1 : 2$

Answer: (C) $\sqrt{2} : 1$ · Key from source paper

Q148 JEE Main 2022 · 26 Jul · Shift 1 Numerical

If the initial velocity in horizontal direction of a projectile is unit vector i and the equation of trajectory is $y = 5x(1 - x)$. The y component vector of the initial velocity is _____ $\hat{j}$.
(Take $g = 10\ \mathrm{m\ s^{-2}}$)

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q149 JEE Main 2022 · 26 Jul · Shift 2 MCQ

Two projectiles are thrown with same initial velocity making an angle of 45° and 30° with the horizontal respectively. The ratio of their respective ranges will be

(A) $1 : \sqrt{2}$
(B) $\sqrt{2} : 1$
(C) $2 : \sqrt{3}$
(D) $\sqrt{3} : 2$

Answer: (C) $2 : \sqrt{3}$ · Key from source paper

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Q150 JEE Main 2022 · 26 Jul · Shift 2 Numerical

If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ m and $\vec{B} = \hat{i} + 2\hat{j} + 2\hat{k}$ m. The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be _____ m.

Numerical value type: the answer is a number.

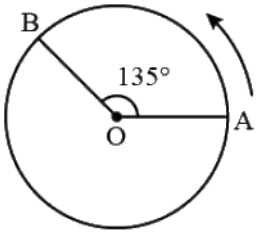
Answer: 2. · Key from source paper

Q151 JEE Main 2022 · 25 Jul · Shift 1 MCQ

A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be : (Given $\cos 135^\circ$ = - 0.7)

(see the figure above)

Q1. A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be : (Given $\cos 135^\circ = -0.7$)



(1) 42 m
(2) 47 m
(3) 19 m
(4) 40 m

(A) 42 m
(B) 47 m
(C) 19 m
(D) 40 m

Answer: (B) 47 m · Key from source paper

Q152 JEE Main 2022 · 25 Jul · Shift 1 Numerical

A car is moving with speed of 150 $\mathrm{km\ h^{-1}}$ and after applying the brake it will move 27 m 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 value type: the answer is a number.

Answer: 3. · Key from source paper

Q153 JEE Main 2022 · 25 Jul · Shift 2 MCQ

A ball is projected from the ground with a speed 15 $\mathrm{m\,s^{-1}}$ at an angle θ with horizontal so that its range and maximum height are equal, then $\tan\theta$ will be equal to

(A) $\frac{1}{4}$
(B) $\frac{1}{2}$
(C) 2
(D) 4

Answer: (D) 4 · Key from source paper

Q154 JEE Main 2022 · 25 Jul · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 100. · Key from source paper

Q155 JEE Main 2022 · 29 Jun · Shift 1 MCQ

Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A}+\vec{B}$ is equal to two times the magnitude of $\vec{A}-\vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be

(A) $\cos^{-1}\left(\frac{3}{5}\right)$
(B) $\cos^{-1}\left(\frac{1}{3}\right)$
(C) $\sin^{-1}\left(\frac{1}{3}\right)$
(D) $\sin^{-1}\left(\frac{3}{5}\right)$

Answer: (A) $\cos^{-1}\left(\frac{3}{5}\right)$ · Key from source paper

Q156 JEE Main 2022 · 29 Jun · Shift 1 MCQ

Two balls A and B are placed at the top of $180\ \mathrm{m}$ 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 $100\ \mathrm{m}$ above the ground. Find the value of u in $\mathrm{m\,s^{-1}}$. [use $g=10\ \mathrm{m\,s^{-2}}$]

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

Answer: (D) 30 · Key from source paper

Q157 JEE Main 2022 · 29 Jun · Shift 2 MCQ

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

(A) $10\ \mathrm{m}$
(B) $20\ \mathrm{m}$
(C) $30\ \mathrm{m}$
(D) $40\ \mathrm{m}$

Answer: (C) $30\ \mathrm{m}$ · Key from source paper

Q158 JEE Main 2022 · 29 Jun · Shift 2 MCQ

A person can throw a ball upto a maximum range of $100\ \mathrm{m}$. How high above the ground he can throw the same ball?

(A) $25\ \mathrm{m}$
(B) $50\ \mathrm{m}$
(C) $100\ \mathrm{m}$
(D) $200\ \mathrm{m}$

Answer: (B) $50\ \mathrm{m}$ · Key from source paper

Q159 JEE Main 2022 · 28 Jun · Shift 1 MCQ

A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the force acting on it is -

(A) Zero
(B) $2mk^2r^2t$
(C) mk^2r^2t
(D) $2mk^2rt$

Answer: (C) mk^2r^2t · Key from source paper

Q160 JEE Main 2022 · 28 Jun · Shift 2 MCQ

A ball is spun with angular acceleration $\alpha = 6t^2 - 2t$ where t is in second and α is in $\mathrm{rad\ s^{-2}}$. At $t = 0$, the ball has angular velocity of $10\ \mathrm{rad\ s^{-1}}$ and angular position of $4\ \mathrm{rad}$. The most appropriate expression for the angular position of the ball is

(A) $\frac{3}{2}t^4 - t^2 + 10t$
(B) $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$
(C) $\frac{2t^4}{3} - \frac{t^3}{6} + 10t + 12$
(D) $2t^4 - \frac{t^3}{2} + 5t + 4$

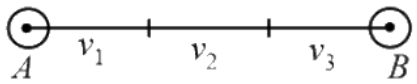
Answer: (B) $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$ · Key from source paper

Q161 JEE Main 2022 · 28 Jun · Shift 2 Numerical

A car covers AB distance with first one-third at velocity v_1 m s^{-1}, second one-third at v_2 m s^{-1} and last one-third at v_3 m s^{-1}. If $v_3 = 3v_1,\ v_2 = 2v_1$ and $v_1 = 11$ m s^{-1}, then the average velocity of the car is _____ m s^{-1}.

(see the figure above)

Q21. A car covers AB distance with first one-third at velocity v_1 m s^{-1}, second one-third at v_2 m s^{-1} and last one-third at v_3 m s^{-1}. If $v_3 = 3v_1, v_2 = 2v_1$ and $v_1 = 11$ m s^{-1}, then the average velocity of the car is _____ m s^{-1}.



Numerical value type: the answer is a number.

Answer: 18. · Key from source paper

Q162 JEE Main 2022 · 27 Jun · Shift 1 MCQ

A projectile is launched at an angle α with the horizontal with a velocity 20 m s^{-1}. After 10 s, its inclination with horizontal is β. The value of $\tan\beta$ will be : ($g = 10$ m s^{-2}).

(A) $\tan\alpha + 5\sec\alpha$

(B) $\tan\alpha - 5\sec\alpha$

(C) $2\tan\alpha - 5\sec\alpha$

(D) $2\tan\alpha + 5\sec\alpha$

Answer: (B) $\tan\alpha - 5\sec\alpha$ · Key from source paper

Q163 JEE Main 2022 · 27 Jun · Shift 1 MCQ

A girl standing on road holds her umbrella at 45° with the vertical to keep the rain away. If she starts running without umbrella with a speed of $15\sqrt{2}$ km h^{-1}, the rain drops hit her head vertically. The speed of rain drops with respect to the moving girl is

(A) 30 km h^{-1}

(B) $\frac{25}{\sqrt{2}}$ km h^{-1}

(C) $\frac{30}{\sqrt{2}}$ km h^{-1}

(D) 25 km h^{-1}

Answer: (C) $\frac{30}{\sqrt{2}}$ km h^{-1} · Key from source paper

Q164 JEE Main 2022 · 27 Jun · Shift 2 MCQ

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) $39.2\ \mathrm{m}$
(B) $19.6\ \mathrm{m}$
(C) $73.5\ \mathrm{m}$
(D) $29.4\ \mathrm{m}$

Answer: (D) $29.4\ \mathrm{m}$ · Key from source paper

Q165 JEE Main 2022 · 26 Jun · Shift 1 MCQ

An object is thrown vertically upwards. At its maximum height, which of the following quantity becomes zero ?

(A) Momentum
(B) Potential energy
(C) Acceleration
(D) Force

Answer: (A) Momentum · Key from source paper

Q166 JEE Main 2022 · 26 Jun · Shift 1 Numerical

A ball of mass $0.5\ \mathrm{kg}$ is dropped from the height of $10\ \mathrm{m}$. The height, at which the magnitude of velocity becomes equal to the magnitude of acceleration due to gravity, is _____ m. [Use $g = 10\ \mathrm{m\ s^{-2}}$]

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q167 JEE Main 2022 · 26 Jun · Shift 1 Numerical

A fighter jet is flying horizontally at a certain altitude with a speed of $200\ \mathrm{m\ s^{-1}}$. When it passes directly overhead an anti-aircraft gun, a bullet is fired from the gun, at an angle θ with the horizontal, to hit the jet. If the bullet speed is $400\ \mathrm{m\ s^{-1}}$, the value of θ will be _____ $^\circ$.

Numerical value type: the answer is a number.

Answer: 60. · Key from source paper

Q168 JEE Main 2022 · 26 Jun · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q169 JEE Main 2022 · 25 Jun · Shift 1 MCQ

$\vec{A}$ is a vector quantity such that $\vec{A}$ = non-zero constant. Which of the following expression is true for $\vec{A}$?

(A) $\vec{A} \cdot \vec{A} = 0$
(B) $\vec{A} \times \vec{A} < 0$
(C) $\vec{A} \times \vec{A} = 0$
(D) $\vec{A} \times \vec{A} > 0$

Answer: (C) $\vec{A} \times \vec{A} = 0$ · Key from source paper

Q170 JEE Main 2022 · 25 Jun · Shift 1 MCQ

Which of the following relations is true for two unit vector $\hat{A}$ and $\hat{B}$ making an angle θ to each other?

(A) $\hat{A} + \hat{B} = \hat{A} - \hat{B}\frac{\tan\theta}{2}$
(B) $\hat{A} - \hat{B} = \hat{A} + \hat{B}\frac{\tan\theta}{2}$
(C) $\hat{A} + \hat{B} = \hat{A} - \hat{B}\frac{\cos\theta}{2}$
(D) $\hat{A} - \hat{B} = \hat{A} + \hat{B}\frac{\cos\theta}{2}$

Answer: (B) $\hat{A} - \hat{B} = \hat{A} + \hat{B}\frac{\tan\theta}{2}$ · Key from source paper

Q171 JEE Main 2022 · 25 Jun · Shift 2 MCQ

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) $\frac{\alpha + f}{21 + \beta}$
(D) $\frac{f - \alpha}{21 + \beta}$

Answer: (D) $\frac{f-\alpha}{21+\beta}$ · Key from source paper

Q172 JEE Main 2022 · 25 Jun · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Two identical balls A and B thrown with same velocity 'u' at two different angles with horizontal attained the same range R. If A and B reached the maximum height h_1 and h_2 respectively, then $R = 4\sqrt{h_1 h_2}$
Reason R: Product of said heights. $h_1 h_2 = \frac{u^2 \sin^2\theta}{2g} \cdot \frac{u^2 \cos^2\theta}{2g}$

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(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

Answer: (A) Both A and R are true and R is the correct explanation of A. · Key from source paper

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Q173 JEE Main 2022 · 25 Jun · Shift 2 MCQ

For a particle in uniform circular motion, the acceleration $\vec{a}$ at any point PR, θ on the circular path of radius R is (when θ is measured from the positive x-axis and v is uniform speed):

(A) $-\frac{v^2}{R}\sin\theta\hat{i} + \frac{v^2}{R}\cos\theta\hat{j}$
(B) $-\frac{v^2}{R}\cos\theta\hat{i} + \frac{v^2}{R}\sin\theta\hat{j}$
(C) $-\frac{v^2}{R}\cos\theta\hat{i} - \frac{v^2}{R}\sin\theta\hat{j}$
(D) $-\frac{v^2}{R}\hat{i} + \frac{v^2}{R}\hat{j}$

Answer: (C) $-\frac{v^2}{R}\cos\theta\hat{i} - \frac{v^2}{R}\sin\theta\hat{j}$ · Key from source paper

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Q174 JEE Main 2022 · 24 Jun · Shift 1 MCQ

A projectile is projected with velocity of $25\ \mathrm{m\ s^{-1}}$ at an angle θ with the horizontal. After t seconds its inclination with horizontal becomes zero. If R represents horizontal range of the projectile, the value of θ will be : [use use $\mathrm{g} = 10\ \mathrm{m\ s^{-2}}$]

(A) $\frac{1}{2}\sin^{-1}\left(\frac{5t^2}{4R}\right)$
(B) $\frac{1}{2}\sin^{-1}\left(\frac{4R}{5t^2}\right)$
(C) $\tan^{-1}\left(\frac{4t^2}{5R}\right)$
(D) $\cot^{-1}\left(\frac{R}{20t^2}\right)$

Answer: (D) $\cot^{-1}\left(\frac{R}{20t^2}\right)$ · Key from source paper

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Q175 JEE Main 2022 · 24 Jun · Shift 1 Numerical

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

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q176 JEE Main 2022 · 24 Jun · Shift 2 MCQ

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

(A) $1 : 1$
(B) $\sqrt{2} : \sqrt{3}$
(C) $\sqrt{3} : \sqrt{2}$
(D) $2 : 3$

Answer: (B) $\sqrt{2} : \sqrt{3}$ · Key from source paper

Q177 JEE Main 2022 · 24 Jun · Shift 2 Numerical

A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after $2\ \mathrm{s}$ is $20\ \mathrm{m\ s^{-1}}$. The maximum height reached by the body during its motion is _____ m. (use $g = 10\ \mathrm{m\ s^{-2}}$)

Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q178 JEE Main 2021 · 1 Sep · Shift 2 MCQ

The ranges and heights for two projectiles projected with the same initial velocity at angles 42° and 48° with the horizontal are R_1, R_2 and H_1, H_2 respectively. Choose the correct option:

(A) $R_1 = R_2$ and $H_1 = H_2$
(B) $R_1 = R_2$ and $H_1 < H_2$
(C) $R_1 > R_2$ and $H_1 = H_2$
(D) $R_1 < R_2$ and $H_1 < H_2$

Answer: (B) $R_1 = R_2$ and $H_1 < H_2$ · Key from source paper

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Q179 JEE Main 2021 · 31 Aug · Shift 1 MCQ

A helicopter is flying horizontally with a speed v at an altitude h has to drop a food packet for a man on the ground. What is the distance of helicopter from the man when the food packet is dropped ?

(A) $\sqrt{\frac{2ghv^2+1}{h^2}}$
(B) $\sqrt{2ghv^2 + h^2}$
(C) $\sqrt{\frac{2gh}{v^2} + h^2}$
(D) $\sqrt{\frac{2v^2h}{g} + h^2}$

Answer: (D) $\sqrt{\frac{2v^2h}{g} + h^2}$ · Key from source paper

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Q180 JEE Main 2021 · 31 Aug · Shift 2 MCQ

Statement I: If three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented by three sides of a triangle and $\vec{F}_1 + \vec{F}_2 = -\vec{F}_3$, then these three forces are concurrent forces and satisfy the condition for equilibrium.
Statement II: A triangle made up of three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ as its sides were taken in the same order, satisfies the condition for translatory equilibrium.

In the light of the above statements, choose the most appropriate answer from the options given below:

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

Answer: (A) Both Statement I and Statement II are true. · Key from source paper

Q181 JEE Main 2021 · 31 Aug · Shift 2 MCQ

Statement-I : Two forces $\vec{P}+\vec{Q}$ and $\vec{P}-\vec{Q}$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 to each other, the magnitude of their resultant is $\sqrt{3\left(P^2+Q^2\right)}$, when they act at an angle θ_2, the magnitude of their resultant becomes $\sqrt{2\left(P^2+Q^2\right)}$. This is possible only when $\theta_1 < \theta_2$.
Statement-II : In the situation given above. $\theta_1 = 60^\circ$ and $\theta_2 = 90^\circ$
In the light of the above statement, choose the most appropriate answer from the options given below :

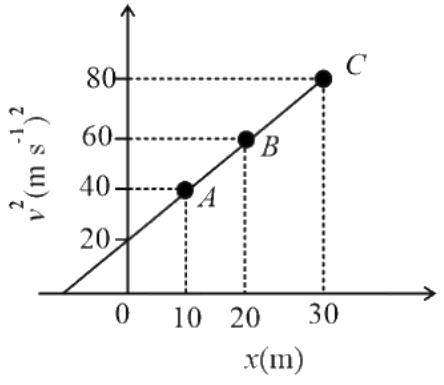
(A) Statement I is false but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is true but Statement II is false.

Answer: (B) Both Statement I and Statement II are true. · Key from source paper

Q182 JEE Main 2021 · 31 Aug · Shift 2 Numerical

A particle is moving with constant acceleration a. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is _____ m s^{-2}.
(see the figure above)

Q21. A particle is moving with constant acceleration a. Following graph shows v^2 versus x (displacement) plot. The acceleration of the particle is _____ m s^{-2}.



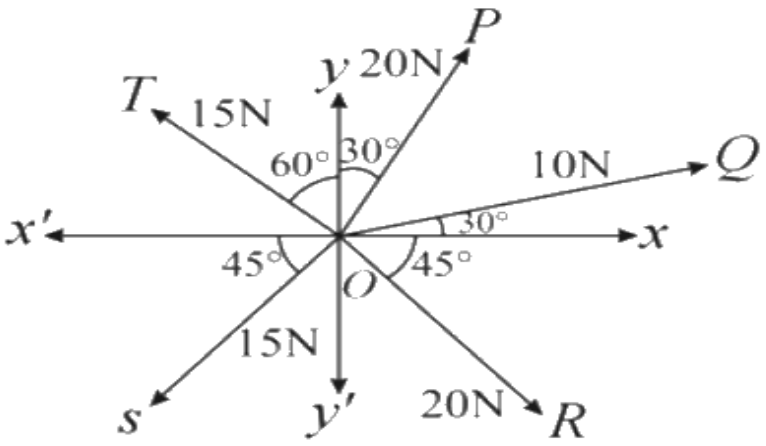
Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q183 JEE Main 2021 · 27 Aug · Shift 1 MCQ

The resultant of these forces $\overrightarrow{OP}, \overrightarrow{OQ}, \overrightarrow{OR}, \overrightarrow{OS}$ and $\overrightarrow{OT}$ is approximately _____N.
[Take $\sqrt{3} = 1.7$, $\sqrt{2} = 1.4$ Given $\hat{i}$ and $\hat{j}$ unit vectors along x, y axis]
(see the figure above)

Q1. The resultant of these forces $\overrightarrow{OP}, \overrightarrow{OQ}, \overrightarrow{OR}, \overrightarrow{OS}$ and $\overrightarrow{OT}$ is approximately _____N.
[Take $\sqrt{3} = 1.7, \sqrt{2} = 1.4$ Given $\hat{i}$ and $\hat{j}$ unit vectors along x, y axis]



(1) $-1.5\hat{i} - 15.5\hat{j}$
(2) $9.25\hat{i} + 5\hat{j}$
(3) $3\hat{i} + 15\hat{j}$
(4) $2.5\hat{i} - 14.5\hat{j}$

(A) $-1.5\hat{i} - 15.5\hat{j}$
(B) $9.25\hat{i} + 5\hat{j}$
(C) $3\hat{i} + 15\hat{j}$
(D) $2.5\hat{i} - 14.5\hat{j}$

Answer: (B) $9.25\hat{i} + 5\hat{j}$ · Key from source paper

Q184 JEE Main 2021 · 27 Aug · Shift 1 Numerical

If the velocity of a body related to displacement x is given by $v = \sqrt{5000 + 24x}$ m s^{-1}, then the acceleration of the body is _____ m s^{-2}.

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q185 JEE Main 2021 · 27 Aug · Shift 2 MCQ

Water drops are falling from a nozzle of a shower onto the floor from a height of 9.8 m. The drops fall at a regular interval of time. When the first drop strikes the floor, at that instant, the third drop begins to fall. Locate the position of second drop from the floor when the first drop strikes the floor.

(A) $2.94\ \text{m}$

(B) $4.18\ \text{m}$

(C) $2.45\ \text{m}$

(D) $7.35\ \text{m}$

Answer: (D) $7.35\ \text{m}$ · Key from source paper

Q186 JEE Main 2021 · 27 Aug · Shift 2 MCQ

A player kicks a football with an initial speed of $25\ \text{m s}^{-1}$ at an angle of 45° from the ground. What are the maximum height and the time taken by the football to reach at the highest point during motion? (Take $\text{g} = 10\ \text{m s}^{-2}$)

(A) $h_{\max} = 15.625\ \text{m}$, $\text{T} = 1.77\ \text{s}$

(B) $h_{\max} = 3.54\ \text{m}$, $\text{T} = 0.125\ \text{s}$

(C) $h_{\max} = 10\ \text{m}$, $\text{T} = 2.5\ \text{s}$

(D) $h_{\max} = 15.625\ \text{m}$, $\text{T} = 3.54\ \text{s}$

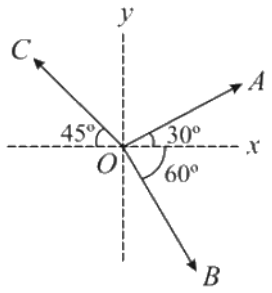
Answer: (A) $h_{\max} = 15.625\ \text{m}$, $\text{T} = 1.77\ \text{s}$ · Key from source paper

Q187 JEE Main 2021 · 26 Aug · Shift 1 MCQ

The magnitude of vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ in the given figure are equal. The direction of $\overrightarrow{OA} + \overrightarrow{OB} - \overrightarrow{OC}$ with $x-$axis will be:

(see the figure above)

Q1. The magnitude of vectors $\overrightarrow{\text{OA}}$, $\overrightarrow{\text{OB}}$ and $\overrightarrow{\text{OC}}$ in the given figure are equal. The direction of $\overrightarrow{\text{OA}} + \overrightarrow{\text{OB}} - \overrightarrow{\text{OC}}$ with $x-$axis will be:



(1) $\tan^{-1}\dfrac{\left(\sqrt{3}-1+\sqrt{2}\right)}{\left(1+\sqrt{3}-\sqrt{2}\right)}$

(2) $\tan^{-1}\dfrac{\left(1-\sqrt{3}-\sqrt{2}\right)}{\left(1+\sqrt{3}+\sqrt{2}\right)}$

(3) $\tan^{-1}\dfrac{\left(\sqrt{3}-1+\sqrt{2}\right)}{\left(1-\sqrt{3}+\sqrt{2}\right)}$

(4) $\tan^{-1}\dfrac{\left(1+\sqrt{3}-\sqrt{2}\right)}{\left(1-\sqrt{3}-\sqrt{2}\right)}$

(A) $\tan^{-1}\frac{(\sqrt{3}-1+\sqrt{2})}{(1+\sqrt{3}-\sqrt{2})}$

(B) $\tan^{-1}\frac{(1-\sqrt{3}-\sqrt{2})}{(1+\sqrt{3}+\sqrt{2})}$

(C) $\tan^{-1}\frac{(\sqrt{3}-1+\sqrt{2})}{(1-\sqrt{3}+\sqrt{2})}$

(D) $\tan^{-1}\frac{(1+\sqrt{3}-\sqrt{2})}{(1-\sqrt{3}-\sqrt{2})}$

Answer: (B) $\tan^{-1}\frac{(1-\sqrt{3}-\sqrt{2})}{(1+\sqrt{3}+\sqrt{2})}$ · Key from source paper

Q188 JEE Main 2021 · 26 Aug · Shift 1 Numerical

Two spherical balls having equal masses with radius of $5\ \text{cm}$ each are thrown upwards along the same vertical direction at an interval of $3\ \text{s}$ with the same initial velocity of $35\ \text{m s}^{-1}$, then these balls collide at a height of _____m,
(take $g = 10\ \text{m s}^{-2}$)

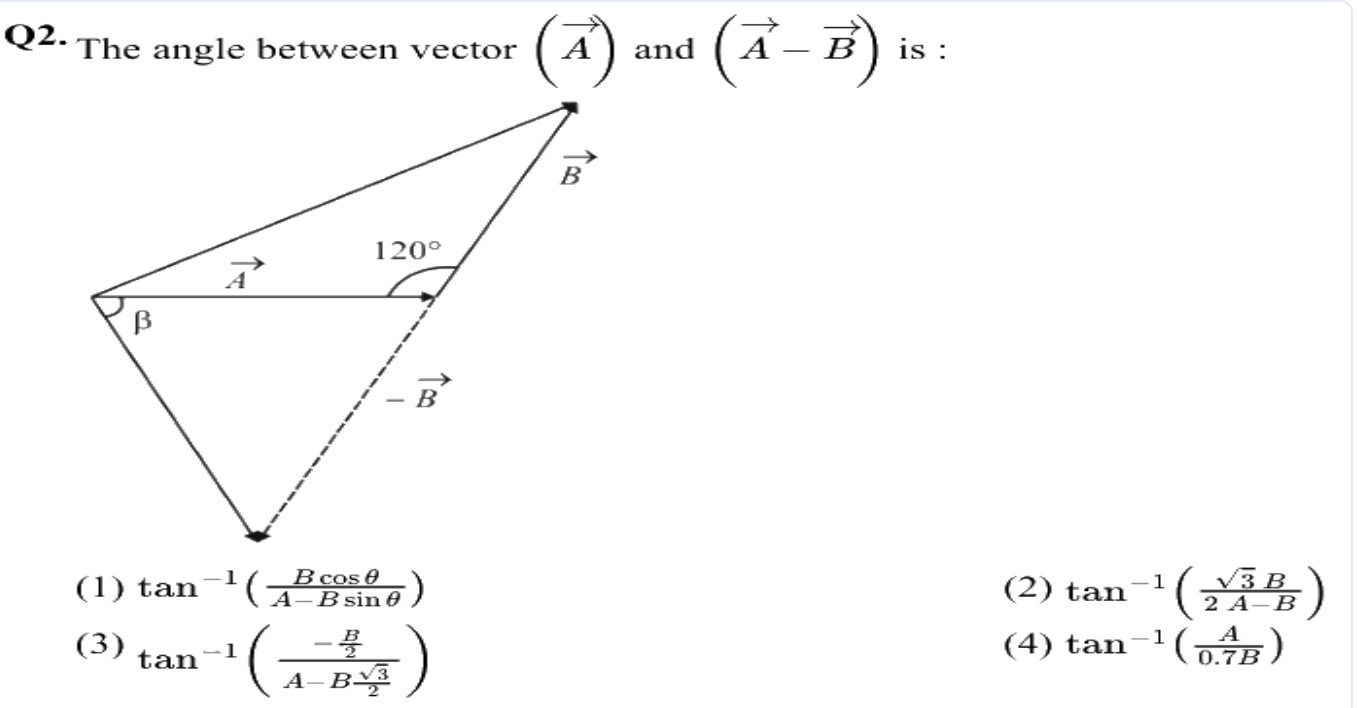
Numerical value type: the answer is a number.

Answer: 50. · Key from source paper

Q189 JEE Main 2021 · 26 Aug · Shift 2 MCQ

The angle between vector $\left(\vec{A}\right)$ and $\left(\vec{A}-\vec{B}\right)$ is :

(see the figure above)



(A) $\tan^{-1}\left(\frac{B\cos\theta}{A-B\sin\theta}\right)$
(B) $\tan^{-1}\left(\frac{\sqrt{3}B}{2A-B}\right)$
(C) $\tan^{-1}\left(\frac{-\frac{B}{2}}{A-B\frac{\sqrt{3}}{2}}\right)$
(D) $\tan^{-1}\left(\frac{A}{0.7B}\right)$

Answer: (B) $\tan^{-1}\left(\frac{\sqrt{3}B}{2A-B}\right)$ · Key from source paper

Q190 JEE Main 2021 · 26 Aug · Shift 2 MCQ

A bomb is dropped by a fighter plane flying horizontally. To an observer sitting in the plane, the trajectory of the bomb is a :

(A) straight line vertically down the plane
(B) parabola in a direction opposite to the motion of plane
(C) parabola in the direction of motion of plane
(D) hyperbola

Answer: (A) straight line vertically down the plane · Key from source paper

Q191 JEE Main 2021 · 27 Jul · Shift 1 MCQ

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.

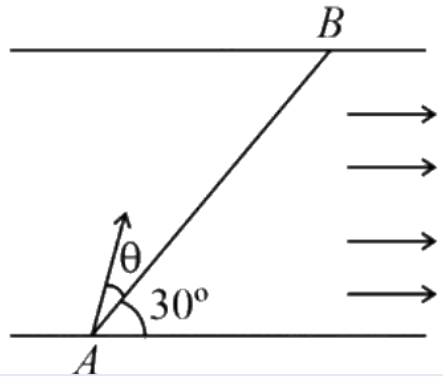
(A) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$
(B) $\frac{1}{3}$
(C) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$
(D) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

Answer: (C) $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$ · Key from source paper

Q192 JEE Main 2021 · 27 Jul · Shift 2 Numerical

A swimmer wants to cross a river from point A to point B. Line AB makes an angle of 30° with the flow of the river. The magnitude of the velocity of the swimmer is the same as that of the river. The angle θ with the line AB should be _____ $^\circ$, so that the swimmer reaches point B.
(see the figure above)

Q21. A swimmer wants to cross a river from point A to point B. Line AB makes an angle of 30° with the flow of the river. The magnitude of the velocity of the swimmer is the same as that of the river. The angle θ with the line AB should be _____$^\circ$, so that the swimmer reaches point B.



Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q193 JEE Main 2021 · 25 Jul · Shift 1 MCQ

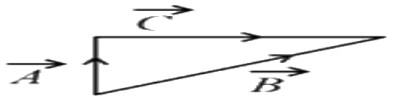
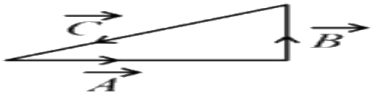
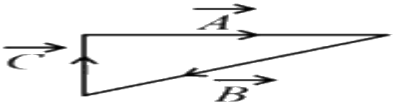
Match List I with List II.

List I: (a) $\vec{C}-\vec{A}-\vec{B}=0$; (b) $\vec{A}-\vec{C}-\vec{B}=0$; (c) $\vec{B}-\vec{A}-\vec{C}=0$; (d) $\vec{A}+\vec{B}=-\vec{C}$

List II: (i) *(see the figure above)*; (ii) *(see the figure above)*; (iii) *(see the figure above)*; (iv) *(see the figure above)*

Choose the correct answer from the options given below:

Q1. Match List I with List II.

List I		List II	
(a)	$\vec{C}-\vec{A}-\vec{B}=0$	(i)	
(b)	$\vec{A}-\vec{C}-\vec{B}=0$	(ii)	
(c)	$\vec{B}-\vec{A}-\vec{C}=0$	(iii)	
(d)	$\vec{A}+\vec{B}=-\vec{C}$	(iv)	

Choose the correct answer from the options given below:

(1) (a) → (iv), (b) → (i), (c) → (iii), (d) → (ii)

(2) (a) → (iv), (b) → (iii), (c) → (i), (d) → (ii)

(3) (a) → (iii), (b) → (ii), (c) → (iv), (d) → (i)

(4) (a) → (i), (b) → (iv), (c) → (ii), (d) → (iii)

(A) (a) → (iv), (b) → (i), (c) → (iii), (d) → (ii)
(B) (a) → (iv), (b) → (iii), (c) → (i), (d) → (ii)
(C) (a) → (iii), (b) → (ii), (c) → (iv), (d) → (i)
(D) (a) → (i), (b) → (iv), (c) → (ii), (d) → (iii)

Answer: (B) (a) → (iv), (b) → (iii), (c) → (i), (d) → (ii) · Key from source paper

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Q194 JEE Main 2021 · 25 Jul · Shift 1 MCQ

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

(A) 3 drops/2 seconds
(B) 2 drops/second
(C) 1 drop/second
(D) 1 drop/7 seconds

Answer: (C) 1 drop/second · Key from source paper

Q195 JEE Main 2021 · 25 Jul · Shift 2 MCQ

Two vectors $\vec{X}$ and $\vec{Y}$ have equal magnitude. The magnitude of $\left(\vec{X}-\vec{Y}\right)$ is n times the magnitude of $\left(\vec{X}+\vec{Y}\right)$. The angle between $\vec{X}$ and $\vec{Y}$ is :

(A) $\cos^{-1}\left(\frac{-n^2-1}{n^2-1}\right)$
(B) $\cos^{-1}\left(\frac{n^2-1}{-n^2-1}\right)$
(C) $\cos^{-1}\left(\frac{n^2+1}{-n^2-1}\right)$
(D) $\cos^{-1}\left(\frac{n^2+1}{n^2-1}\right)$

Answer: (B) $\cos^{-1}\left(\frac{n^2-1}{-n^2-1}\right)$ · Key from source paper

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Q196 JEE Main 2021 · 25 Jul · Shift 2 MCQ

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) $2n^2v^3$

Answer: (A) $2mv^3$ · Key from source paper

Q197 JEE Main 2021 · 25 Jul · Shift 2 MCQ

A balloon was moving upwards with a uniform velocity of $10\ \mathrm{m\ s^{-1}}$. An object of finite mass is dropped from the balloon when it was at a height of $75\ \mathrm{m}$ from the ground level. The height of the balloon from the ground when object strikes the ground was around: (takes the value of g as $10\ \mathrm{m\ s^{-2}}$)

(A) $300\ \mathrm{m}$
(B) $200\ \mathrm{m}$
(C) $125\ \mathrm{m}$
(D) $250\ \mathrm{m}$

Answer: (C) $125\ \mathrm{m}$ · Key from source paper

Q198 JEE Main 2021 · 25 Jul · Shift 2 MCQ

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

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

Answer: (B) $\frac{3}{2}\alpha + \frac{7}{3}\beta$ · Key from source paper

Q199 JEE Main 2021 · 22 Jul · Shift 1 MCQ

What will be the projection of vector $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ on vector $\vec{B} = \hat{i} + \hat{j}$?

(A) $\sqrt{2}\left(\hat{i} + \hat{j} + \hat{k}\right)$
(B) $2\left(\hat{i} + \hat{j} + \hat{k}\right)$
(C) $\sqrt{2}\left(\hat{i} + \hat{j}\right)$
(D) $\left(\hat{i} + \hat{j}\right)$

Answer: (D) $\left(\hat{i} + \hat{j}\right)$ · Key from source paper

Q200 JEE Main 2021 · 22 Jul · Shift 1 Numerical

Three particles P, Q and R are moving along the vectors $\vec{A} = \hat{i} + \hat{j}$, $\vec{B} = \hat{j} + \hat{k}$ and $\vec{C} = -\hat{i} + \hat{j}$, respectively. They strike on a point and start to move in different directions. Now particle P is moving normal to the plane which contains vector $\vec{A}$ and $\vec{B}$. Similarly particle Q is moving normal to the plane which contains vector $\vec{A}$ and $\vec{C}$. The angle between the direction of motion of P and Q is $\cos^{-1}\left(\frac{1}{\sqrt{x}}\right)$. Then the value of x is _____.

EdLoop JEE

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q201 JEE Main 2021 · 20 Jul · Shift 1 MCQ

If $\vec{A}$ and $\vec{B}$ are two vectors satisfying the relation $\vec{A} \cdot \vec{B} = \left|\vec{A} \times \vec{B}\right|$. Then the value of $\left|\vec{A} - \vec{B}\right|$ will be:

(A) $\sqrt{A^2 + B^2}$
(B) $\sqrt{A^2 + B^2 + \sqrt{2}AB}$
(C) $\sqrt{A^2 + B^2 + 2AB}$
(D) $\sqrt{A^2 + B^2 - \sqrt{2}AB}$

Answer: (D) $\sqrt{A^2 + B^2 - \sqrt{2}AB}$ · Key from source paper

Q202 JEE Main 2021 · 20 Jul · Shift 1 MCQ

A butterfly is flying with a velocity $4\sqrt{2}\ \mathrm{m\ s^{-1}}$ in north-east direction. Wind is slowly blowing at $1\ \mathrm{m\ s^{-1}}$ from north to south. The resultant displacement of the butterfly in 3 seconds is:

(A) $3\ \mathrm{m}$
(B) $20\ \mathrm{m}$
(C) $12\sqrt{2}\ \mathrm{m}$
(D) $15\ \mathrm{m}$

Answer: (D) $15\ \mathrm{m}$ · Key from source paper

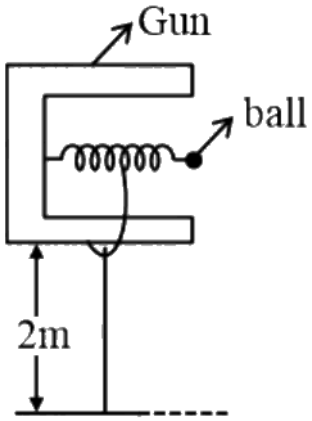
Q203 JEE Main 2021 · 20 Jul · Shift 1 Numerical

In a spring gun having spring constant $100\ \mathrm{N\ m^{-1}}$ a small ball B of mass $100\ \mathrm{g}$ is put in its barrel (as shown in figure) by compressing the spring through $0.05\ \mathrm{m}$. There should be a box placed at a distance d on the ground so that the ball falls in it. If the ball leaves the gun horizontally at a height of $2\ \mathrm{m}$ above the ground. The value of d is m.
($g = 10\ \mathrm{m\ s^{-2}}$)
(see the figure above)

EdLoop JEE

Q21. In a spring gun having spring constant $100\ \text{N m}^{-1}$ a small ball B of mass $100\ \text{g}$ is put in its barrel (as shown in figure) by compressing the spring through $0.05\ \text{m}$. There should be a box placed at a distance d on the ground so that the ball falls in it. If the ball leaves the gun horizontally at a height of $2\ \text{m}$ above the ground. The value of d is m.

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



Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q204 JEE Main 2021 · 20 Jul · Shift 2 MCQ

Two vectors $\vec{P}$ and $\vec{Q}$ have equal magnitudes. If the magnitude of $\vec{P}+\vec{Q}$ is n times the magnitude of $\vec{P}-\vec{Q}$, then angle between $\vec{P}$ and $\vec{Q}$ is

(A) $\sin^{-1}\left(\frac{n-1}{n+1}\right)$

(B) $\cos^{-1}\left(\frac{n-1}{n+1}\right)$

(C) $\sin^{-1}\left(\frac{n^2-1}{n^2+1}\right)$

(D) $\cos^{-1}\left(\frac{n^2-1}{n^2+1}\right)$

Answer: (D) $\cos^{-1}\left(\frac{n^2-1}{n^2+1}\right)$ · Key from source paper

Q205 JEE Main 2021 · 20 Jul · Shift 2 MCQ

A boy reaches the airport and finds that the escalator is not working. He walks up the stationary escalator in time t_1. If he remains stationary on a moving escalator then the escalator takes him in time t_2. The time taken by him to walk up on the moving escalator will be:

(A) $\frac{t_1 t_2}{t_2 - t_1}$

(B) $\frac{t_1 + t_2}{2}$

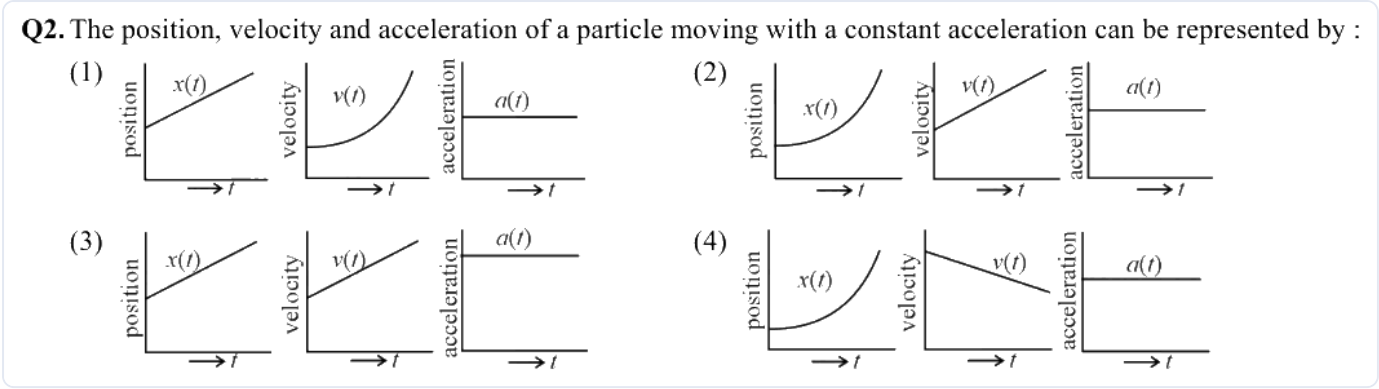
(C) $\frac{t_1 t_2}{t_2 + t_1}$

(D) $t_2 - t_1$

Answer: (C) $\frac{t_1 t_2}{t_2 + t_1}$ · Key from source paper

Q206 JEE Main 2021 · 18 Mar · Shift 1 MCQ

The position, velocity and acceleration of a particle moving with a constant acceleration can be represented by :



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (B) · Key from source paper

Q207 JEE Main 2021 · 18 Mar · Shift 1 Numerical

A person is swimming with a speed of $10\ \mathrm{m\ s^{-1}}$ at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is $x\ \mathrm{m\ s^{-1}}$. The value of x to the nearest integer is _____ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q208 JEE Main 2021 · 18 Mar · Shift 1 Numerical

A bullet of mass $0.1\ \mathrm{kg}$ is fired on a wooden block to pierce through it, but it stops after moving a distance of $50\ \mathrm{cm}$ into it. If the velocity of the bullet before hitting the wood is $10\ \mathrm{m\ s^{-1}}$ and, it slows down with uniform deceleration, then the magnitude of effective retarding force on the bullet is x N. The value of x to the nearest integer is,

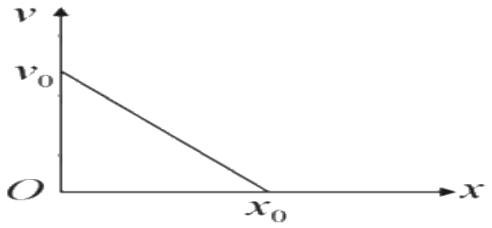
Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q209 JEE Main 2021 · 18 Mar · Shift 2 MCQ

The velocity-displacement graph of a particle is shown in the figure.
(see the figure above)
The acceleration-displacement graph of the same particle is represented by :

Q1. The velocity-displacement graph of a particle is shown in the figure.

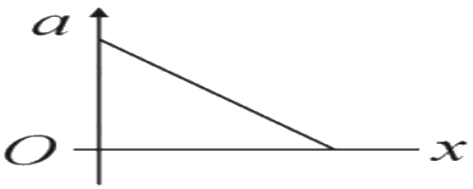


The acceleration-displacement graph of the same particle is represented by :

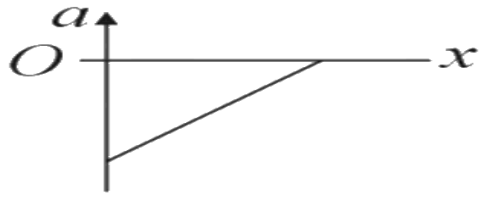
(1)



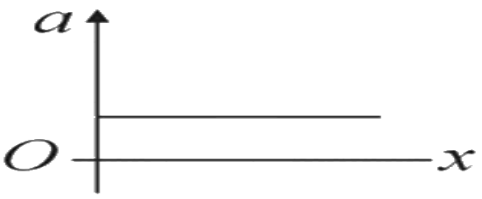
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (C) · Key from source paper

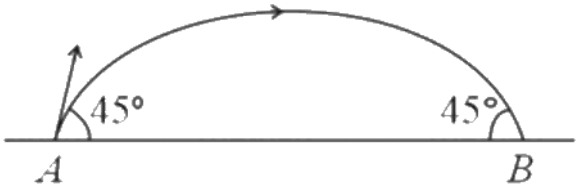
Q210 JEE Main 2021 · 18 Mar · Shift 2 Numerical

The projectile motion of a particle of mass 5 g is shown in the figure.

(see the figure above)

The initial velocity of the particle is $5\sqrt{2}\ \text{ms}^{-1}$ and the air resistance is assumed to be negligible. The magnitude of the change in momentum between the points A and B is $x \times 10^{-2}\ \text{kgms}^{-1}$. The value of x, to the nearest integer, is _____ .

Q22. The projectile motion of a particle of mass 5 g is shown in the figure.



The initial velocity of the particle is $5\sqrt{2}\ \text{ms}^{-1}$ and the air resistance is assumed to be negligible. The magnitude of the change in momentum between the points A and B is $x \times 10^{-2}\ \text{kgms}^{-1}$. The value of x, to the nearest integer, is ___ .

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q211 JEE Main 2021 · 17 Mar · Shift 1 MCQ

A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t seconds, the total distance travelled is:

(A) $\frac{4\alpha\beta}{(\alpha+\beta)}t^2$
(B) $\frac{2\alpha\beta}{(\alpha+\beta)}t^2$
(C) $\frac{\alpha\beta}{2(\alpha+\beta)}t^2$
(D) $\frac{\alpha\beta}{4(\alpha+\beta)}t^2$

Answer: (C) $\frac{\alpha\beta}{2(\alpha+\beta)}t^2$ · Key from source paper

Q212 JEE Main 2021 · 17 Mar · Shift 2 MCQ

The velocity of a particle is $v = \left(v_0 + gt + Ft^2\right)\ \mathrm{ms}^{-1}$. Its position is $x = 0$ at $t = 0$; then its displacement after time $(t = 1\ \mathrm{s})$ is :

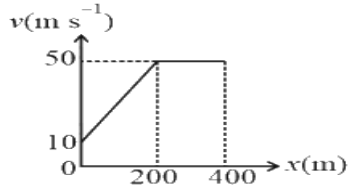
(A) $v_0 + g + F$
(B) $v_0 + \frac{g}{2} + \frac{F}{3}$
(C) $v_0 + \frac{g}{2} + F$
(D) $v_0 + 2\ \mathrm{g} + 3\ \mathrm{F}$

Answer: (B) $v_0 + \frac{g}{2} + \frac{F}{3}$ · Key from source paper

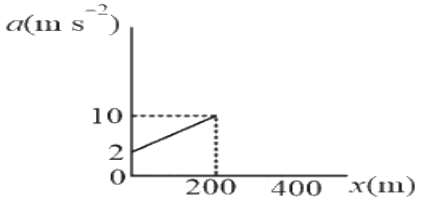
Q213 JEE Main 2021 · 16 Mar · Shift 1 MCQ

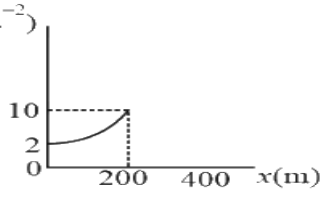
The velocity-displacement graph describing the motion of a bicycle is shown in the figure.
(see the figure above)
The acceleration-displacement graph of the bicycle's motion is best described by :

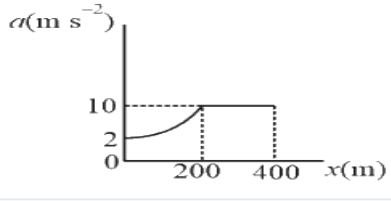
Q1. The velocity-displacement graph describing the motion of a bicycle is shown in the figure.



The acceleration-displacement graph of the bicycle's motion is best described by :

(1)


(2)


(3)


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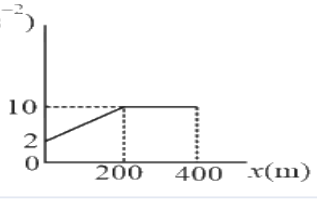


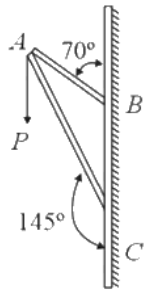
(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q214 JEE Main 2021 · 16 Mar · Shift 1 Numerical

Consider a frame that is made up of two thin massless rods AB and AC as shown in the figure. A vertical force $\vec{P}$ of magnitude 100 N is applied at point A of the frame.
(see the figure above)
Suppose the force is $\vec{P}$ resolved parallel to the arms AB and AC of the frame. The magnitude of the resolved component along the arm AC is x N. The value of x, to the nearest integer, is _____.
[Given : $\sin(35^\circ) = 0.573, \cos(35^\circ) = 0.819, \sin(110^\circ) = 0.939, \cos(110^\circ) = -0.342$]

Q22. Consider a frame that is made up of two thin massless rods AB and AC as shown in the figure. A vertical force $\overrightarrow{P}$ of magnitude 100 N is applied at point A of the frame.



Suppose the force is $\overrightarrow{P}$ resolved parallel to the arms AB and AC of the frame. The magnitude of the resolved component along the arm AC is xN. The value of x, to the nearest integer, is _____.
[Given : $\sin(35^\circ) = 0.573, \cos(35^\circ) = 0.819,\ \sin(110^\circ) = 0.939, \cos(110^\circ) = -0.342$]

Numerical value type: the answer is a number.

Answer: 164. · Checked by our team

Q215 JEE Main 2021 · 16 Mar · Shift 2 MCQ

A mosquito is moving with a velocity $\vec{v} = 0.5t^2\hat{i} + 3t\hat{j} + 9\hat{k}\ \mathrm{m\,s^{-1}}$ and accelerating in uniform conditions. What will be the direction of mosquitoes after 2 s ?

(A) $\tan^{-1}\left(\frac{2}{3}\right)$ from x-axis
(B) $\tan^{-1}\left(\frac{\sqrt{85}}{6}\right)$ from y-axis
(C) $\tan^{-1}\left(\frac{5}{2}\right)$ from y-axis
(D) $\tan^{-1}\left(\frac{5}{2}\right)$ from x-axis

Answer: (B) $\tan^{-1}\left(\frac{\sqrt{85}}{6}\right)$ **from y-axis** · Key from source paper

Q216 JEE Main 2021 · 16 Mar · Shift 2 Numerical

A swimmer can swim with velocity of $12\ \mathrm{km/h}$ in still water. Water flowing in a river has velocity $6\ \mathrm{km/h}$. The direction with respect to the direction of flow of river water he should swim in order to reach the point on the other bank just opposite to his starting point is _____°. (Round off to the Nearest Integer) (find the angle in degree)

Numerical value type: the answer is a number.

Answer: 120. · Key from source paper

Q217 JEE Main 2021 · 26 Feb · Shift 2 MCQ

A scooter accelerates from rest for time t_1 at constant rate a_1 and then retards at constant rate a_2 for time t_2 and comes to rest. The correct value of $\frac{t_1}{t_2}$ will be :

(A) $\frac{a_2}{a_1}$
(B) $\frac{a_1}{a_2}$
(C) $\frac{a_1+a_2}{a_1}$
(D) $\frac{a_1+a_2}{a_2}$

Answer: (A) $\frac{a_2}{a_1}$ · Key from source paper

Q218 JEE Main 2021 · 26 Feb · Shift 2 MCQ

The trajectory of a projectile in a vertical plane is $y = \alpha x - \beta x^2$, where α and β are constants and x & y are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection θ and the maximum height attained H are respectively given by

(A) $\tan^{-1}\alpha,\ \frac{4\alpha^2}{\beta}$
(B) $\tan^{-1}\left(\frac{\beta}{\alpha}\right),\ \frac{\alpha^2}{\beta}$
(C) $\tan^{-1}\beta,\ \frac{\alpha^2}{2\beta}$
(D) $\tan^{-1}\alpha,\ \frac{\alpha^2}{4\beta}$

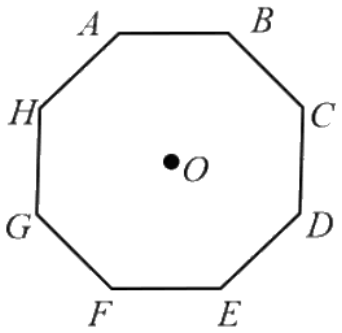
Answer: (D) $\tan^{-1}\alpha,\ \frac{\alpha^2}{4\beta}$ · Key from source paper

Q219 JEE Main 2021 · 25 Feb · Shift 1 MCQ

In an octagon $ABCDEFGH$ of equal side, what is the sum of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} + \overrightarrow{AG} + \overrightarrow{AH}$, if, $\overrightarrow{AO} = 2\hat{i} + 3\hat{j} - 4\hat{k}$

(see the figure above)

Q1. In an octagon $ABCDEFGH$ of equal side, what is the sum of $\overrightarrow{AB}+\overrightarrow{AC}+\overrightarrow{AD}+\overrightarrow{AE}+\overrightarrow{AF}+\overrightarrow{AG}+\overrightarrow{AH}$, if, $\overrightarrow{AO}=2\hat{i}+3\hat{j}-4\hat{k}$



(1) $16\hat{i}+24\hat{j}-32\hat{k}$
(2) $16\hat{i}-24\hat{j}+32\hat{k}$
(3) $16\hat{i}+24\hat{j}+32\hat{k}$
(4) $-16\hat{i}-24\hat{j}+32\hat{k}$

(A) $16\hat{i}+24\hat{j}-32\hat{k}$
(B) $16\hat{i}-24\hat{j}+32\hat{k}$
(C) $16\hat{i}+24\hat{j}+32\hat{k}$
(D) $-16\hat{i}-24\hat{j}+32\hat{k}$

Answer: (A) $16\hat{i}+24\hat{j}-32\hat{k}$ · Key from source paper

Q220 JEE Main 2021 · 25 Feb · Shift 1 MCQ

An engine of a train, moving with uniform acceleration, passes the signal-post with velocity u and the last compartment with velocity v. The velocity with which middle point of the train passes the signal post is :

(A) $\frac{u+v}{2}$
(B) $\sqrt{\frac{v^2+u^2}{2}}$
(C) $\frac{v-u}{2}$
(D) $\sqrt{\frac{v^2-u^2}{2}}$

Answer: (B) $\sqrt{\frac{v^2+u^2}{2}}$ · Key from source paper

Q221 JEE Main 2021 · 25 Feb · Shift 2 MCQ

A stone is dropped from the top of a building. When it crosses a point $5\ \mathrm{m}$ below the top, another stone starts to fall from a point $25\ \mathrm{m}$ below the top. Both stones reach the bottom of building simultaneously. The height of the building is :

(A) 25 m
(B) 45 m
(C) 35 m
(D) 50 m

Answer: (B) 45 m · Key from source paper

Q222 JEE Main 2021 · 25 Feb · Shift 2 Numerical

If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between $\vec{P}$ and $\vec{Q}$ is $\theta(0^\circ < \theta < 360^\circ)$. The value of θ will be _____°.

Numerical value type: the answer is a number.

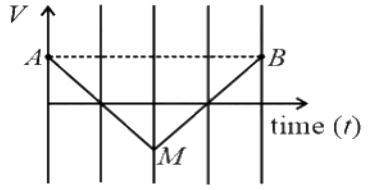
Answer: 180. · Key from source paper

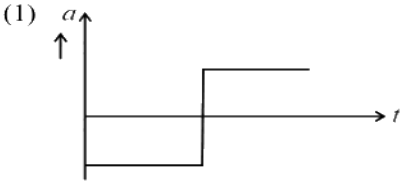
Q223 JEE Main 2021 · 24 Feb · Shift 1 MCQ

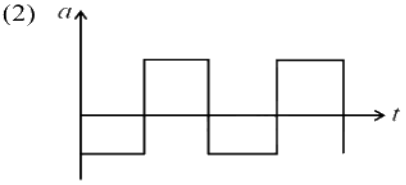
If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph?

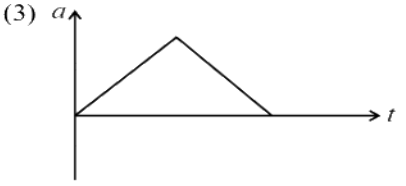
(see the figure above)

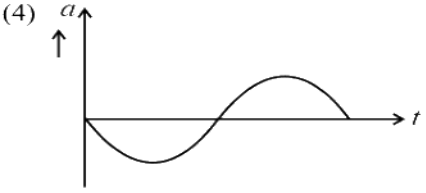
Q2. If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph?



(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q224 JEE Main 2021 · 24 Feb · Shift 2 MCQ

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) $\left(\frac{2v_0}{3\alpha}\right)^{\frac{1}{3}}$

(B) $\left(\frac{3mv_0^2}{2\alpha}\right)^{\frac{1}{3}}$

(C) $\left(\frac{3v_0^2}{2\alpha}\right)^{\frac{1}{2}}$

(D) $\left(\frac{2v_0^2}{3\alpha}\right)^{\frac{1}{2}}$

Answer: (B) $\left(\frac{3mv_0^2}{2\alpha}\right)^{\frac{1}{3}}$ · Key from source paper

Q225 JEE Main 2020 · 6 Sep · Shift 1 MCQ

A clock has a continuously moving second's hand of $0.1\mathrm{m}$ length. The average acceleration of the tip of the hand (in units of ms^{-2}]) is of the order of :

(A) 10^{-3}

(B) 10^{-4}

(C) 10^{-2}

(D) 10^{-1}

Answer: (A) 10^{-3} · Key from source paper

Q226 JEE Main 2020 · 6 Sep · Shift 2 MCQ

When a car is at rest, its driver sees rain drops falling on it vertically. When driving the car with speed v, he sees that rain drops coming at an angle 60° from the horizontal. On further increasing the speed of the car to $(1+\beta)v$, this angle changes to 45°. The value of β is close to :

(A) 0.50

(B) 0.41

(C) 0.37

(D) 0.73

Answer: (D) 0.73 · Key from source paper

Q227 JEE Main 2020 · 5 Sep · Shift 1 MCQ

A helicopter rises from rest on the ground vertically upwards with a constant acceleration g. A food packet is dropped from the helicopter when it is at a height h. The time taken by the packet to reach the ground is close to [g is the acceleration due to gravity]:

(A) $t = \frac{2}{3}\sqrt{\left(\frac{h}{g}\right)}$

(B) $t = 1.8\sqrt{\left(\frac{h}{g}\right)}$

(C) $t = 3.4\sqrt{\left(\frac{h}{g}\right)}$

(D) $t = \sqrt{\frac{2h}{3g}}$

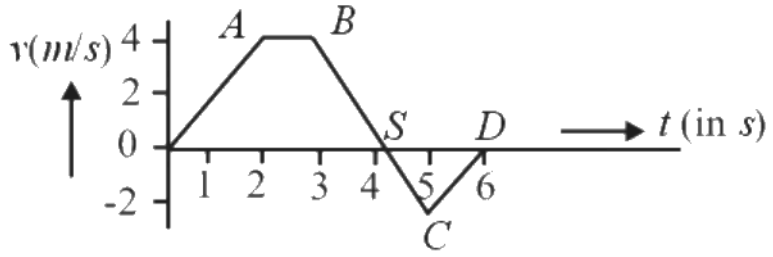
Answer: (C) $t = 3.4\sqrt{\left(\frac{h}{g}\right)}$ · Key from source paper

Q228 JEE Main 2020 · 5 Sep · Shift 2 MCQ

The velocity (v) and time (t) graph of a body in a straight line motion is shown in the figure. The point S is at 4. 333 seconds. The total distance covered by the body in 6 s is :

(see the figure above)

Q2. The velocity (v) and time (t) graph of a body in a straight line motion is shown in the figure. The point S is at 4. 333 seconds. The total distance covered by the body in 6 s is :



(1) $\frac{37}{3}$m (2) 12m

(3) 11m (4) $\frac{49}{4}$m

(A) $\frac{37}{3}$m

(B) 12m

(C) 11m

(D) $\frac{49}{4}$m

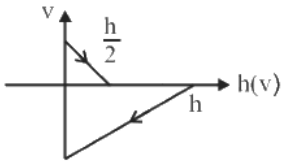
Answer: (A) $\frac{37}{3}$m · Key from source paper

Q229 JEE Main 2020 · 4 Sep · Shift 1 MCQ

A tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height h/2. The velocity versus height of the ball during its motion may be represented graphically by: (graphs are drawn schematically and on not to scale)

Q2. A tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height $h/2$. The velocity versus height of the ball during its motion may be represented graphically by: (graphs are drawn schematically and on not to scale)

(1)



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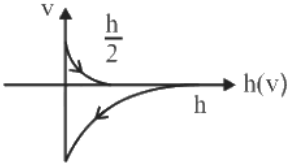

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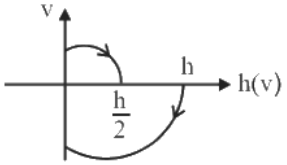

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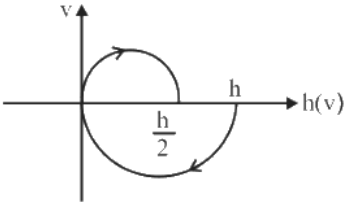

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q230 JEE Main 2020 · 4 Sep · Shift 1 MCQ

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

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

Answer: (A) 2 s and 18 m · Key from source paper

Q231 JEE Main 2020 · 4 Sep · Shift 2 MCQ

A small ball of mass m is thrown upward with velocity u from the ground. The ball experiences a resistive force mkv^2 where v is it speed. The maximum height attained by the ball is :

(A) $\frac{1}{2k}\tan^{-1}\frac{ku^2}{g}$
(B) $\frac{1}{k}\ln\left(1+\frac{ku^2}{2g}\right)$
(C) $\frac{1}{k}\tan^{-1}\frac{ku^2}{2g}$
(D) $\frac{1}{2k}\ln\left(1+\frac{ku^2}{g}\right)$

Answer: (D) $\frac{1}{2k}\ln\left(1+\frac{ku^2}{g}\right)$ · Key from source paper

Q232 JEE Main 2020 · 4 Sep · Shift 2 Numerical

The speed verses time graph for a particle is shown in the figure. The distance travelled (in m) by the particle during the time interval t = 0 to t = 5 s will be _____

(see the figure above)

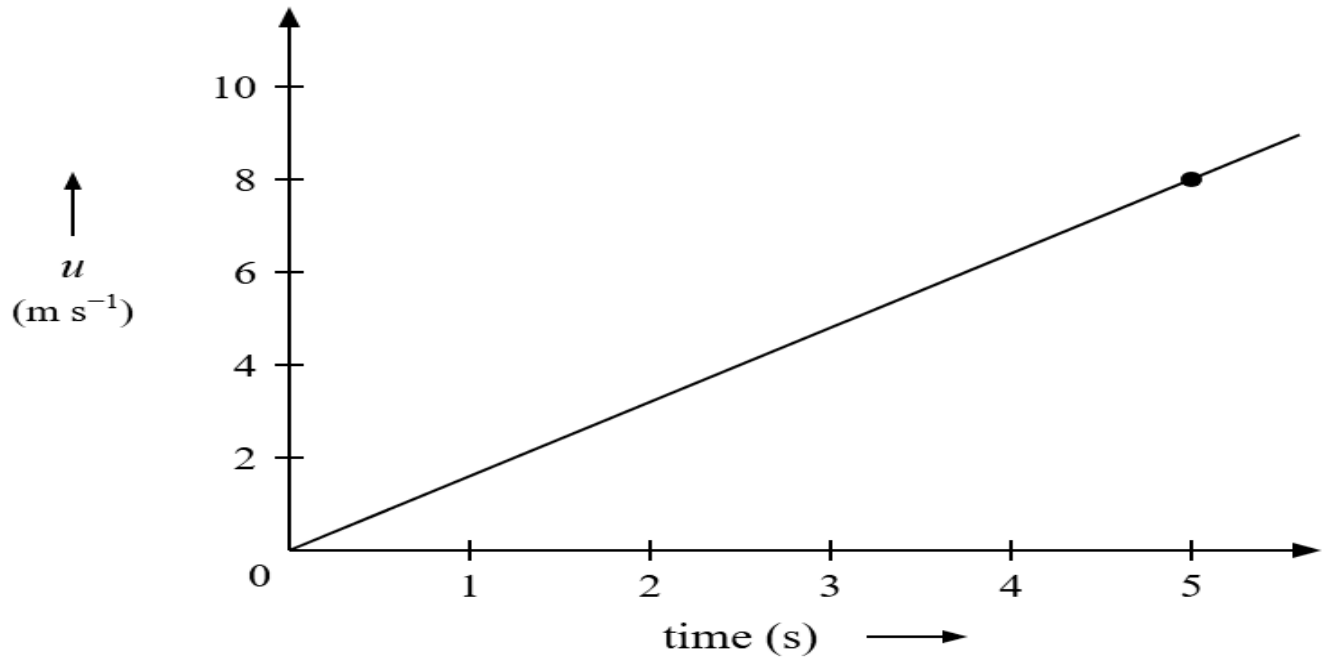

Figure redrawn by EdLoop

Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q233 JEE Main 2020 · 2 Sep · Shift 1 MCQ

Train A and train B are running on parallel tracks in the opposite directions with speed of $36\ \text{km hour}^{-1}$ and $72\ \text{km hour}^{-1}$, respectively. A person is walking in train A in the direction opposite to its motion with a speed of $1.8\ \text{km hour}^{-1}$. Speed (in m s^{-1}) of this person as observed from train B will be close to: (take the distance between the tracks as negligible)

(A) $29.5\ \text{m s}^{-1}$

(B) $28.5\ \text{m s}^{-1}$

(C) $31.5\ \text{m s}^{-1}$

(D) $30.5\ \text{m s}^{-1}$

Answer: (A) $29.5\ \text{m s}^{-1}$ · Key from source paper

Q234 JEE Main 2020 · 9 Jan · Shift 1 Numerical

The distance x covered by a paritcle (sic) 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 value type: the answer is a number.

Answer: 3. · Key from source paper

Q235 JEE Main 2020 · 9 Jan · Shift 2 MCQ

A particle starts from the origin at $t = 0$ with an initial velocity of $3.0\hat{i}\,\mathrm{m/s}$ and moves in the $x - y$ plane with a constant acceleration $\left(6.0\hat{i} + 4.0\hat{j}\right)\mathrm{m/s^2}$. The $x-$ coordinate of the particle at the instant when its $y-$ coordinate is $32m$ is D meters. The value of D is:

(A) 32
(B) 50
(C) 60
(D) 40

Answer: (C) 60 · Key from source paper

Q236 JEE Main 2020 · 9 Jan · Shift 2 MCQ

A particle of mass m is projected with a speed u from the ground at an angle $\theta = \frac{\pi}{3}$ w.r.t. horizontal (x-axis). When it has reached its maximum height, it collides completely inelastically with another particle of the same mass and velocity $u\hat{i}$. The horizontal distance covered by the combined mass before reaching the ground is:

(A) $\frac{3\sqrt{3}}{8}\frac{u^2}{g}$
(B) $\frac{3\sqrt{2}}{4}\frac{u^2}{g}$
(C) $\frac{5}{8}\frac{u^2}{g}$
(D) $2\sqrt{2}\frac{u^2}{g}$

Answer: (A) $\frac{3\sqrt{3}}{8}\frac{u^2}{g}$ · Key from source paper

Q237 JEE Main 2020 · 8 Jan · Shift 1 Numerical

A particle is moving along the x -axis with its coordinate with time t given by $x(t) = 10 + 8t - 3t^2$. Another particle is moving along the y -axis with its coordinate as a function of time given by $y(t) = 5 - 8t^3$. At $t = 1$ s, the speed of the second particle as measured in the frame of the first particle is given as $\sqrt{v}$. Then $v(\text{in m s}^{-1})$ is _____.

Numerical value type: the answer is a number.

Answer: 580. · Key from source paper

Q238 JEE Main 2020 · 8 Jan · Shift 2 MCQ

A particle moves such that its position vector $\vec{r}(t) = \cos\omega t\,\hat{i} + \sin\omega t\,\hat{j}$ where ω is a constant and t is time. Then which of the following statements is true for the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle:

(A) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed away from the origin

(B) $\vec{v}$ and $\vec{a}$ both are perpendicular to $\vec{r}$

(C) $\vec{v}$ and $\vec{a}$ both are parallel to $\vec{r}$

(D) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed towards the origin

Answer: (D) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed towards the origin · Key from source paper

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Q239 JEE Main 2020 · 8 Jan · Shift 2 MCQ

A particle of mass m is dropped from a height h above the ground. At the same time another particle of the same mass is thrown vertically upwards from the ground with a speed of $\sqrt{2gh}$. If they collide head-on completely inelastically, the time taken for the combined mass to reach the ground, in units of $\sqrt{\frac{h}{g}}$ is:

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

(B) $\sqrt{\frac{3}{4}}$

(C) $\frac{1}{2}$

(D) $\sqrt{\frac{3}{2}}$

Answer: (D) $\sqrt{\frac{3}{2}}$ · Key from source paper

Q240 JEE Main 2020 · 8 Jan · Shift 2 Numerical

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

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q241 JEE Main 2020 · 7 Jan · Shift 2 Numerical

The sum of two forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$ such that $|\vec{R}| = |\vec{P}|$. Find the angle between resultant of $2\vec{P}$ and $\vec{Q}$ and $\vec{Q}$

_____

Numerical value type: the answer is a number.

Answer: 90. · Key from source paper

Q242 JEE Main 2019 · 12 Apr · Shift 1 MCQ

The trajectory of a projectile near the surface of the earth is given as $y = 2x - 9x^2$. If it were launched at an angle θ_0 with speed v_0 then $\mathrm{g} = 10\ \mathrm{m\ s^{-2}}$:

(A) $\theta_0 = \cos^{-1}\frac{1}{\sqrt{5}}$ and $v_0 = \frac{5}{3}\ \mathrm{ms}^{-1}$
(B) $\theta_0 = \cos^{-1}\frac{2}{\sqrt{5}}$ and $v_0 = \frac{3}{5}\ \mathrm{ms}^{-1}$
(C) $\theta_0 = \sin^{-1}\frac{1}{\sqrt{5}}$ and $v_0 = \frac{5}{3}\ \mathrm{ms}^{-1}$
(D) $\theta_0 = \sin^{-1}\frac{2}{\sqrt{5}}$ and $v_0 = \frac{3}{5}\ \mathrm{ms}^{-1}$

Answer: (A) $\theta_0 = \cos^{-1}\frac{1}{\sqrt{5}}$ and $v_0 = \frac{5}{3}\ \mathrm{ms}^{-1}$ · Key from source paper

Q243 JEE Main 2019 · 12 Apr · Shift 1 MCQ

A shell is fired from a fixed artillery gun with an initial speed u such that it hits the target on the ground at a distance R from it. If t_1 and t_2 are the values of the time taken by it to hit the target in two possible ways, the product $\mathrm{t}_1\mathrm{t}_2$ is:

(A) R / 2g
(B) R / g
(C) 2R / g
(D) R / 4g

Answer: (C) 2R / g · Key from source paper

Q244 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A particle is moving with speed $v = b\sqrt{x}$ along positive $x-$ axis. Calculate the speed of the particle at time $t = \tau$ (assume that the particle is at origin at $t = 0$)

(A) $b^2\tau$
(B) $\frac{b^2\tau}{\sqrt{2}}$
(C) $\frac{b^2\tau}{2}$
(D) $\frac{b^2\tau}{4}$

Answer: (C) $\frac{b^2\tau}{2}$ · Key from source paper

Q245 JEE Main 2019 · 12 Apr · Shift 2 MCQ

Two particles are projected from the same point with the same speed u such that they have the same range R, but different maximum heights, h_1 and h_2. Which of the following is correct?

(A) $\mathrm{R}^2 = \mathrm{h}_1\mathrm{h}_2$
(B) $\mathrm{R}^2 = 4\,\mathrm{h}_1\mathrm{h}_2$
(C) $\mathrm{R}^2 = 2\,\mathrm{h}_1\mathrm{h}_2$
(D) $\mathrm{R}^2 = 16\,\mathrm{h}_1\mathrm{h}_2$

Answer: (D) $\mathrm{R}^2 = 16\,\mathrm{h}_1\mathrm{h}_2$ · Key from source paper

Q246 JEE Main 2019 · 10 Apr · Shift 1 MCQ

A ball is thrown upward with an initial velocity V_0 from the surface of the earth. The motion of the ball is affected by a drag force equal to $m\gamma v^2$ (where m is mass of the ball, v is its instantaneous velocity and γ is a constant). Time taken by the ball to rise to its zenith is:

(A) $\frac{1}{\sqrt{\gamma g}} \ln\left(1+\sqrt{\frac{\gamma}{g}}V_0\right)$

(B) $\frac{1}{\sqrt{\gamma g}} \tan^{-1}\left(\sqrt{\frac{\gamma}{g}}V_0\right)$

(C) $\frac{1}{\sqrt{\gamma g}} \sin^{-1}\left(\sqrt{\frac{\gamma}{g}}V_0\right)$

(D) $\frac{1}{\sqrt{2\gamma g}} \tan^{-1}\left(\sqrt{\frac{2\gamma}{g}}V_0\right)$

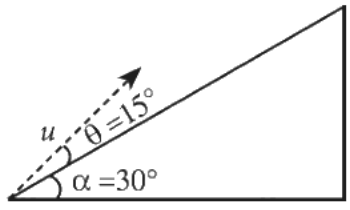
Answer: (B) $\frac{1}{\sqrt{\gamma g}} \tan^{-1}\left(\sqrt{\frac{\gamma}{g}}V_0\right)$ · Key from source paper

Q247 JEE Main 2019 · 10 Apr · Shift 2 MCQ

A plane is inclined at an angle $\alpha = 30^\circ$ with respect to the horizontal. A particle is projected with a speed $u = 2\ \mathrm{m\,s^{-1}}$, from the base of the plane, making an angle $\theta = 15^\circ$ with respect to the plane as shown in the figure. The distance from the base, at which the particle hits the plane, is close to:
(Take $g = 10\ \mathrm{m\,s^{-2}}$)

(see the figure above)

Q3. A plane is inclined at an angle $\alpha = 30°$ with respect to the horizontal. A particle is projected with a speed $u = 2\ \mathrm{m\,s^{-1}}$, from the base of the plane, making an angle $\theta = 15°$ with respect to the plane as shown in the figure. The distance from the base, at which the particle hits the plane is close to:
(Take $g = 10\ \mathrm{m\,s^{-2}}$)



(1) 20 cm (2) 18 cm
(3) 14 cm (4) 26 cm

(A) 20 cm

(B) 18 cm

(C) 14 cm

(D) 26 cm

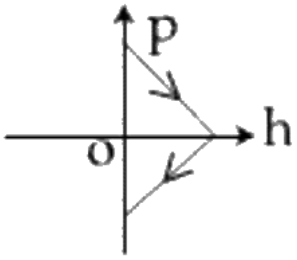
Answer: (A) 20 cm · Key from source paper

Q248 JEE Main 2019 · 9 Apr · Shift 1 MCQ

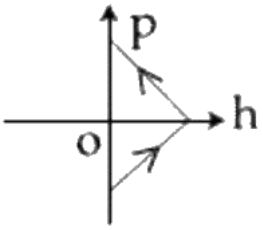
A ball is thrown vertically up (taken as $+z-$axis) from the ground. The correct momentum-height ($\mathrm{p}-\mathrm{h}$) diagram is:

Q2. A ball is thrown vertically up (taken as $+\mathrm{z}-$ axis) from the ground. The correct momentum-height $(\mathrm{p}-\mathrm{h})$ diagram is:

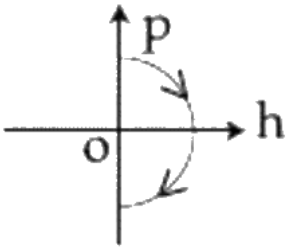
(1)



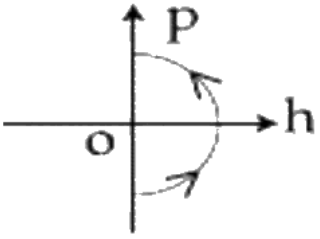
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (C) · Key from source paper

Q249 JEE Main 2019 · 9 Apr · Shift 1 MCQ

The stream of a river is flowing with a speed of 2 $\mathrm{km\ h^{-1}}$. A swimmer can swim at a speed of 4 $\mathrm{km\ h^{-1}}$. The direction of the swimmer with respect to the flow of the river, to cross the river straight, is

(A) 150°

(B) 90°

(C) 120°

(D) 60°

Answer: (C) 120° · Key from source paper

Q250 JEE Main 2019 · 9 Apr · Shift 2 MCQ

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 particles zero acceleration, then its velocity will be:

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

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

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

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

Answer: (A) $a + \frac{b^2}{3c}$ · Key from source paper

Q251 JEE Main 2019 · 9 Apr · Shift 2 MCQ

The position vector of a particle changes with time according to the relation $\vec{r}(t) = 15t^2\hat{i} + (4 - 20t^2)\hat{j}$. What is the magnitude of the acceleration at $t = 1$?

(A) 40

(B) 25

(C) 100

(D) 50

Answer: (D) 50 · Key from source paper

Q252 JEE Main 2019 · 8 Apr · Shift 1 MCQ

Ship A is sailing towards north-east with velocity) $\vec{v} = 30\hat{i} + 50\hat{j}$ km h^{-1} where $\hat{i}$ points east and $\hat{j}$, north. The ship B is at a distance of 80 km east and 150 km north of Ship A and is sailing towards the west at 10 km h^{-1}. A will be at the minimum distance from B in:

(A) 4.2 h

(B) 3.2 h

(C) 2.6 h

(D) 2.2 h

Answer: (C) 2.6 h · Key from source paper

Q253 JEE Main 2019 · 8 Apr · Shift 2 MCQ

Let $\overrightarrow{A_1} = 3$, $\overrightarrow{A_2} = 5$ and $\overrightarrow{A_1} + \overrightarrow{A_2} = 5$. The value of $2\overrightarrow{A_1} + 3\overrightarrow{A_2} \cdot 3\overrightarrow{A_1} - 2\overrightarrow{A_2}$ is:

(A) -112.5

(B) -118.5

(C) -106.5

(D) -99.5

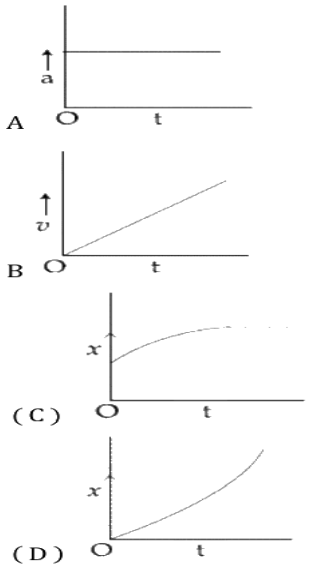
Answer: (B) -118.5 · Key from source paper

Q254 JEE Main 2019 · 8 Apr · Shift 2 MCQ

A particle starts from origin O from rest and moves with a uniform acceleration along the positive x - axis . Identify all figures that correctly represent the motion qualitatively.
(a = acceleration, v = velocity, x = dispalcement, t = time)

(see the figure above)

Q4. A particle starts from origin O from rest and moves with a uniform acceleration along the positive x - axis . Identify all figures that correctly represent the motion qualitatively.
(a = acceleration, v = velocity, x = dispalcement, t = time)



(1) A, B, (D)
(2) A, B, (C)
(3) B, (C)
(4) (A)

(A) A, B, (D)
(B) A, B, (C)
(C) B, (C)
(D) (A)

Answer: (A) A, B, (D) · Key from source paper

Q255 JEE Main 2019 · 12 Jan · Shift 1 MCQ

A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60° with ground level, but he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is:

(A) $\frac{2v}{\sqrt{3}}$
(B) v
(C) $\frac{v}{2}$
(D) $\frac{\sqrt{3}}{2}v$

Answer: (C) $\frac{v}{2}$ · Key from source paper

Q256 JEE Main 2019 · 12 Jan · Shift 1 MCQ

A passenger train of length 60 m travels at a speed of 80 km/hr. Another freight train of length 120 m travels at a speed of 30 km/hr. The ratio of times taken by the passenger train to completely cross the freight train when: (i) they are moving in the same direction, and (ii) in the opposite directions is:

(A) $\frac{5}{2}$
(B) $\frac{3}{2}$
(C) $\frac{11}{5}$
(D) $\frac{25}{11}$

Answer: (C) $\frac{11}{5}$ · Key from source paper

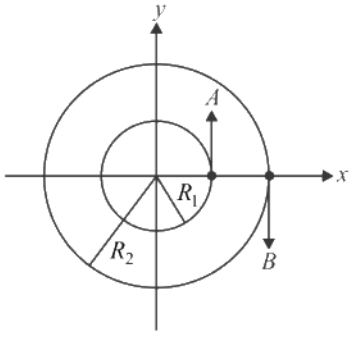
Q257 JEE Main 2019 · 12 Jan · Shift 2 MCQ

Two particles A, B are moving on two concentric circles of radii R_1 and R_2 with equal angular speed ω. At $t = 0$, their positions and direction of motion are shown in the figure:

(see the figure above)

The relative velocity $\overrightarrow{V_A} - \overrightarrow{V_B}$ at $t = \frac{\pi}{2\omega}$ is given by:

Q2. Two particles A, B are moving on two concentric circles of radii R_1 and R_2 with equal angular speed ω. At $t = 0$, their positions and direction of motion are shown in the figure:



The relative velocity $\overrightarrow{V_A} - \overrightarrow{V_B}$ at $t = \frac{\pi}{2\omega}$ is given by:

(1) $\omega\,(R_1 + R_2)\hat{i}$
(2) $-\omega\,(R_1 + R_2)\hat{i}$
(3) $\omega\,(R_2 - R_1)\hat{i}$
(4) $\omega\,(R_1 - R_2)\hat{i}$

(A) $\omega\,(R_1 + R_2)\hat{i}$
(B) $-\omega\,(R_1 + R_2)\hat{i}$
(C) $\omega\,(R_2 - R_1)\hat{i}$
(D) $\omega\,(R_1 - R_2)\hat{i}$

Answer: (C) $\omega\,(R_2 - R_1)\hat{i}$ · Checked by our team

Q258 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A particle is moving along a circular path with a constant speed of 10 ms^{-1}. What is the magnitude of the change in velocity of the particle, when it moves through an angle of 60° around the centre of the

circle?

(A) $10\sqrt{3}$ m/s
(B) zero
(C) $10\sqrt{2}$ m/s
(D) 10 m/s

Answer: (D) 10 m/s · Key from source paper

Q259 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A body is projected at $t = 0$ with a velocity 10 ms^{-1} at an angle of 60° with the horizontal. The radius of curvature of its trajectory at $t = 1$ s is R. Neglecting air resistance and taking acceleration due to gravity g = 10 ms^{-2}, the value of R is:

(A) 10.3 m
(B) 2.8 m
(C) 2.5 m
(D) 5.1 m

Answer: (B) 2.8 m · Key from source paper

Q260 JEE Main 2019 · 11 Jan · Shift 2 MCQ

A particle moves from the point $(2.0\hat{i} + 4.0\hat{j})$m, at t = 0, with an initial velocity $(5.0\hat{i} + 4.0\hat{j})ms^{-1}$. It is acted upon by a constant force which produces a constant acceleration $(4.0\hat{i} + 4.0\hat{j})ms^{-2}$. What is the distance of the particle from the origin at time 2 s?

(A) 15 m
(B) $20\sqrt{2}$ m
(C) 5 m
(D) $10\sqrt{2}$ m

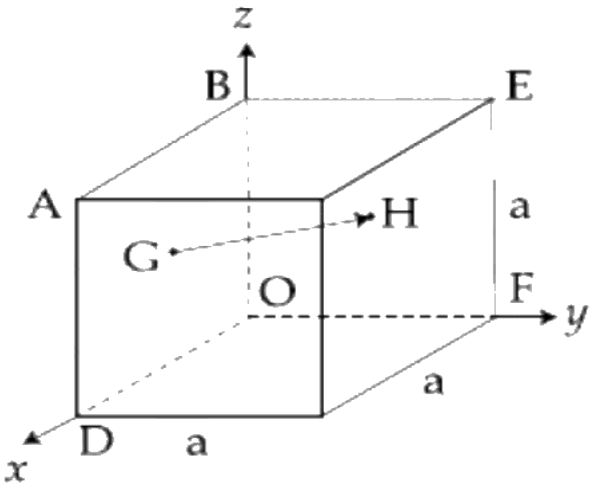
Answer: (B) $20\sqrt{2}$ m · Key from source paper

Q261 JEE Main 2019 · 10 Jan · Shift 1 MCQ

In the cube of side 'a' shown in the figure, the vector from the central point of the face $ABOD$ to the central point of the face $BEFO$ will be:

(see the figure above)

Q1. In the cube of side 'a' shown in the figure, the vector from the central point of the face $ABOD$ to the central point of the face $BEFO$ will be:



(1) $\frac{1}{2}a\left(\hat{k}-\hat{i}\right)$
(2) $\frac{1}{2}a\left(\hat{i}-\hat{k}\right)$
(3) $\frac{1}{2}a\left(\hat{j}-\hat{i}\right)$
(4) $\frac{1}{2}a\left(\hat{j}-\hat{k}\right)$

(A) $\frac{1}{2}a\left(\hat{k}-\hat{i}\right)$
(B) $\frac{1}{2}a\left(\hat{i}-\hat{k}\right)$
(C) $\frac{1}{2}a\left(\hat{j}-\hat{i}\right)$
(D) $\frac{1}{2}a\left(\hat{j}-\hat{k}\right)$

Answer: (C) $\frac{1}{2}a\left(\hat{j}-\hat{i}\right)$ · Key from source paper

Q262 JEE Main 2019 · 10 Jan · Shift 1 MCQ

Two guns A and B can fire bullets at speeds $1\ km/s$ and $2\ km/s$ respectively. From a point on a horizontal ground, they are fired in all possible directions. The ratio of maximum areas covered by the bullets fired by the two guns, on the ground is:

(A) $1:16$
(B) $1:2$
(C) $1:4$
(D) $1:8$

Answer: (A) $1:16$ · Key from source paper

Q263 JEE Main 2019 · 10 Jan · Shift 2 MCQ

Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. The magnitude of $\left(\vec{A}+\vec{B}\right)$ is ' n ' times the magnitude of $\left(\vec{A}-\vec{B}\right)$. The angle between $\vec{A}$ and $\vec{B}$ is:

(A) $\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

(B) $\sin^{-1}\left[\frac{n-1}{n+1}\right]$

(C) $\cos^{-1}\left[\frac{n-1}{n+1}\right]$

(D) $\sin^{-1}\left[\frac{n^2-1}{n^2+1}\right]$

Answer: (A) $\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ · Key from source paper

Q264 JEE Main 2019 · 10 Jan · Shift 2 MCQ

Two forces P and Q, of magnitude $2F$ and $3F$, respectively, are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle θ is:

(A) 120°

(B) 60°

(C) 30°

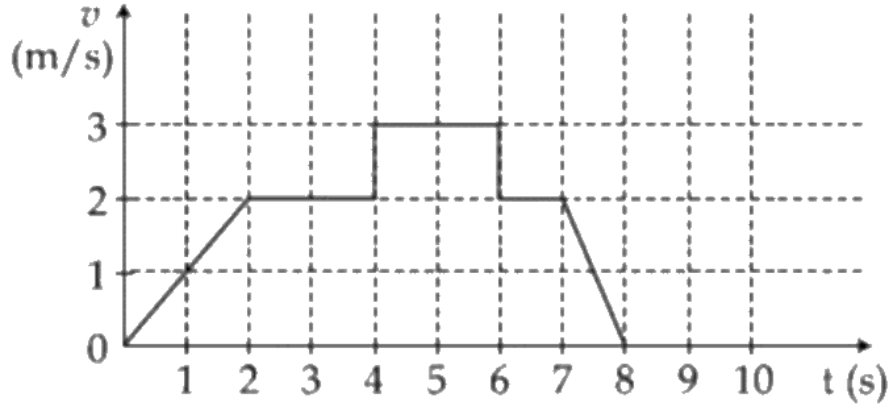
(D) 90°

Answer: (A) 120° · Key from source paper

Q265 JEE Main 2019 · 10 Jan · Shift 2 MCQ

A particle starts from the origin at time $t = 0$ and moves along the positive x-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time $t = 5s$? *(see the figure above)*

Q4. A particle starts from the origin at time $t = 0$ and moves along the positive x-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time $t = 5s$?



(1) $10\ m$

(2) $9\ m$

(3) $6m$

(4) $3m$

(A) $10\ m$
(B) $9\ m$
(C) $6m$
(D) $3m$

Answer: (B) $9\ m$ · Key from source paper

Q266 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A particle is moving with a velocity $\overrightarrow{v} = Ky\hat{i} + x\hat{j}$, where K is a constant. The general equation for its path is:

(A) $y^2 = x + \text{constant}$
(B) $xy = \text{constant}$
(C) $y = x^2 + \text{constant}$
(D) $y^2 = x^2 + \text{constant}$

Answer: (D) $y^2 = x^2 + \text{constant}$ · Key from source paper

Q267 JEE Main 2019 · 9 Jan · Shift 2 MCQ

The position co-ordinates of a particle moving in a $3D$ coordinate system is given by
$x = a\cos\omega t$
$y = a\sin\omega t$
and $z = a\omega t$
The speed of the particle is:

(A) $\sqrt{2}\,a\omega$
(B) $a\omega$
(C) $2a\omega$
(D) $\sqrt{3}\,a\omega$

Answer: (A) $\sqrt{2}\,a\omega$ · Key from source paper

Q268 JEE Main 2019 · 9 Jan · Shift 2 MCQ

In a car race on straight road, car A takes a time t less than car B at the finish and passes finishing point with a speed v more than that of car B. Both the cars start from rest and travel with constant acceleration a_1 and a_2 respectively. Then v is equal to:

(A) $\frac{2a_1a_2}{a_1+a_2}t$
(B) $\frac{a_1+a_2}{2}t$
(C) $\sqrt{a_1a_2}\,t$
(D) $\sqrt{2a_1a_2}\,t$

Answer: (C) $\sqrt{a_1a_2}\,t$ · Key from source paper

Q269 JEE Main 2018 · 16 Apr · Online MCQ

Let $\vec{A}=(\hat{i}+\hat{j})$ and $\vec{B}=(2\hat{i}-\hat{j})$. The magnitude of a coplanar vector $\vec{C}$ such that $\vec{A}\cdot\vec{C}=\vec{B}\cdot\vec{C}=\vec{A}\cdot\vec{B}$ is given by:

(A) $\sqrt{\frac{9}{12}}$
(B) $\sqrt{\frac{20}{9}}$
(C) $\sqrt{\frac{5}{9}}$
(D) $\sqrt{\frac{10}{9}}$

Answer: (C) $\sqrt{\frac{5}{9}}$ · Key from source paper

Q270 JEE Main 2018 · 16 Apr · Online MCQ

A body of mass m starts moving from rest along x-axis so that its velocity varies as $v=a\sqrt{s}$ where a is a constant and s is the distance covered by the body. The total work done by all the forces acting on the body in the first t second after the start of the motion is

(A) $8\,ma^4t^2$
(B) $\frac{1}{4}\,ma^4t^2$
(C) $4\,ma^4t^2$
(D) $\frac{1}{8}\,ma^4t^2$

Answer: (D) $\frac{1}{8}\,ma^4t^2$ · Key from source paper

Q271 JEE Main 2018 · 15 Apr · Shift 1 MCQ

An automobile, travelling at $40\ \mathrm{km/h}$, can be stopped at a distance of $40\ \mathrm{m}$ by applying brakes. If the same automobile is travelling at $80\ \mathrm{km/h}$, the minimum stopping distance, in metres, is (assume no skidding)

(A) $75\ \mathrm{m}$
(B) $160\ \mathrm{m}$
(C) $100\ \mathrm{m}$
(D) $150\ \mathrm{m}$

Answer: (B) $160\ \mathrm{m}$ · Key from source paper

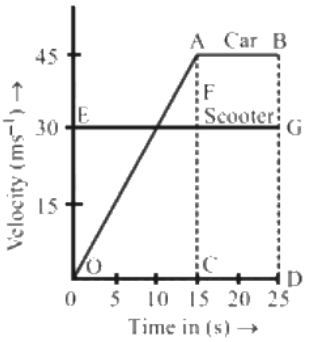
Q272 JEE Main 2018 · 15 Apr · Shift 1 MCQ

The velocity-time graphs of a car and a scooter are shown in the figure. (i) the difference between the distance travelled by the car and the scooter in 15 s and (ii) the time at which the car will catch up with the scooter are,

(see the figure above)

respectively

Q3. The velocity-time graphs of a car and a scooter are shown in the figure. (i) the difference between the distance travelled by the car and the scooter in 15 s and (ii) the time at which the car will catch up with the scooter are,



respectively

(1) 337.5 m and 25 s
(2) 225.5 m and 10 s
(3) 112.5 m and 22.5 s
(4) 112.5 m and 15 s

(A) 337.5 m and 25 s
(B) 225.5 m and 10 s
(C) 112.5 m and 22.5 s
(D) 112.5 m and 15 s

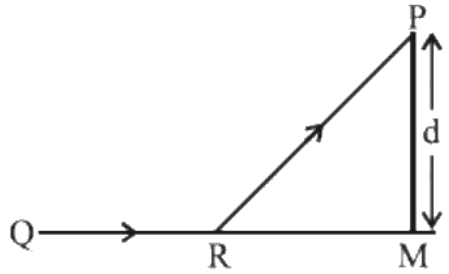
Answer: (C) 112.5 m and 22.5 s · Key from source paper

Q273 JEE Main 2018 · 15 Apr · Shift 2 MCQ

A man in a car at location Q on a straight highway is moving with speed v. He decides to reach a point P in a field at a distance d from highway (point M) as shown in the figure. Speed of the car in the field is half to that on the highway. What should be the distance RM, so that the time taken to reach P is minimum?

(see the figure above)

Q2. A man in a car at location Q on a straight highway is moving with speed v. He decides to reach a point P in a field at a distance d from highway (point M) as shown in the figure.Speed of the car in the field is half to that on the highway. What should be the distance RM, so that the time taken to reach P is minimum?



(1) $\frac{d}{\sqrt{3}}$
(2) $\frac{d}{2}$
(3) $\frac{d}{\sqrt{2}}$
(4) d

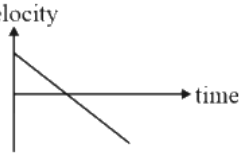
(A) $\frac{d}{\sqrt{3}}$
(B) $\frac{d}{2}$
(C) $\frac{d}{\sqrt{2}}$
(D) d

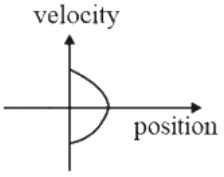
Answer: (A) $\frac{d}{\sqrt{3}}$ · Key from source paper

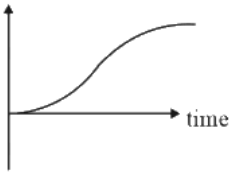
Q274 JEE Main 2018 · 8 Apr · Offline MCQ

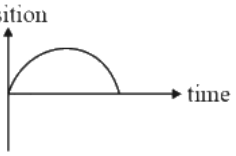
All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.

Q2. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q275 JEE Main 2017 · 9 Apr · Online MCQ

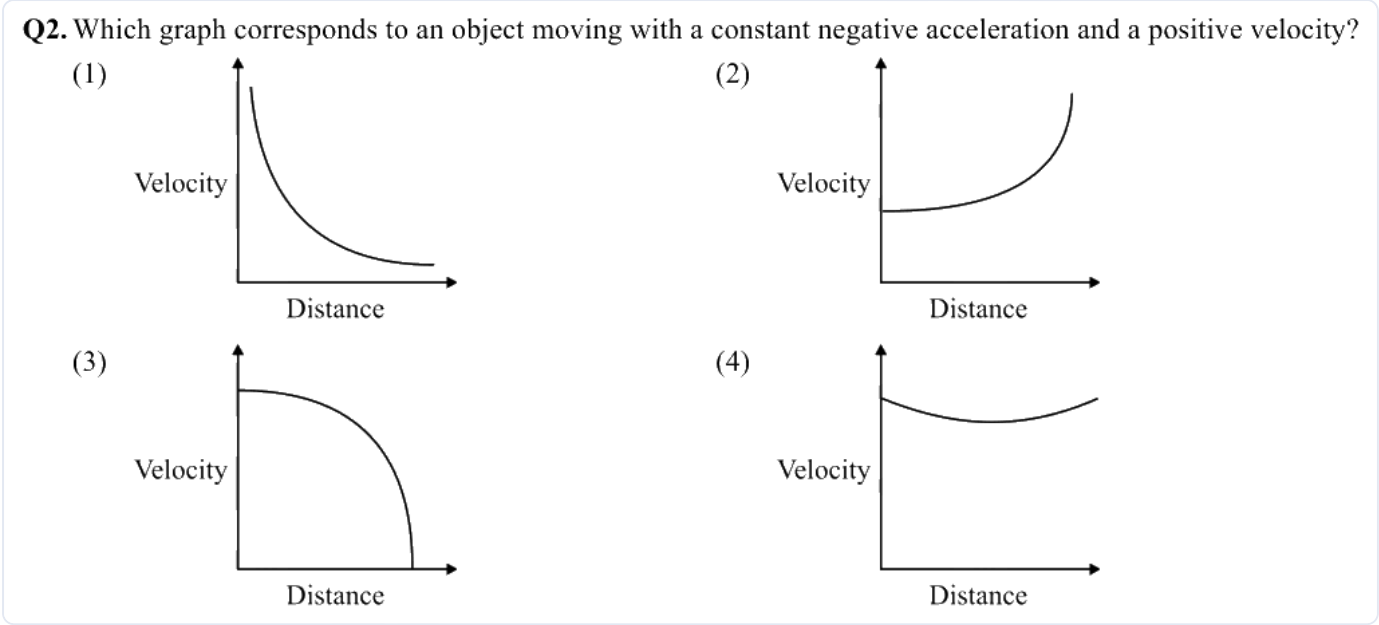
A car is standing 200 m behind a bus, which is also at rest. The two start moving at the same instant but with different forward accelerations. The bus has acceleration $2\ \mathrm{m\,s^{-2}}$ and the car has acceleration $4\ \mathrm{m\,s^{-2}}$. The car will catch up with the bus after time :

(A) $\sqrt{120}$ s
(B) 15 s
(C) $\sqrt{110}$ s
(D) $10\sqrt{2}$ s

Answer: (D) $10\sqrt{2}$ s · Key from source paper

Q276 JEE Main 2017 · 8 Apr · Online MCQ

Which graph corresponds to an object moving with a constant negative acceleration and a positive velocity?



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

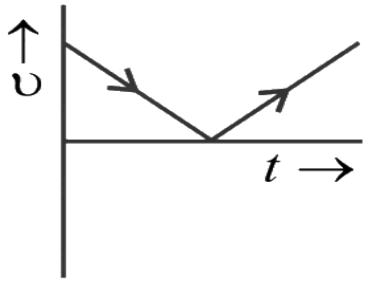
Answer: (C) · Key from source paper

Q277 JEE Main 2017 · 2 Apr · Offline MCQ

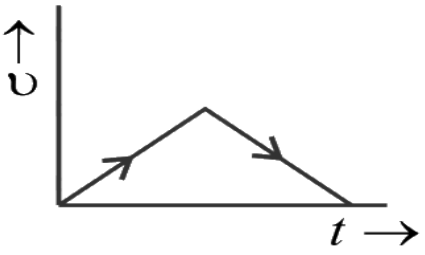
A body is thrown vertically upwards. Which one of the following graphs correctly represents the velocity v vs time t?

Q2. A body is thrown vertically upwards. Which one of the following graphs correctly represents the velocity v vs time t?

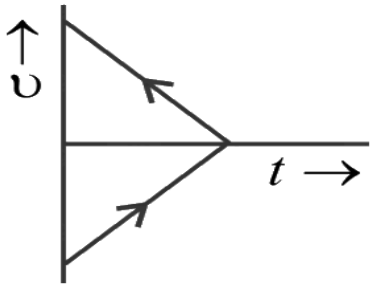
(1)



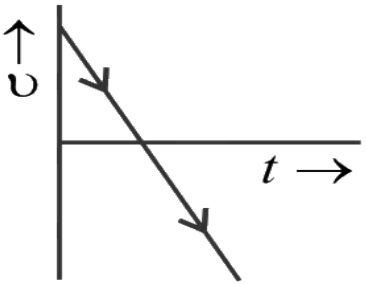
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (D) · Key from source paper

Q278 JEE Main 2017 · 2 Apr · Offline MCQ

A body of mass $m = 10^{-2}$ kg is moving in a medium and experiences a frictional force $F = -kv^2$. Its initial speed is $v_0 = 10\ \text{m s}^{-1}$. After 10 s its kinetic energy is $\frac{1}{8}mv_0^2$, then value of k will be:-

(A) $10^{-1}\ \text{kg m}^{-1}\ \text{s}^{-1}$

(B) $10^{-3}\ \text{kg m}^{-1}$

(C) $10^{-3}\ \text{kg s}^{-1}$

(D) $10^{-4}\ \text{kg m}^{-1}$

Answer: (D) $10^{-4}\ \text{kg m}^{-1}$ · Key from source paper

Q279 JEE Main 2016 · 10 Apr · Online MCQ

A particle of mass m is acted upon by a force F given by the empirical law $F = \frac{R}{t^2}\,v(t)$. If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot

(A) $\log v(t)$ against $\frac{1}{t}$
(B) $v(t)$ against t^2
(C) $\log v(t)$ against $\frac{1}{t^2}$
(D) $\log v(t)$ against t

Answer: (A) $\log v(t)$ **against** $\frac{1}{t}$ · Key from source paper

Q280 JEE Main 2016 · 10 Apr · Online MCQ

A particle of mass M is moving in a circle of fixed radius R in such a way that its centripetal acceleration at time t is given by n^2Rt^2, where n is a constant. The power delivered to the particle by the force acting on it, is :

(A) $\frac{1}{2}Mn^2R^2t^2$
(B) Mn^2R^2t
(C) MnR^2t^2
(D) MnR^2t

Answer: (B) Mn^2R^2t · Key from source paper

Q281 JEE Main 2015 · 11 Apr · Online MCQ

A vector $\vec{A}$ is rotated by a small angle $\Delta\theta$ radians ($\Delta\theta \ll 1$) to get a new vector $\vec{B}$. In that case $|\vec{B} - \vec{A}|$ is :

(A) $|\vec{A}|\left[1 - \frac{(\Delta\theta)^2}{2}\right]$
(B) 0
(C) $|\vec{A}|\,\Delta\theta$
(D) $|\vec{B}|\,\Delta\theta - |\vec{A}|$

Answer: (C) $|\vec{A}|\,\Delta\theta$ · Key from source paper

Q282 JEE Main 2015 · 11 Apr · Online MCQ

From the top of a 64 metres high tower, a stone is thrown upwards vertically with the velocity of 48 m/s. The greatest height (in metres) attained by the stone, assuming the value of the gravitational acceleration $g = 32$ m/s^2, is:

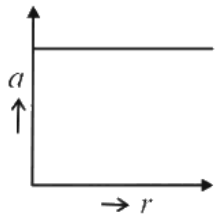
(A) 112
(B) 88
(C) 128
(D) 100

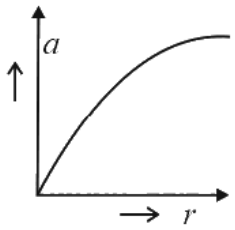
Answer: (D) 100 · Key from source paper

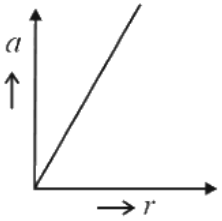
Q283 JEE Main 2015 · 10 Apr · Online MCQ

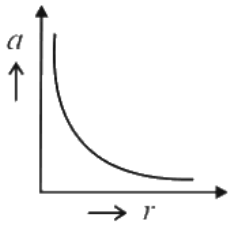
If a body moving in a circular path maintains constant speed of $10\ \mathrm{m\,s^{-1}}$, then which of the following correctly describes the relation between acceleration and radius?

Q4. If a body moving in a circular path maintains constant speed of $10\ \mathrm{m\,s^{-1}}$, then which of the following correctly describes the relation between acceleration and radius?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

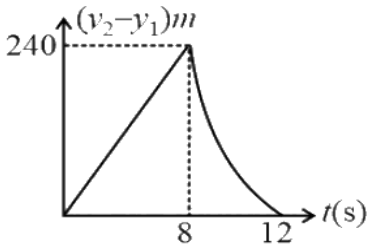
Answer: (D) · Key from source paper

Q284 JEE Main 2015 · 4 Apr · Offline MCQ

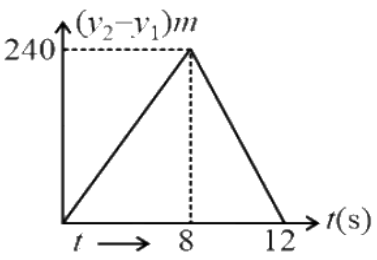
Two stones are thrown up simultaneously from the edge of a cliff $240\ \mathrm{m}$ high with an initial speed of $10\ \mathrm{m\,s^{-1}}$ and $40\ \mathrm{m\,s^{-1}}$ respectively. Which of the following graph best represents the time variation of the relative position of the second stone with respect to the first? (Assume stones do not rebound after hitting the ground and neglect air resistance, take $g = 10\ \mathrm{m\,s^{-2}}$)(the figure are schematic and not drawn to scale)

Q2. Two stones are thrown up simultaneously from the edge of a cliff 240 m high with an initial speed of 10 m s^{-1} and 40 m s^{-1} respectively. Which of the following graph best represents the time variation of the relative position of the second stone with respect to the first? (Assume stones do not rebound after hitting the ground and neglect air resistance, take $g = 10\ ms^{-2}$)(the figure are schematic and not drawn to scale)

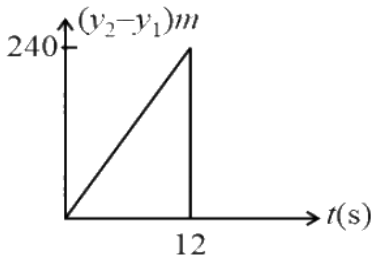
(1)



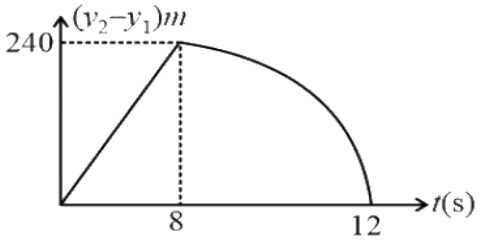
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (D) · Key from source paper

Q285 JEE Main 2014 · 19 Apr · Online MCQ

A bullet loses $\left(\frac{1}{n}\right)^{\text{th}}$ of its velocity passing through one plank. Considering uniform retardation, the number of such planks that are required to stop the bullet can be:

(A) Infinite

(B) n

(C) $\frac{n^2}{(2n-1)}$

(D) $\frac{2n^2}{(n-1)}$

Answer: (C) $\frac{n^2}{(2n-1)}$ · Key from source paper

Q286 JEE Main 2014 · 12 Apr · Online MCQ

A person climbs up a stalled escalator in 60 s. If standing on the same but escalator running with constant velocity he takes 40 s. How much time is taken by the person to walk up the moving escalator?

(A) $37\ \text{s}$
(B) $27\ \text{s}$
(C) $24\ \text{s}$
(D) $45\ \text{s}$

Answer: (C) $24\ \text{s}$ · Key from source paper

Q287 JEE Main 2014 · 11 Apr · Online MCQ

The initial speed of a bullet fired from a rifle is $630\ \text{m/s}$. The rifle is fired at the centre of a target $700\ \text{m}$ away at the same level as the target. How far above the centre of the target ?

(A) $1.0\ \text{m}$
(B) $4.2\ \text{m}$
(C) $6.1\ \text{m}$
(D) $9.8\ \text{m}$

Answer: (C) $6.1\ \text{m}$ · Key from source paper

Q288 JEE Main 2014 · 9 Apr · Online MCQ

The position of a projectile launched from the origin at t = 0 is given by $\vec{r} = \left(40\,\hat{i} + 50\,\hat{j}\right)\ \text{m}$ at t = 2s. If the projectile was launched at an angle θ from the horizontal, then θ is (take g = 10 ms^{-2}).

(A) $\tan^{-1}\frac{3}{2}$
(B) $\tan^{-1}\frac{2}{3}$
(C) $\tan^{-1}\frac{7}{4}$
(D) $\tan^{-1}\frac{4}{5}$

Answer: (C) $\tan^{-1}\frac{7}{4}$ · Key from source paper

Q289 JEE Main 2014 · 6 Apr · Offline MCQ

From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is :

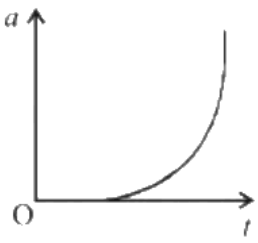
(A) $2\,gH = n^2u^2$
(B) $gH = (n-2)^2u^2$
(C) $2gH = nu^2(n-2)$
(D) $gH = (n-2)u^2$

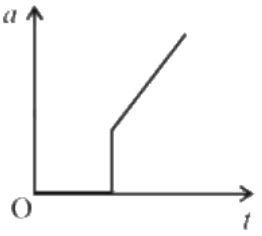
Answer: (C) $2gH = nu^2(n-2)$ · Key from source paper

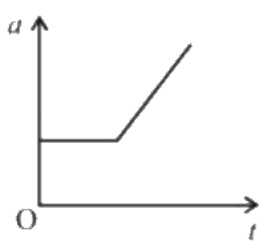
Q290 JEE Main 2013 · 25 Apr · Online MCQ

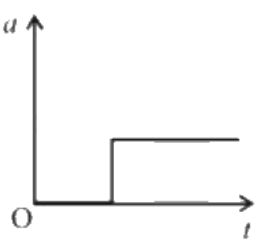
A block is placed on a rough horizontal plane. A time dependent horizontal force $F = kt$ acts on the block, where k is a positive constant. The acceleration - time graph of the block is :

Q1. A block is placed on a rough horizontal plane. A time dependent horizontal force $\mathrm{F} = \mathrm{kt}$ acts on the block, where k is a positive constant. The acceleration - time graph of the block is :

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q291 JEE Main 2013 · 25 Apr · Online MCQ

The maximum range of a bullet fired from a toy pistol mounted on a car at rest is $R_0 = 40$ m. What will be the acute angle of inclination of the pistol for maximum range when the car is moving in the direction of firing with uniform velocity $v = 20$ m/s on a horizontal surface? ($g = 10$ m/s^2)

(A) 30°
(B) 60°
(C) 75°
(D) 45°

Answer: (B) 60° · Key from source paper

Q292 JEE Main 2013 · 22 Apr · Online MCQ

A ball projected from ground at an angle of 45° just clears a wall in front. If point of projection is $4\ \mathrm{m}$ from the foot of wall and ball strikes the ground at a distance of $6\ \mathrm{m}$ on the other side of the wall, the height of the wall is :

(A) $4.4\ \text{m}$

(B) $2.4\ \text{m}$

(C) $3.6\ \text{m}$

(D) $1.6\ \text{m}$

Answer: (B) $2.4\ \text{m}$ · Key from source paper

Q293 JEE Main 2013 · 7 Apr · Offline MCQ

A projectile is given an initial velocity of $\left(\hat{i}+2\hat{j}\right)\ \text{m s}^{-1}$, where $\hat{i}$ is along the ground and $\hat{j}$ is along the vertical upward. If $g = 10\ \text{m s}^{-2}$, the equation of its trajectory is :

(A) $4y = 2x - 5x^2$

(B) $4y = 2x - 25x^2$

(C) $y = x - 5x^2$

(D) $y = 2x - 5x^2$

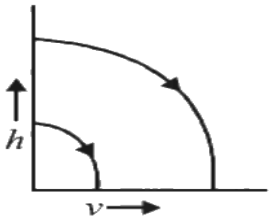
Answer: (D) $y = 2x - 5x^2$ · Key from source paper

Q294 AIEEE 2012 · 26 May · Online MCQ

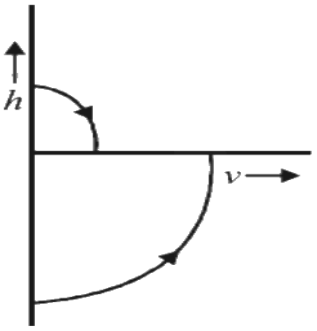
A ball is dropped vertically downwards from a height h above the ground. It hits the ground inelastically and bounces up vertically. Neglecting subsequent motion and air resistance, which of the following graph represents variation between speed (v) and height (h) correctly?

Q2. A ball is dropped vertically downwards from a height h above the ground. It hits the ground inelastically and bounces up vertically. Neglecting subsequent motion and air resistance, which of the following graph represents variation between speed (v) and height (h) correctly?

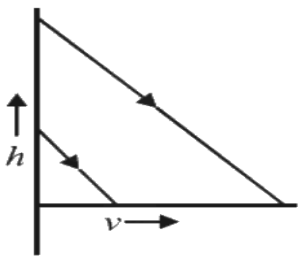
(1)



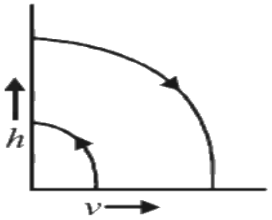
(2)



(3)



(4)



(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q295 AIEEE 2012 · 19 May · Online MCQ

A goods train accelerating uniformly on a straight railway track, approaches an electric pole standing on the side of track. Its engine passes the pole with velocity u and the guard's room passes with velocity v. The middle wagon of the train passes the pole with a velocity.

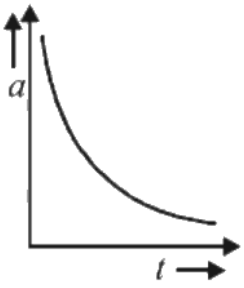
(A) $\frac{u+v}{2}$
(B) $\frac{1}{2}\sqrt{u^2+v^2}$
(C) $\sqrt{uv}$
(D) $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$

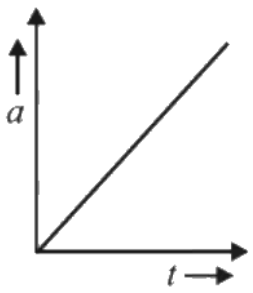
Answer: (D) $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$ · Key from source paper

Q296 AIEEE 2012 · 12 May · Online MCQ

The distance travelled by a body moving along a line in time t is proportional to t^3. The acceleration-time (a, t) graph for the motion of the body will be

Q2. The distance travelled by a body moving along a line in time t is proportional to t^3. The acceleration-time (a, t) graph for the motion of the body will be

(1)


(2)


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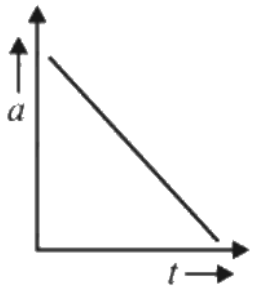

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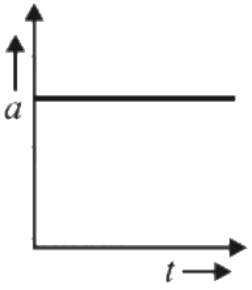


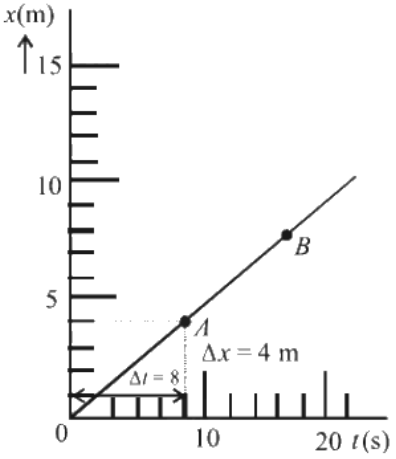
(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q297 AIEEE 2012 · 7 May · Online MCQ

The graph of an object's motion (along the $x-$ axis) is shown in the figure. The instantaneous velocity of the object at points A and B are v_A and v_B respectively. Then
(see the figure above)

Q2. The graph of an object's motion (along the $x-$ axis) is shown in the figure. The instantaneous velocity of the object at points A and B are v_A and v_B respectively. Then



(1) $v_A = v_B = 0.5$ m/s
(2) $v_A = 0.5$ m/s $< v_B$
(3) $v_A = 0.5$ m/s $> v_B$
(4) $v_A = v_B = 2$ m/s

(A) $v_A = v_B = 0.5\ \mathrm{m/s}$
(B) $v_A = 0.5\ \mathrm{m/s} < v_B$
(C) $v_A = 0.5\ \mathrm{m/s} > v_B$
(D) $v_A = v_B = 2\ \mathrm{m/s}$

Answer: (A) $v_A = v_B = 0.5\ \mathrm{m/s}$ · Key from source paper

Q298 AIEEE 2012 · 7 May · Online MCQ

A car of mass 1000 kg is moving at a speed of 30 m/s. Brakes are applied to bring the car to rest. If the net retarding force is 5000 N, the car comes to stop after travelling d m in t s. Then

(A) $d = 150, t = 5$
(B) $d = 120, t = 8$
(C) $d = 180, t = 6$
(D) $d = 90, t = 6$

Answer: (D) $d = 90, t = 6$ · Key from source paper

Q299 AIEEE 2012 · Offline MCQ

A boy can throw a stone up to a maximum height of $10\ \mathrm{m}$. The maximum horizontal distance that the boy can throw the same stone to will be

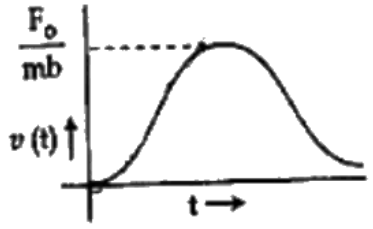
(A) $20\sqrt{2}\ \mathrm{m}$
(B) $10\ \mathrm{m}$
(C) $10\sqrt{2}\ \mathrm{m}$
(D) $20\ \mathrm{m}$

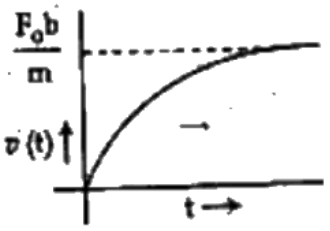
Answer: (D) $20\ \mathrm{m}$ · Key from source paper

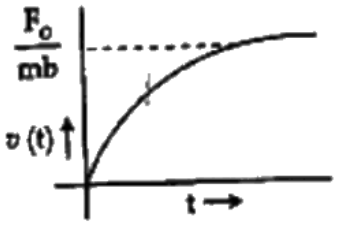
Q300 AIEEE 2012 · Offline MCQ

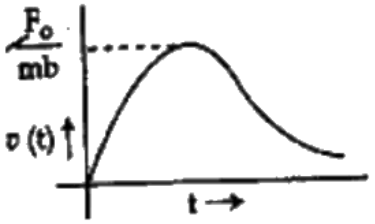
A particle of mass m is at rest at the origin at time $\mathrm{t} = 0$. It is subjected to a force $\mathrm{F}(t) = \mathrm{F}_0\mathrm{e}^{-\mathrm{bt}}$ in the x direction. Its speed $v(t)$ is depicted by which of the following curves?

Q3. A particle of mass m is at rest at the origin at time $\mathrm{t} = 0$. It is subjected to a force $\mathrm{F}(\mathrm{t}) = \mathrm{F}_0\mathrm{e}^{-\mathrm{bt}}$ in the x direction. Its speed $v(t)$ is depicted by which of the following curves?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (C) · Key from source paper

Q301 AIEEE 2012 · Offline MCQ

Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2, respectively. Their speeds are such that they make complete circles in the same time t. The ratio of their centripetal acceleration is

(A) $m_1 r_1 : m_2 r_2$

(B) $m_1 : m_2$

(C) $r_1 : r_2$

(D) $1 : 1$

Answer: (C) $r_1 : r_2$ · Key from source paper

Q302 AIEEE 2011 MCQ

An object, moving with a speed of $6.25\ \mathrm{m/s}$, is decelerated at a rate given by :

$$\frac{dv}{dt} = -2.5\sqrt{v}$$

where v is the instantaneous speed. The time taken by the object, to come to rest, would be:

(A) $2\ \mathrm{s}$

(B) $4\ \mathrm{s}$

(C) $8\ \mathrm{s}$

(D) $1\ \mathrm{s}$

Answer: (A) $2\ \mathrm{s}$ · Key from source paper

Q303 AIEEE 2011 MCQ

A water fountain on the ground sprinkles water all around it. If the speed of water coming out of the fountain is v, the total area around the fountain that gets wet is :

(A) $\pi \frac{v^4}{g^2}$

(B) $\frac{\pi}{2} \frac{v^4}{g^2}$

(C) $\pi \frac{v^2}{g^2}$

(D) $\pi \frac{v^4}{g}$

Answer: (A) $\pi \frac{v^4}{g^2}$ · Key from source paper

Q304 AIEEE 2010 MCQ

A particle is moving with velocity $\overrightarrow{v} = K(y\hat{i} + x\hat{j})$, where K is a constant. The general equation for its path is

(A) $y = x^2 + \text{constant}$

(B) $y^2 = x + \text{constant}$

(C) $xy = \text{constant}$

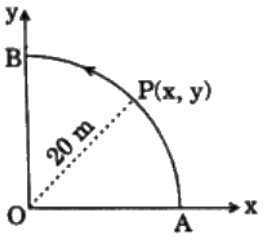
(D) $y^2 = x^2 + \text{constant}$

Answer: (D) $y^2 = x^2 + \text{constant}$ · Key from source paper

Q305 AIEEE 2010 MCQ

A point P moves in counter-clockwise direction on a circular path as shown in the figure. The movement of ' P ' is such that it sweeps out a length $s = t^3 + 5$, where s is in metres and t is in seconds. The radius of the path is 20 m. The acceleration of ' P ' when $t = 2$ s is nearly
(see the figure above)

Q8. A point P moves in counter-clockwise direction on a circular path as shown in the figure. The movement of ' P ' is such that it sweeps out a length $s = t^3 + 5$, where s is in metres and t is in seconds. The radius of the path is



20 m. The acceleration of ' P ' when $t = 2$ s is nearly

(1) $13\ \mathrm{m/s^2}$ (2) $12\ \mathrm{m/s^2}$
(3) $7.2\ \mathrm{m/s^2}$ (4) $14\ \mathrm{m/s^2}$

(A) $13\ \mathrm{m/s^2}$
(B) $12\ \mathrm{m/s^2}$
(C) $7.2\ \mathrm{m/s^2}$
(D) $14\ \mathrm{m/s^2}$

Answer: (D) $14\ \mathrm{m/s^2}$ · Key from source paper

Q306 AIEEE 2010 MCQ

For a particle in uniform circular motion the acceleration $\vec{a}$ at a point $P(R, \theta)$ on the circle of radius R is (here θ is measured from the x-axis)

(A) $-\frac{v^2}{R}\cos\theta\,\hat{i} + \frac{v^2}{R}\sin\theta\,\hat{j}$
(B) $-\frac{v^2}{R}\sin\theta\,\hat{i} + \frac{v^2}{R}\cos\theta\,\hat{j}$
(C) $-\frac{v^2}{R}\cos\theta\,\hat{i} - \frac{v^2}{R}\sin\theta\,\hat{j}$
(D) $\frac{v^2}{R}\hat{i} + \frac{v^2}{R}\hat{j}$

Answer: (C) $-\frac{v^2}{R}\cos\theta\,\hat{i} - \frac{v^2}{R}\sin\theta\,\hat{j}$ · Key from source paper

Q307 AIEEE 2009 MCQ

A particle has an initial velocity $3i + 4j$ and an acceleration of $0.4i + 0.3j$. Its speed after 10 s is

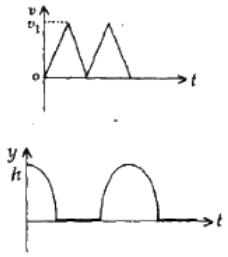
(A) 10 units
(B) $7\sqrt{2}$ units
(C) 7 units
(D) 8.5 units

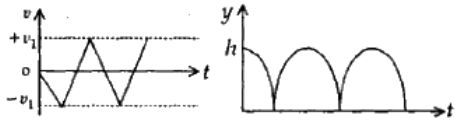
Answer: (B) $7\sqrt{2}$ units · Key from source paper

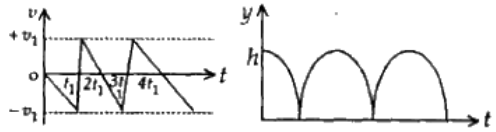
Q308 AIEEE 2009 MCQ

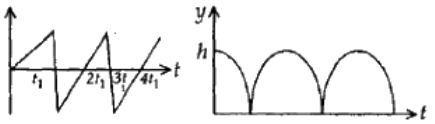
Consider a rubber ball freely falling from a height $h = 4.9$ m onto a horizontal elastic plate. Assume that the duration of collision is negligible and the collision with the plate is totally elastic. Then the velocity as a function of time the height as function of time will be

Q2. Consider a rubber ball freely falling from a height $h = 4.9$ m onto a horizontal elastic plate. Assume that the duration of collision is negligible and the collision with the plate is totally elastic. Then the velocity as a function of time the height as function of time will be

(1) 

(2) 

(3) 

(4) 

(A) *see figure*

(B) *see figure*

(C) *see figure*

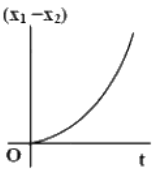
(D) *see figure*

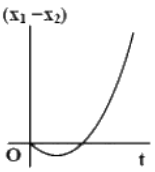
Answer: (C) · Key from source paper

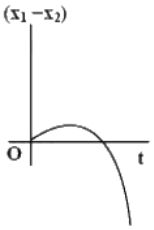
Q309 AIEEE 2008 MCQ

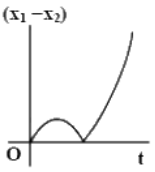
A body is at rest at $x = 0$. At $t = 0$, it starts moving in the positive x-direction with a constant acceleration. At the same instant another body passes through $x = 0$ moving in the positive x direction with a constant speed. The position of the first body is given by $x_1(t)$ after time ' t ' and that of the second body by $x_2(t)$ after the same time interval. Which of the following graphs correctly describes $(x_1 - x_2)$ as a function of time ' t '?

Q2. A body is at rest at $x = 0$. At $t = 0$, it starts moving in the positive x-direction with a constant acceleration. At the same instant another body passes through $x = 0$ moving in the positive x direction with a constant speed. The position of the first body is given by $x_1(t)$ after time ' t ' and that of the second body by $x_2(t)$ after the same time interval. Which of the following graphs correctly describes $(x_1 - x_2)$ as a function of time ' t '?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (B) · Key from source paper

Q310 AIEEE 2007 MCQ

The velocity of a particle is $v = v_0 + gt + ft^2$. If its position is $x = 0$ at $t = 0$, then its displacement after unit time ($t = 1$) is

(A) $v_0 + 2g + 3f$
(B) $v_0 + g/2 + f/3$
(C) $v_0 + g + f$
(D) $v_0 + g/2 + f$

Answer: (B) $v_0 + g/2 + f/3$ · Key from source paper

Q311 AIEEE 2007 MCQ

A particle is projected at 60° to the horizontal with a kinetic energy K. The kinetic energy at the highest point is

(A) K
(B) Zero
(C) K/2
(D) K/4

Answer: (D) K/4 · Key from source paper

Q312 AIEEE 2007 MCQ

A particle just clears a wall of height b at distance a and strikes the ground at a distance c from the point of projection. The angle of projection is

(A) $\tan^{-1}\frac{b}{ac}$
(B) 45°
(C) $\tan^{-1}\frac{bc}{a(c-a)}$
(D) $\tan^{-1}\frac{bc}{a}$

Answer: (C) $\tan^{-1}\frac{bc}{a(c-a)}$ · Key from source paper

Q313 AIEEE 2006 MCQ

A particle located at $x=0$ at time $t=0$, starts moving along the positive x-direction with a velocity ' v ' that varies as $v=\alpha\sqrt{x}$. The displacement of the particle varies with time as

(A) t^3
(B) t^2
(C) t
(D) $t^{1/2}$

Answer: (B) t^2 · Key from source paper

Q314 AIEEE 2006 MCQ

A body falling from rest under gravity passes a certain point P. It was at a distance of 400 m from P, 4 s prior to passing through P. If $g=10\ \mathrm{m/s^2}$, then the height above the point P from where the body began to fall is

(A) 720 m
(B) 900 m
(C) 320 m
(D) 680 m

Answer: (A) 720 m · Key from source paper

Q315 AIEEE 2005 MCQ

A particle is moving eastwards with a velocity of $5\ \mathrm{m/s}$ in 10 seconds the velocity changes to $5\ \mathrm{m/s}$ northwards. The average acceleration in this time is

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(A) $\frac{1}{\sqrt{2}}\ \mathrm{m/s^2}$ towards north-east
(B) $\frac{1}{2}\ \mathrm{m/s^2}$ towards north.
(C) zero
(D) $\frac{1}{\sqrt{2}}\ \mathrm{m/s^2}$ towards north-west

Answer: (D) $\frac{1}{\sqrt{2}}\ \mathrm{m/s^2}$ **towards north-west** · Key from source paper

Q316 AIEEE 2005 MCQ

The relation between time t and distance x is $\mathrm{t} = ax^2 + bx$ where a and b are constants. The acceleration is

(A) $-2abv^2$
(B) $2bv^3$
(C) $-2av^3$
(D) $2av^2$

Answer: (C) $-2av^3$ · Key from source paper

Q317 AIEEE 2005 MCQ

A car starting from rest accelerates at the rate f through a distance S, then continues at constant speed for time t and then decelerates at the rate $f/2$ to come to rest. If the total distance traversed is 15 S, then

(A) $S = ft$
(B) $\mathrm{S} = 1/6\mathrm{ft}^2$
(C) $\mathrm{S} = 1/2\mathrm{ft}^2$
(D) None of these

Answer: (D) None of these · Key from source paper

Q318 AIEEE 2005 MCQ

A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at $2\ \mathrm{m/s^2}$. He reaches the ground with a speed of $3\ \mathrm{m/s}$. At what height, did he bail out?

(A) 91 m
(B) 182 m
(C) 293 m
(D) 111 m

Answer: (C) 293 m · Key from source paper

Q319 AIEEE 2005 MCQ

Two points A and B move from rest along a straight line with constant acceleration f and f' respectively. If A takes m sec. more than B and describes ' n ' units more than B in acquiring the same speed then

(A) $(f-f')m^2 = ff'n$
(B) $(f+f')m^2 = ff'n$
(C) $\frac{1}{2}(f+f')m = ff'n^2$
(D) $(f'-f)n = \frac{1}{2}ff'm^2$

Answer: (D) $(f'-f)n = \frac{1}{2}ff'm^2$ · Key from source paper

Q320 AIEEE 2005 MCQ

A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flights in the two cases, then the product of the two time of flights is proportional to

(A) R^2
(B) $1/\mathrm{R}^2$
(C) $1/\mathrm{R}$
(D) R

Answer: (D) R · Key from source paper

Q321 AIEEE 2005 MCQ

A particle is projected from a point O with velocity u at an angle of 60° with the horizontal. When it is moving in a direction at right angles to its direction at O, its velocity then is given by

(A) $\frac{u}{3}$
(B) $\frac{u}{2}$
(C) $\frac{2u}{3}$
(D) $\frac{u}{\sqrt{3}}$

Answer: (D) $\frac{u}{\sqrt{3}}$ · Key from source paper

Q322 AIEEE 2005 MCQ

A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further will it penetrate before coming to rest assuming that it faces constant resistance to motion?

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(A) 3.0 cm
(B) 2.0 cm
(C) 1.5 cm
(D) 1.0 cm

Answer: (D) 1.0 cm · Key from source paper

Q323 AIEEE 2004 MCQ

If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, then the angle between A and B is

(A) π
(B) $\pi/3$
(C) $\pi/2$
(D) $\pi/4$

Answer: (A) π · Key from source paper

Q324 AIEEE 2004 MCQ

A ball is released from the top of a tower of height h metres. It takes T seconds to reach the ground. What is the position of the ball in T/3 seconds?

(A) h/9 metres from the ground
(B) 7 h/9 metres from the ground
(C) 8 h/9 metres from the ground
(D) 17 h/18 metres from the ground.

Answer: (C) 8 h/9 metres from the ground · Key from source paper

Q325 AIEEE 2004 MCQ

An automobile travelling with speed of 60 km/h, can brake to stop within a distance of 20 cm. If the car is going twice as fast, i.e 120 km/h, the stopping distance will be

(A) 20 m
(B) 40 m
(C) 60 m
(D) 80 m

Answer: (D) 80 m · Key from source paper

Q326 AIEEE 2004 MCQ

A ball is thrown from a point with a speed v_0 at an angle of projection θ. From the same point and at the same instant person starts running with a constant speed $v_0/2$ to catch the ball. Will the person be able to catch the ball? If yes, what should be the angle of projection?

(A) yes, 60°
(B) yes, 30°
(C) no
(D) yes, 45°

Answer: (A) yes, 60° · Key from source paper

Q327 AIEEE 2004 MCQ

A projectile can have the same range R for two angles of projection. If T_1 and T_2 be the time of flights in the two cases, then the product of the two time of flights is directly proportional to

(A) $1/R^2$
(B) $1/\mathrm{R}$
(C) R
(D) R^2

Answer: (C) R · Key from source paper

Q328 AIEEE 2004 MCQ

If t_1 and t_2 are the times of flight of two particles having the same initial velocity u and range R on the horizontal, then $\mathrm{t}_1^2 + \mathrm{t}_2^2$ is equal to

(A) $\frac{u^2}{g}$
(B) $\frac{4u^2}{g^2}$
(C) $\frac{u^2}{2g}$
(D) 1

Answer: (B) $\frac{4u^2}{g^2}$ · Key from source paper

Q329 AIEEE 2004 MCQ

Which of the following statements is false for a particle moving in a circle with a constant angular speed?

(A) The velocity vector is tangent to the circle.
(B) The acceleration vector is tangent to the circle.
(C) The acceleration vector points to the centre of the circle.
(D) The velocity and acceleration vectors are perpendicular to each other.

Answer: (B) The acceleration vector is tangent to the circle. · Key from source paper

Q330 AIEEE 2003 MCQ

A car, moving with a speed of 50 km/hr, can be stopped by brakes after at least 6 m. If the same car is moving at a speed of 100 km/hr, the minimum stopping distance is

(A) 12 m
(B) 18 m
(C) 24 m
(D) 6 m

Answer: (C) 24 m · Key from source paper

Q331 AIEEE 2003 MCQ

The co-ordinates of a moving particle at any time ' t ' are given by $x = \alpha t^3$ and $y = \beta t^3$. The speed of the particle at time ' t ' is given by

(A) $3t\sqrt{\alpha^2 + \beta^2}$
(B) $3t^2\sqrt{\alpha^2 + \beta^2}$
(C) $t^2\sqrt{\alpha^2 + \beta^2}$
(D) $\sqrt{\alpha^2 + \beta^2}$

Answer: (B) $3t^2\sqrt{\alpha^2 + \beta^2}$ · Key from source paper

Q332 AIEEE 2003 MCQ

A body travels a distance s in t seconds. It starts from rest and ends at rest. In the first part of the journey, it moves with constant acceleration f and in the second part with constant retardation r. The value of t is given by

(A) $\sqrt{2s\left(\frac{1}{f} + \frac{1}{r}\right)}$
(B) $2s\left(\frac{1}{f} + \frac{1}{r}\right)$
(C) $\frac{2s}{\frac{1}{f} + \frac{1}{r}}$
(D) $\sqrt{2s(f + r)}$

Answer: (A) $\sqrt{2s\left(\frac{1}{f} + \frac{1}{r}\right)}$ · Key from source paper

Q333 AIEEE 2003 MCQ

Two particles start simultaneously from the same point and move along two straight lines, one with uniform velocity $\vec{u}$ and the other from rest with uniform acceleration $\vec{f}$. Let α be the angle between their directions of motion. The relative velocity of the second particle w.r.t. the first is least after a time.

(A) $\frac{u\cos\alpha}{f}$
(B) $\frac{u\sin\alpha}{f}$
(C) $\frac{f\cos\alpha}{u}$
(D) $u\sin\alpha$.

Answer: (A) $\frac{u\cos\alpha}{f}$ · Key from source paper

Q334 AIEEE 2003 MCQ

A boy playing on the roof of a 10 m high building throws a ball with a speed of 10 m/s at an angle of 30° with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground?

$\left[g = 10\ \text{m/s}^2,\ \sin 30^\circ = \frac{1}{2},\ \cos 30^\circ = \frac{\sqrt{3}}{2}\right]$

(A) 5.20 m
(B) 4.33 m
(C) 2.60 m
(D) 8.66 m

Answer: (D) 8.66 m · Key from source paper

Q335 AIEEE 2002 MCQ

Two forces are such that the sum of their magnitudes is 18 N and their resultant is 12 N which is perpendicular to the smaller force. Then the magnitudes of the forces are

(A) 12 N, 6 N
(B) 13 N, 5 N
(C) 10 N, 8 N
(D) 16 N, 2 N

Answer: (B) 13 N, 5 N · Key from source paper

Q336 AIEEE 2002 MCQ

From a building two balls A and B are thrown such that A is thrown upwards A and B downwards (both vertically). If $\mathrm{v_A}$ and $\mathrm{v_B}$ are their respective velocities on reaching the ground, then

(A) $\mathrm{V_B} > \mathrm{V_A}$
(B) $\mathrm{V_A} = \mathrm{V_B}$
(C) $\mathrm{V_A} > \mathrm{V_B}$
(D) their velocities depend on their masses

Answer: (B) $\mathrm{V_A} = \mathrm{V_B}$ · Key from source paper

Q337 AIEEE 2002 MCQ

If a body looses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

(A) 1 cm
(B) 2 cm
(C) 3 cm
(D) 4 cm

Answer: (A) 1 cm · Key from source paper

Q338 AIEEE 2002 MCQ

Speeds of two identical cars are u and $4u$ at the specific instant. The ratio of the respective distances in which the two cars are stopped from that instant is

(A) 1 : 1
(B) 1 : 4
(C) 1 : 8
(D) 1 : 16

Answer: (D) 1 : 16 · Key from source paper

Q339 AIEEE 2002 MCQ

A ball whose kinetic energy is E, is projected at an angle of 45° to the horizontal. The kinetic energy of the ball at the highest point of its flight will be

(A) E
(B) $E/\sqrt{2}$
(C) $E/2$
(D) zero

Answer: (C) $E/2$ · Key from source paper

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