Vector Algebra

TEST – 01

Q01. Two adjacent sides of a parallelogram are $2\hat{i}-4\hat{j}+5\hat{k}$ and $\hat{i}-2\hat{j}-3\hat{k}$. Write a vector which is parallel to its diagonal having the magnitude same as its area.

Q02. Three vectors $\vec{a},\vec{b},\vec{c}$ are such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$. Evaluate the quantity $\lambda=\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$, if it is given that $|\vec{a}|=1,|\vec{b}|=4,|\vec{c}|=2$.

Q03. Evaluate: $\hat{i}.(\hat{j}\times\hat{k})+\hat{j}.(\hat{i}\times\hat{k})+\hat{k}.(\hat{i}\times\hat{j})$.

Q04. Write the scalar components of a vector joining the points (a,b,c) and (α,β,γ).

Q05. If $\vec{\alpha}=3\hat{i}-\hat{j}$ and $\vec{\beta}=2\hat{i}+\hat{j}-3\hat{k}$ then, express $\vec{\beta}$ in the form $\vec{\beta}=\vec{a}+\vec{b}$, where $\vec{a}$ is parallel to $\vec{\alpha}$ and $\vec{b}$ is perpendicular to $\vec{\alpha}$.

Q06. If a unit vector $\vec{p}$ makes the angle $\frac{\pi}{4}$ with $\hat{i}$, $\frac{\pi}{3}$ with $\hat{k}$ and $\omega,\left(0<\omega<\frac{\pi}{2}\right)$ with $\hat{j}$ then, find ω and hence the vector components of $\vec{p}$.

Q07. Show that the vector $\hat{i}+\hat{j}+\hat{k}$ is equally inclined to OX, OY and OZ.

Q08. If $\vec{p}$ is a unit vector and $(\vec{m}-\vec{p}).(\vec{m}+\vec{p})=15$ then, write the value of $|\vec{m}|$.

Q09. If a vector makes α,β,γ angles with the coordinate axes respectively then, determine the value of expression: $\sin^2\alpha+\sin^2\beta+\sin^2\gamma$.

OR Find the projection of vector $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$ on $\vec{b}=2\hat{j}-\hat{i}-\hat{k}$.

Q10. If the sum of two unit vectors is also a unit vector, then find the magnitude of their difference.

OR If $\vec{a}=\hat{i}+4\hat{j}+2\hat{k},\vec{b}=3\hat{i}-2\hat{j}+7\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$ then, find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ if $\vec{c}.\vec{d}=15$.

TEST – 02

Q01. Write the value of α and β if $(2\hat{i}+6\hat{j}+27\hat{k})\times(\hat{i}+\alpha\hat{j}+\beta\hat{k})=$ Null vector.

Q02. It is given that $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+\hat{j}$. Find a unit vector in the direction of the resultant of these vectors. Also find a vector $\vec{d}$ which is normal to both $\vec{a}$ and $\vec{b}$. What is the inclination between $\vec{d}$ and $\vec{c}$?

Q03. Determine a unit vector $\hat{a}$ which makes an angle $\frac{\pi}{4}$ with $\hat{k}$ and is such that $\hat{a}+\hat{i}+\hat{j}$ is also a unit vector.

Q04. Let $\vec{a}=\hat{i}-\hat{j}$, $\vec{b}=3\hat{j}-\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ such that $\vec{c}.\vec{d}$ is unity.

Q05. Find the area of a triangle with the vertices $(3,-1,2)$, $(1,-1,-3)$ and $(4,-3,1)$.

Q06. Find the angle between $\vec{a}$ and $\vec{b}$ if $|\vec{a}|=2$, $|\vec{b}|=7$ and $|\vec{a}\times\vec{b}|=|3\hat{i}+2\hat{j}+6\hat{k}|$.

Q07. Find the angles which the vector $3\hat{i}-6\hat{j}+2\hat{k}$ makes with the coordinate axes.

Q08. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, prove that $\cos\frac{\theta}{2}=\frac{1}{2}|\vec{a}+\vec{b}|$.

Q09. Determine the area of a parallelogram whose adjacent sides are determined by the vectors $\hat{i}-\hat{j}+3\hat{k}$ and $2\hat{i}-7\hat{j}+\hat{k}$.

Q10. Find the projection of $2\hat{i}+3\hat{j}+2\hat{k}$ on the vector $\hat{i}+2\hat{j}+\hat{k}$.

OR If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a}.\vec{b}=\vec{a}.\vec{c}=0$ and the angle between $\vec{b}$ and $\vec{c}$ is 30° then, show that $\vec{a}=\pm 2(\vec{b}\times\vec{c})$.

Answers of Vector Algebra

TEST 01

Q01. $\frac{11\sqrt{5}}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right)$ Q02. $-\frac{21}{2}$ Q03. 1

Q04. $\alpha-a, \beta-b, \gamma-c$ Q05. $\vec{\beta}=\left(\frac{3}{2}\hat{i}-\frac{1}{2}\hat{j}\right)+\left(\frac{1}{2}\hat{i}+\frac{3}{2}\hat{j}-3\hat{k}\right)$

Q06. $\omega=\frac{\pi}{3}; \frac{1}{\sqrt{2}}\hat{i}, \frac{1}{2}\hat{j}, \frac{1}{2}\hat{k}$ Q08. 4 Q09. 2 or $\frac{5\sqrt{6}}{6}$

Q10. $\sqrt{3}$ or $\vec{d}=\frac{1}{3}(160\hat{i}-5\hat{j}-70\hat{k})$.

TEST 02

Q01. $\alpha=3, \beta=\frac{27}{2}$ Q02. $\frac{1}{5\sqrt{2}}(3\hat{i}+5\hat{j}+4\hat{k}); \vec{d}=-4(\hat{i}+\hat{j}-\hat{k}); \cos^{-1}\left(-\frac{4}{\sqrt{30}}\right)$

Q03. $-\frac{1}{2}(\hat{i}+\hat{j}-\sqrt{2}\hat{k})$ Q04. $\frac{1}{13}(\hat{i}+\hat{j}+3\hat{k})$

Q05. $\frac{1}{2}\sqrt{165}$ sq.units Q06. $\frac{\pi}{6}$

Q07. $\cos^{-1}\left(\frac{3}{7}\right), \cos^{-1}\left(-\frac{6}{7}\right), \cos^{-1}\left(\frac{2}{7}\right)$

Q09. $15\sqrt{2}$ sq.units Q10. $\frac{5\sqrt{6}}{3}$.

 # If you've any query regarding any question in this test, please write to me on email id at ***theopgupta@gmail.com***