

Vector Algebra — Assignment 1

Class 12 Maths · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
 (2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
 (3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Vectors and Components

MCQ Questions (choose the correct option)

- A vector has
 - magnitude and direction
 - only magnitude
 - only direction
 - neither
- The magnitude of $\mathbf{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ is
 - $\sqrt{a_1^2 + a_2^2 + a_3^2}$
 - $a_1 + a_2 + a_3$
 - $\sqrt{a_1 + a_2 + a_3}$
 - $a_1a_2a_3$
- A unit vector in the direction of $\mathbf{a}$ is
 - $\mathbf{a}/|\mathbf{a}|$
 - $\mathbf{a}|\mathbf{a}|$
 - $|\mathbf{a}|/\mathbf{a}$
 - $\mathbf{a} + |\mathbf{a}|$
- The position vector of point (x, y, z) is
 - $x\hat{i} + y\hat{j} + z\hat{k}$
 - $x + y + z$
 - $xy\hat{j} + z\hat{k}$
 - $x\hat{i} - y\hat{j} + z\hat{k}$

1 Mark Questions

- Define a vector.
- Write the magnitude of $\mathbf{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$.
- Find the unit vector in the direction of $3\hat{i} + 4\hat{j}$.

2 Mark Questions

- Find the magnitude of $2\hat{i} + 3\hat{j} + 6\hat{k}$.
- Find a unit vector in the direction of $\hat{i} + \hat{j} + \hat{k}$.

3 Mark Questions

- Find a vector of magnitude 6 in the direction of $2\hat{i} - \hat{j} + 2\hat{k}$.
- Find the position vector of the point dividing the join of $A(1, 2, 3)$ and $B(3, 4, 5)$ in the ratio 1 : 1.

Dot (Scalar) Product

MCQ Questions (choose the correct option)

- The dot product $\mathbf{a} \cdot \mathbf{b}$ equals
 - $|\mathbf{a}||\mathbf{b}| \cos \theta$
 - $|\mathbf{a}||\mathbf{b}| \sin \theta$
 - $|\mathbf{a}| + |\mathbf{b}|$
 - $|\mathbf{a}||\mathbf{b}|$
- Two non-zero vectors are perpendicular if
 - $\mathbf{a} \cdot \mathbf{b} = 0$
 - $\mathbf{a} \cdot \mathbf{b} = 1$
 - $\mathbf{a} \times \mathbf{b} = 0$
 - $|\mathbf{a}| = |\mathbf{b}|$
- $\hat{i} \cdot \hat{i}$ equals
 - 1
 - 0
 - $\hat{i}$
 - 1
- The projection of $\mathbf{a}$ on $\mathbf{b}$ is
 - $(\mathbf{a} \cdot \mathbf{b})/|\mathbf{b}|$
 - $(\mathbf{a} \cdot \mathbf{b})|\mathbf{b}|$
 - $\mathbf{a} \cdot \mathbf{b}$
 - $|\mathbf{a}|$

1 Mark Questions

- Write the formula for the dot product.
- When are two vectors perpendicular?
- Write the value of $\hat{i} \cdot \hat{j}$.

2 Mark Questions

- Find $\mathbf{a} \cdot \mathbf{b}$ if $\mathbf{a} = \hat{i} + 2\hat{j}$ and $\mathbf{b} = 2\hat{i} + \hat{j}$.
- Find the angle between $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$.

3 Mark Questions

- Find the angle between $\mathbf{a} = \hat{i} + \hat{j} + \hat{k}$ and $\mathbf{b} = \hat{i} - \hat{j} + \hat{k}$.
- Find the projection of $\mathbf{a} = 2\hat{i} + 3\hat{j}$ on $\mathbf{b} = \hat{i} + \hat{j}$.

Cross (Vector) Product**MCQ Questions (choose the correct option)**

- The cross product $\mathbf{a} \times \mathbf{b}$ has magnitude
 - $|\mathbf{a}||\mathbf{b}| \sin \theta$
 - $|\mathbf{a}||\mathbf{b}| \cos \theta$
 - $|\mathbf{a}| + |\mathbf{b}|$
 - $|\mathbf{a}||\mathbf{b}|$
- Two non-zero vectors are parallel if

- (A) $a \times b = 0$
 (B) $a \cdot b = 0$
 (C) $a \times b = 1$
 (D) $|a| = |b|$
3. $\hat{i} \times \hat{j}$ equals
 (A) $\hat{k}$
 (B) $-\hat{k}$
 (C) $\hat{i}$
 (D) 0
4. The area of a parallelogram with adjacent sides a and b is
 (A) $|a \times b|$
 (B) $a \cdot b$
 (C) $\frac{1}{2}|a \times b|$
 (D) $|a||b|$

1 Mark Questions

- Write the magnitude of $a \times b$.
- When are two vectors parallel?
- Write the value of $\hat{i} \times \hat{j}$.

2 Mark Questions

- Find $a \times b$ if $a = \hat{i} + \hat{j}$ and $b = \hat{j} + \hat{k}$.
- Find the area of the parallelogram with adjacent sides $\hat{i}$ and $\hat{j}$.

3 Mark Questions

- Find the area of the triangle with vertices $A(1, 1, 1)$, $B(1, 2, 3)$ and $C(2, 3, 1)$.
- Find a unit vector perpendicular to both $a = \hat{i} + \hat{j}$ and $b = \hat{j} + \hat{k}$.

Collinearity and Coplanarity

MCQ Questions (choose the correct option)

- Three points A, B, C are collinear if
 (A) $AB \times AC = 0$
 (B) $AB \cdot AC = 0$
 (C) $|AB| = |AC|$
 (D) $AB + AC = 0$
- Four points are coplanar if
 (A) the scalar triple product of three vectors is 0
 (B) their dot products are equal
 (C) their magnitudes are equal
 (D) they lie on a line
- The scalar triple product $[a, b, c]$ equals
 (A) $a \cdot (b \times c)$
 (B) $a \times (b \times c)$
 (C) $a \cdot b \cdot c$

(D) $|a||b||c|$

4. Vectors a, b, c are coplanar if

(A) $[a, b, c] = 0$

(B) $[a, b, c] = 1$

(C) $a \cdot b = 0$

(D) $a \times b = 0$

1 Mark Questions

1. State the condition for three points to be collinear.
2. Write the scalar triple product of a, b, c .
3. When are three vectors coplanar?

2 Mark Questions

1. Show that the points $(1, 1), (2, 2), (3, 3)$ are collinear using vectors.
2. Find $[a, b, c]$ if $a = \hat{i}, b = \hat{j}, c = \hat{k}$.

3 Mark Questions

1. Show that the vectors $a = \hat{i} + \hat{j}, b = \hat{j} + \hat{k}, c = \hat{k} + \hat{i}$ are coplanar or not.
2. Show that the points $A(1, 0, 0), B(0, 1, 0), C(0, 0, 1)$ and $D(1, 1, 1)$ are coplanar.