Model Question Paper

Vector Algebra - Part I

12th Standard

Maths

Reg.No. : | | | | | | |

I.Answer all the Questions.

II.Use blue pen only.

Time : 00:45:00 Hrs

Total Marks : 80

Section-A

4 x 1 = 4

1) If $\vec{a}$is a non-zero vector and m is a non-zero scalar then $m\vec{a}$ is a unit vector if

(a) $m = \pm 1$ (b) $a = |m|$ (c) $a = \frac{1}{|m|}$ (d) $a = 1$

2) If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, then $(\vec{a} + \vec{b})$ is a unit vector if

(a) $\theta = \frac{\pi}{3}$ (b) $\theta = \frac{\pi}{4}$ (c) $\theta = \frac{\pi}{2}$ (d) $\theta = \frac{2\pi}{3}$

3) If $\vec{a}$ and $\vec{b}$ include an angle 120° and their magnitude are2 and $\sqrt{3}$ then $\vec{a}.\vec{b}$ is equal to

(a) $\sqrt{3}$ (b) $-\sqrt{3}$ (c) 2 (d) $\frac{-\sqrt{3}}{2}$

4) If $\vec{u} = \vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c}(\vec{a} \times \vec{b})$, then

(a) u is a unit vector (b) $\vec{u} = \vec{a} + \vec{b} + \vec{c}$ (c) $\vec{u} = \vec{0}$ (d) $\vec{u} \neq \vec{0}$

Section-B

4 x 3 = 12

5) If $\vec{a} = \vec{i} + \vec{j} + 2\vec{k} \quad and \quad \vec{b} = 3\vec{i} + 2\vec{j} - \vec{k} \quad find \quad \left(\vec{a} + 3\vec{b}\right) . \left(2\vec{a} - \vec{b}\right)$

6) Find the angles which the vectors $\vec{i} - \vec{j} + \sqrt{2}\,\vec{k}$ makes with the coordinate axes.

7) Show that the vector $\vec{i} + \vec{j} + \vec{k}$ is equally inclined with the coordinate axes.

8) If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ, then prove that $cos\frac{\theta}{2} = \frac{1}{2}\left|\vec{a} + \vec{b}\right|$

Section-C

4 x 6 = 24

9) Prove by vector method If the diagonals of a parallelogram are equal then it is a rectangle

10) Prove by vector method The mid point of the hypotenuse of a right angled triangle is equidistant from its vertices.

11) Prove by vector method The sum of the squares of the diagonals of a parallelogram is equal to the sum of the squares of the sides.

12) Forces of magnitudes 3 and 4 units acting in the directions $6\vec{i} + 2\vec{j} + 3\vec{k}$ and respectively act on a particle which is displaced from the point$(2, 2, -1)\ to\ (4, 3, 1)$. Find the work done by the forces.

Section-D

4 x 10 = 40

13) Prove that $\cos(A - B) = \cos A \cos B + \sin A\ sinB$

14) Prove that $\sin(A - B) = \sin A \cos B - \cos A \sin B$

15) If $\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}$, $\vec{b} = -2\vec{i} + 5\vec{k}$, $\vec{c} = \vec{j} - 3\vec{k}$ Verify that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = (\vec{a}.\vec{c})\,\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$

16) Verify $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a} \quad \vec{b} \quad \vec{d}\right]\vec{c} - \left[\vec{a} \quad \vec{b} \quad \vec{d}\right]\vec{d}$ where $\vec{a} = \vec{i} + \vec{j} + \vec{k}$; $\vec{b} = 2\vec{i} + k\ \vec{}$; $\vec{c} = 2\vec{i} + \vec{j} + \vec{k}$; $\vec{d} = \vec{i} + \vec{j} + 2\vec{k}$

****