# CTQ - 2023

**CTQ : Concept Through Questions** **Year : 2023**

## Topic : Vector 2

1. Let $\vec{A} = 2\hat{\imath} + \hat{\jmath} - 2\hat{k}$ and $\vec{B} = \hat{\imath} + \hat{\jmath}$ . If $\vec{C}$ is a vector such that $\vec{A}.\vec{C} = |\vec{C}|, |\vec{C} - \vec{A}| = 2\sqrt{2}$ and the angle between
$\vec{A} \times \vec{B}$ and $\vec{C}$ is 30° , then $|\vec{A} \times \vec{B} \times \vec{C}|$ is equal to:
(a) 2/3 (b) 3/2
(c) 2 (d) 3

[NIMCET 2008]

2. Force $3\hat{\imath} + 2\hat{\jmath} + 5\hat{k}$ and $2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ are acting on a particle and displace it from the point $2\hat{\imath} - \hat{\jmath} - 3\hat{k}$ to the point $4\hat{\imath} - 2\hat{\jmath} + 7\hat{k}$, then the work done by the force is.
(a) 18 units (b) 30 units
(c) 27 units (d) 36 units

[NIMCET 2013]

3. Constant forces $P = 2\hat{\imath} - 5\hat{\jmath} + 6\hat{k}$ and $Q = -\hat{\imath} + 2\hat{\jmath} - \hat{k}$ act on a particle. The work done when the particle is displaced from A whose position vectors is $4\hat{\imath} - 3\hat{\jmath} - 2\hat{k}$ to B whose position vector is $6\hat{\imath} + \hat{\jmath} - 3\hat{k}$, is
(a) 10 units (b) – 15 units
(c) – 50 units (d) 25 units

[NIMCET 2014]

4. The direction cosines of the vector $\vec{a} = (-2\hat{\imath} + \hat{\jmath} - 5\hat{k})$ are
(a) -2,1,-5 (b) $\frac{1}{3}, -\frac{1}{6}, -\frac{5}{6}$
(c) $\frac{2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{5}{\sqrt{30}}$ (d) $\frac{-2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{-5}{\sqrt{30}}$

[NIMCET 2017]

5. A bird is flying in a straight line with velocity vector $10\hat{\imath} + 6\hat{\jmath} + \hat{k}$, measured in km/hr. If starting point is (1,2,3), how much time does it to take to reach a point in space that is 13 meter high from the ground?
(a) 600 seconds (b) 360 seconds
(c) 36 seconds (d) 60 seconds

[NIMCET 2018]

6. The position vectors of the vertices A,B,C of a tetrahedron ABCD are $\hat{\imath} + \hat{\jmath} + \hat{k}$, $\hat{\imath}$ and $3\hat{\imath}$ respectively and the altitude for the vertex D to the opposite face ABC meets the face at E. If the length of ED is 4 and the volume of tetrahedron is $\frac{2\sqrt{2}}{3}$, then the length of DE is
(a) 1 (b) 2
(c) 3 (d) 4

[NIMCET 2019]

7. $\vec{a}$ and $\vec{b}$ are non-zero non-collinear vectors such that $|\vec{a}| = 2$, $\vec{a}.\vec{b} = 1$ and the angle between $\vec{a}$ and $\vec{b}$ is $\pi/3$. If $\vec{r}$ is any vector satisfying $\vec{r}.\vec{a} = 2, \vec{r}.\vec{b} = 8, (\vec{r} + 2\vec{a} - 10\vec{b}).(\vec{a} \times \vec{b}) = 6$ and $\vec{r} + 2\vec{a} - 10\vec{b} = \lambda(\vec{a} \times \vec{b})$, then $\lambda$=
(a) 1/2 (b) 2 (c) $4/\sqrt{3}$ (d) 3
[NIMCET 2019]

8. Forces of magnitude 5, 3, 1 units act in the directions 6i+2j+3k, 3i-2j+6k, 2i-3j-6k respectively on a particle which is displaced from the point (2,-1,-3) to (5,-1,1). The total work done by the force is
(a) 21 units (b) 5 units
(c) 33 units (d) 105 units
[NIMCET 2020]

9. Two forces $F_1$ and $F_2$ are used to pull a car, which met an accident. The angle between the two forces is θ. Find the values of $\boldsymbol{\theta}$ for which the resultant force is equal to $\sqrt{\{F_1^2 + F_2^2\}}$.
(a) θ=0 (b) θ=45
(c) θ=90 (d) θ=135
[NIMCET 2020]

10. The angle between $\vec{a}$ and $\vec{b}$ is $5\pi/6$ and the projection of $\vec{a}$ in the direction of $\vec{b}$ is $\frac{-6}{\sqrt{3}}$ then $|\vec{a}|$ is equal to
a) 6 b) $\sqrt{3}/2$ c) 12 d) 4

11. When a right handed rectangular cartesian system OXYZ rotated about z-axis through $\pi/4$ in the counter-clock-wise sense it is found that a vector $\vec{r}$ has the components $2\sqrt{2}, 3\sqrt{2}$ and 4. The components of $\vec{a}$ in the OXYZ coordinate system are
a) 5,-1,4 b) $5,-1,4\sqrt{2}$
c) $-1,-5,4\sqrt{2}$ d) None of these

12. If $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are the position vectors of points A,B,C,D such that no three of them are collinear and $\vec{a} + \vec{c} = \vec{b} + \vec{d}$, then ABCD is a
a) Rhombus b) Rectangle
c) Square d) Parallelogram

13. If D,E,F are respectively the mid point of AB, AC and BC in Δ ABC, then $\overrightarrow{BE} + \overrightarrow{AF}$ is equal to
a) $\overrightarrow{DC}$ b) $1/2\ \overrightarrow{BF}$ c) $2\ \overrightarrow{BF}$ d) $3/2\ \overrightarrow{BF}$

14. If the area of the parallelogram with $\vec{a}$ and $\vec{b}$ as two adjacent side is 15 sq units, then the area of the parallelogram having $3\vec{a} + 2\vec{b}$ and $\vec{a} + 3\vec{b}$ as two adjacent sides in sq units is
a) 120 b) 105 c) 75 d) 45

15. The vectors $2\hat{\imath} - m\hat{\jmath} + 3m\hat{k}$ and $(1+m)\hat{\imath} - 2m\hat{\jmath} + \hat{k}$ include an acute angle for
a) m=-1/2 b) m∈[-2,-1/2] c) m∈R d) m∈(-∞,-2)∪(-1/2,∞)

16. Two adjacent sides of a parallelogram ABCD are given by $\overrightarrow{AB} = 2\hat{\imath} + 10\hat{\jmath} + 11\hat{k}$ and $\overrightarrow{AD} = -\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$. The side AD is rotated by an acute angle α in the plane of the parallelogram so that AD becomes AD'. If AD' makes a right angle with the side AB, then the cosine of the angle α is given by
a) 8/9 b) $\frac{\sqrt{17}}{9}$ c) 1/9 d) $\frac{4\sqrt{5}}{9}$

17. If A,B,C,D are any four points in space, then $|\overrightarrow{AB} \times \overrightarrow{CD} + \overrightarrow{BC} \times \overrightarrow{AD} + \overrightarrow{CA} \times \overrightarrow{BD}|$ is equal to
a) 2Δ b) 4Δ c) 3Δ d) 5Δ

18. The value of 'a' so that volume of parallelopiped formed by $\hat{\imath}+a\hat{\jmath}+\hat{k}, \hat{\jmath}+a\hat{k}$ and $a\hat{\imath}+\hat{k}$ becomes minimum, is
    a) -3 b) 3 c) $1/\sqrt{3}$ d) $\sqrt{3}$
19. If the non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other, then the solution of the equation, $\vec{r}\times\vec{a}=\vec{b}$ is given by
    a) $\vec{r}=x\vec{a}+\frac{\vec{a}\times\vec{b}}{|\vec{a}|^2}$ b) $\vec{r}=x\vec{b}-\frac{\vec{a}\times\vec{b}}{|\vec{b}|^2}$ c) $\vec{r}=x(\vec{a}\times\vec{b})$ d) $\vec{r}=x(\vec{b}\times\vec{a})$
20. If a tetrahedron has vertices at O(0,0,0),A(1,2,1),B(2,1,3) and C(-1,1,2). Then, the angle between the faces OAB and ABC will be
    a) $\cos^{-1}\left(\frac{19}{35}\right)$ b) $\cos^{-1}\left(\frac{17}{31}\right)$
    c) 30° d) 90°
21. If V is the volume of the parallelopiped having three coterminous edges as $\vec{a},\vec{b}$ and $\vec{c}$, then the volume of the parallelopiped having three coterminous edges as
    $\vec{\alpha}=(\vec{a}\cdot\vec{a})\vec{a}+(\vec{a}\cdot\vec{b})\vec{b}+(\vec{a}\cdot\vec{c})\vec{c}$
    $\vec{\beta}=(\vec{a}\cdot\vec{b})\vec{a}+(\vec{b}\cdot\vec{b})\vec{b}+(\vec{b}\cdot\vec{c})\vec{c}$
    $\vec{\gamma}=(\vec{a}\cdot\vec{c})\vec{a}+(\vec{b}\cdot\vec{c})\vec{b}+(\vec{c}\cdot\vec{c})\vec{c}$, is
    a) $V^3$ b) 3V c) $V^2$ d) 2V
22. Constant forces $\vec{P}_1=\hat{\imath}-\hat{\jmath}+\hat{k}$ , $\vec{P}_2=-\hat{\imath}+2\hat{\jmath}-\hat{k}$ and $\vec{P}_3=\hat{\jmath}-\hat{k}$ act on a particle at point A. The work done when the particle is displaced from the point A to B where $\vec{A}=4\hat{\imath}-3\hat{\jmath}-2\hat{k}$ and $\vec{B}=6\hat{\imath}+\hat{\jmath}-3\hat{k}$ is
    a) 3 b) 9 c) 20 d) None of these
23. If unit vector $\vec{c}$ makes an angle $\pi/3$ with $\hat{\imath}+\hat{\jmath}$, then minimum and maximum values of $(\hat{\imath}\times\hat{\jmath})\cdot\vec{c}$ respectively are
    a) $0,\frac{\sqrt{3}}{2}$ b) $-\frac{\sqrt{3}}{2},\frac{\sqrt{3}}{2}$ c) $-1,\frac{\sqrt{3}}{2}$ d) None of these
24. If $\vec{a}=2\hat{\imath}-3\hat{\jmath}+5\hat{k}, \vec{b}=3\hat{\imath}-4\hat{\jmath}+5\hat{k}$ and $\vec{c}=5\hat{\imath}-3\hat{\jmath}-2\hat{k}$, then the volume of the parallelopiped with coterminous edges $\vec{a}+\vec{b},\vec{b}+\vec{c},\ \vec{c}+\vec{a}$ is
    a) 2 b) 1 c) -1 d) 16
25. If $\vec{a},\vec{b},\vec{c}$ are the pth,qth,nth terms of an HP and $\vec{u}=(q-r)\hat{\imath}+(r-p)\hat{\jmath}+(p-q)\hat{k}$ and $\vec{v}=\frac{\hat{\imath}}{a}+\frac{\hat{\jmath}}{b}+\frac{\hat{k}}{c}$, then
    a) $\vec{u},\vec{v}$ are parallel vectors b) $\vec{u},\vec{v}$ are orthogonal vectors
    c) $\vec{u}\cdot\vec{v}=1$ d) $\vec{u}\times\vec{v}=\hat{\imath}+\hat{\jmath}+\hat{k}$

# Answer Key

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | B | C | B | D | C | B | B | C | C | D |
| | | | | | | | | | | |
| Ques. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Ans. | D | D | A | B | D | B | B | C | A | A |
| | | | | | | | | | | |
| Ques. | 21 | 22 | 23 | 24 | 25 | | | | | |
| Ans. | A | B | B | D | B | | | | | |