Model Question Paper

Vector Algebra - Part III

12th Standard

Maths

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

I.Answer all the Questions.

II.Use blue pen only.

Time : 01:15:00 Hrs

Total Marks : 71

Section-A

5 x 1 = 5

1) If $\overrightarrow{PR} = 2\vec{i} + \vec{j} + \vec{k}, \overrightarrow{QS} = -\vec{i} + 3\vec{j} + 2\vec{k}$ then the area of the quadrilateral $PQRS$ is

(a) $5\sqrt{3}$ (b) $10\sqrt{3}$ (c) $\frac{5\sqrt{3}}{2}$ (d) $\frac{3}{2}$

2) The projection of $\overrightarrow{OP}$ on a unit vector $\overrightarrow{OQ}$ equals thrice the area of parallelogram$OPRQ$. Then $\angle POQ$ is,

(a) $tan^{-1}(\frac{1}{3})$ (b) $cos^{-1}(\frac{3}{10})$ (c) $sin^{-1}(\frac{3}{\sqrt{10}})$ (d) $sin^{-1}(\frac{1}{3})$

3) If the projection of $\vec{a}$ on $\vec{b}$ and the projection of $\vec{b}$ on $\vec{a}$ are equal then the angle between $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ is,

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

4) If $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$for non coplanar vectors $\vec{a},\vec{b},\vec{c}$ then

(a) $\vec{a}$ is parallel to $\vec{b}$ (b) $\vec{b}$ is parallel to $\vec{c}$ (c) $\vec{c}$ is parallel to $\vec{a}$ (d) $\vec{a}+\vec{b}+\vec{c} = \vec{0}$

5) If a line makes 45^o,60^o with positive direction of axes x and y then the angle it makes with the z axis is

(a) 30^o (b) 90^o (c) 45^o (d) 60^o

Section-B

4 x 3 = 12

6) Find the unit vectors perpendicular to the plane containing the vectors $2\vec{i} + \vec{j} + \vec{k}$ and $\vec{i} + 2\vec{j} + \vec{k}$

7) Find the vectors whose length 5 and which are perpendicular to the vectors $\vec{a} = 3\vec{i} + \vec{j} - 4\vec{k}$ and $\vec{b} = 6\vec{i} + 5\vec{j} - 2\vec{k}$

8) If $\vec{a} = \vec{i} + 3\vec{j} - 2\vec{k}$ and $\vec{b} = -\vec{i} + 3\vec{k}$ then find $\vec{a} \times \vec{b}$. Verify that $\vec{a}$ and $\vec{b}$are perpendicular to $\vec{a} \times \vec{b}$ separately.

9) For any three vectors$\vec{a}, \vec{b}, \vec{c}$ show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times \left(\vec{a} + \vec{b}\right) = \vec{0}$

Section-C

4 x 6 = 24

10) Show that the points $(1, 3, 1)$, $(1, 1, -1)$, $(-1, 1, 1)(2, 2, -1)$ are lying on the same plane.(Hint : It is enough to prove any three vectors formed by these four points are coplanar).

11) If $\vec{a} = 2\vec{i} + 3\vec{j} - 5\vec{k}$, $\vec{b} = -\vec{i} + \vec{j} + 2\vec{k}$ and $\vec{c} = 4\vec{i} - 2\vec{j} + 3\vec{k}$, show that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} \neq \vec{a} \times \left(\vec{b} \times \vec{c}\right)$.

12) Prove that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$ if $\vec{a}$ and $\vec{c}$ are collinear.(vector triple products is non-zero)

13) Prove that $\left(\vec{a} \times \vec{b}\right) . \left(\vec{c} \times \vec{d}\right) + \left(\vec{b} \times \vec{c}\right) . \left(\vec{a} \times \vec{d}\right) + (\vec{c} \times \vec{a}) . \left(\vec{b} \times \vec{d}\right) = 0$

Section-D

3 x 10 = 30

14) Find the vector and Cartesian equations of the plane passing through the points $A(1, -2, 3)$ and $B(-1, 2, -1)$ and its parallel to the line $\frac{x-2}{2} = \frac{y+1}{3} = \frac{z-1}{4}$

15) Find the vector and cartesian equation of the plane through the points $(1, 2, 3)$ and $(2, 3, 1)$ perpendicular to the plane $3x - 2y + 4z - 5 = 0$.

16) a) Find the vector and Cartesian equation of the plane containing the line $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-1}{-2}$ and passing through the point $(-1, 1, -1)$.

(OR)

b) Find the vector and Cartesian equation of the plane passing through points with position vectors $3\vec{i} + 4\vec{j} + 2\vec{k}$, $2\vec{i} - 2\vec{j} - \vec{k}$ and $7\vec{i} + \vec{k}$

****