PHYSICS

BOOKS - SURA PHYSICS (TAMIL ENGLISH)

KINEMATICS

Exercise Questions Multiple Choice Questions

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1. Which one of the following Cartesian coordinate systems is not follwed in physics?

A.

B.

C.

D.

Answer: D

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2. Identify the unit vector in the following .

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

B. $\dfrac{\hat{i}}{\sqrt{2}}$

C. $\hat{k} - \dfrac{\hat{j}}{\sqrt{2}}$

D. $\dfrac{\hat{i} + \hat{j}}{\sqrt{2}}$

Answer: D

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3. Which one of the following physical quantities cannot be represented by a scalar?

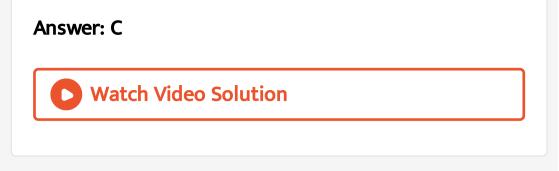A. Mass

B. length

C. momentum

D. magnitude of acceleration

Answer: C

4. Two objects of masses m_1 and m_2 fall from the heights h_1 and h_2 respectively. The ratio of the magntidue of their momenta when they hit the ground is

A. $\sqrt{\dfrac{h_1}{h_2}}$

B. $\sqrt{\dfrac{m_1 h_1}{m_2 h_2}}$

C. $\dfrac{m_1}{m_2}\sqrt{\dfrac{h_1}{h_2}}$

D. $\dfrac{m_1}{m_2}$

Answer: C

5. If a particle has negative velocity and negative acceleration, its speed

    A. increases

    B. decreases

    C. remains same

    D. zero

Answer: A

6. If the velocity is $\vec{v} = 2\hat{i} + t^2\hat{j} - 9\hat{k}$ then the magntidue of acceleration at $t = 0.5s$ is

A. $1ms^{-2}$

B. $2ms^{-2}$

C. zero

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

Answer: A

7. If an object is dropped from the top of a building and it reaches the ground at t = 4s, then the height of the building is (ignoring air resistance) $\left(g = 9.8ms^{-2}\right)$

A. 77.3 m

B. 78.4 m

C. 80.5 m

D. 79.2 m

Answer: B

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8. Distinguish between uniform and non uniform acceleration.

9. If one object is dropped vertically downward and another object is thrown horizontally from the same height, then the ratio of vertical distance covered by both objects at any instant t is

A. 1

B. 2

C. 4

D. 0.5

Answer: A

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10. A particle moves in a straight line with acceleration described by equation given below:

$$a = mx - \frac{v_0^2}{x_0}$$

The value of constant m is

A. $\dfrac{v_0^2}{x_0^2}$

B. $-\dfrac{v_0^2}{x_0^2}$

C. $2\dfrac{v_0^2}{x_0^2}$

D. $-2\dfrac{v_0^2}{x_0^2}$

Answer: A

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11. If a particle executes uniform circular motion in the xy plane in clock wise direction, then the angular velocity is in :

A. $+y$ direction

B. $+z$ direction

C. $-z$ direction

D. $-x$ direction

Answer: C

12. If a particle executes uniform circular motion, choose the correct statement

A. The velocity and speed are constant

B. The acceleration and speed are constant.

C. The velocity and accleration are constant.

D. The speed and magnitude of accelertion are

constant.

Answer: D

13. If an object is thrown vertically up with initial speed u from the ground, then the time taken by the object to return back to ground is

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

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

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

D. $\dfrac{2u}{g}$

Answer: D

14. Two objects are projected at angles $30°$ and $60°$ respectively with respect to the horizontal direction. The range of two objects are denoted as $R_{30°}$ and $R_{60°}$. Choose the correct relation from the following.

A. $R_{30°} = R_{60°}$

B. $R_{30°} = 4R_{60°}$

C. $R_{30°} = \dfrac{R_{60°}}{2}$

D. $R_{30°} = 2R_{60°}$

Answer: A

15. An object is dropped is an unknown planet from height 50 m, it reaches the ground is 2 s. The acceleration due to gravity in this unknwon planet is

A. $g = 20ms^{-2}$

B. $g = 25ms^{-2}$

C. $g = 15ms^{-2}$

D. $g = 30ms^{-2}$

Answer: B

Exercise Questions Short Answer Questions

1. What is meant by Cartesian coordinate system?

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2. Define a vector. Give examples.

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3. Define a scalar. Give examples

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4. Write a short note on the scalar product between two vectors.

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5. Write a short note on vector product between two vectors.

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6. How do you deduce that two vectors are perpendicular?

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7. Define displacement and distance.

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8. Define velocity and speed.

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9. Define acceleration.

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10. What is the difference between velocity and average velocity?

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11. Define a radian.

▶ **Watch Video Solution**

12. Define angular displacement and angular velocity.

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13. What is non uniform circular motion?

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14. Write down the Kinematic equations for Angular motion.

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15. Write down the expression for angle made by resultant acceleration and radius vector in the non uniform circular motion.

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1. Explain in detail the triangle law of addition.

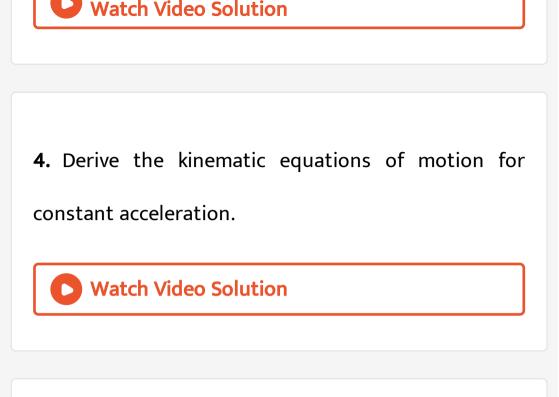 ▶ **Watch Video Solution**

2. Explain in detail the triangle law of addition.

 ▶ **Watch Video Solution**

3. Discuss the properties of scalar and vector

4. Derive the kinematic equations of motion for constant acceleration.

5. Derive equations of uniformly acceleration motion by calculus method.

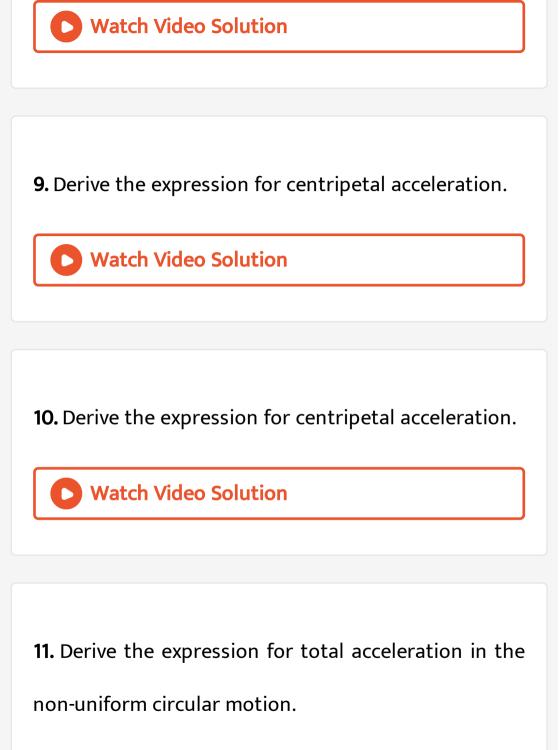**6.** Derive the equations of motion for a particle (a) falling vertically (b) projected vertically.

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7. Derive the equations of motion for a particle (a) falling vertically (b) projected vertically.

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8. Derive the equation of motion, range and maximum height reached by the particle thrown at an oblique angle θ with respect to the horizontal direction.
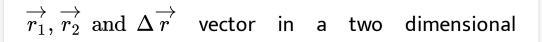
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9. Derive the expression for centripetal acceleration.

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10. Derive the expression for centripetal acceleration.

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11. Derive the expression for total acceleration in the non-uniform circular motion.
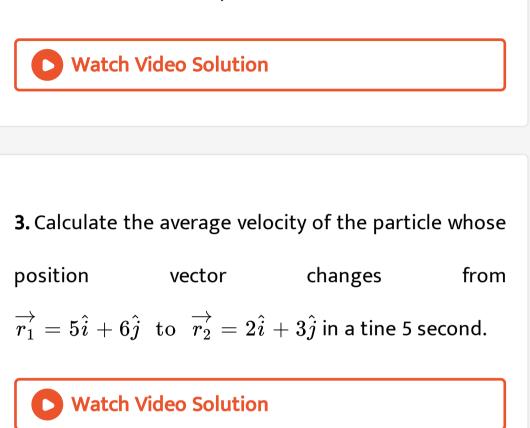
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1. The position vectors particle has length 1m and makes $30°$ with the x-axis. What are the lengths of the x and y components of the position vector?

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2. A particle has its position moved from $\vec{r_1} = 3\hat{i} + 4\hat{j}$ to $\vec{r_2} = \hat{i} + 2\hat{j}.$ Calculate the displacment vector $\left(\Delta\vec{r}\right)$ and draw the

$\overrightarrow{r_1}$, $\overrightarrow{r_2}$ and $\overrightarrow{\Delta r}$ vector in a two dimensional Cartesian coordinate system.

3. Calculate the average velocity of the particle whose position vector changes from $\overrightarrow{r_1} = 5\hat{i} + 6\hat{j}$ to $\overrightarrow{r_2} = 2\hat{i} + 3\hat{j}$ in a tine 5 second.

4. Convert the vector $\overrightarrow{r} = 3\hat{i} + 2\hat{j}$ into a unit vector.

5. What are the resultants of the vector product of two given vectors. Given by $\vec{A} = 4\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = 5\hat{i} + 3\hat{j} - 4\hat{k}$

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6. An object at an angle such that the horizontal range is 4 time of the maximum height. What is the angle of projection of the object?

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7. The following graphs represent velocity - time graph. Identify what kind of motion a paraticle undergoes in each graph.

8. The following velocity - time graph represents a particle moving in the positive x - direction. Analyse its motion from 0 to 7 s. Calculate the displacement covered and distance travelled by the particle from 0 to 2 s.

9. A particle is projected at an angle of θ with respect to the horizontal direction. Match the following for the above motion.

(a) V_x — decrease and increases

(b) V_y — remains constant

(c) Acceleration - varies

(d) Position vector — remains downward

10. A water fountain on the ground sprinkles water all around it. If the speed of the water coming out of the fountain is v. Calculate the total area around the fountain that gets wet.

11. The following table gives the range of a particle when thrown on different planets. All the particles are thrown at the same angle with the horizontal and with the same initial speed. Arrange the planets is ascending order according to their acceleration due

to gravity, (g value)

12. The resultant of two vectors A and B is perpendicular to vector A and its magnitude is equal to half of the magnitude of vector B.

Then the angle between A and B is

A. $30°$

B. $45°$

C. $150°$

D. $120°$

Answer: 3

13. Compare the components for the following vector

equations

(a) $T\hat{j} - mg\hat{j} = ma\hat{j}$ (b) $\overrightarrow{T} + \overrightarrow{F} = \overrightarrow{A} + \overrightarrow{B}$ ©

$\overrightarrow{T} - \overrightarrow{F} = \overrightarrow{A} - \overrightarrow{B}$ (d) $T\hat{j} + mg\hat{j} = ma\hat{j}$
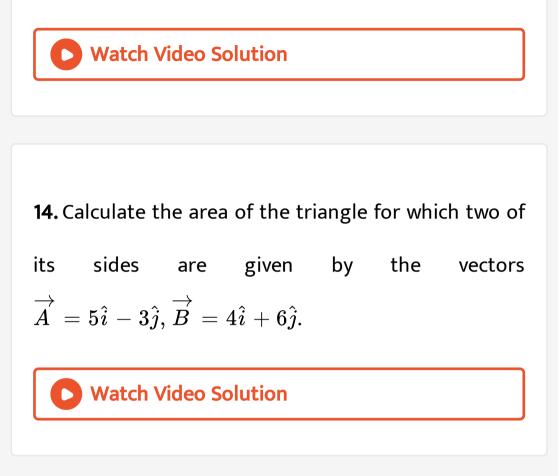
A. $T\hat{j} - mg\hat{j} = ma\hat{j}$

B. $\overrightarrow{T} + \overrightarrow{F} = \overrightarrow{A} + \overrightarrow{B}$

C. $\overrightarrow{T} - \overrightarrow{F} = \overrightarrow{A} - \overrightarrow{B}$

D. $T\hat{j} + mg\hat{j} = ma\hat{j}$

Answer:

14. Calculate the area of the triangle for which two of its sides are given by the vectors $\overrightarrow{A} = 5\hat{i} - 3\hat{j}, \overrightarrow{B} = 4\hat{i} + 6\hat{j}.$

15. If Earth completes one revolution in 24 hours, what is the angular displacement made by Earth in

one hour? Express your answer in both radian and degree.

16. An object is thrown with initial speed $5ms^{-1}$ with an angle of projection $30°$. What is the maximum height and range reached by the particle?

17. A foot - ball player hits the ball with speed $20ms^{-1}$ with angle $30°$ with respect to horizontal direction as shown in the figure. The goal post is at

distance of 40 m from him. Find out whether ball reaches the goal post ?

18. If an object is thrown horizontally with an initial speed $10 \, \text{ms}^{-1}$ from the top of a building of height 100 m. What is the horizontal distance covered by the particle.

19. An object is executing uniform circular motion with an angular speed of $\frac{\pi}{12}$ radian per second. At $t = 0$, the object starts at an angle $\theta = 0$. What is the angular displacement of the particle after 4s?

20. Consider the x - axis as representing east, the y - axis as north and z - axis as vertically upwards. Give the vector representing each of the following points and the direction is of 45°.

a) 5 m north east and 2 m up

b) 4 m south east and 3 m up

c) 2 m north west and 4 m up

21. The moon is orbiting the Earth approximately in 27 days, what is the angle transversed by the Moon per day?

22. An object of mass m has angular acceleration $\alpha = 0.2 \ \text{rad s}^{-2}$. What is the angular displacement covered by the object after 3 second ? (Assume that

the object started with angle zero with angular velocity).

Additional Questions Multiple Choice Questions

1. Which of the following physical quantities have same dimensional formula?

    A. Toque and Work done

    B. Energy and Angular momentum

    C. Force and Torue
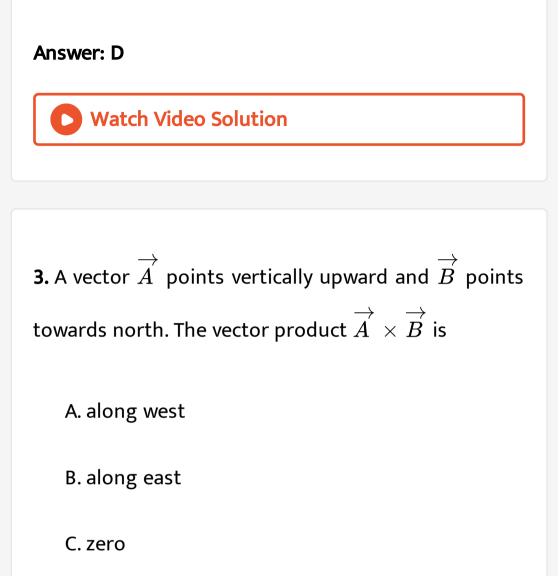
D. Angular momentum and Linear momentum

Answer: A

2. The dimensions of physical quantity X in the equation Force $= \dfrac{X}{\text{Density}}$ is given by

A. $M^1 L^4 T^{-2}$

B. $M^2 L^{-2} T^{-1}$

C. $M^2 L^{-2} T^{-2}$

D. $M^1 L^{-2} T^{-1}$

Answer: D

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3. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north. The vector product $\vec{A} \times \vec{B}$ is

    A. along west

    B. along east

    C. zero

    D. vertivally downward

Answer: A

4. The maximum value of fractional error in division of two quantities i.e., $x = \dfrac{A}{B}$ is

A. $\dfrac{\Delta x}{x} = \pm \left(\dfrac{\Delta A}{A} - \dfrac{\Delta B}{B} \right)$

B. $\dfrac{\Delta x}{x} = \left(-\dfrac{\Delta A}{A} + \dfrac{\Delta B}{B} \right)$

C. $\dfrac{\Delta x}{x} = \left(\dfrac{\Delta A}{A} + \dfrac{\Delta B}{B} \right)$

D. $\dfrac{\Delta x}{x} = \left(\dfrac{\Delta A}{x} - \dfrac{\Delta B}{B} \right)$

Answer: C

5. The unit vector in the direction of $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ is

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

B. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{2}}$

C. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$

D. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{6}}$

Answer: C

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6. Which one of the following statement is true?

A. A scalar quantity is conserved in a process

B. A scalar quantity does not vary from one point

to another in space

C. A scalar quantity can never tke $-ve$ values

D. A scalar quantity has only magntitude and no

direction.

Answer: D

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7. The angle between Ai +j and B = i-j is

A. 45°

B. 90°

C. -45°

D. 180°

Answer: B

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8. The component of position vector $\vec{r}$ along x - axis

will maximum value if

A. $\vec{r}$ is along the x - axis

B. $\vec{r}$ makes an angle of $45°$ with x - axis

C. $\vec{r}$ is along the y - axis

D. $\vec{r}$ is along $-ve$ y - axis

Answer: A

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9. Consider the quantities pressure, power, energy, impulse, change. Out of these, the only vector quantity is

A. pressure

B. power

C. impulse
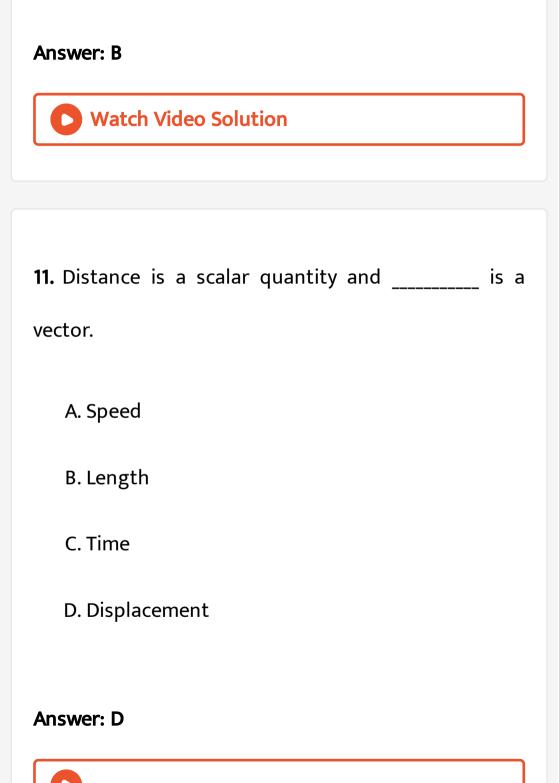
D. charge

Answer: C

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10. The length of a vector is _____

A. always a negative quantity

B. always a positive quantity

C. either positive or negative

D. denoted by 'λ'

Answer: B

11. Distance is a scalar quantity and _____ is a vector.

    A. Speed

    B. Length

    C. Time

    D. Displacement

Answer: D

12. The horizontal range of a projectile fired at an angle of $15°$ is 50 m. If it is fired with the same used at angle of $45°$, its range will be

    A. 125 m

    B. 75 m

    C. 100 m

    D. 150 m

Answer: C

13. Choose the motion in two dimension from the following.

A. Motion of a train along a straight railway track

B. An object falling freely under gravity close to the Earth.

C. A particle moving along a curved path in a plane.

D. Flying of a kite on a windy day.

Answer: C

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14. Which one of the following physical quantities cannot be represented by a scalar?

A. Mass

B. Length

C. Momentum

D. Magnitude of acceleration

Answer: C

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15. An object is dropped is an unknown planet from height 50 m, it reaches the ground is 2 s. The acceleration due to gravity in this unknwon planet is

A. $g = 20ms^{-2}$

B. $g = 25ms^{-2}$

C. $g = 15ms^{-2}$

D. $g = 30ms^{-2}$

Answer: B

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16. The dimensions of physical quantity X in the equation Force $= \dfrac{X}{\text{Density}}$ is given by

A. $M^1 L^4 T^{-2}$

B. $M^2 L^{-2} T^{-2}$

C. $M^2 L^2 T^{-2}$

D. $M^1 L^{-4} T^{-1}$

Answer: D

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17. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north. The vector product $\vec{A} \times \vec{B}$ is

A. along west

B. along east

C. Zero

D. vertically downward

Answer: A

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18. The length of a vector is _____

A. always a negative quantity

B. always a positive quantity

C. either positive or negative

D. None of these

Answer: B

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19. The horizontal range of a projectile fired at an angle of $15°$ is 50 m. If it is fired with the same used at angle of $45°$, its range will be

A. 125m

B. 75m

C. 100m

D. 150m

Answer: C

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20. Kinematics is the branch of mechanics which delas with the motion of objects without taking _____ into account

A. displacement

B. mass

C. motion

D. force

Answer: D

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21. A mass which has finite value with Zero dimension

is called _____

A. Point mass

B. Linear mass

C. Rotational mass

D. heavy mass

Answer: A

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22. _____ is an example for motion in 3 dimension

    A. A body falling freely under gravity close to earth

    B. An insect crawling in a room, on the wall

    C. Movement of clouds

    D. Fast moving steam boat

Answer: C

23. Vectors which act along the same line whose angle between them can be $0°$ or $180°$ are called _____.

A. Orthogonal vectors

B. Collinear vectors

C. Unit vectors

D. Resultant vectors

Answer: B

24. The unit vector in the direction of $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ is

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

B. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{2}}$

C. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$

D. $\dfrac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{6}}$

Answer: C

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25. The acceleration which will not give the value of acceleration at any instant of tine 't' is _____

A. Instantaneous acceleration

B. Negative acceleration

C. Positive acceleration

D. Average acceleration

Answer: D

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26. The relation between linear velocity and angular velocity of a body moving in a circle is

A. $v = R/\omega$

B. $v = \omega/r$

C. $v = r\omega^2$

D. $v = r\omega$

Answer: D

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Additional Questions Fill In The Blanks

1. The Greek word " Kinema" means

    A. Motion

    B. Force

    C. Velocity

    D. Energy

Answer: A

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2. The motion of a top is an example for

    A. Centripetal force

B. Rotational motion

C. Torqe

D. Centrifugal force

Answer: B

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3. Apart from linear, circular, vibratory, and rotational motions, other type oof motion like _____and helical motion are also possible

A. elliptical

B. plane

C. Inclined

D. zig zag

Answer: A

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4. ____is a vector which denotes the position of a particle at any instant of time with respect to some frame of reference
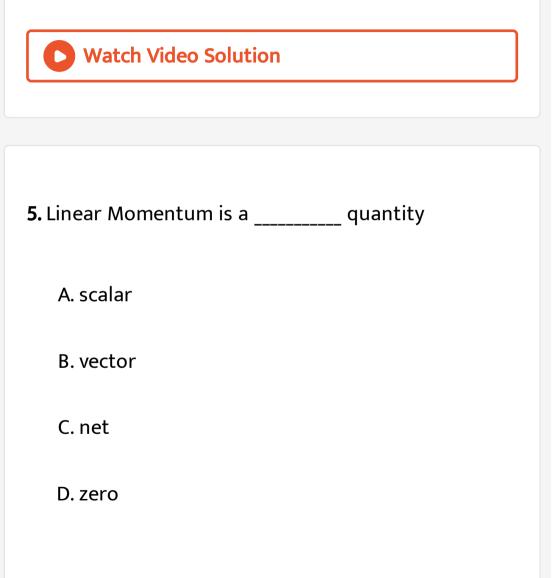
A. position vector

B. non vector

C. unit vector

D. coplanar vector

Answer: A

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5. Linear Momentum is a _____ quantity

A. scalar

B. vector

C. net

D. zero

Answer: B

6. A train is travelling from west to east at an average speed of 120 km/hr. How far does this train travel in 6.0 second?

7. The negative acceleration is also called as _____ .

8. The parabolic path followed by a projectile in air is called _____

9. Shooting of an arrow from the bow, is an example for_____

A. projectile motion

B. free fall

C. linear momentum

D. curved motion

Answer: A

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10. The expression for relation between Linear and angular acceleration is _____

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Additional Questions Choose The Odd One Out

1. CHOOSE THE ODD ONE OUT:

A. Distance

B. Displacement

C. Velocity

D. Projectile

Answer: A

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2. CHOOSE THE ODD ONE OUT:

A. Spinning of earth

B. Moving of satellite around earth

C. Turbine motion

D. Apple falling down.

Answer: D

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3. CHOOSE THE ODD ONE OUT:

A. Unit vector

B. Resoluation of a vector

C. Collinear Vector

D. Equal vectors

Answer: B

4. CHOOSE THE ODD ONE OUT:

A. $v = -gt$

B. $s = \dfrac{1}{2}gt^2$

C. $s = \dfrac{(u + v)t}{2}$

D. $v^2 = -2gs$

Answer: C

5. CHOOSE THE ODD ONE OUT:

A. $\dfrac{u^2 \sin 2\theta}{g}$

B. $\dfrac{2u \sin \theta}{g}$

C. $\sqrt{u^2 + g^2 t^2}$

D. $\dfrac{u^2 \sin^2 \theta}{2g}$

Answer: D

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Additional Questions Choose The Incorrect Pair

1. CHOOSE THE INCORRECT PAIR :

A. a — $\propto$

B. v — ω

C. x — θ

D. p — I

Answer: D

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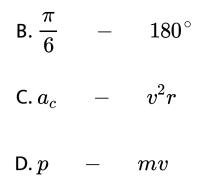**2.** CHOOSE THE ODD ONE OUT :

A. Angle

B. Radius

C. Time

D. Mass

Answer: A

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Additional Questions Choose The Correct Pair

1. CHOOSE THE CORRECT PAIR :

A. $(\omega_0 + \propto t)$ $-$ $(u + at)$

B. $\dfrac{\pi}{6}$ $-$ $180\,^{\circ}$

C. a_c $-$ $v^2 r$

D. p $-$ mv

Answer: D

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2. CHOOSE THE CORRECT PAIR :

A. Equal vectors - Unity

B. Unit vectors - Parallel

C. Collinear vectors - Opposite

D. Orthogonal vectors - Perpendicualr

Answer: D

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Additional Questions Assertion Reason

1. If $\overrightarrow{B} = 6\hat{i} + 8\hat{j}$ then obtain the magnitude and direction of $\overrightarrow{B}$

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2. Assertion : Rule is an example for Orthogonal vectors.

Reason : When we stretch first three fingers of our right hand, Magnetic field along fore finger (i.e. X- axis) current direction along middle finger (i.e. Y - axis) and motion of the conductor along the thumb direction (i.e. Z axis)

    A. Assertion and Reason are correct and Reason is

       correct explanation of Assertion

    B. Assertion and Reason are true but Reason is

       the false explanation of the Assertion

    C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: A

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3. If two objects A and B are moving along a straight line in the same direction with the velocities V_A and V_B respectively, then the relative velocity is

A. Assertion and Reason are correct and Reason is correct explanation of Assertion

B. Assertion and Reason are true but Reason is the false explanation of the Assertion

C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: C

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4. Assertion : Any object thrown at an angle of $90°$ with an initial velocity is called projectile

Reason : When any object is thrown at an angle of $45°$, it reaches the maximum (horizontal) distance ex : Javelin throw, shot put throw etc.

A. Assertion and Reason are correct and Reason is correct explanation of Assertion

B. Assertion and Reason are true but Reason is the false explanation of the Assertion

C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: D

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5. Assertion : Beating a person with a scale or stick is an example for how momentum is converted into

force.

Reason : If 'm' is the mass of the scale 'v' is the velocity of the scale (movement), this 'mv' changes, from the initial point to the final point (i.e. hand or body) with respect to time

As we know $\dfrac{mv}{t} = ma\left(\dfrac{V}{t}\right) = ma = F$

This is how momentum is converted into force.

A. Assertion and Reason are correct and Reason is correct explanation of Assertion

B. Assertion and Reason are true but Reason is the false explanation of the Assertion

C. Assertion is true but Reason is false

D. Assertion is false but Reason is true

Answer: A

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1. (I) Two vecotrs which are perpendicular to each other are called Orthogonal vectors.

(II) To find resultant of two of addition.

Which statement is is correct?

A. I only

B. I only

C. Both are correct

D. None

Answer: C

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2. (I) $\hat{i}.\,\hat{i} = \hat{j}.\,\hat{j} = \hat{k}.\,\hat{k} = 0$

(II) $\hat{i} \times \hat{i} = \hat{j} \times \hat{j} = \hat{k} \times \hat{k} = 0$

Which statement is is correct?

A. I only

B. II only

C. Both are correct

D. None

Answer: B

3. (I) Area of a Parallelogram in vectors is $\left|\vec{A} \times \vec{B}\right| = \left|\vec{A}\right|\left|\vec{B}\right| \sin\theta$

(II) Area of a Triangle in vectors is $1/2\left(\vec{A} \times \vec{B}\right)$

Which statement is in correct?

A. I only

B. II only

C. Both are correct

D. None

Answer: B

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4. (I) $\vec{L} = \vec{r} \cdot \vec{p}$ where P is the Linear momentum

(II) $\vec{v} = r \cdot \vec{\omega}$ where ω is the angular velocity

Which statement is is correct?

A. I only

B. II only

C. Both are correct

D. None

Answer: A

5. (I) From equations of Linear motion $S = \dfrac{(u-v)t}{2}$

(II) From equations of rotational (Angular) motion

$$\omega^2 = \omega_0^2 + 2 \propto \theta$$

Which statement is in correct?

A. I only

B. II only

C. Both are correct

D. None

Answer: B

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6. (I) If the speed of the object in a circular motion is not constant, it is called a non - uniform circular motion.

(II) Acceleration which is acting away from the centre of the circle is called Centripetal Acceleration.

Which statement is in correct?

A. I only

B. II only

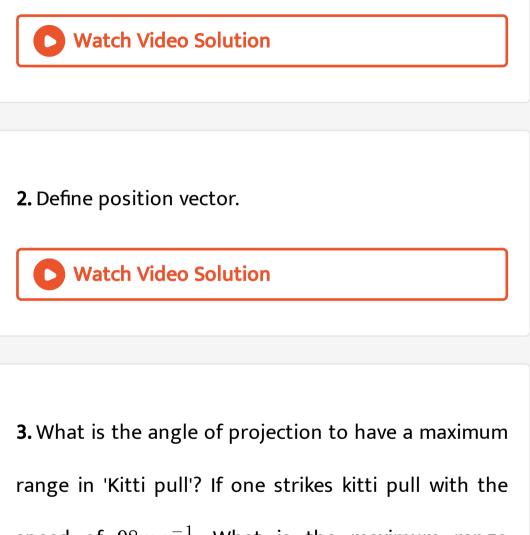C. Both are correct

D. None

Answer: B

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Very Short Answer Questions

1. A particle moves in a circle of radius 10 m. Its linear speed is given by $v = 3t$ where t is the lime in second

and v is in ms^{-1}.Compute the centripetal and tangential acceleration at time t = 2s.

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2. Define position vector.

> ▶ **Watch Video Solution**

3. What is the angle of projection to have a maximum range in 'Kitti pull'? If one strikes kitti pull with the speed of $98ms^{-1}$. What is the maximum range achieved?

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4. What is Kinematics?
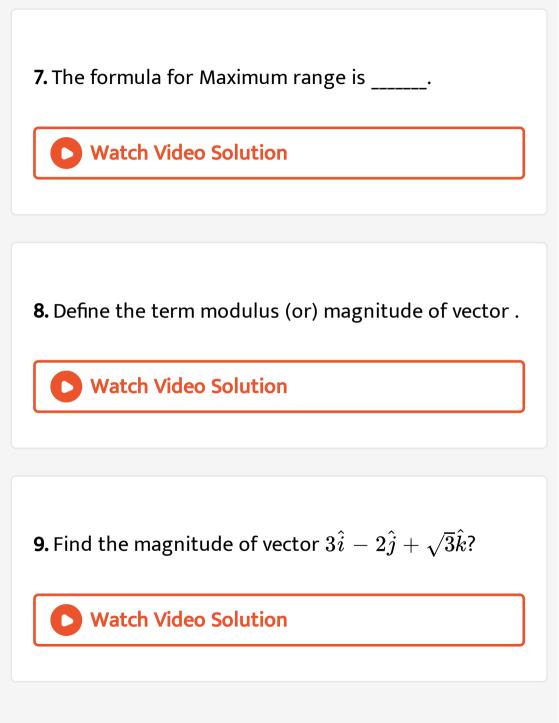
  ▶ **Watch Video Solution**

5. What is meant by Frame of reference?

  ▶ **Watch Video Solution**

6. What is meant by right-handed Cartesian coordinate system ?

  ▶ **Watch Video Solution**

7. The formula for Maximum range is _____.

▶ **Watch Video Solution**

8. Define the term modulus (or) magnitude of vector .

▶ **Watch Video Solution**

9. Find the magnitude of vector $3\hat{i} - 2\hat{j} + \sqrt{3}\hat{k}$?

▶ **Watch Video Solution**

10. How will you find the sum (resultant) of two vectors , which are inclined to each other ?

▶ **Watch Video Solution**

11. State the vector product of two vectors . Also prove that whether it is commutative or not commutative.

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12. What is meant by resolution of vector ?

▶ **Watch Video Solution**

13. Give some examples of physical quantities which can be expressed as the vector product of two vectors .

▶ **Watch Video Solution**

14. Write the required Equations of motion in a straight line.

▶ **Watch Video Solution**

15. Define displacement and distance.

16. A car covers the first half of the distance between two places at 40 km/hr and another half at 60 km/hr. The average speed of the car is
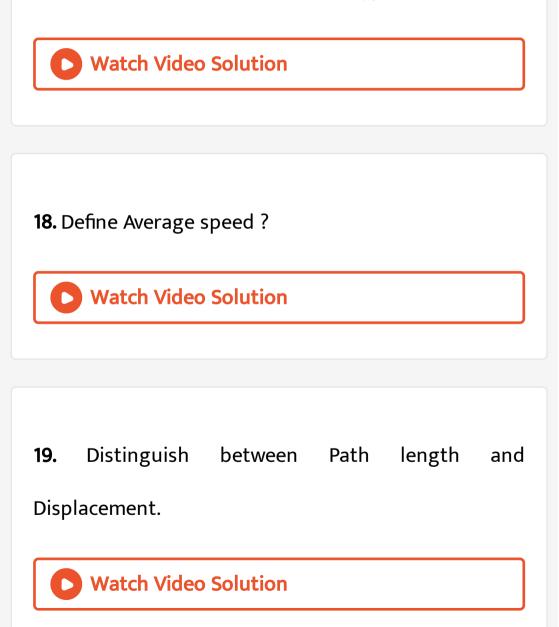
A. 40 km/hr

B. 48 km/hr

C. 50 km/hr

D. 60 km/hr

Answer: 2

17. What is Calculus ? What are the types of Calculus ?

> ▶ **Watch Video Solution**

18. Define Average speed ?

> ▶ **Watch Video Solution**

19. Distinguish between Path length and Displacement.

> ▶ **Watch Video Solution**

20. What is the SI unit of Average speed and Average velocity ?
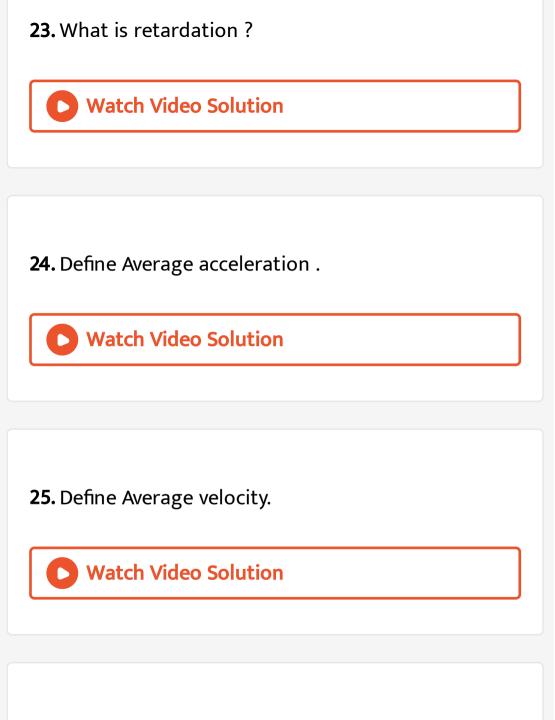
▶ **Watch Video Solution**

21. Write the component form of the momentum.

▶ **Watch Video Solution**

22. Define relative velocity.

▶ **Watch Video Solution**

23. What is retardation ?

  ▶ **Watch Video Solution**

24. Define Average acceleration .
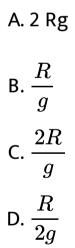
  ▶ **Watch Video Solution**

25. Define Average velocity.

  ▶ **Watch Video Solution**

26. What is projectile ? Give it's examplees.

27. Two objects are projected with same velocity at different angles with the horizontal range and is same for both of them. If t_1 and t_2 are their time of flights, then $t_1 t_2 =$_____

A. 2 Rg

B. $\dfrac{R}{g}$

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

D. $\dfrac{R}{2g}$

Answer: 3

28. Write the combined effect of two velocities of a projectile.

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29. What are the assumptions made in the projectile motion ?
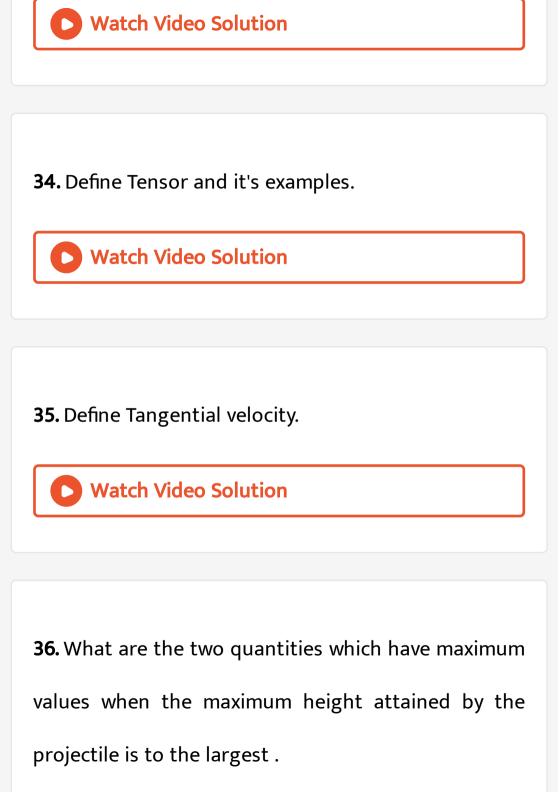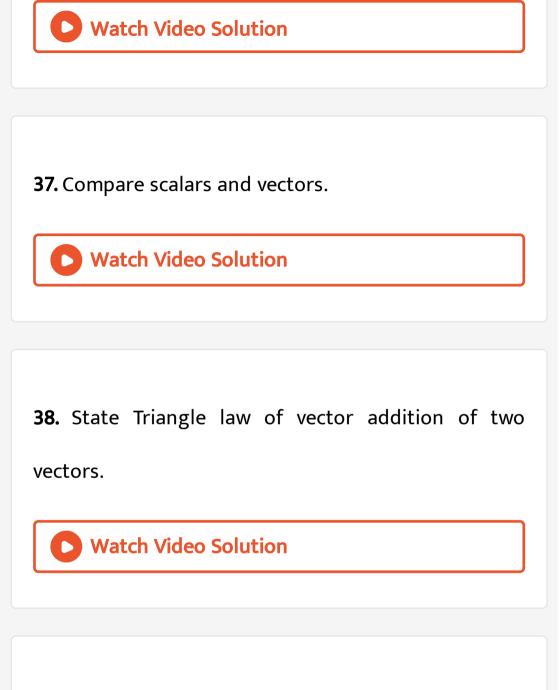
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30. Define Air resistance ?

31. What are the factors the horizontal range directly and inversely depends ?

32. Write the condition for the maximum horizontal range.

33. What is degree ? Express 1 radian in degree.

34. Define Tensor and it's examples.

35. Define Tangential velocity.

36. What are the two quantities which have maximum values when the maximum height attained by the projectile is to the largest .

37. Compare scalars and vectors.

38. State Triangle law of vector addition of two vectors.

39. Mention the properties of Addition of vectors.

40. Mention the properties of dot product of two vectors.

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41. Mention the properties of cross product of two vectors .

▶ **Watch Video Solution**

42. Write down the formula for Maximum height.

43. Mention some of the salient points about angular

projection of projectiles.

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44. What is uniform motion ?

> ▶ **Watch Video Solution**

45. What is non - uniform accelerated motion ?

> ▶ **Watch Video Solution**

46. What is free fall of a body ?

> ▶ **Watch Video Solution**

47. What is centripetal acceleration or radial acceleration or normal acceleration ?
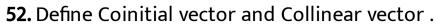
> ▶ **Watch Video Solution**

48. Define one dimensional motion . Give examples .

> ▶ **Watch Video Solution**

49. Define two dimensional motion . Give examples .

▶ **Watch Video Solution**

50. Define three dimensional motion . Give examples .

▶ **Watch Video Solution**

51. What is the condition for two vectors are orthogonal ?

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52. Define Coinitial vector and Collinear vector .

 ▶ **Watch Video Solution**

53. Give the importance of displacement - time graph .

 ▶ **Watch Video Solution**

54. Give the importance of velocity - time graph .

 ▶ **Watch Video Solution**

55. Write down the Formulas for projectile motion.

56. 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: 4

1. Displacement of a particle is given by the expression $x = 3t^2 + 7t - 9$, where x is in meter and t is in seconds. What is acceleration ?

    A. 10m/s^2

    B. 15m/s^2

    C. 8m/s^2

    D. 6m/s^2

Answer: 4

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2. The velocitities of three particles A, B and C are $\overrightarrow{v_A} = \left(3\hat{i} - 5\hat{j} + 2\hat{k}\right)ms^{-1}$, $\overrightarrow{v_B} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right)ms^{-1}$ and $\overrightarrow{v_C} = \left(5\hat{i} + 3\hat{j} + 4\hat{k}\right)ms^{-1}$, respectively. Which particle travels at neither greatest nor lowest speed?
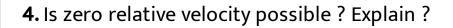
> ▶ **Watch Video Solution**

3. Derive expression for maximum height, time of flight and range of a projectile.

> ▶ **Watch Video Solution**

4. Is zero relative velocity possible ? Explain ?

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5. A railway train 400m long is going from Chennai Central railway station to Madurai. Can we consider railway train as a point object ?

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6. State any four characteristics of Displacement.

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7. Under what condition the distance and displacement of a moving object will have the same magnitude ?
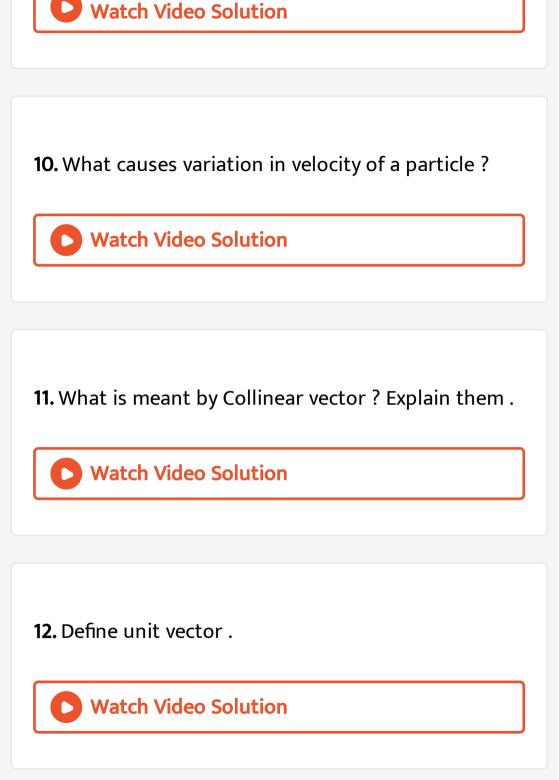
▶ **Watch Video Solution**

8. What is meant by point mass and give suitable example ?

▶ **Watch Video Solution**

9. What do you mean by motion in one, two and three dimensions ?

10. What causes variation in velocity of a particle ?

 ▶ **Watch Video Solution**

11. What is meant by Collinear vector ? Explain them .

 ▶ **Watch Video Solution**

12. Define unit vector .

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13. Define Orthogonal unit vectors.

14. Deepak went on his bike from Chennai to Thiruvallur at a speed of 60 km/hr and came back at a speed of 40 km/hr. What is his average speed for entire journey.
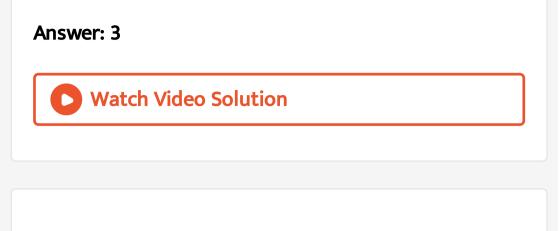
    A. 40 km/hr

    B. 45 km/hr

    C. 48 km/hr

    D. 52 km/hr

Answer: 3

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15. How are two vectors expressed in a Cartesian system ? Explain the addition & subtraction using components.

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16. How is the direction of vector product determined ?
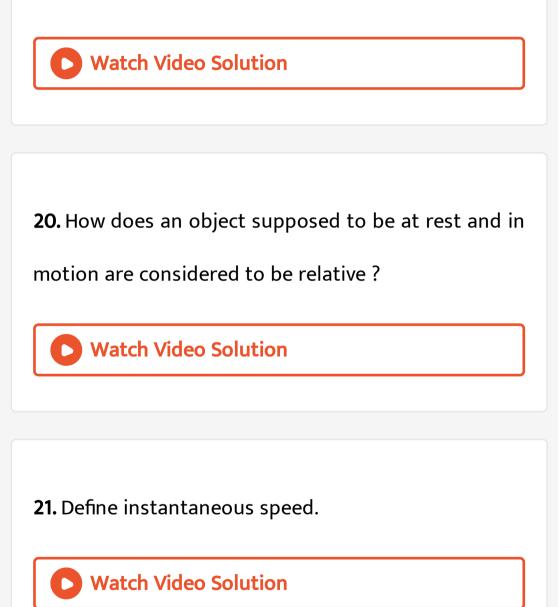
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17. A car moving along a straight highway with a speed of 126 kilometre per hour is brought to a stop within a distance of 200m. What is the retardation of the car (assumed uniform) and how long does it taken for the car to stop?

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18. Write the expression for time of flight in projectile motion.

▶ **Watch Video Solution**

19. Distinguish between Distance and Displacement.

> ▶ **Watch Video Solution**

20. How does an object supposed to be at rest and in motion are considered to be relative ?

> ▶ **Watch Video Solution**

21. Define instantaneous speed.

> ▶ **Watch Video Solution**

22. Write an expression for component of Instantancous velocity or velocity and also define it.

▶ **Watch Video Solution**

23. What does the slope of 'position - time' graph represent? Which physical quantity is obtained from it?

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24. Write down the different methods for obtaining addition of vectors.

25. Write an expression for the two objects, moving with uniform velocities along the same striaght tracks but opposite in direction.

26. List out the conditions of Magnitude and Direction for the following vectors:

(i) Equal vectors.

(ii) Parallel vectors.

(iii) Opposite vectors.

(iv) Anti-parallel vectors.

(v) Aparallel vectors.

> ▶ **Watch Video Solution**

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27. What is meant by accelerated motion ?

> ▶ **Watch Video Solution**

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28. Define Instantaneous acceleration.

> ▶ **Watch Video Solution**

29. Write an expression for an acceleration of rectangular components.

▶ **Watch Video Solution**

30. How can the depth of well is measured and also estimate the $\%$ of real error .

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31. Derive the expression for a body projected horizontally.

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32. If $\vec{A} = 12\hat{i} + 14\hat{j}$ and $\vec{B} = 10\hat{i} + 8\hat{j}$. Then find $\left|\vec{A} - \vec{B}\right|$

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33. Find the expressions tangential acceleration.

▶ **Watch Video Solution**

34. Define uniform circular motion . Give some examples.

35. What is meant by point mass and give suitable example ?

36. Define three dimensional motion . Give examples .

Long Answer Questions

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

    A. 7 units

    B. 8.5 units

    C. 10 units

    D. $7\sqrt{2}$ units

Answer: D

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2. The speed of a projectile at it's maximum height is half of it's initial speed. The angle of projection is

A. $60°$

B. $15°$

C. $30°$

D. $45°$

Answer: A

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

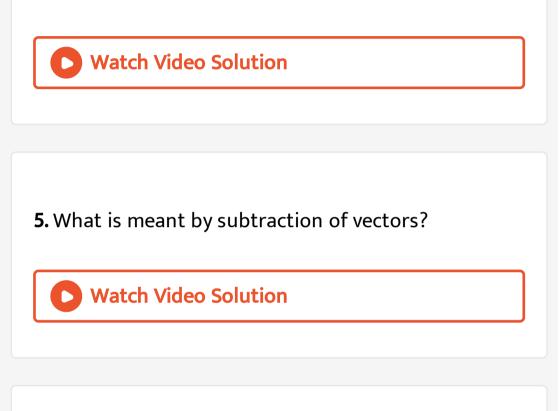A. $45°$

B. $60°$

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

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

Answer: C

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4. Define the term motion and explain the different types of motion.

5. What is meant by subtraction of vectors?

6. A boat which has a speed of 5 km/hr in still water crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water in km/hr is

A. 1 km/hr

B. 3 km/hr

C. 4 km/hr

D. 5 km/hr

Answer: B

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7. Define time of flight.

▶ **Watch Video Solution**

8. If $\vec{A} = 4\hat{i} - 3\hat{j}$, $\vec{B} = 6\hat{i} + 8\hat{j}$ then obtain the magnitude and direction of $\vec{A} + \vec{B}$

9. Write the important properties of vector (cross) product.

Numerical Problems

1. The positiion vectors of two point masses 10 kg and 5 kg are $\left(3\hat{i} + 2\hat{j} + 4\hat{k}\right)m$ and $\left(3\hat{i} + 6\hat{j} + 5\hat{k}\right)m$ respectively. Locate the position of center of mass.

2. A car moving with a speed of 40 km/hr comes to rest at a distance of 2 m after applying brakes. If the same car is moving with a speed of 80 km/hr, what is the minimum stopping distance?

3. The displacement of particle moving along x-axis is given by $x = 6t + 12t^2$, calculate the instantaneous velocity at $t = 0$ and $t = 2s$.

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4. The displacement x of a particle varies with time 't' as, $x = 3t^2 - 4t + 30$. Find the position, velocity and acceleration of the particle at t = 0.

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5. A particle is moving in a straight line its displacement at any instant t is given by $x = 5t^2 + 20t^3$. Find the average acceleration in the interval t = 0 to t = 3 seconds.

6. Spring is pulled down by 2 cm. What is amplitude of motion?

    A. 0 cm

    B. 2 cm

    C. 7 cm

D. 4 cm

Answer: B

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7. A body starting from rest has an acceleration of $25ms^{-2}$. Find the distance travelled by it in 20th second.

> ▶ **Watch Video Solution**

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8. A car moving uniform motion with speed $120\,\text{kmh}^{-1}$ is brought to a stop within a distance of

200 m. How long does it take for the car to stop?

9. The velocity - time graph of an object moving along

a straight line is as shown.

Calculate distance covered by object between t = 0 to

t = 3 and t = 3 to t = 6.

10. Find the angle between two vectors.

$A = \hat{i} + 2\hat{j} - \hat{k}$ and $B = -4\hat{i} + \hat{j} - 2\hat{k}$.

11. Two bodies of mass 3g and 6g have position vectors $2\hat{i} + \hat{j} + 3\hat{k}$ and $\hat{i} + 3\hat{j} + 2\hat{k}$ respectively. Find the position vectors of center of mass.
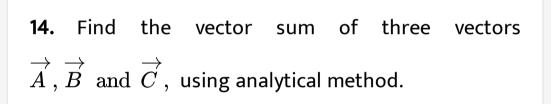
12. Express cross and dot product of two vectors in Cartesian coordinate.

13. Find the magnitude and directions of the vecots, $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$

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14. Find the vector sum of three vectors $\vec{A}, \vec{B}$ and $\vec{C}$, using analytical method.

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15. Calculate the vector which has to be added to the resultant of

$$\overrightarrow{A} = 2\hat{i} - 3\hat{j} - 4\hat{k} \text{ and } \overrightarrow{B} = 6\hat{i} - 4\hat{j} - 4\hat{k} \quad \text{gives}$$
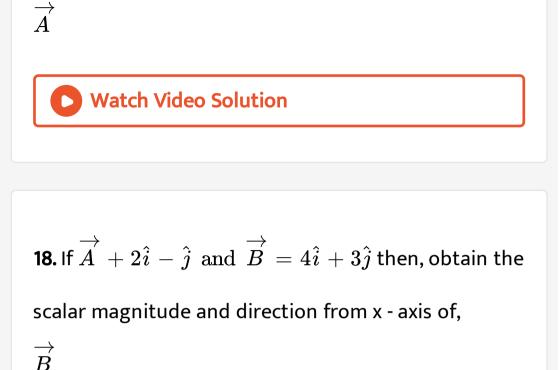
unit vector along x - direction.

16. Chennai is a distance of 500 km from Coimbatore.

(A) sets out from Coimbatore at a speed of 50 kmh^{-1}

and (B) sets out at the same time from Chennai at a

speed of 40 kmh^{-1}. When will they meet each other ?

17. If $\overrightarrow{A} + 2\hat{i} - \hat{j}$ and $\overrightarrow{B} = 4\hat{i} - 3\hat{j}$ then, obtain the
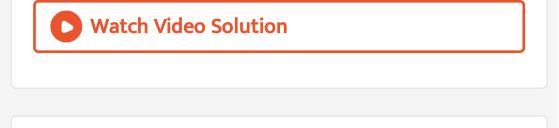
scalar magnitude and direction from x - axis of,

$$\overrightarrow{A}$$

18. If $\overrightarrow{A} + 2\hat{i} - \hat{j}$ and $\overrightarrow{B} = 4\hat{i} + 3\hat{j}$ then, obtain the scalar magnitude and direction from x - axis of,

$$\overrightarrow{B}$$

19. If $\overrightarrow{A} + 2\hat{i} - \hat{j}$ and $\overrightarrow{B} = 4\hat{i} + 3\hat{j}$ then, obtain the scalar magnitude and direction from x - axis of,

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

20. If $\vec{A} + 2\hat{i} - \hat{j}$ and $\vec{B} = 4\hat{i} - 3\hat{j}$ then, obtain the scalar magnitude and direction from x - axis of, $\vec{A} - \vec{B}$

21. The position of a particle is given by $r = 2.00t\hat{i} - 1.00t^2\hat{j} + 3.00\hat{k}$ where t is in seconds and the coefficients have the proper unit for r to be in metres. Find the velocity and acceleration of a particle then what is the magnitude and direction of velocity of the particle at t = 2 s?

22. If position of a particle at instant t is given by $x = 3t^2$, find the velocity and acceleration of the particle.

23. Determine that vector which when added to the resultant of $A = 2\hat{i} - 4\hat{j} + 6\hat{k}$ and $B = \hat{i} + 3\hat{j} - 3\hat{k}$ gives unit vector along z - direction.

1. Balu went to kuttraalam with his grandpa, when he saw the waterfalls falling down from the top of a mountain he could not believe his eyes. He loved admiring it. He adked grandpa how this is possible. Grandpa said even now the answer to this question from where the water is coming from the top of a mountain is a puzzle, but we got some scientific truths behind this flow.

(ii) Give the formula for time of flight of the waterfall.

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2. Balu went to kuttraalam with his grandpa, when he saw the waterfalls falling down from the top of a mountain he could not believe his eyes. He loved admiring it. He adked grandpa how this is possible. Grandpa said even now the answer to this question from where the water is coming from the top of a mountain is a puzzle, but we got some scientific truths behind this flow.

(ii) Give the formula for time of flight of the waterfall.

3. Balu went to kuttraalam with his grandpa, when he saw the waterfalls falling down from the top of a mountain he could not believe his eyes. He loved admiring it. He adked grandpa how this is possible. Grandpa said even now the answer to this question from where the water is coming from the top of a mountain is a puzzle, but we got some scientific truths behind this flow.

(ii) Give the formula for time of flight of the waterfall.

4. Lord Rama and Arjuna were skilled in archery. As we apply more action (tension) to the string, the faster an arrow flies. After reading about Rama and Arjuna, Raju asked his friend Bhaskar is there any scientific facts behind Archery. He also asked Bhaskar about how to find force of the arrow.

(i) Is there any physics concept behind this archery?

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5. A car accelerates from rest at a constant rate α for sometime after which it decelerates at a constant rate β to come to rest. If the total time lapse is t

seconds, evaluate:

(i) Maximum velocity reached and

(ii) The total distance travelled.

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

A. $\dfrac{1}{\sqrt{2}}\dfrac{m}{s^2}$ towards north-west

B. $\dfrac{1}{\sqrt{2}}\dfrac{m}{s^2}$ towards north-east

C. $\dfrac{1}{2}\dfrac{m}{s^2}$ towards north-west

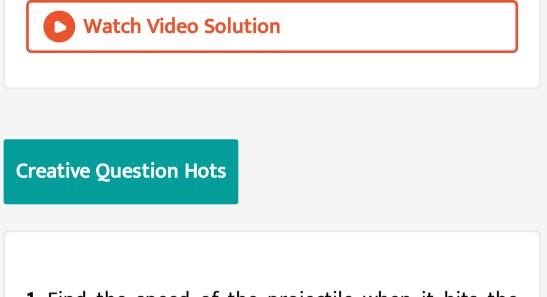D. $\dfrac{1}{2}\dfrac{m}{s^2}$ towards north

Answer: A

7. Displacement (y) of the particle is given by:

$y = 2t + t^2 - 2t^3$. Then, the velocity of the particle

when acceleration is zero is

A. $\dfrac{5}{2}$

B. $\dfrac{9}{4}$

C. $\dfrac{13}{6}$

D. $\dfrac{17}{8}$

Answer: C

Creative Question Hots

1. Find the speed of the projectile when it hits the ground.

2. Find the position and velocity of x at time, t = 2 seconds

    A. (19m , 19m/s)

B. (19.6m , 19.6m/s)

C. (10m , 10m/s)

D. (11m , 12m/s)

Answer: B

3. If the velocity of projectile is $20ms^{-1}$ at what angle to the horizontal should be projected as that it covers maximum horizontal distance of 10m

4. A man moving in rain holds his umbrella inclined to the vertical even though the rain drops are falling vertically downwards. Why?

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5. A train 20 m long is moving with a speed of 40 km/h. In what time shall it cross a bridge of 500 m long?

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6. The position of an particle is given by $x = 6t + 2t^3$. Find out whether is motion is uniform or non - uniform.

7. A bus starting from rest moves with a uniform acceleration of $0.2ms^{-2}$ for 3 minutes. Find the speed and distance travelled.

8. At train moving with a speed of 100 km/h can be stopped by brakes after atleast 15m. What will be the minimum stopping distance, if the same train is moving at a speed of 120 km/h?

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9. A person travels along a straight road for the first half distance 4 m with a velocity $1ms^{-1}$ and the second half distance 3 m with a velocity $0.7ms^{-1}$. What is the mean velocity of the person?

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10. If three cars A, B and C move with velocities along directions on that road side, what is the vector hidden in this case.

11. Name the quantity which remains unchanged during the flight of an oblique projectile.

12. If the velocity of projectile is $20ms^{-1}$ at what angle to the horizontal should be projected as that it

covers maximum horizontal distance of 10m

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