PHYSICS

BOOKS - MTG GUIDE PHYSICS (HINGLISH)

KINEMATICS

Illustration

1. The relation between time t and displacement x is $t = \alpha x^2 + \beta x,$ where α and β are constants. The retardation is

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2. A body moving in a straight line with uniform acceleration describes three successive equal distances in time intervals t_1, t_2 and t_3 respectively. Show that

$$\frac{1}{t_1} - \frac{1}{t_2} + \frac{1}{t_3} = \frac{3}{t_1 + t_2 + t_3}$$

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3. At time t, positions of three particles A,B, and C are as follows.

$$x_A = 2t + 7, x_8 = 3t^2 + 2t + 6, x_C = 5t^3 + 4t$$

Which of them has uniform (constant) acceleration ?

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4. The velocity-time graph of the motion of a car is given below. Find the distance travelled by the car in the first six seconds. What is the deceleration of the car during the last two seconds?

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5. Indicate the velocity (v) - time (t) graphs for a body:

(i) falling under gravity.

(ii) thrown vertically upwards till it falls back to the ground after reaching the highest point.

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6. Motion of a particle is defined by $x = (3 - 4t + 5t^2)$ m. Graphically represent the variation of velocity $\left(\frac{dx}{dt}\right)$ with time.

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7. From the top of a tower, a stone is thrown up and it reaches the ground in time t_1A second stone is thrown down with the same speed and it reaches the ground in time t_2 A third stone is released from rest and it reaches the ground in time The correct relation between t_1, t_2 and t_3 is :

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8. A ball is dropped on to the floor from a height of 10 m. It rebounds to a height of 2.5 m. If the ball is in contact with the floor for 0.01 sec, what is the average acceleration during contact ?

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9. A body is dropped from a height h above the ground. Find the ratio of distances fallen in first one second, firt two seconds, first three seconds, also find the ratio of distance fallen in 1^{st} second, in 2^{nd} second, in 3^{rd} second etc.

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10. The diagonals of a parallelogram are vectors $\overrightarrow{A}$ and $\overrightarrow{B}$. If $\overrightarrow{A} = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $\overrightarrow{B} = 3\hat{i} - 2\hat{j} - \hat{k}$. Calculate the magnitude of area of this parallelogram.

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11. If $\left|\overrightarrow{A}+\overrightarrow{B}\right|=\left|\overrightarrow{A}-\overrightarrow{B}\right|$, then find the angle between $\overrightarrow{A}$ and $\overrightarrow{B}$

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12. The resultant of two vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$ is $\overrightarrow{R}$. If $\overrightarrow{Q}$ is doubled then the new resultant vector is perpendicular to $\overrightarrow{P}$. Then magnitude of $\overrightarrow{R}$ is :-

A. $\left(\dfrac{P^2-Q^2}{2PQ}\right)$

B. Q

C. $\dfrac{P}{Q}$

D. $\frac{P+Q}{P-Q}$

Answer: B

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13. A river is following from west to east at a speed of 5m/minute. A boy on the south bank of the river, capable of swimming at 10 meters/minute in still water, wants to swin across the river in the shortest time, (i) Find the direaction in which he should swin, (ii) find the direction when drift along the river is zero.

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14. A river $400m$ wide is flowing at a rate of $2.0m/s$. A boat is sailing at a velocity of $10.0m/s$ with respect to the water In a direction perpendicular to the river.

(a) Find the time taken by the boat to reach the opposite bank.

(b) How far from the point directly opposite to the starting point does the boat reach the opposite bank?

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15. A man is moving due east with a speed 1 km/hr and rain is falling vertically with a speed $\sqrt{3}$ km/hr. At what angle from vertical the man has to hold his umbrella to keep the rain away. Also find the speed of rain drops w.r.t. man.

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16. In a reference frame a man A is moving with velocity $\left(3\hat{i} - 4\hat{j}\right)ms^{-1}$ and another man B is moving with velocity $\left(\hat{i} + \hat{j}\right)ms^{-1}$ relative to A. Find the actual velocity of B.

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17. A boy is runing on the plane road with velocity v with a long hollow tube in his hand. The water is falling vertically downwards with velocity u. At water angle to the verticaly, he must inclined the tube the water drops enter it without touching its sides ?

A. $\tan^{-1}\left(\frac{v}{u}\right)$

B. $\sin^{-1}\left(\frac{v}{u}\right)$

C. $\tan^{-1}\left(\frac{u}{v}\right)$

D. $\cos^{-1}\left(\frac{v}{u}\right)$

Answer: B

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18. A body of mass m is projected horizontally with a velocity v from the top of a tower of height h and it reaches the ground at a distance x from the foot of the tower. If a second body of mass 2m is projected horizontally from the top of a tower of height 2h, it reaches the ground at a distance 2x from the foot of the tower. The horizontal velocity of the second body is :

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19. The maximum range of a projecitle fired with some initial velocity is found to be 1000 metre The maximum height (H) reached by this projectile is:-

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20. A particle is projected up the inclined plane strikes the plane at right angles. Find the relation between angle of inclination of the plane and angle of projection from the inclined plane.

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21. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ The Cartesian equation of its path is $\left(g = 10ms^{-1}\right)$ (Here , $\hat{i}$ is the unit vector along horizontal and $\hat{j}$ is unit vector vertically upwards)

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22. Two bodies are thrown with the same initial speed at angles α and $(90^\circ - \alpha)$ with the horizontal. What will be the ratio of (a) maximum heights attained by them and (b) horizontal ranges ?

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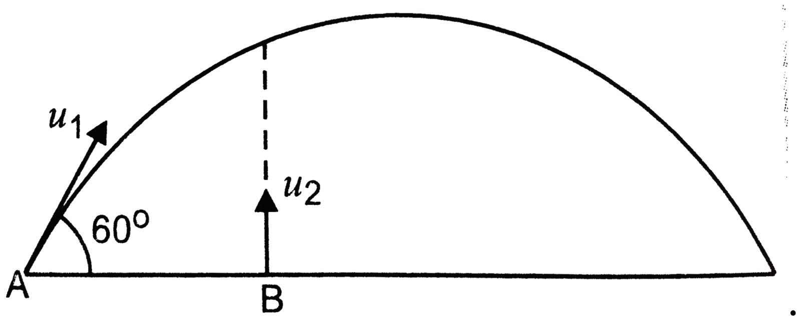
23. A body is projectd with the velcity (U_1) from the point (A) as shown in Fig. 2. (d). 37. At the same tiem another body uis projected vertcally upwards with the velcoity u_2 from the point (B) .What should be the value of $u_1) / u_1$ for both the bodies to collide ?



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24. An astronaout is rotating in a rotor of radius 4m. If he can withstand upto acc. Of 10g, then what is the maximum number of permissible revolutions? $(g = 10m/s^2)$

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25. A motor car is travelling at $30m/s$ on a circular road of radius $500m$. It is increasing in speed at the rate of $2ms^{-2}$. What is its acceleration ?

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Topicwise Practice Questions Distance And Displacement

1. A drunkard is walking along a straight road. He takes five steps forward and three steps backward and so on. Each step is $1m$ long and takes $1s$. There is a pit on the road $11m$, away from the starting point. The drunkard will fall into the pit after.

A. 21 s

B. 29 s

C. 31 s

D. 41 s

Answer: B

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2. The position x of a particle varies with time t as $x = 6 + 12t - 2t^2$ where x is in metre and t is in seconds. The distance travelled by the particle in first five seconds is

A. 16 m

B. 26 m

C. 10 m

D. 36 m

Answer: B

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Topicwise Practice Questions Speed And Velocity

1. A car travels half the distance with a constant velocity of $40m/s$ and the remaining half with a constant velocity of $60m/s$. The average velocity of the car in m/s is

A. 40

B. 45

C. 48

D. 50

Answer: C

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2. A particle located at $x = 0$ at time $t = 0$, starts moving along with the positive $x - direction$ with a velocity 'v' that varies as $v = a\sqrt{x}$. The displacement of the particle varies with time as

A. t^3

B. t^2

C. t

D. $t^{1/2}$

Answer: B

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3. A boy walks to his school at a distance of 6 km with constant speed of $2.5 km h^{-1}$ and walks back with a constant speed of $4 km h^{-1}$. His average speed for round trip expressed in $km h^{-1}$, is

A. $\frac{24}{13}$

B. $\frac{40}{13}$

C. 3

D. $\frac{1}{2}$

Answer: B

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4. A body travelling along a straight line traversed one-third of the total distance with a velocity v_1 . The remaining part of the distance was covered with a velocity v_2 for half the time and with velocity v_3 for the other half of time. The mean velocity averaged over the whole time of motion

A. $\dfrac{3v_1(v_2+v_3)}{2v_1+v_2+v_3}$

B. $\dfrac{3v_1(v_2+v_3)}{4v_1+v_2+v_3}$

C. $\dfrac{v_1(v_2+v_3)}{4v_1+v_2+v_3}$

D. $\dfrac{v_1(v_2+v_3)}{v_1+v_2+v_3}$

Answer: B

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5. The displacement s of a point moving in a straight line is given by:

$s = 8t^2 + 3t - 5$

s being in cm and t in s. The initial velocity of the particle is:

A. 3 unit

B. -3 unit

C. 5 unit

D. -5 unit

Answer: A

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6. A train moving with a speed of 36 kmph takes 14 s to cross a bridge of length 100 m. The length of the train is

A. 140 m

B. 40 m

C. 100 m

D. 360 m

Answer: B

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7. The position of an object moving along x-axis is given by $x = a + bt^2$ where $a = 8.5m, b = 2.5ms^{-2}$ and t is measured in seconds. What is its velocity at $t = 0s$ and $t = 2.0s$. What is the average velocity between $t = 2.0s$ and $t = 4.0s$?

A. $2ms^{-1}, 5ms^{-1}$

B. $5ms^{-1}, 10ms^{-1}$

C. $10ms^{-1}, 15ms^{-1}$

D. $10ms^{-1}, 20ms^{-1}$

Answer: C

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8. A body of mass (m) moving along a straight line covers half the distance with a speed of $2ms^{-1}$. The remaining half of the distance is covered in two equal time intervals with a speed of $3ms^{-1}$ and $5ms^{-2}$ respectively.

The average speed of the particle for the entire journey is .

A. $\frac{3}{8}ms^{-1}$

B. $\frac{8}{3}ms^{-1}$

C. $\frac{4}{3}ms^{-1}$

D. $\frac{16}{3}ms^{-1}$

Answer: B

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9. The area under velocity-time graph for a particle in a given interval of time represnets

A. velocity

B. acceleration

C. work done

D. displacement

Answer: D

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Topicwise Practice Questions Acceleration

1. A body is moving according to the equation $x = at + bt^2 - ct^3$ where x = displacement and a,b and c are constants. The acceleration of the body is

A. $a + 2bt$

B. $2b + 6ct$

C. $2b - 6ct$

D. $3b - 6ct^2$

Answer: C

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2. The displacement 'x' of a particle moving along a straight line at time t is given by

$x = a_0 + a_1 t + a_2 t^2$. The acceleration of the particle is :-

A. a_0

B. $2a_1$

C. $\frac{a_2}{2}$

D. $2a_2$

Answer: D

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3. The relation between time t and distance x is $t = ax^2 + bx$ where a and b` are constants. The acceleration is

A. $-2av^3$

B. $2av^2$

C. $-2av^2$

D. $2bv^3$

Answer: A

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4. The distance time graph of a particle at time t makes angle 45° with respect to time axis. After $1s$, if makes angle 60° with respect to time axis. What is the acceleration of the particle?

A. $\frac{1}{2}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{\sqrt{3}-1}{2}$

D. $\frac{\sqrt{3}+1}{2}$

Answer: C

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5. A particle is moving under constant acceleration $a = \alpha t + \beta t^2$, where alpha beta constants. If the position and velocity of the partical at start, i.e. $t = 0$ are x_0 and v_0, find the displacement and velocity as a function of time t.

A. $x(t) = x_0 + v_0 t + \frac{1}{6}\alpha t^3 + \frac{1}{12}\beta t^4$

B. $x(t) = x_0 + v_0 t + \frac{1}{6}\alpha t^2 + \frac{1}{24}\beta t^3$

C. $x(t) = x_0 + v_0 t + \frac{1}{12}\alpha t^2 + \frac{1}{6}\beta t^3$

D. $x(t) = x_0 + v_0 t + \frac{1}{6}\alpha t^2 + \frac{1}{12}\beta t^3$

Answer: A

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6. The position x of a particle varies with time t as $x = at^2 - bt^3$. The acceleration at time t of the particle will be equal to zero, where (t) is equal to .`

A. $\frac{2a}{3b}$

B. $\frac{b}{a}$

C. $\frac{a}{3b}$

D. zero

Answer: C

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7. A particle moves with uniform velocity. Which of the following statements about the motion of the particle is true?

A. Its speed is zero.

B. Its acceleration is zero.

C. Its acceleration is opposite to the velocity.

D. Its speed may be variable.

Answer: B

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8. The displacement x of a particle at time t moving along a straight line path is given by $x^2 = at^2 + 2bt + c$ where a, b and c are constants. The acceleration of the particle varies as

A. x^{-1}

B. x^{-2}

C. x^{-3}

D. x^{-4}

Answer: C

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9. A particle moves a distance x in time t according to equation $x^2 = 1 + t^2$. The acceleration of the particle is

A. $\frac{1}{x^3}$

B. $\frac{1}{x} - \frac{1}{x^2}$

C. $-\frac{t}{x^2}$

D. $\frac{1}{x} - \frac{t^2}{x^3}$

Answer: A

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10. A point initially at rest moves along x-axis. Its acceleration varies with time as $a = (6t + 5)m/s^2$. If it starts from origin, the distance covered in 2 s is:

A. 20 m

B. 18 m

C. 16 m

D. 25 m

Answer: B

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11. The acceleration a in ms^{-2} of a particle is given by $a = 3t^2 + 2t + 2$, where t is the time. If the particle starts out with a velocity $v = 2ms^{-1}$ at $t = 0$, then find the velocity at the end of $2s$.

A. $12ms^{-1}$

B. $18ms^{-1}$

C. $27ms^{-1}$

D. $36ms^{-1}$

Answer: B

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12. A particle moving along a straight line has a velocity vms^{-1}, when it cleared a distance of x m. These two are connected by the relation v = $\sqrt{49 + x}$. When its velocity is $1ms^{-1}$, its acceleration is

A. 1

B. 2

C. 7

D. $\frac{1}{2}$

Answer: D

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Topicwise Practice Questions Graphical Study Of Motion

1. The displacement-time graphs of two bodies A and B are shown in figure. The ratio of velocity of $A(v_A)$ to velocity of $B(v_B)$ is

A. $\frac{1}{\sqrt{3}}$

B. $\sqrt{3}$

C. $\frac{1}{3}$

D. 3

Answer: C

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2. The velocity versus time curve of a moving point is as shown in the figure. The maximum acceleration is

A. $1m/s^2$

B. $4m/s^2$

C. $2m/s^2$

D. $1.5m/s^2$

Answer: B

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3. Figure gives the speed-time graph of the motion of a car. What is the ratio of the distance travelled by the car during the last two seconds to the total distance travelled in seven seconds?

A. $\frac{1}{9}$

B. $\frac{2}{9}$

C. $\frac{1}{3}$

D. $\frac{4}{9}$

Answer: B

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4. Acceleration(a)-displacement(s) graph of a particle moving in a straight line is shown in adjacent figure. The initial velocity of the particle is zero. The v-s graph of the particle would be

A.

B.

C.

D.

Answer: D

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5. Which of the following curves does not represent motion in one dimensions?

A.

B.

C.

D.

Answer: B

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6. The given shows the variation of velocity with displacement .

Which one of the graph given below correctly represents the variation of acceleration with displacement ?

A.

B.

C.

D.

Answer: A

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7. The velocity - time graph of a body moving in a straight line is shown in the figure. The displacement and distance travelled by the body in 6 s are respectively

A. 8m , 16 m

B. 16 m , 8 m

C. 16 m , 16 m

D. 8m, 8m

Answer: A

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8. The acceleration-displacement graph of a particle moving in a straight line is as shown in the figure. Initial velocity of particle is zero. Velocity of the particle when displacement of the particle is s = 10 m is

A. $\sqrt{10}m / s$

B. $2\sqrt{10}m / s$

C. $3\sqrt{10}m / s$

D. $10\sqrt{3}m / s$

Answer: B

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9. The velocity v versus time t graph of a body in a straight linc is as shown in figure.

The displacement of the body in five seconds is

A. 2 m

B. 3 m

C. 4 m

D. 5 m

Answer: B

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10. The variation of velocity of a particle moving along a straight line is shown in figure. The distance traversed by the particle in 4 second is

A. 60 m

B. 25 m

C. 55 m

D. 30 m

Answer: C

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11. In the given v-t graph the distance travelled by the body in 5 seconds will be

A. 100 m

B. 80 m

C. 40 m

D. 20 m

Answer: A

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12. For the velocity-time graph shown in figure below the distance covered by the body in last two seconds of its motion is what fraction of the total distance covered by it in all the six seconds?

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Answer: B

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13. The displacement-time graph of a moving particle is as shown in figure. The instantaneous velocity of the particle is negative at the point

A. D

B. F

C. C

D. E

Answer: D

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14. Position - time graph for motion with negative acceleration is

A.

B.

C.

D.

Answer: B

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15. The nature of s-t graph shown here is a parabola. From this graph we find that

A. the body is moving with uniform velocity.

B. the body is moving with uniform speed.

C. the body is starting from rest and moving with uniform acceleration.

D. the body is not moving at all.

Answer: C

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16. A body starting from rest moves along a straight line with a constant acceleration. The variation of speed (v) with distance (s) is represented by the graph:

A.

B.

C.

D.

Answer: C

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Topicwise Practice Questions Kinematic Equations For Uniformly Accelerated Motion

1. A ball rleased from the tope of a tower travels $\frac{11}{36}$ of the height of the tower in the last second of its journey. The height of the tower is (g= 10 ms^(2)).

A. 11 m

B. 36 m

C. 47 m

D. 180 m

Answer: D

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2. A bullet moving with a speed of $100 ms^{-1}$ can just penetrate into two planks of equal thickness. Then the number of such planks, if speed is doubled will be .

A. 4

B. 6

C. 8

D. 10

Answer: C

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3. A car is moving on a straight horizontal road with a speed v. When brakes are applied to give a constant retardation a, the car is stopped in a shortest distance S. If the car was moving on the same road with a speed 3v and the same retardation a is applied, the shortest distance in which the car is stopped will be

A. 3S

B. 6S

C. 9S

D. 27S

Answer: C

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4. Balls are thrown vertically upwards in such a way that the next ball is thorwn when the previous one is at the maximum height. If the maximum hieght is $5m$, the number of balls thrown per minute will be

A. 120

B. 80

C. 60

D. 40

Answer: C

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5. A particle starting from rest travels a distance x in first 2 seconds and a distance y in next two seconds, then

A. y = 4x

B. y=x

C. y = 3x

D. y = 2x

Answer: C

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6. A ball is dropped from the top of a building 100 m high. At the same instant another ball is thrown upwards with a velocity of $40ms^{-1}$ from the bottom of the building. The two balls will meet after.

A. 3 s

B. 2 s

C. 2.5 s

D. 5 s

Answer: C

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7. A stone with weight W is thrown vertically upward into the air with initial velocity v_0. If a constant forcef due to air drag acts on the stone throughout the flight & if the maximum height attain by stone is h and velocity when it strikes to the ground is v. Which one is correct?

A. $v_0\left(\frac{w-f}{w+f}\right)^{1/2}$

B. $v_0\left(\frac{w+f}{w-f}\right)^{1/2}$

C. $v_0\left(\frac{w-f}{w}\right)^{1/2}$

D. $v_0\left(\frac{w+f}{f}\right)^{1/2}$

Answer: A

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8. A body starts from rest with uniform acceleration. The velocity of the body after t seconds is v. The displacement of the body in last three seconds is

A. $\frac{3v}{2}(t-3)$

B. $\frac{3v}{2}(t+3)$

C. $3v\left[1-\frac{3}{2t}\right]$

D. $3v\left[1+\frac{3}{2t}\right]$

Answer: C

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9. A bus starts from rest with constant acceleration of 5 $ms^{-}2$. At the same time a car travelling with a constant velocity of 50 $ms^{-}1$ overtakes and passes the bus. (i) Find at what distance will the bus overtake the car ? (ii) How fast will the bus be travelling then ?

A. $25ms^{-1}$

B. $50ms^{-1}$

C. $75ms^{-1}$

D. $100ms^{-1}$

Answer: D

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10. A particle is dropped from certain height. The time taken by it to fall through successive distance of 1 m each will be

A. all equal, being equal to $\sqrt{\frac{2}{g}}$ second

B. in the ratio of the square roots of the integers 1,2,3,.....

C. in the ratio of the difference in the square roots of the integers,

i.e.,

$\sqrt{1}, (\sqrt{2}-\sqrt{1}), (\sqrt{3}-\sqrt{2}), (\sqrt{4}-\sqrt{3}), \ldots .$

D. in the ratio of the reciprocals of the square roots of the integers, i.e., $\frac{1}{\sqrt{1}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{3}}, \ldots\ldots.$

Answer: C

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11. A body starts from rest and is uniformly accelerated for 30 s. The distance travelled in the first 10 s is x_1, next 10 s is x_2 and the last 10 s is x_3. Then $x_1 : x_2 : x_3$ is the same as :-

A. $1 : 2 : 3$

B. $1:1:1$

C. $1:3:5$

D. $1:3:9$

Answer: C

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12. A particle starts from rest and traverses a distance l with uniform acceleration, then moves uniformly over a further distance 2l and finally comes to rest after moving a further distance 3l under uniform retardation. Assuming entire motion to be rectilinear motion the ratio of average speed over the journey to the maximum speed on its ways is

A. $\frac{4}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{5}$

D. $\frac{1}{5}$

Answer: B

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13. An automobile travelling with a speed $60km/h$, can brake to stop within a distance of $20m$. If the car is going twice as fast i. e. , $120km/h$, the stopping distance will be

A. 20 m

B. 40 m

C. 60 m

D. 80 m

Answer: D

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14. A ball is thrown upwards. Its height varies with time as shown in figure. If the acceleration due to gravity is $7.5 m/s^2$ then the height h is

A. 10 m

B. 15 m

C. 20 m

D. 25 m

Answer: B

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15. A body starting from rest moves with constant acceleration. The ratio of distance covered by the body during the 5th sec to that covered in 5 sec is

A. $\frac{9}{25}$

B. $\frac{3}{25}$

C. $\frac{25}{9}$

D. $\frac{1}{25}$

Answer: A

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16. A body falling freely under the action of gravity passes 2 points 9 m apart vertically in 0.2 s. From what height above the higher point did it start to fall?

A. 99 m

B. 200 m

C. 20 m

D. 109 m

Answer: A

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17. Two cars travelling towards each other on a straight road at velocity $10m/s$ and $12m/s$

respectively. When they are 150 metre apart, both drivers apply their brakes and each car decelerates at $2m/s^2$ until it stops. How far apart will they be when they have both come to a stop?

A. 89 m

B. 98 m

C. 108 m

D. 150 m

Answer: A

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18. A particle is projected vertically upwards and it reaches the maximum height H in time T seconds. The height of the particle at any time t will be-

A. $g(t-T)^2$

B. $H-\frac{1}{2}g(t-T)^2$

C. $\frac{1}{2}g(t-T)^2$

D. $H-g(t-T)$

Answer: B

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19. A body dropped from top of a tower falls through $40m$ during the last two seconds of its fall. The height of tower in m is (g= 10 m//s^@)`

A. 60 m

B. 45 m

C. 80 m

D. 50 m

Answer: B

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20. A train starts from rest and for the first kilometer moveswith constant acceleration. For the next 3 kilometers it has constant velocity and for another two kilometers it moves with constant retardation to come to rest after a total time of 10 minutes. The maximum velocity of the train is

A. 18 km/h

B. 36 km/h

C. 54 km/h

D. 39 km/h

Answer: C

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21. A scooterist sees a bus 1 km ahead of him moving with a velocity of $10ms^{-1}$ With what speed the scooterist should move so as to overtake the bus in 100 s?

A. $10ms^{-1}$

B. $20ms^{-1}$

C. $50ms^{-1}$

D. $30ms^{-1}$

Answer: B

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22. From the top of a tower, a stone is thrown up and it reaches the ground in time t_1A second stone is thrown down with the same speed and it reaches the ground in time t_2 A third stone is released from rest and it reaches the ground in time The correct relation between t_1, t_2 and t_3 is :

A. $t_3 = \frac{(t_1 + t_2)}{2}$

B. $t_3 = \sqrt{t_1 t_2}$

C. $\frac{1}{t_3} = \frac{1}{t_1} + \frac{1}{t_2}$

D. $t_3^2 = t_2^2 - t_1^2$

Answer: B

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23. The velocity of a particle moving with constant acceleration at an instant t_0 is $10m/s$ After 5 seconds of that instant the velocity of the particle is 20m/s. The velocity at 3 second before t_0 is:-

A. 2 m/s

B. 3 m/s

C. 4 m/s

D. 5 m/s

Answer: C

Watch Video Solution

24. A wooden block is dropped from the top of a cliff 100m high and simultaneously a bullet of mass 10 g is fired from the foot of the cliff upwards with a velocity of $100m/s$. The bullet and wooden block will meet each other after a time:

A. 10 s

B. 0.5 s

C. 1 s

D. 7 s

Answer: C

Watch Video Solution

25. A player throws a ball upwards with an initial speed of $30ms^{-1}$. How long does the ball take to return to the player's hands? (Take g = 10 ms^{-2})

A. 30 m

B. 45 m

C. 90 m

D. 100 m

Answer: B

Watch Video Solution

26. A body travels 200 cm in the first two seconds and 220 cm in the next 4 seconds with deceleration. the velocity of the body at the end of the 7^{th} second is

A. 10 cm s^{-1}

B. 20 cm s^{-1}

C. 5 cm s^{-1}

D. $30 \quad \text{cm s}^{-1}$

Answer: A

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27. A body is thrown vertically up to reach its maximum height in t seconds. The total time from the time of projection to reach a point at half of its maximum height while returning (in seconds) is

A. $\sqrt{2}t$

B. $\left(1+\frac{1}{\sqrt{2}}\right)t$

C. $\frac{3t}{2}$

D. $\frac{t}{\sqrt{2}}$

Answer: B

Watch Video Solution

28. A particle travels a distance of 20 m in the 7^{th} seconds and 24 m in 9^{th} second. How much distance shall it travel in the 15^{th} second?

A. 10 m

B. 16 m

C. 24 m

D. 36 m

Answer: D

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29. A particles starts from rest and has an acceleration of $2m/s^2$ for 10 sec. After that , it travels for 30 sec with constant speed and then undergoes a retardation of $4m/s^2$ and comes back to rest. The total distance covered by the particle is

A. 650 m

B. 750 m

C. 700 m

D. 800 m

Answer: B

Watch Video Solution

30. A body is projected veritclaly upwards.The times corresponding to height h while ascending and while descending are t_1 and t_2 respectively.

Then, the velocity of projection will be (take g as acceleration due to gravity)

A. $\dfrac{g\sqrt{t_1 t_2}}{2}$

B. $\frac{g(t_1 t_2)}{2}$

C. $g\sqrt{t_1 t_2}$

D. $\frac{g t_1 t_2}{(t_1 + t_2)}$

Answer: B

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31. A body moving with uniform acceleration describes 12 m in the third second of its motion and 20 m in the fifth second. The velocity of the body after 10^{th} s is

A. 40 m s^{-1}

B. $42 \ \mathrm{m\,s}^{-1}$

C. $52 \ \mathrm{m\,s}^{-1}$

D. $4 \ \mathrm{m\,s}^{-1}$

Answer: B

Watch Video Solution

32. A ball is thrown vertically up with a velocity u. It passes three points A, B and C in its upward journey with velocities $\frac{u}{s}, \frac{u}{3}$ and $\frac{u}{4}$, respectively. Find $\frac{AB}{BC}$.

A. 1

B. 2

C. $\left(\frac{10}{7}\right)$

D. $\left(\frac{20}{7}\right)$

Answer: D

Watch Video Solution

33. 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 travelled is 15 s, then

A. $S = \frac{1}{2} f t^2$

B. $S = \frac{1}{4} f t^2$

C. $S = ft$

D. $S = \frac{1}{6} f t^2$

Answer: A

Watch Video Solution

34. A juggler keeps n balls going with one hand, so that at any instant, (n - 1) balls are in air and one ball in the hand. If each ball rises to a height of x metres, the time for each ball to stay in his hand is

A. 1 s

B. 1.5 s

C. 2 s

D. 4 s

Answer: A

Watch Video Solution

35. A body starts to fall freely under gravity. The distances covered by it in first, second and third second are in ratio

A. $1:4:9$

B. $1:2:3$

C. $1:3:5$

D. $1:5:6$

Answer: C

Watch Video Solution

36. A particle moving with uniform acceleration has velocity of $6ms^{-1}$ at a distance 5 m from the initial position. After moving another 7 m the velocity becomes $8ms^{-1}$ The initial velocity and acceleration of the particle are

A. $2ms^{-1}, 4ms^{-2}$

B. $4ms^{-1}, 2ms^{-2}$

C. $4ms^{-1}, 4ms^{-2}$

D. $6ms^{-1}, 1ms^{-2}$

Answer: B

Watch Video Solution

37. The initial velocity of a particle is u (at t = 0) and the acceleration f is given by f = at. Which of the following relation is valid?

A. $v = u + at^2$

B. $v = u + \frac{at^2}{2}$

C. $v = u + at$

D. $v = u$

Answer: B

Watch Video Solution

38. A ball is dropped on to the floor from a height of 10 m. It rebounds to a height of 2.5 m. If the ball is in contact with the floor for 0.01 sec, what is the average acceleration during contact ?

A. $700ms^{-2}$

B. $1400ms^{-2}$

C. $2100ms^{-2}$

D. $2800ms^{-2}$

Answer: C

Watch Video Solution

39. A particle starting with certain initial velocity and uniform acceleration covers a distance of 12 m in first

3 seconds and a distance of 30 m in next 3 seconds.

The initial velocity of the particle is

A. $1ms^{-1}$

B. $2ms^{-1}$

C. $2.5ms^{-1}$

D. $3ms^{-1}$

Answer: A

Watch Video Solution

40. A body covers 26, 28, 30, 32 meters in 10^(th), 11^(th), 12^(th) and 13^(th) seconds respectively. The body starts

A. from rest and moves with uniform acceleration.

B. from rest and moves with uniform velocity.

C. with an initial velocity and moves with uniform acceleration.

D. with an initial velocity and moves with uniform velocity.

Answer: C

Watch Video Solution

41. A ball is thrown vertically upwards with a speed of $10m/s$ from the top of a tower 200 m height and another is thrown vertically downwards with the same speed simultaneously. The time difference between them on reaching the ground is $(g = 10m/s^2)$

A. 12

B. 6

C. 2

D. 1

Answer: C

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Watch Video Solution

42. A juggler throws balls into air. He throws one when ever the previous one is at its height point. If he throws n balls each second, the height to which each ball will rise is

A. $\dfrac{g}{2n^2}$

B. $\dfrac{2g}{n^2}$

C. $\dfrac{2g}{n}$

D. $\dfrac{g}{4n^2}$

Answer: A

Watch Video Solution

43. A body travelling with uniform acceleration crosses two point A and B with velocities $20ms^{-1}$ and $30ms^{-1}$ respectively. The speed of the body at the mid-point of A and B is.

A. $25.5ms^{-1}$

B. $25ms^{-1}$

C. $24ms^{-1}$

D. $10\sqrt{6}ms^{-1}$

Answer: A

Watch Video Solution

44. Free fall of an object (in vacuum) is a case of motion with

A. uniform velocity

B. uniform acceleration

C. variable acceleration

D. uniform speed

Answer: B

Watch Video Solution

45. A stone is dropped from the top of a tall cliff and n seconds later another stone is thrown vertically downwards with a velocity u. Then the second stone overtakes the first, below the top of the cliff at a distance given by

A. $\frac{g}{2}\left[\frac{n\left(u-\frac{gn}{2}\right)}{(u-gn)}\right]^2$

B. $\frac{g}{2}\left[\frac{n\left(\frac{u}{2}-gn\right)}{(u-gn)}\right]^2$

C. $\frac{g}{2}\left[\frac{n\left(\frac{u}{2}-gn\right)}{\left(u-\frac{gn}{2}\right)}\right]^2$

D. $\frac{g}{5}\left[\frac{(u-gn)}{\left(\frac{u}{2}-gn\right)}\right]^2$

Answer: A

Watch Video Solution

46. A point moves with a uniform acceleration and v_1, v_2, v_3 denote the average velociies in the three succellive intervals of time t_1 ,t_2 and t_3. Find the ratio of (v_1 - v_2) and (v_2 - v_3).

A. $\dfrac{t_1 - t_2}{t_2 - t_3}$

B. $\dfrac{t_1 - t_2}{t_2 + t_3}$

C. $\dfrac{t_1 + t_2}{t_2 - t_3}$

D. $\dfrac{t_1 + t_2}{t_2 + t_3}$

Answer: D

Watch Video Solution

47. A car accelerates from rest at a constant rate for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t, the maximum velocity acquired by the car is given by :

A. $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$

B. $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$

C. $\frac{(\alpha^2-\beta)t}{\alpha\beta}$

D. $\dfrac{\alpha\beta t}{\alpha+\beta}$

Answer: D

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48. A body is allowed to fall from a height of $100m$. If the time taken for the first $50m$ is t_1 and for the remaining $50m$ is t_2 then :

A. $t_1 = t_2$

B. $t_1 > t_2$

C. $t_1 < t_2$

D. depends upon the mass

Answer: B

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Topicwise Practice Questions Relative Velocity

1. A motorboat covers a given distance in $6h$ moving downstream on a river. It covers the same distance in $10h$ moving upstream. The time it takes to cover the same distance in still water is

A. 6

B. 7.5

C. 10

D. 15

Answer: B

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2. Two trains 121 m and 99 m in length are running in opposite directions with velocities $40kmh^{-1}$ and $32kmh^{-1}$. In what time they will completely cross each other?

A. 9 s

B. 11 s

C. 13 s

D. 15 s

Answer: B

Watch Video Solution

3. A train of $150m$ length is going toward north direction at a speed of $10ms^{-1}$. A parrot flies at a speed of $5ms^{-1}$ toward south direction parallel to the railway track. The time taken by the parrot to cross the train is equal to.

A. 12 s

B. 8 s

C. 15 s

D. 10 s

Answer: D

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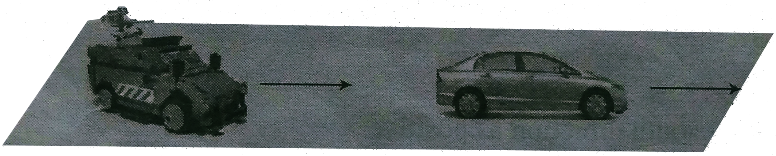
4. A police van moving on a highway with a speed of $30kmh^{-1}$ Fires a bullet at a thief's car speeding away in a same direction with a speed of $192kmh^{-1}$. If the muzzle speed of the buller is $150ms^{-1}$, with what speed does the bullet hit thief's car? .



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A. $105ms^{-1}$

B. $205ms^{-1}$

C. $305ms^{-1}$

D. $405ms^{-1}$

Answer: A

Watch Video Solution

5. Two particles A and B get 4m closer each second while traveling in opposite direction They get 0.4 m closer every second while traveling in same direction. The speeds of A and B are respectively :

A. $2.2ms^{-1}$ and $0.4ms^{-1}$

B. $2.2ms^{-1}$ and $1.8ms^{-1}$

C. $4ms^{-1}$ and $0.4ms^{-1}$

D. $2.2ms^{-1}$ and $4ms^{-1}$

Answer: B

Watch Video Solution

6. A train of length 200 m traveling at $30ms^{-1}$ overtakes another train of length 300 m traveling at $20ms^{-1}$. The time taken by the first train to pass the second is

A. 30 s

B. 10 s

C. 50 s

D. 40 s

Answer: C

Watch Video Solution

7. On a two lane road , car (A) is travelling with a speed of $36 kmh^{-1}$. Tho car B and C approach car (A) in opposite directions with a speed of $54 kmh^{-1}$ each . At a certain instant , when the distance (AB) is equal to (AC), both being $1 km, (B) decides \rightarrow overtake$ A before C does , What minimum accelration of car (B) is required to avoid and accident.

A. $9.8 ms^{-2}$

B. $10 ms^{-2}$

C. $1 ms^{-2}$

D. $2.0 ms^{-2}$

Answer: C

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8. A passenger is walking on an escalator at a speed of 6 km/h relative to the escalator. The escalator is moving at 3 km/h relative to ground and has a total length of 120 m. The time taken by him to reach the end of the escalator is

A. 16 s

B. 48 s

C. 32 s

D. 80 s

Answer: B

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9. A train is moving slowly on a straightly track with a constant speed of $2ms^{-1}$. A passenger in the train starts walking at a steady speed of $2ms^{-1}$ to the back of the train in the opposite direction of the motion of the train . So, to an observer standing on the platform directly in the front of that passenger appears to be

A. $4ms^{-1}$

B. $2ms^{-1}$

C. $2ms^{-1}$ in the positive direction of the train

D. zero

Answer: D

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10. A river 2 km wide is flowing at the rate of 2km/hr. A boatman, can row the boat at a speed of 4 km/hr in still water, goes a distance of 2 km upstream and them comes back. The time taken by him to complete his journey is

A. 60 minutes

B. 70 minutes

C. 80 minutes

D. 90 minutes

Answer: C

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11. A swimmer crosses a flowing stream of width d to and fro normal to the flow of the river at time t_1. The time taken to cover the same distance up and down the stream is t_2. If t_3 is the time the swimmer would take to swim a distance $2d$ in still water, then relation between t_1, $t_2 \& t_3$.

A. $\frac{t_1^2}{t_2}$

B. $\frac{t_2^2}{t_1}$

C. $\sqrt{t_1 t_2}$

D. $(t_1 + t_2)$

Answer: A

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12. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T min. A man cycling with a speed of $20kmh^{-1}$ in the direction A to B notices that a bus goes past him every $18\ \mathrm{min}$ in the direction of his motion, and every $6\ \mathrm{min}$ in the opposite direction. What is the period T of the bus service and with what speed (assumed constant)do the buses ply on the road?

A. 4.5 min

B. 9 min

C. 12 min

D. 24 min

Answer: B

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13. Two trains are moving with equal speed in opposite directions along two parallel railway tracks. If the wind is blowing with speed u along the track so that the relative velocities of the trains with respect to the wind are in the ratio $1:2$, then the speed of each train must be

A. 3u

B. 2u

C. u

D. 4u

Answer: A

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14. Two trains, each $50m$ long, are travelling in opposite directions with velocities $10ms^{-1}$ and $15ms^{-1}$. The time of their crossing each other is.

A. 2 s

B. 4 s

C. $2\sqrt{s}$

D. $4\sqrt{3}s$

Answer: B

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15. The speed of boat is $5kmh^{-1}$ in still water. It crosses a river of width 1 km along the shortest possible path in 15 min. Then, velocity of river will be

A. 5

B. 1

C. 3

D. 4

Answer: C

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Topicwise Practice Questions Vectors

1. If $\overrightarrow{P} - \overrightarrow{Q} - \overrightarrow{R} = 0$ and the magnitudes of $\overrightarrow{P}$, $\overrightarrow{Q}$ and $\overrightarrow{R}$ are 5 , 4 and 3 units respectively, the angle between $\overrightarrow{P}$ and $\overrightarrow{R}$ is

A. $\cos^{-1}\left(\frac{3}{5}\right)$

B. $\cos^{-1}\left(\frac{4}{5}\right)$

C. $\frac{\pi}{2}$

D. $\sin^{-1}\left(\frac{3}{4}\right)$

Answer: A

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2. Two forces P and Q have a resultant perpendicular to P. The angle between the forces is

A. $\tan^{-1}\left(\frac{-P}{Q}\right)$

B. $\tan^{-1}\left(\frac{P}{Q}\right)$

C. $\sin^{-1}\left(\frac{P}{Q}\right)$

D. $\cos^{-1}\left(-\frac{P}{Q}\right)$

Answer: D

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3. The sum of magnitudes of two forces acting at a point is $16N$. If the resultant force is $8N$ and its direction is perpendicular to smaller force, then the forces are :-

A. 6 N and 10 N

B. 8 N and 8N

C. 4 N and 12N

D. 2 N and 14 N

Answer: A

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4. In the given figure, if $\overrightarrow{PQ} = \overrightarrow{A}, \overrightarrow{QR} = \overrightarrow{B}$ and $\overrightarrow{RS} = \overrightarrow{C}$ then $\overrightarrow{PS}$ equals

A. $\overrightarrow{A} - \overrightarrow{B} + \overrightarrow{C}$

B. $\overrightarrow{A} + \overrightarrow{B} - \overrightarrow{C}$

C. $\overrightarrow{A} + \overrightarrow{B} + \overrightarrow{C}$

D. $\overrightarrow{A} - \overrightarrow{B} - \overrightarrow{C}$

Answer: C

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5. If $\overrightarrow{A}$ is a vector of magnitude 4 units due east. What is the magnitude and direction of a vector $-4\overrightarrow{A}$?

A. 4 units due east

B. 8 units due east

C. 16 units due east

D. 16 units due west

Answer: D

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6. If vectors $\overrightarrow{P}, \overrightarrow{Q}$ and $\overrightarrow{R}$ have magnitudes 5, 12 and 13 units and $\overrightarrow{P} + \overrightarrow{Q} = \overrightarrow{R}$, the angle between $\overrightarrow{Q}$ and $\overrightarrow{R}$ is :

A. $\cos^{-1}\left(\frac{5}{12}\right)$

B. $\cos^{-1}\left(\frac{5}{13}\right)$

C. $\cos^{-1}\left(\frac{12}{13}\right)$

D. $\cos^{-1}\left(\frac{2}{13}\right)$

Answer: C

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7. Two forces are such that the sum of their magnitudes is 18N and their resultant is 12 N which is perpendicular to the smaller force. Then the magnitude of the forces are

A. 12 N, 6N

B. 13 N, 5 N

C. 10 N, 8N

D. 16 N, 2N

Answer: B

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8. A boat man can row with a speed of $10kmh^{-1}$ in still water. If the river flows steadily at $5km/h$, in which direction should the boatman row in order to reach a point on the other bank directly opposite to the point from where he stared ? The width of the river is $2km$.

A. in a direction inclined at 120° to the direction of river flow.

B. in a direction inclined at 90° to the direction of river flow.

C. 60° in the north-west direction.

D. should row directly along the river flow.

Answer: A

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9. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $30\sqrt{3}$ N, the magnitude of each force is

A. 40N

B. 20N

C. 80N

D. 30N

Answer: D

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10. The resultant of two forces (A + B) and (A - B) is a force $\sqrt{3A^2 + B^2}$ The angle between two given forces is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. π

Answer: B

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11. A man can swim with a speed of $4 \mathrm{km} \mathrm{~h}^{-1}$ in still water. How lonu does he lake lo Cross a river 1 km wide if the 0.81 in river flows steadily at $3 \mathrm{km} \mathrm{~h}^{-1}$ and he makes his strokes normal to the river current?

A. 5 min

B. 10 min

C. 15 min

D. 20 min

Answer: C

View Text Solution

12. A boatman can row with a speed of $10 kmh^{-1}$ in still water. River flows at $6 kmh^{-1}$. If he crosses the river from one bank to the other along the shortest possible path, time taken to cross that river of width 1 km is

A. $\frac{1}{8}h$

B. $\frac{1}{4}h$

C. $\frac{1}{2}h$

D. $1h$

Answer: A

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13. Given $\overrightarrow{A} = \hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{B} = -\hat{i} - \hat{j} - \hat{k}$. $\left(\overrightarrow{A} - \overrightarrow{B}\right)$ will make angle with $\overrightarrow{A}$ as

A. 0°

B. 180°

C. 90°

D. 60°

Answer: A

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14. The resultant of two vectors $\vec{A}$ and $\vec{b}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half the magnitude of vector $\vec{B}$. The angle between $\vec{A}$ and $\vec{B}$ is

A. 30°

B. 45°

C. 150°

D. 120°

Answer: C

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15. If vectors $2\hat{i}-3\hat{j}-5\hat{k}$ and $2\hat{i}-3\hat{j}-a\hat{k}$ are equal vectors, then the value of a is

A. 5

B. 2

C. -3

D. -5

Answer: D

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16. Two force in the ratio $1:2$ act simultaneously on a particle. The resultant of these forces is three times the first force. The angle between them is

A. 0°

B. 60°

C. 90°

D. 45°

Answer: A

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17. Resultant of two vectors $\vec{A}$ and $\vec{B}$ is of magnitude P, If $\vec{B}$ is reversed, then resultant is of magnitude Q. What is the value of $P^2 + Q^2$?

A. $2(A^2 + B^2)$

B. $2(A^2 - B^2)$

C. $A^2 - B^2$

D. $A^2 + B^2$

Answer: A

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18. Vectors $\vec{\grave{a}}$ and $\vec{b}$ include an angle θ between them. If $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$ respectively subtend angles α and β with $\vec{a}$, then $(\tan\alpha + \tan\beta)$ is

A. $\frac{(\text{ab}\sin\theta)}{(a^2 + b^2\cos^2\theta)}$

B. $\frac{2\text{ab}\sin\theta}{(a^2 - b^2\cos^2\theta)}$

C. $\frac{a^2\sin^2\theta}{(a^2 + b^2\cos^2\theta)}$

D. $\frac{(b^2\sin^2\theta)}{(a^2 - b^2\cos^2\theta)}$

Answer: B

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19. Two vectors $\vec{A}_1$ and $\vec{A}_2$ each of magnitude A are inclinded to each other such that their resultant is equal to $\sqrt{3}A$. What is the magnitude of the resultant of $\vec{A}_1$ and $-\vec{A}_2$ is

A. $2A$

B. $\sqrt{3}A$

C. $\sqrt{2}A$

D. A

Answer: D

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20. The maximum and minimum magnitude of the resultant of two given vectors are 17 units and 7 unit respectively. If these two vectors are at right angles to each other, the magnitude of their resultant is

A. 14

B. 16

C. 18

D. 13

Answer: D

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21. Given : $\overrightarrow{A} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\overrightarrow{B} = 6\hat{i} + 9\hat{j} + 3\hat{k}$ which of the following statements is correct ?

A. $\vec{A}$ and $\vec{B}$ are equal vectors

B. $\vec{A}$ and $\vec{B}$ are parallel vectors

C. $\vec{A}$ and $\vec{B}$ are perpendicular vectors

D. None of these

Answer: B

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22. If a body placed at the origin is acted upon by a force $\vec{F} = \left(\hat{i} + \hat{j} + \sqrt{2}\hat{k}\right)$, then which of the following statements are correct?

Magnitude of $\vec{F}$ is (2+ $\sqrt{2}$)

Magnitude of $\overrightarrow{F}$ is 2.

$\overrightarrow{F}$ makes an angle of 45° with the Z-axis

$\overrightarrow{F}$ makes an angle of 30° with the Z-axis.

Select the correct answer using the codes given below

A. 1 and 3

B. 2 and 3

C. 1 and 4

D. 2 and 4

Answer: B

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23. With respect to a rectangular Cartesian co-ordinate system, three vectors are expressed as $\vec{a} = 4\hat{i} - \hat{j}$, $\vec{b} = -3\hat{i} + 2\hat{j}$, $\vec{c} = -\hat{k}$ where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors, along the x, y and z-axes respectively. The unit vector $\hat{r}$ along the direction of the sum of these three vectors is given by

A. $\hat{r} = \frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

B. $\hat{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

C. $\hat{r} = \frac{1}{\sqrt{3}}\left(\hat{i} - \hat{j} + \hat{k}\right)$

D. $\hat{r} = \frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: A

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Topicwise Practice Questions Scalar And Vector Products Of Vectors

1. Given $\overrightarrow{A} = 3\hat{i} + 2\hat{j}$ and $\overrightarrow{B} = \hat{i} + \hat{j}$. The component of vector $\overrightarrow{A}$ along vector $\overrightarrow{B}$ is

A. $\dfrac{1}{\sqrt{2}}$

B. $\dfrac{3}{\sqrt{2}}$

C. $\dfrac{5}{\sqrt{2}}$

D. $\dfrac{7}{\sqrt{2}}$

Answer: C

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2. A vector $\overrightarrow{A}$ is along the positive z-axis and its vector product with another vector $\overrightarrow{B}$ is zero, then vector $\overrightarrow{B}$ could be :

A. $\hat{i} + \hat{j}$

B. $4\hat{j}$

C. $\hat{j} + \hat{k}$

D. $-7\hat{k}$

Answer: D

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3. What is the angle between $\hat{i}+\hat{j}+\hat{k}$ and $\hat{j}$?

A. 0°

B. 45°

C. 60°

D. None of these

Answer: D

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4. What is the area of the triangle formed by sides $\overrightarrow{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\overrightarrow{B} = \hat{i} - \hat{k}$

A. $\sqrt{13.5}$ unit

B. 13.5 unit

C. $\sqrt{38.7}$ unit

D. 38.7 unit

Answer: A

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5. If $\widehat{n} = a\hat{i} + b\hat{j}$ is perpendicualr to the vector $(\hat{i} + \hat{j})$, then the value of a and b may be:

A. 1,0

B. $-2, 0$

C. 3,0

D. $\frac{1}{\sqrt{2}}, \ -\frac{1}{\sqrt{2}}$

Answer: D

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6. If the vectors $\overrightarrow{A} = 2\hat{i} + 4\hat{j}$ and $\overrightarrow{B} = 5\hat{i} - p\hat{j}$ are parallel to each other, the magnitude of $\overrightarrow{B}$ is

A. $5\sqrt{5}$

B. 10

C. 15

D. $2\sqrt{5}$

Answer: A

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7. Diagonals of a parallelogram are respresented by vectors $\overrightarrow{A} = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $\overrightarrow{B} = 3\hat{i} + 2\hat{j} - \hat{k}$. Area of the parallelogram is :

A. $\sqrt{171}$ units

B. $\sqrt{72}$ units

C. 171 units

D. 72 units

Answer: A

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8. The angle subtended by vector $\vec{A} = 4\hat{i} + 3\hat{j} + 12\hat{k}$ with the x-axis is :

A. $\sin^{-1}\left(\frac{3}{13}\right)$

B. $\sin^{-1}\left(\frac{4}{13}\right)$

C. $\cos^{-1}\left(\frac{4}{13}\right)$

D. $\cos^{-1}\left(\frac{3}{13}\right)$

Answer: C

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9. The angle made by the vector $\vec{A} = 2\hat{i} + 3\hat{j}$ with Y-axis is

A. $\tan^{-1}\left(\frac{3}{2}\right)$

B. $\tan^{-1}\left(\frac{2}{3}\right)$

C. $\sin^{-1}\left(\frac{2}{3}\right)$

D. $\cos^{-1}\left(\frac{3}{2}\right)$

Answer: B

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10. If $\overrightarrow{A} = \hat{i} + 2\hat{j} - \hat{k}, \overrightarrow{B} = -\hat{i} + \hat{j} - 2\hat{k}$, then angle between $\overrightarrow{A}$ and $\overrightarrow{B}$ is

A. $\frac{\pi}{2}$

B. 0

C. π

D. $\frac{\pi}{3}$

Answer: D

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11. The component of vector $\vec{A} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$ along th direction of $\left(\hat{i} - \hat{j}\right)$ is

A. $(a_x - a_y + a_z)$

B. $(a_x - a_y)$

C. $\left(\dfrac{a_x - a_y}{\sqrt{2}}\right.$

D. $(a_x + a_y + a_z)$

Answer: C

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12. If $\overrightarrow{A} = -4\hat{j} + 3\hat{j}$ and $\overrightarrow{B} = 2\hat{i} + 5\hat{j}$ and $\overrightarrow{C} = \overrightarrow{A} \times \overrightarrow{B}$, then the vector $\overrightarrow{C}$ makes an angle of

A. 45° with x - axis

B. 180° with y - axis

C. 0° with z - axis

D. 180° with z - axis

Answer: D

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13. For the any two vecrtors $\overrightarrow{A}$ and $\overrightarrow{B}$, if $\overrightarrow{A}.\overrightarrow{B} = \left|\overrightarrow{A} \times \overrightarrow{B}\right|$, the magnitude of $\overrightarrow{C} = \overrightarrow{A} + \overrightarrow{B}$ is equal to

A. $\sqrt{A^2 + B^2}$

B. $A + B$

C. $\sqrt{A^2 + B^2 + \frac{AB}{\sqrt{2}}}$

D. $\sqrt{A^2 + B^2 + \sqrt{2}AB}$

Answer: D

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14. What is the angle between $\vec{A} = 5\hat{i} - 5\hat{j}$ and $\vec{B} = 5\hat{i} - 5\hat{j}$?

A. 90°

B. 45°

C. 0°

D. 60°

Answer: C

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15. If $\vec{A} + \vec{B} + \vec{C} = 0$, then $\vec{A} \times \vec{B}$ is

A. $\vec{B} \times \vec{C}$

B. $\vec{C} \times \vec{B}$

C. $\vec{A} \times \vec{C}$

D. None of these

Answer: A

Watch Video Solution

16. The angle btween two vectors $2\hat{i} + 3\hat{j} + \hat{k}$ and $-3\hat{i} + 6\hat{k}$ is

A. 0°

B. 45°

C. 60°

D. 90°

Answer: D

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Topicwise Practice Questions Motion In A Plane

1. Calculate the distance travelled by the car, if a car travels $4km$ towards north at an angle of 45° to the east and then travells a distance of $2km$ towards north at an angle of 135° to the est.

A. 6 km

B. 8 km

C. 5 km

D. 2 km

Answer: A

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2. The co-ordinates of a moving particle at any time t are given by $x = ct^2$ and $y = bt^2$~? The speed of the particle is given by:

A. $2t\sqrt{a^2 + b^2}$

B. $2t\sqrt{a + b}$

C. $2t\sqrt{a^2 - b^2}$

D. $2\sqrt{a^2 + b^2}$

Answer: A

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3. The coordinates 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

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4. A particle is moving eastwards with velocity of $5m/s$. In $10\sec$ the velocity changes to $5m/s$ northwards. The average acceleration in this time is.

A. zero

B. $\frac{1}{\sqrt{2}} ms^{-2}$ s towards north-west

C. $\frac{1}{\sqrt{2}} ms^{-2}$ towards north-east

D. $\frac{1}{\sqrt{2}} ms^{-2}$ towards north

Answer: B

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5. A car travels due east on a level road for $30km$. It then turns due north at an intersection and travels $40km$ before stopping. Find the resultant displacement of the car.

A. $50km, 53^\circ$ north of east

B. $50km, 53^\circ$ east of north

C. $100km, 37^\circ$ north of east

D. $100km, 37^\circ$ east of north

Answer: A

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6. In 1.0 s, a particle goes from point A to point B, moving in a semicircle of radius 1.0 m. The magnitude of the average velocity of the particle is

A. $3.14ms^{-1}$

B. $2.0ms^{-1}$

C. $1.0ms^{-1}$

D. zero

Answer: B

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7. The x and y coordinates of a particle at any time t are given by $x = 7t + 4t^2$ and $y = 5t$, where x is in meter and t is in seconds. The acceleration of particle at $t = 5$s is

A. zero

B. $8ms^{-2}$

C. $20ms^{-2}$

D. $40ms^{-2}$

Answer: B

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8. A particle moves in the x-y plane with velocity $v_x = 8t - 2$ and $v_y = 2$. If it passes through the point $x = 14$ and $y = 4att = 2s$, the equation of the path is

A. $x=y^{3}-y^{2}+2$

B. $x=y^{2}-y+2$

C. $x=y^{2}-3y+2$

D. $x=y^{3}-2y^{2}+2$

Answer: B

Watch Video Solution

9. A person travels towards north by 4 m and then turns to west and travels by 3 m. The distance and displacement are

A. 7 m and 5 m

B. 7 m and 7 m

C. 7 m and 1 m

D. 7 m and 3.5 m

Answer: A

Watch Video Solution

10. A cyclist starts from the centre O of a circular park of radius one kilometre , reaches the edge P of the park, then cycles along the circumference and returns to the centre.along QO as shown in the figure. If the round trip takes ten minutes, the net displacement and average speed of the cyclist in metre and kilometre per hour)

A. 0,1

B. $\frac{\pi+4}{2}, 0$

C. $21.4, \frac{\pi+4}{2}$

D. $0, 21.4$

Answer: D

11. An athelete completes one round of a circular track of radius R in 40 seconds. What will be the displacement at the end of ` 2 min. 20 second ?

A. Zero

B. 2R

C. $2\pi R$

D. $7\pi R$

Answer: B

Watch Video Solution

12. Four person K,L,M and N are initally at the corners of a square of side of length d. If every person starts moving, such that K always heads towards L, L heads towards M, M heads directly towards N and N heads towards K, then the four perons will meet after

A. $\frac{d}{v}$

B. $\frac{\sqrt{2}d}{v}$

C. $\frac{d}{\sqrt{2}v}$

D. $\frac{d}{2v}$

Answer: A

Watch Video Solution

13. A toy cyclist completes one round of a square track of side 2 min 40 seconds. What will be the displacement at the end of 3 minutes?

A. 52 m

B. zero

C. 16 m

D. $2\sqrt{2}m$

Answer: D

View Text Solution

14. A particle motion on a shape curve is governed by x=2sint, y = 3cost and $z = \sqrt{5}$ sint. What is the magnitude of velocity of the particle at any timet?

A. $3\sqrt{2}\sin t$

B. 3

C. $3\sqrt{2}\cot t$

D. $3\sqrt{2}$

Answer: B

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15. Two cars A and B start moving from the same point with same velocity v=5km/minute. Car A moves towards North and car B in moving towards East. What is the relative velocity of B with respect to A ?

A. $5\sqrt{2}$ km/min towards south-east

B. $5\sqrt{2}$ km/min towards north-west

C. $5\sqrt{2}$ km/min towards south-west

D. $5\sqrt{2}$ km/min towards north-east

Answer: A

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16. A car runs at a constant speed on a circulat track of radius $100m$. Taking $62.8s$ for every circular lap. The average velocity and average speed for each circular lap respectively are :

A. $10ms^{-1}, 0$

B. $0, 0$

C. $0, 10ms^{-1}$

D. $10ms^{-1}, 10ms^{-1}$

Answer: C

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17. If the velocity (in ms^{-1}) of a particle is given by , $4.0\hat{i} + 5.0t\hat{j}$ then the magnitude of its acceleration (in ms^{-2}) is

A. 4

B. 9

C. 1

D. 5

Answer: D

Watch Video Solution

18. A particle is moving on circular path as shown in the figure. Then displacement from P_1 to P_2 is

A. $2r\dfrac{\cos(\theta)}{2}$

B. $2r\dfrac{\tan(\theta)}{2}$

C. $2r\sin\theta$

D. $2r\dfrac{\sin(\theta)}{2}$

Answer: D

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19. A boat is moving with a velocity $3\hat{i} - 4\hat{j}$ w.r.t ground. The water in the river is moving with a velocity $-3\hat{i} - 4\hat{j}$ w.r.t ground. What is the relative velocity of boat w.r.t water.

A. $6\hat{i} + 8\hat{j}$

B. $8\hat{i} + 6\hat{j}$

C. $4\hat{i} + 3\hat{j}$

D. $-6\hat{i} - 8\hat{j}$

Answer: A

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20. A particle starts from the origin of coordinates at time $t = 0$ and moves in the xy plane with a constant acceleration α in the y-direction. Its equation of motion is $y = \beta x^2$. Its velocity component in the x-directon is

A. $\sqrt{\frac{2b}{2}}$

B. $\sqrt{\frac{a}{2b}}$

C. $\sqrt{\frac{a}{b}}$

D. $\sqrt{\frac{b}{a}}$

Answer: B

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21. The position of a particle is given by $\vec{r} = 2t^2\hat{i} + 3t\hat{j} + 4\hat{k}$ where t is in second and the coefficients have proper units for $\vec{r}$ to be in metre. The $\vec{a}(t)$ of the particle at t = 1 s is

A. $4ms^{-2}$ along y-direction

B. $3ms^{-2}$ along x-direction

C. $4ms^{-2}$ along x-direction

D. $2ms^{-2}$ along z-direction

Answer: C

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22. The (x,y,z) co -ordinates of two points A and B are give respectively as (0,3,- 1) and (-2,6,4) The displacement vector from A to B is given by

A. $-2\hat{i}+6\hat{j}+4\hat{k}$

B. $-2\hat{i}+3\hat{j}+3\hat{k}$

C. $-2\hat{i}+3\hat{j}+5\hat{k}$

D. $2\hat{i}-3\hat{j}-3\hat{k}$

Answer: C

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23. A man moves 20 m north, then 10m east and then $10\sqrt{2}$ m south-west. His displacement is

A. 20 m north

B. $10\sqrt{2}$ m north-west

C. 10 m north

D. $10\sqrt{2}$ m south-east

Answer: C

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Topicwise Practice Questions Projectile Motion

1. A particle is thrown with velocity u making an angle θ with the vertical. It just crosses the top of two poles each of height h after 1 s and 3 s respectively. The maximum height of projectile is

A. 9.8 m

B. 19.6 m

C. 39.2 m

D. 4.9 m

Answer: B

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2. A projectile is thrown at an angle of 40° with the horizontal and its range is R_1 Another projectile is thrown at an angle 40° with the vertical and its range is R_2 What is the relation between R_1 and R_2 ?

A. $R_1 = R_2$

B. $R_1 = 2R_2$

C. $R_1 = \frac{R_2}{2}$

D. $R_1 = \frac{4R_2}{5}$

Answer: A

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3. From the top of a tower of height 40m, a ball is projected upward with a speed of $20ms^{-1}$ at an angle of elevation of 30°. Then the ratio of the total time taken by the ball to hit the ground to the time taken to ball come at same level as top of tower.

A. $2:1$

B. $3:1$

C. $3:2$

D. $4:1$

Answer: A

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4. A body is projected with velocity v_1 from the point A as shown inz figure

At the same time, another body is projected vertically upwards from B with velocity V_2 . The point B lies vertically below the highest point. For both the bodies to collide, $\frac{v_2}{v_1}$ should be

A. 2

B. 0.5

C. $\frac{\sqrt{3}}{2}$

D. 1

Answer: B

View Text Solution

5. A cricketer can throw a ball to a maximum horizontal distance of 100m. With the same speed how much high above the ground can the cricketer throw the same ball?

A. 50 m

B. 100 m

C. 150 m

D. 200 m

Answer: A

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6. A body of mass m is projected horizontally with a velocity v from the top of a tower of height h and it reaches the ground at a distance x from the foot of the tower. If a second body of mass 2m is projected horizontally from the top of a tower of height 2h, it reaches the ground at a distance 2x from the foot of the tower. The horizontal velocity of the second body is :

A. v

B. 2v

C. $\sqrt{2}v$

D. $\frac{v}{2}$

Answer: C

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7. The maximum range of a projecitle fired with some initial velocity is found to be 1000 metre The maximum height (H) reached by this projectile is:-

A. 250 metre

B. 500 metre

C. 1000 metre

D. 2000 metre

Answer: A

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8. Time taken by the projectile to reach from A to B is t, then the distance AB is equal to

A. 2ut

B. $\sqrt{3}$ ut

C. $\frac{\sqrt{3}}{2}$ ut

D. $\frac{\mathrm{ut}}{\sqrt{3}}$

Answer: D

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9. A projectile is given an initial velocity of $\left(\hat{i} + 2\hat{j}\right)$ The Cartesian equation of its path is $\left(g = 10ms^{-1}\right)$ (Here , $\hat{i}$ is the unit vector along horizontal and $\hat{j}$ is unit vector vertically upwards)

A. $y = 2x - 5x^2$

B. $y = x - 5x^2$

C. $4y = 2x - 5x^2$

D. $y = 2x - 25x^2$

Answer: A

Watch Video Solution

10. A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flight in the two cases:-

A. $\frac{1}{R}$

B. R

C. R^2

D. $\frac{1}{R^2}$

Answer: B

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11. 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 instance a person starts running with a constant speed $\frac{V_0}{\sqrt{2}}$ 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

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12. A particle is projected at an angle of 60° above the horizontal with a speed of $10m/s$. After some time the direction of its velocity makes an angle of 30° above the horizontal. The speed of the particle at this instant is s

A. $\frac{5}{\sqrt{3}} m / s$

B. $5\sqrt{3}$ m/s

C. 5 m/s

D. $\frac{10}{\sqrt{3}}$ m/s

Answer: D

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13. A projectile is projected with the initial velocity $(6i + 8j)m/s.$ The horizontal range is $(g = 10m/s^2)$

A. 4.8 m

B. 9.6 m

C. 19.2 m

D. 14.0 m

Answer: B

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14. A body is thrown with a velocity of $9.8m/s$ making an angle of 30° with the horizontal. It will hit the ground after a time

A. 3.0 s

B. 2.0 s

C. 1.5 s

D. 1 s

Answer: D

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15. A projectile has initially the same horizontal velocity as it would acquire if it had moved from rest with uniform acceleration of $3ms^{-2}$ for $0.5 \min$. If the maximum height reached by it is $80m$, then the angle of projection is $\left(g = 10ms^{-2}\right)$.

A. $\tan^{-1}(3)$

B. $\tan^{-1}\left(\frac{3}{2}\right)$

C. $\tan^{-1}\left(\frac{4}{9}\right)$

D. $\sin^{-1}\left(\frac{4}{9}\right)$

Answer: C

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16. Three projectiles A, B and Care projected at an angle of $30^\circ, 45^\circ, 60^\circ$ respectively. If R_A, R_B and R_C` are ranges of A, B and C respectively then (velocity of projection is same for A, B and C)

A. $R_A = R_B = R_C$

B. $R_A = R_C > R_B$

C. $R_A < R_B < R_C$

D. $R_A = R_C < R_B$

Answer: D

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17. Two balls are projected making angles of 30° and 45°respectively with the horizontal. If both have same velocity at the highest point of their path, then the ratio of their horizontal ranges is

A. 1:3

B. $3:1$

C. $\sqrt{3}:\sqrt{2}$

D. $1:\sqrt{3}$

Answer: D

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18. A hose lying on the ground shoots a stream of water upward at an angle of 60° to the horizontal with the velocity of $16ms^{-1}$. The height at which the water strikes the wall $8m$ away is.

A. 8.96 m

B. 10.96 m

C. 12. 96 m

D. 6.96 m

Answer: A

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19. A ball is thrown at a certain angle with the horizontal and it returns to the ground describing a parabolic path. Which of the following remains constant?

A. Momentum of the ball

B. Kinetic energy of the ball

C. Vertical component of the velocity

D. Horizontal component of the velocity

Answer: D

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20. Two bodies are thrown up at angles of 45° and 60° respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is

A. $\sqrt{\frac{2}{3}}$

B. $\frac{2}{\sqrt{3}}$

C. $\sqrt{\frac{3}{2}}$

D. $\frac{\sqrt{3}}{2}$

Answer: C

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21. Four particles are fired with the same velocities at angles $250^{\circ}, 40^{\circ}, 55^{\circ}$ and 70° with the horizontal. The range of projectile will be largest for the one projected at angle

A. 25°

B. 40°

C. 55°

D. 70°

Answer: B

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22. The equations of motion of a projectile are given by $x = 36tm$ and $2y = 96t - 9.8t^2 m$ .The angle of projection is

A. $\sin^{-1}\left(\frac{4}{5}\right)$

B. $\sin^{-1}\left(\frac{3}{5}\right)$

C. $\sin^{-1}\left(\frac{4}{3}\right)$

D. $\sin^{-1}\left(\frac{3}{4}\right)$

Answer: A

Watch Video Solution

23. The speed of a projectile when it is at its greatest height is $\sqrt{2/5}$ times its speed at half the maximum height. The angle of projection is

A. 30°

B. 60°

C. 45°

D. 0°

Answer: B

Watch Video Solution

24. A ball of mass M is thrown vertically upwards. Another ball of mass 2M is thrown at an angle θ with the vertical. Both of them stay in air for the same period of time. The heights attained by the two are in the ratio

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:\cos\theta$

Answer: C

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25. A particle is projected from the ground with an initial speed of v at an angle θ with horizontal. The average velocity of the particle between its point of projection and highest point of trajectroy is :

A. $u \cos \theta$

B. $\frac{u}{2}\sqrt{1+\cos^2 \theta}$

C. $\frac{u}{2}\sqrt{1+2\cos^2 \theta}$

D. $\frac{u}{2}\sqrt{1+3\cos^2 \theta}$

Answer: D

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26. Two stones are projected with the same speed but making different angles with the horizontal. Their horizontal ranges are equal. The angle of projection of one is $\frac{\pi}{3}$ and the maximum height reached by it is 102 m. Then the maximum height reached by the other in metres is

A. 336

B. 224

C. 56

D. 34

Answer: D

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27. A ball is thrown at different angles with the same speed u and from the same points and it has same range in both the cases. If y_1 and y_2 be the heights attained in the two cases, then find the value of $y_1 + y_2$.

A. $\frac{u^2}{g}$

B. $\frac{2u^2}{g}$

C. $\frac{u^2}{2g}$

D. $\frac{u^2}{4g}$

Answer: C

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28. A cricket ball thrown across a field is at heights h_1 and h_2 from the point of projection at time t_1 and t_2 respectively after the throw. The ball is caught by a fielder at the same height as that of projection. The time of flight of the ball in this journey is

A. $\dfrac{h_1 t_2^2 - h_2 t_1^2}{h_1 t_2 - h_2 t_1}$

B. $\dfrac{h_1 t_1^2 + h_2 t_2^2}{h_2 t_1 + h_1 t_2}$

C. $\dfrac{h_1 t_2^2 + h_2 t_1^2}{h_1 t_2 + h_2 t_1}$

D. $\dfrac{h_1t_1^2 - h_2t_2^2}{h_1t_1 - h_2t_2}$

Answer: A

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29. A particle is projected from a horizontal plane with a velocity of $8\sqrt{2}ms^{-1}$ ms at an angle θ. At highest point its velocity is found to be $8ms^{-1}$ Its range will be $\left(g = 10ms^{-2}\right)$

A. 3.2 m

B. 4.6 m

C. 6.4 m

D. 12.8 m

Answer: D

Watch Video Solution

30. A stone is projected with a velocity $20\sqrt{2}m/s$ at an angle of 45° to the horizontal.The average velocity of stone during its motion from starting point to its maximum height is

A. $5\sqrt{5}ms^{-1}$

B. $10\sqrt{5}ms^{-1}$

C. $20ms^{-1}$

D. $20\sqrt{5}ms^{-1}$

Answer: B

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31. Three particles A, B and C are projected from the same point with the same initial speeds making angles $30^\circ, 45^\circ$ and 60° respectively with the horizontal. Which of the following statement is correct?

A. B

B. A

C. D

D. C

Answer: D

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32. A stone is thrown horizontally with velocity u. The velocity of the stone 0.5 s later is 3u/2. The value of u is

A. 2.2 m/s

B. 3.3 m/s

C. 4.4 m/s

D. 5.5 m/s

Answer: C

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33. A projectile is thrown with an initial velocity of $\left(a\hat{i} + b\hat{j}\right)ms^{-1}$. If the range of the projectile is twice the maximum height reached by it, then

A. $b = \frac{a}{2}$

B. $b = a$

C. $b = 2a$

D. $b = 4a$

Answer: C

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34. A particle is thrown with a speed u at an angle θ with the horizontal. When the particle makes an angle ϕ with the horizontal. Its speed changes to v :

A. $v = u \cos \theta$

B. $v = u \cos \theta \cos \phi$

C. $v = u \cos\theta \sec\phi$

D. $v = u \sec\theta \cos\phi$

Answer: C

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35. A particle is projected with an initial velocity of $200m/s$ in a direction making an angle of 30° with the vertical. The horizontal distance covered by the particle in $3s$ is

A. 100 m

B. 200 m

C. 300 m

D. 400 m

Answer: C

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36. The kinetic energy of a projectile at the highest point of its path is found to be $3/4^{th}$ of its initial kinetic energy. If the body is projected from the ground, the angle of projection is

A. 30°

B. 60°

C. 45°

D. 120°

Answer: A

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37. If a stone is to hit at a point which is at a distance d away and at a height h above the point from where the stone starts as shown in the figure bo then what is the value of initial speed u if stone is launched at an angle θ ?

A. $\frac{g}{\cos\theta}\sqrt{\frac{d}{2(dtan\theta - h)}}$

B. $\frac{d}{\cos\theta}\sqrt{\frac{g}{2(dtan\theta - h)}}$

C. $\sqrt{\frac{gd^2}{h\cos^2\theta}}$

D. $\sqrt{\frac{gd^2}{(d-h)}}$

Answer: B

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38. The speed of a projectile at its maximum height is $\sqrt{3}/2$ times its initial speed. If the range of the projectile is n times the maximum height attained by it, n is equal to :

A. $\frac{4}{3}$

B. $2\sqrt{3}$

C. $4\sqrt{3}$

D. $\frac{3}{4}$

Answer: B

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39. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of $150ms^{-1}$. Then the time after which its inclination with the horizontal is 45° is

A. 15 s

B. 10.98 s

C. 5.49 s

D. 2.745 s

Answer: B

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40. When the angle of projection is 75°, a ball falls 10 m short of the target. When the angle of projection is 45°, it falls 10 m ahead of the target. Both are projected from the same point with the same speed in the same direction, the distance of the target from the point of projection is

A. 15 m

B. 30 m

C. 45 m

D. 10 m

Answer: B

View Text Solution

41. Two particles A and B are projected with same speed so that the ratio of their maximum height reached is 3 : 1. If the speed of A is doubled without altering other parameters, the ratio of the horizontal ranges attained by A and B is

A. $1:1$

B. $2:1$

C. $4:1$

D. $3:2$

Answer: C

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42. Two paper screens A and B are separated by a distance of 200 m. A bullet pierces A and then B. The hole in B is 40 cm below the hole in A. If the bullet is travelling horizontally at the time of hitting A, then the velocity of the bullet at A is

A. $200ms^{-1}$

B. $400ms^{-1}$

C. $600ms^{-1}$

D. $700ms^{-1}$

Answer: D

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43. If a body is projected with an angle θ to the horizontal, then

A. its velocity is always perpendicular to its acceleration

B. its velocity becomes zero at its maximum height

C. its velocity makes zero angle with the horizontal at its maximum height

D. the body just before hitting the ground, the direction of velocity coincides with the accclcration

Answer: C

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44. For a projectile thrown with a velocity v, the horizontal range is $\frac{\sqrt{3}v^2}{2g}$. The vertical range is $\frac{v^2}{8g}$. The angle which the projectile makes with the horizontal initially is:

A. 15°

B. 30°

C. 45°

D. 60°

Answer: B

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45. A bomb is dropped on an enemy post by an aeroplane flying. With a horizontal velocity of 60km/hr and at a height of 490 m. how far the aeroplane must be from the enemy post at the time of dropping the bomb, so that it may directly hit the target? $(g = 9.8m/s^2)$

A. $\frac{400}{3}m$

B. $\frac{500}{3}m$

C. $\frac{1700}{3}m$

D. 498 m

Answer: B

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46. A projectile is thrown with initial velocity u_0 and angle 30° with the horizontal. If it remains in the air for 1s. What was its initial velocity ?

A. 19.6 m/s

B. 9.8 m/s

C. 4.9 m/s

D. 1 m/s

Answer: B

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47. If the angle of projection of a projector with same initial velocity exceed or fall short of 45° by equal amount α, then the ratio of horizontal rages is

A. $1:2$

B. $1:\sqrt{2}$

C. $1:4$

D. $1:1$

Answer: D

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48. A ball is projected from the ground at a speed of $10ms^{-1}$ making an angle of 30° with the horizontal. Another ball is simultaneously released from a point on the vertical line along the maximum height of the projectile. The initial height of the second ball is

(Take $g = 10ms^{-2}$)

A. 6.25 m

B. 2.5 m

C. 3.75 m

D. 5 m

Answer: B

View Text Solution

49. A body rolls down a stair case of 5 steps. Each step has height 0.1 m and width 0.1 m. With what velocity will the body reach the bottom?

A. 6.25 m

B. 2.5 m

C. 3.75 m

D. 5 m

Answer: D

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50. A projectile is fired at an angle of 30° to the horizontal such that the vertical component of its initial velocity is $80m/s$. Its time of fight is T. Its velocity at $t=T/4$ has a magnitude of nearly.

A. $200ms^{-1}$

B. $160ms^{-1}$

C. $144ms^{-1}$

D. $140ms^{-1}$

Answer: C

Watch Video Solution

51. The velocity at the maximum height of a projectile is half of its velocity of projection u. Its range on the horizontal plane is

A. $\frac{2u^2}{5g}$

B. $\frac{3u^2}{5g}$

C. $\frac{u^2}{g}$

D. $\frac{4u^2}{5g}$

Answer: D

Watch Video Solution

52. A projectile is thrown with an initial velocity of $\overrightarrow{v} = \left(p\hat{i} + q\hat{j}\right)$ m/s. If the range of the projectile is four times the maximum height reached by it, then

A. p = 2q

B. q = 4p

C. q - 2p

D. q = p

Answer: D

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53. The relation between the time of flight of projectile T_f and the time to reach the maximum height t_m is

A. $T_f = 2t_m$

B. $T_f = t_m$

C. $T_f = \frac{t_m}{2}$

D. $T_f = \sqrt{2}(t_m)$

Answer: A

Watch Video Solution

54. A cannon ball has a range Ron a horizontal plane, such that the corresponding possible maximum heights reached are H_1 and H_2 . Then, the correct expression for R is

A. $\frac{(H_1)+H_2}{2}$

B. $(H_1H_2)^2$

C. $2(H_1H_2)^{1/2}$

D. $4(H_1H_2)^{1/2}$

Answer: D

View Text Solution

55. From the top of a tower of height 40m, a ball is projected upward with a speed of $20ms^{-1}$ at an angle of elevation of 30°. Then the ratio of the total time taken by the ball to hit the ground to the time taken to ball come at same level as top of tower.

A. $2:1$

B. $1:2$

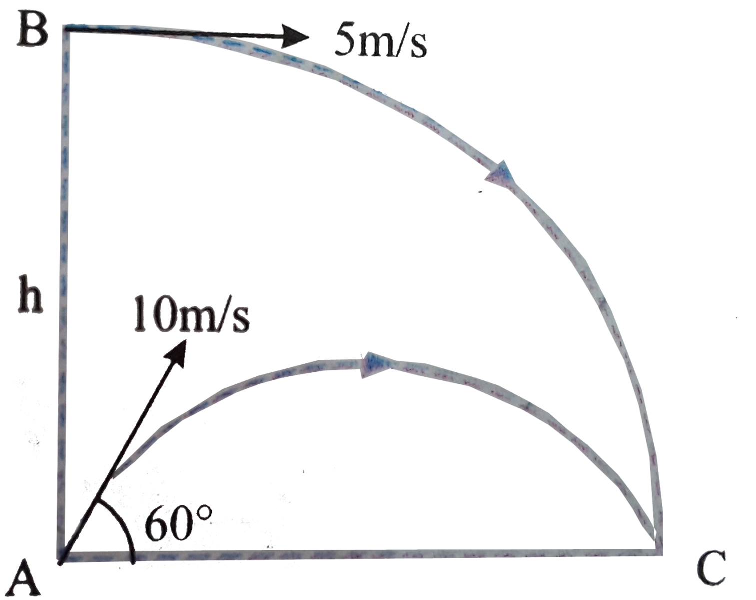
C. $4:1$

D. $1:4$

Answer: B

Watch Video Solution

56. A particle A is projected from the ground with an initial velocity of $10m/s$ at an angle of 60° with horizontal. From what height should an another particle B be projected horizontally with velocity $5m/s$ so that both the particles collide in ground at point C if both are projected simultaneously $g = 10m/s^2$.



A. 10 m

B. 15 m

C. 20 m

D. 30 m

Answer: B

Watch Video Solution

57. Two projectiles A and B are thrown with velocities v and $\frac{v}{2}$ respectively. They have the same range. If B is thrown at an angle of 15° to the horizontal, A must have been thrown at an angle

A. $\sin^{-1}\left(\frac{1}{16}\right)$

B. $\sin^{-1}\left(\frac{1}{4}\right)$

C. $2\sin^{-1}\left(\frac{1}{4}\right)$

D. $\frac{1}{2}\sin^{-1}\left(\frac{1}{8}\right)$

Answer: D

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58. Two particles having mass 'M' and 'm' are moving in a circular path having radius R & r respectively. If their time period are same then the ratio of angular velocity will be : -

A. $\frac{r}{R}$

B. $\frac{R}{r}$

C. 1

D. $\sqrt{\frac{R}{r}}$

Answer: C

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Topicwise Practice Questions Uniform Circular Motion

1. An electric fan has blades of length $30cm$ as measured from the axis of rotation. If the fan is rotating at $1200r \pm$, find the acceleration of a point on the tip of a blade.

A. $1600ms^{-2}$

B. $4740ms^{-2}$

C. $2370ms^{-2}$

D. $5055ms^{-2}$

Answer: B

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2. The angular velocity of second's hand of a watch will be.

A. $\frac{\pi}{60}$ rad/sec

B. $\frac{\pi}{30}$ rad/sec

C. 60 pi rad/sec

D. 30 pi rad/sec

Answer: B

Watch Video Solution

3. A stone tied at the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 25 revolutions in 14 s, what is the magnitude of acceleration of the stone ?

A. $90ms^2$

B. $100ms^2$

C. $110ms^2$

D. $120ms^2$

Answer: B

Watch Video Solution

4. If the length of the second's hand in a stop clock is 3 cm the angular velocity and linear velocity of the tip is

A. 0.2047 rad/s, $0.0314ms^{-1}$

B. 0.2547 rad/s, $0.0314ms^{-1}$

C. 0.1472 rad/s, $0.06341ms^{-1}$

D. 0.1047 rad/s, $0.00314ms^{-1}$

Answer: D

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5. What is the ratio of the angular speeds of the minute hand second hand of a clock ?

A. $1:12$

B. $12:1$

C. $1:60$

D. $60:1$

Answer: C

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6. An object moves at a constant speed along a circular path in a horizontal XY plane, with the center at the origin. When the object is at $x = -2m$, its velocity is $-(4m/s)\hat{j}$. What is the object's acceleration when it is $y = 2m$

A. $-8\hat{j}ms^{-2}$

B. $-8\hat{i}ms^{-2}$

C. $-4\hat{j}ms^{-2}$

D. $-8\hat{i}ms^{-2}$

Answer: A

Watch Video Solution

7. A stonetied to the end of a string 100 cm long is whirled in a horizontal circle with a constant speed . If the stone makes 14 revolutions in 25 s, what is the acceleration of the stone ?

A. $\left(\frac{88}{25}\right)^2 ms^{-2}$

B. $\left(\frac{25}{88}\right)^2 ms^{-2}$

C. $\left(\frac{88}{25}\right) ms^{-2}$

D. $\left(\frac{25}{88}\right) ms^{-2}$

Answer: A

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8. A particle is moving on a circular path of 10 m radius. At any instant of time, its speed is $5ms^{-1}$ and the speed is increasing at a rate of $2ms^{-2}$. At this instant, the magnitude of the net acceleration will be

A. $5ms^{-2}$

B. $2ms^{-2}$

C. $3.2ms^{-2}$

D. $4.3ms^{-2}$

Answer: C

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Check Your Neet Vitals

1. Points P, Q and R are in vertical line such that $PQ = QR$. A ball at (P) is allowed to fall freely. What is the ratio of the times of descent through PQ and QR ?

A. $1:1$

B. $1:\sqrt{2}$

C. $1:(\sqrt{2}+1)$

D. $1:(\sqrt{2}-1)$

Answer: C

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2. Two particles A and B are moving in XY plane. Particle A moves along a line with equation $y = x$

while B moves along X axis such that their X coordinates are always equal. If B moves with a uniform speed 3 m/s the speed of A is

A. $3\sqrt{2}ms^{-1}$

B. $\frac{3}{\sqrt{2}}ms^{-1}$

C. $\frac{1}{3}ms^{-1}$

D. $3ms^{-1}$

Answer: A

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3. Two card are moving in the same direction with the same speed of $30kmh^{-10}$ at a distance of $5km$ from each other . A third car moving in the opposite direction meets these two card at an interval of 4 minutes. Find the speed of third car.

A. $30kmh^{-1}$

B. $35kmh^{-1}$

C. $40kmh^{-1}$

D. $45kmh^{-1}$

Answer: D

Watch Video Solution

4. A particle is projected from the ground with an initial speed of $5ms^{-1}$ at an angle of projection 60º with horizontal. The average velocity of the particle between its time of projection and the time it reaches highest point of trajectory

A. $1.25ms^{-1}$

B. $1ms^{-1}$

C. $1.25\sqrt{7}ms^{-1}$

D. $2ms^{-1}$

Answer: C

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5. A man running at a speed of 5 kmph finds that the rain falls vertically. When he stops running, he finds that the rain is falling at an angle of 60° with the horizontal. The velocity of rain with respect to running man is

A. $\frac{5}{\sqrt{3}} kmh^{-1}$

B. $\frac{5\sqrt{3}}{2} kmh^{-1}$

C. $\frac{4\sqrt{3}}{5} kmh^{-1}$

D. $5\sqrt{3} kmh^{-1}$

Answer: D

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6. A certain vector in the xy-plane has an x-component of 4 m and a y-component of 10 m. It is then rotated in the xy-plane so that its x-component is doubled. Then its new y-component is (approximately)

A. 20 m

B. 7.2 m

C. 5.0 m

D. 4.5 m

Answer: B

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7. A police party is moving in a jeep at a constant speed v. They saw a thief at a distance x on a motorcycle which is at rest. The moment the police saw the thief, the thief started at constant acceleration a. Which of the following relations is true if the police is able to catch the thief?

A. $v^2 < ax$

B. $v^2 < 2ax$

C. $v^2 \geq 2ax$

D. $v^2 = ax$

Answer: C

Watch Video Solution

8. A car starts from rest and accelerates at uniform rate of $6ms^{-2}$ for some time, then moves with constant speed for some time and retards at the same uniform rate and comes to rest. Total time for the journey is 24 s and average speed for journey is $20ms^{-1}$, How long does the car move with constant speed?

A. 4 s

B. 8 s

C. 12 s

D. 16 s

Answer: D

View Text Solution

9. A particle P is moving in a circle of radius r with a uniform speed u. C is the centre of the circle and AB is diameter. The angular velocity of P about A and V are in the ratio :

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

10. The distance travelled by a particle in time t is given by $x = kt^3$, where $k = 10ms^{-3}$. The average speed of the particle from t = 1 s to t = 5 s is

A. $280ms^{-1}$

B. $300ms^{-1}$

C. $310ms^{-1}$

D. $320ms^{-1}$

Answer: C

Watch Video Solution

11. The maximum height attained by a projectile is increased by 1% by increasing its speed of projection without changing the angle of projection. Then the percentage increase in the horizontal range will be

A. 2%

B. 1%

C. 0.5%

D. 0.2%

Answer: B

Watch Video Solution

12. A cricketer can throw a ball to a maximum horizontal distance of 200 m. With the same speed how much high above the ground can the cricketer throw the same ball?

A. 50 m

B. 100 m

C. 150 m

D. 200 m

Answer: A

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13. A particle moving along the x axis has position given by x = $(24t - 2.0t^3)$ m, where t is measured in s. What is the magnitude of the acceleration of the particle at the instant when its velocity is zero?

A. $24ms^{-1}$

B. zero

C. $12ms^{-1}$

D. $48ms^{-1}$

Answer: A

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14. The position of a particle is given by $\overrightarrow{r} = 3.01t\hat{i} + 2.0t^2\hat{j} + 5.0\hat{k}$ where t is in seconds and the coefficients have the proper units for $\overrightarrow{r}$ to be in metres. What is the magnitude and direction of velocity of the particle at t = 1 s? .

A. $5ms^{-1}$, $\tan\left(\frac{4}{3}\right)$ with x - axis.

B. $5ms^{-1}$, $\tan\left(\frac{3}{4}\right)$ with x - axis.

C. $4ms^{-1}$, $\tan\left(\frac{3}{4}\right)$ with x - axis.

D. $4ms^{-1}$, $\tan\left(\frac{4}{3}\right)$ with x - axis.

Answer: A

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15. Which one of the following statements is true?

A. A scalar quantity is the one that is conserved in a process.

B. A scalar quantity is the one that can never take negative values.

C. A scalar quantity is the one that does not vary from one point to another in space.

D. A scalar quantity has the same value for observers with different orientations of the axes.

Answer: D

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16. Which of the following statements is correct about the average velocity of a particle?

(The average stands for average of the quantity over the time interval , t_1 to t_2)

A. $\vec{v}_{\text{average}} = \dfrac{\vec{v}(t_2) - \vec{v}(t_1)}{2}$

B. $\vec{v}_{\text{average}} = \vec{a}_{\text{average}}(t_2 - t_1)$

C. $\vec{v}_{\text{average}} = \dfrac{\vec{v}(t_2) + \vec{v}(t_1)}{2}$

D. $\vec{v}_{\text{average}} = \dfrac{\vec{r}(t_2) + \vec{r}(t_1)}{t_2 - t - 1}$

Answer: D

View Text Solution

17. Suppose that two objects A and B are moving with velocities $\vec{v}_A$ and $\vec{v}_B$ (each with respect to some common frame of refrence). Let $\vec{v}_{AB}$ represent the velocity of with respect to B. Then

A. $\vec{v}_{AB} + \vec{v}_{BA} = 0$

B. $\vec{v}_{AB} - \vec{v}_{BA} = 0$

C. $\vec{v}_{AB} = \vec{v}_A + \overrightarrow{=} B$

D. $\left|\vec{v}_{AB}\right| \neq \left|\vec{v}_{BA}\right|$

Answer: A

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18. For a particle performing uniform circular motion, choose the incorrect statement from the following.

A. Magnitude of particle velocity (speed) remains constant

B. Particle velocity remains directed perpendicular to radius vector.

C. Direction of acceleration keeps changing as particle moves.

D. Magnitude of acceleration does not remain constant.

Answer: D

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19. For two vectors $\overrightarrow{A}$ and $\overrightarrow{B}$, $\left|\overrightarrow{A}+\overrightarrow{B}\right|=\left|\overrightarrow{A}-\overrightarrow{B}\right|$ is always true when

A. $\left|\overrightarrow{A}\right|=\left|\overrightarrow{B}\right|\neq 0$

B. $\overrightarrow{A}\perp\overrightarrow{B}$

C. $\overrightarrow{|A|}=\left|\overrightarrow{B}\right|\neq 0$ and $\overrightarrow{A}$ and $\overrightarrow{B}$ are parallel

D. $\overrightarrow{|A|}=\left|\overrightarrow{B}\right|\neq 0$ and $\overrightarrow{A}$ and $\overrightarrow{B}$ are antiparallel

Answer: B

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20. A fighter plane is flying horizontally at an altitude of 1.5 km with speed $720kmh^{-1}$. At what angle of sight (w.r.t horizontal) when the target is seen, should the pilot drop the bomb in order to attack the target? $(Take g = 10ms^{-2})$

A. 23°

B. 32°

C. 12°

D. 42°

Answer: A

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21. Two particls are projected in air with speed u at angles θ_1 and θ_2 (both acute) to the horizontal, respectively. If the height reached by the first particle is greater than that of the second, then which one of the following is correct? where T_1 and T_2 are the time of flight.

A. $\theta_1 > \theta_2$

B. $\theta_1 = \theta_2$

C. $\theta_1 < \theta_2$

D. $\theta_1 = \theta_2$

Answer: A

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22. Rain is falling vertically with a speed of $30ms^{-1}$ A woman rides a bicycle with a speed of $12ms^{-1}$ in east to west direction. What is the direction in which she should hold her umbrella?

A. At an angle of $\tan - ^{-1}\left(\frac{2}{3}\right)$ (with the vertical

towards the east.

B. At an angle of $\tan - ^{-1}\left(\frac{2}{5}\right)$ (with the vertical

towards the west

C. At an angle of $\tan - ^{-1}\left(\frac{5}{2}\right)$ (with the vertical

towards the east

D. At an angle of $\tan - ^{-1}\left(\frac{5}{2}\right)$ (with the vertical

towards the west.

Answer: B

View Text Solution

1. A particle move a distance x in time t according to equation $x = (t+5)^{-1}$. The acceleration of particle is alphaortional to.

A. $(\text{velocity})^{3/2}$

B. $(\text{distance})^{2}$

C. $(\text{distance})^{-2}$

D. $(\text{velocity})^{2/3}$

Answer: A

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2. A ball is droped from a high rise platform $t = 0$ starting from rest. After $6s$ another ball is thrown downwards from the same platform with a speed v. The two balls meet at $t = 18s$. What is the value of v ?

A. 75 m/s

B. 55 m/s

C. 40 m/s

D. 60m/s

Answer: A

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3. A particle has an initial velocity $3\hat{i} + 4\hat{j}$ and an accleration of $0.4\hat{i} + 0.3\hat{j}$. Its speed after 10s is

A. 7 units

B. $7\sqrt{2}$ units

C. 8.5 units

D. 5 units

Answer: B

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4. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?

A. $\vec{b} + \vec{c} = \vec{f}$

B. $\vec{d} + \vec{c} = \vec{f}$

C. $\vec{d} + \vec{e} = \vec{f}$

D. $\vec{b} + \vec{e} = \vec{f}$

Answer: C

View Text Solution

5. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is .

A. 60°

B. 15°

C. 30°

D. 45°

Answer: A

Watch Video Solution

6. A particle moves in x-y plane according to ru le x $= a\sin\omega t$ and y=$a\cos\omega t$. The particles follows:

A. an elliptical path

B. a circular path

C. a parabolic path

D. a straight line path inclined equally to x and y-axes.

Answer: B

Watch Video Solution

7. A boy standing at the top of a tower of 20m of height drops a stone. Assuming $g = 10ms^{-2}$, the velocity with which it hits the ground is :-

A. 10.0 m/s

B. 20.0 m/s

C. 40.0 m/s

D. 5.0 m/s

Answer: B

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8. A particle moves in a circle of radius 5 cm with constant speed and time period $0.2\pi s$. The acceleration of the particle is

A. $15m/s^2$

B. $25m/s^2$

C. $36m/s^2$

D. $5m/s^2$

Answer: D

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9. A missile is fired for maximum range with an initial velocity of $20m/s$. If $g = 10m/s^2$, the range of the missile is

A. 40 m

B. 50 m

C. 60 m

D. 20 m

Answer: A

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10. A body is moving with velocity $30m/s$ towards east. After $10s$ its velocity becomes $40m/s$ towards north. The average acceleration of the body is.

A. $1m/s^2$

B. $7m/s^2$

C. $\sqrt{7}m/s^2$

D. $5m/s^2$

Answer: D

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11. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projection at its highest point as seen from the point of projection is

A. 45°

B. 60°

C. $\tan^{-1}\left(\frac{1}{2}\right)$

D. $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Answer: C

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12. A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2. Its average speed during the complete journey is.

A. $\frac{v_1 + v_2}{2}$

B. $\frac{v_1 v_2}{v_1 + v_2}$

C. $\frac{2 v_1 v_2}{v_1 + v_2}$

D. $\frac{v_1^2 v_2^2}{v_1^2 + v_2^2}$

Answer: C

Watch Video Solution

13. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is

A. $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

B. $\theta = \tan^{-1}(4)$

C. $\theta = \tan^{-1}(2)$

D. $\theta = 45^{\circ}$

Answer: B

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14. A particle has initial velocity $\left(2\overrightarrow{i}+3\overrightarrow{j}\right)$ and acceleration $\left(0.3\overrightarrow{i}+0.2\overrightarrow{j}\right)$. The magnitude of velocity after 10 seconds will be

A. $9\sqrt{2}$ units

B. $5\sqrt{2}$ units

C. 5 units

D. 9 units

Answer: B

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15. The motion of a particle along a straight line is described by equation : $x = 8 + 12t - t^3$ where x is in metre and t in second. The retardation of the particle when its velocity becomes zero is.

A. $24ms^{-1}$

B. zero

C. $6ms^{-2}$

D. $12ms^{-2}$

Answer:

Watch Video Solution

16. A stone falls freely under gravity. It covered distances h_1, h_2 and h_3 in the first 5 seconds. The next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is :

A. $h_2 = 3h_1 \text{ and } h_3 = 3h_2$

B. $h_1 = h_2 = h_3$

C. $h_1 = 2h_{2 = 3h_3}$

D. $h_1 = \frac{h_2}{3} = \frac{h_2}{5}$

Answer:

Watch Video Solution

17. a projectile is fired from the surface of the earth with a velocity of $5ms^{-1}$ and angle θ with the horizontal. Another projectile fired from another planet with a velocity of $3ms^{-1}$ at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth.The value of the acceleration due to gravity on the planet is in ms^{-2} is given $\left(g = 9.8ms^{-2}\right)$

A. 3.5

B. 5.9

C. 16.3

D. 110.8

Answer:

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18. A particle is moving such that its position coordinates (x, y) are $(2m, 3m)$ at time $t = 0$, $(6m, 7m)$ at time $t = 2s$, and $(13m, 14m)$ at time $t = 5s$.

Average velocity vector $\left(\overrightarrow{V}_{av}\right)$ from $t = 0$ to $t = 5s$ is

A. $\frac{1}{5}\left(13\hat{i} + 14\hat{j}\right)$

B. $\frac{7}{3}\left(\hat{i} + \hat{j}\right)$

C. $2\left(\hat{i}+\hat{j}\right)$

D. $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Answer:

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19. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to

$v(x)=\beta x^{-2n}$

where β and n are constant and x is the position of the particle. The acceleration of the particle as a function of x is given by.

A. $-2\beta^2 x^{-2n+1}$

B. $-2n\beta^2 e^{-4n+1}$

C. $-2n\beta^2 x^{-2n-1}$

D. $-2n\beta^2 x^{-4n-1}$

Answer: A::B::D

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20. A ship A is moving westwards with a speed of $10 kmh^{-1}$ and a ship B 100 km south of A, is moving northwards with a speed of $10 kmh^{-1}$ The time after which the distance between them becomes shortest, is

A. $5\sqrt{2}h$

B. $10\sqrt{2}h$

C. 0 h

D. 5 h

Answer:

Watch Video Solution

21. If vectors $\overrightarrow{A} = \cos\omega t\hat{i} + \sin\omega t\hat{j}$ and $\overrightarrow{B} = \cos\left(\frac{\omega t}{2}\right)\hat{i} + \sin\left(\frac{\omega t}{2}\right)\hat{j}$ are functions of time then the value of t at which they are orthogonal to each other is (A) $t=\frac{\pi}{w}$ (B) $t=0$ (C) $t=\frac{\pi}{4w}$ (D) $t=\frac{\pi}{2w}$

A. $t=\frac{\pi}{\omega}$

B. t = 0

C. $t=\frac{\pi}{4\omega}$

D. $t=\frac{\pi}{2\omega}$

Answer:

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22. The position vector of a particle $\overrightarrow{R}$ as a funtion of time is given by:

$$\overrightarrow{R} = 4\sin(2\pi t)\,\hat{\imath} + 4\cos(2\pi t)\,\hat{\jmath}$$

Where R is in meters, t is in seconds and $\hat{\imath}$ and $\hat{\jmath}$ denote until vectors along x-and y- directions, respectively Which one of the following statements is wrong for the motion of particle ?

A. Magnitude of the velocity of particle is 8 metre/second.

B. Path of the particle is a circle of radius 4 metre.

C. Acceleration vector is along $-\overrightarrow{R}$.

D. Magnitude of acceleration vector is , where v is the velocity of particle.

Answer:

Watch Video Solution

23. If the velocity of a particle is $v = At + Bt^2$, where A and B are constant, then the distance travelled by it between $1s$ and $2s$ is :

A. $\frac{3}{2}A + \frac{7}{3}B$

B. $\frac{A}{2} + \frac{B}{3}$

C. $\frac{3}{2}A + B$

D. $3A + 7B$

Answer:

Watch Video Solution

24. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is

A. 45°

B. 180°

C. 0°

D. 90°

Answer:

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25. A particle moves so that its position vector is given by $\overrightarrow{r} = \cos \omega t \widehat{x} + \sin \omega t \hat{y}$, where ω is a constant which of the following is true ?

A. Velocity of perpendicular to $\overrightarrow{r}$ and acceleration is directed towards the origin.

B. Velocity is perpendicular to $\overrightarrow{r}$ and acceleration is directed away from the origin,

C. Velocity and acceleration both are perpendicular to $\overrightarrow{r}$

D. Velocity and acceleration both are parallel to $\overrightarrow{r}$

Answer:

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26. Two cars P and Q start from a point at the same time in a straight line and their position are represented by $x_p(t) = at + bt^2$ and $x_Q(t) = ft - t^2$. At what time do the cars have the same velocity ?

A. $\dfrac{a-f}{1+b}$

B. $\dfrac{a-f}{2(b-1)}$

C. $\dfrac{a+f}{2(1+b)}$

D. $\dfrac{f-a}{2(1+b)}$

Answer:

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27. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if the remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be :

A. $\frac{t_1 t_2}{t_2 - t_1}$

B. $\frac{t_1 t_2}{t_2 + t_1}$

C. $t_1 - t_2$

D. $\frac{t_1 + t_2}{2}$

Answer:

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28. The x and y coordinates of the particle at any time are $x = 5t - 2t^2$ and y = 10t respectively, where x andy are in metres and / in seconds. The acceleration of the particle at t = 5 s is

A. $5ms^{-2}$

B. $-4ms^{-2}$

C. $-8ms^{-2}$

D. 0

Answer:

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29. The speed of a swimmer in still water is 20 m//s. The speed of river water of river water is 10 m//s and due east. If he is standing on the south bank and wishes to cross the river along the shortest path the angle at which he should make his stroke w.r.t. noth is given by :-

A. 45° west

B. 30° west

C. 0°

D. 60° west

Answer:

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30. When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be :

A. $1 : 2\sqrt{3}$

B. $1 : \sqrt{2}$

C. $\sqrt{2} : 1$

D. $1 : \sqrt{3}$

Answer:

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31. Two particles A and B are moving in uniform circular motion in concentric circles of radii r_A and r_B with speed u_A and u_B respectively. Their time period of rotation is the same. The ratio of angular speed of a to that of B will be:

A. $1 : 1$

B. $r_A : r_B$

C. $v_A : v_B$

D. $r_B : r_A$

Answer:

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