



Blue Print (As per PU Board)

| Topic | 1 mark questions | 2 marks questions | 3 marks questions | 5 marks questions | Total Marks |
|-------------------|------------------|-------------------|-------------------|-------------------|-------------|
| Motion in a Plane | 1 | 1 | 1 | 1 | 11 |

One mark questions

- Give an example for vector quantity.**
Answer: Displacement, velocity acceleration, etc.
- Define null vector**
Answer: Vector having zero magnitude.
- What is position vector?**
Answer: A vector which gives the position of a particle with reference to the origin of a co-ordinate system.
- State law of triangle of vectors.**
Answer: The law states that if the two vectors acting at a point represents the two sides of a triangle taken in order, then the third side of the triangle taken in reverse order gives the resultant.
- Define unit vector.**
Answer: It is a vector whose magnitude is unity.

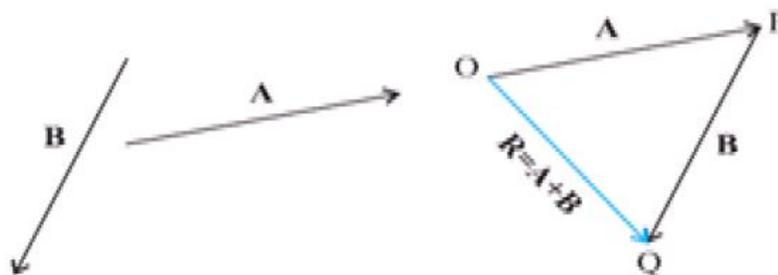
Two marks questions

- Distinguish between scalar and vector with suitable example for each.**

Answer:

| Scalar | Vector |
|---|--|
| physical quantities which are having only magnitude. Ex : mass, length, time | physical quantities which are having both magnitude and direction. Ex : displacement, velocity. |

- Pick out the scalar quantities among the following: Force, work, angular momentum, heat, torque.**
Answer: Scalar quantities : work, heat
- State and explain the law of triangle of vectors.**
Answer: The law of triangle of vectors:
It states that if two vectors can be represented in magnitude and direction by the two sides of a triangle taken in the same order, then the resultant is represented completely by the third side of the triangle taken in the reverse order.



Let two vectors \vec{A} and \vec{B} be represented both in magnitude and direction by the sides AB and BC of the triangle ABC taken in the same order. Then the resultant \vec{R} is by the third side AC taken in the opposite order.

- The horizontal and vertical component of a vector are 3 units and 4 units respectively. What is the magnitude of the vector.**

Answer: $|\vec{A}| = \sqrt{a_x^2 + a_y^2} = \sqrt{3^2 + 4^2} = \sqrt{9+16} = 5$ units

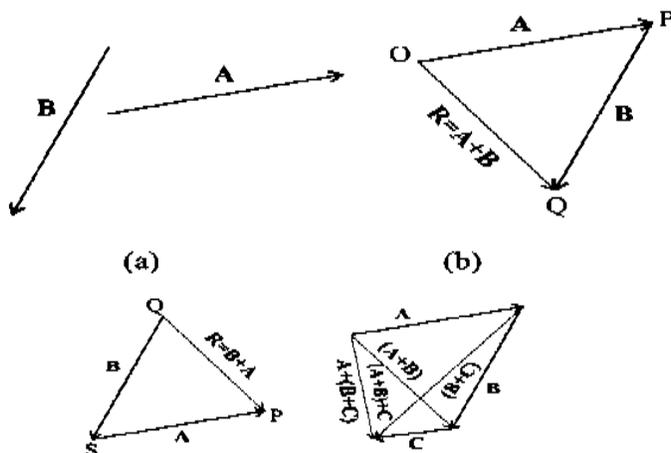


Five marks questions

10. State and explain,

- (i) Law of triangle of vectors
- (ii) Law of parallelogram of vectors

Answer: (i) Triangle method of vector addition OR Tail to tip method of vector addition:



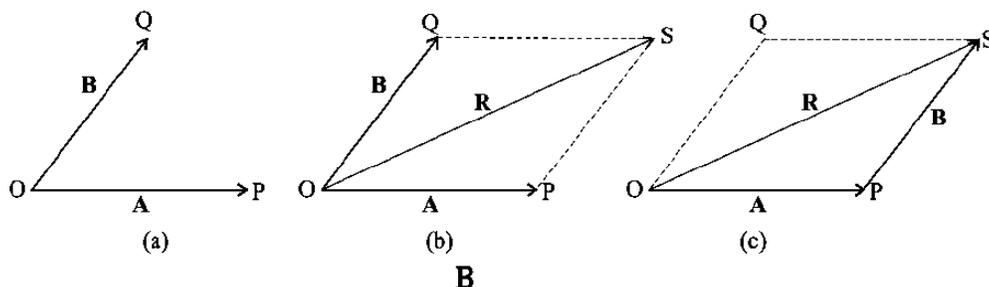
Explanation: To add \vec{A} with \vec{B} , translate \vec{B} , by drawing parallel to itself so that the origin or initial point of \vec{B} is at the tip of vector \vec{A} . \vec{A} and \vec{B} are two vectors represented by two sides of a triangle taken in the same sense (direction). The vector sum of \vec{A} and \vec{B} (also called resultant of \vec{A} and \vec{B}) is represented by the third side of the triangle taken in opposite sense (direction).

Statement: Triangle law of vector addition states that if two vectors can be represented in magnitude and direction by two sides of a triangle taken in the same order, then their resultant is represented completely by the third side of the triangle taken in opposite order.

(ii) Parallelogram method of vector addition:

To add two vectors placed with common initial point, the parallelogram method of vector is used.

Illustration:



Explanation: To add vector \vec{B} with \vec{A} inclined at an angle θ , draw equal vector of \vec{A} at the tip of \vec{B} . By law of triangle method of vector addition $\vec{R} = \vec{B} + \vec{A}$. Again by law of triangle method of vector addition $\vec{R} = \vec{A} + \vec{B}$. Note that $\vec{A} + \vec{B} = \vec{B} + \vec{A}$, that is vector addition follows commutative rule. \vec{R} , the diagonal of the completed parallelogram represents the vector sum of \vec{A} and \vec{B} completely both in magnitude and direction.

Statement of parallelogram law of vector addition:



“It states that if two vectors acting at a point can be represented both in magnitude and direction by the two adjacent sides of a parallelogram drawn from that point, the resultant is represented completely by the diagonal of the parallelogram passing through that point”.

11. Derive the expression for the centripetal acceleration.

Answer: The expression for the centripetal acceleration.

When an object follows a circular path at constant speed, the motion of the object is called uniform

circular motion. The magnitude of its acceleration is $a_c = \frac{v^2}{R}$. The direction of a_c is always towards the centre of the circle.

The angular speed ω is the rate of change of angular distance. It is related to velocity v by $v = \omega R$.

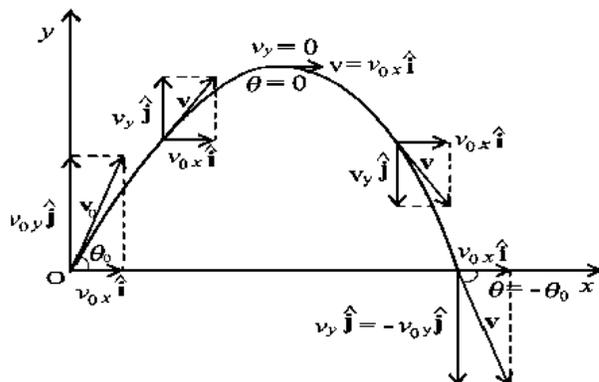
The acceleration is $a_c = \omega^2 R$

If T is the time period of revolution of the object in circular motion and \mathcal{G} is its frequency. We have

$$\omega = 2\pi \mathcal{G}, v = 2\pi R\mathcal{G}, a_c = 4\pi^2 \mathcal{G}^2 R.$$

12. Derive the expression for maximum height and time of flight of projectile.

Answer:



Consider a projectile moving in a direction making an angle θ with the horizontal.

Let v_0 - velocity of the projectile.

The velocity v_0 of the projectile resolved into

$$V_x = v_0 \cos \theta \text{ along horizontal (x-axis)}$$

$$V_y = v_0 \sin \theta \text{ along vertical (y-axis)}$$

After the object has been projected, the acceleration acting on it due to gravity and is directed vertically upwards $\vec{a} = -g\hat{j}$

Therefore, $a_x = 0, a_y = -g$

The maximum height h_m reached by the projectile can be calculated by substituting $t = t_m$