Vernacular

Ultimate KCET Crash Course 2026

MATHEMATICS

DPP: 01

Vectors and 3D

Q1 If $\vec{a} = 3\hat{i} - 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}, \vec{c} = -\hat{i} + 2\hat{j} + 2\hat{k}$

then $\vec{a} + \vec{b} + \vec{c} =$

(A) $3i - 4j$
(B) $3i + 4j$
(C) $4i - 4j$
(D) $4\hat{i} + 4\hat{j}$

Q2 The vector in the direction of the vector $\hat{i} - 2\hat{j} + 2\hat{k}$ that has magnitude 9 is

(A) $\hat{i} - 2\hat{j} + 2\hat{k}$
(B) $\frac{\hat{i}-2\hat{j}+2\hat{k}}{3}$
(C) $3\left(i - 2j + 2\hat{k}\right)$
(D) $9\left(i - 2j + 2\hat{k}\right)$

Q3 The sine of the angle between the vectors $2i + \hat{j} - \hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$ is

(A) $\frac{2}{3\sqrt{3}}$
(B) 1/2
(C) $\frac{\sqrt{3}}{2}$
(D) $\frac{1}{\sqrt{2}}$

Q4 Projection of vector *a* on *b* is

(A) $\left(\frac{a\cdot b}{|b|^2}\right)b$
(B) $\frac{a\cdot b}{|b|}$
(C) $\frac{a\cdot b}{|a|}$
(D) $\left(\frac{a\cdot b}{|a|^2}\right)b$

Q5 The value of x if $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector is

(A) ±3
(B) $\pm 1/\sqrt{3}$
(C) ±1/3
(D) $\pm\sqrt{3}$

Q6 The value of k for which the vectors $\vec{a} = \hat{i} - \hat{j}$ and $\vec{b} = -2\hat{i} + k\hat{j}$ are collinear is

(A) 2
(B) 3
(C) 1/3
(D) 1/2

Q7 Which of the following is an example of two different vectors with same magnitude?

(A) $\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$ and $\left(2\hat{i} + 3\hat{j} - \hat{k}\right)$
(B) $\left(3\hat{i} + 5\hat{j} + \hat{k}\right)$ and $\left(3\hat{i} + 4\hat{j} - \hat{k}\right)$
(C) $\left(\hat{i} + \hat{k}\right)$ and $\left(2\hat{j} + 3\hat{k}\right)$
(D) None of these

Q8 If $\vec{a} = 2\hat{i} + 3\hat{j} - 5\hat{k}, \vec{b} = m\hat{i} + n\hat{j} + 12\hat{k}$ $and\ \vec{a} \times \vec{b} = \vec{0}\ then\ \left(m, n\right) =$

and , then

(A) $\left(-\frac{24}{5}, \frac{36}{5}\right)$
(B) $\left(\frac{24}{5}, -\frac{36}{5}\right)$
(C) $\left(-\frac{24}{5}, -\frac{36}{5}\right)$
(D) $\left(\frac{24}{5}, \frac{36}{5}\right)$

Q9 The points with vectors $60\hat{i} + 3\hat{j},\ 40\hat{i} - 8\hat{j}$ and $p\hat{i} - 52\hat{j}$ are collinear, if p=

(A) -40
(B) 40
(C) 20
(D) 30

Q10 If a line makes an angle of π/3 with each X and Y axis then the acute angle made by Z-axis is

(A) π/2
(B) π/6
(C) π/4
(D) π/3

Q11 If $|\vec{a}|=3, |\vec{b}|=4, |\vec{c}|=5$ and $\vec{a}+\vec{b}+\vec{c}=0$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) 0
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{2}$

Q12 If $\vec{a}=2\hat{i}+\hat{j}+2\hat{k}$ *and* $\vec{b}=5\hat{i}-3\hat{j}+\hat{k}$ then the projection of $\vec{b}$ *on* $\vec{a}$ *is*

(A) 3
(B) 4
(C) 5
(D) 6

Q13 If a line lies in the octane OXYZ and it makes equal angles with the axes, then

(A) $l=m=n=\frac{1}{\sqrt{3}}$
(B) $l=m=n=\pm\frac{1}{\sqrt{3}}$
(C) $l=m=n=-\frac{1}{\sqrt{3}}$
(D) $l=m=n=\pm\frac{1}{\sqrt{2}}$

Q14 The position vectors of the points *A*, *B*, *C* and *D* are $2\hat{i}+4\hat{k}, 5\hat{i}+3\sqrt{3}\hat{j}+4\hat{k}, -2\sqrt{3}\hat{j}+\hat{k}$ and $2\hat{i}+\hat{k}$ respectively. Then $\overrightarrow{CD}=$

(A) $\frac{2}{3}\overrightarrow{AB}$
(B) $\frac{1}{3}\overrightarrow{AB}$
(C) $\frac{3}{2}\overrightarrow{AB}$
(D) $\frac{2}{5}\overrightarrow{AB}$

Q15 If $\vec{r}.\hat{i}=\vec{r}.\hat{j}=\vec{r}.\hat{k}$ *and* $|\vec{r}|=3$, *then* $\vec{r}=$

(A) $\pm 3(\hat{i}+\hat{j}+\hat{k})$
(B) $\pm\frac{1}{3}(\hat{i}+\hat{j}+\hat{k})$
(C) $\pm\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$
(D) $\pm\sqrt{3}(\hat{i}+\hat{j}+\hat{k})$

Q16 If $\vec{a}=(1,-7,2), \vec{b}=(-2,3,5), \vec{c}=(2,-2,4)$ then $(\vec{a}-2\vec{b}+3\vec{c})\cdot\hat{i}=$

(A) 10
(B) 11
(C) 12
(D) 13

Q17 The area of the triangle with vertices $(1,2,3)$,$(2,5,-1)$ and $(-1, 1, 2)$ is

(A) 6
(B) $\frac{\sqrt{3}}{2}$
(C) $\sqrt{29}$
(D) $\frac{1}{2}\sqrt{155}$

Q18 If the points A(1,-2,2),B(3,1,1) and C(-1,p,3) are collinear, then p=

(A) 5
(B) -5
(C) 1
(D) -1

Q19 If the direction cosines of a vector of magnitude 3 are $\frac{2}{3}$, $\frac{-a}{3}$, $\frac{2}{3}$, a > 0, then the vector is

(A) $2\hat{i}+\hat{j}+2\hat{k}$
(B) $2\hat{i}-\hat{j}+2\hat{k}$
(C) $\hat{i}-2\hat{j}+2\hat{k}$
(D) $\hat{i}+2\hat{j}+2\hat{k}$

Q20 $\vec{a}, \vec{b}, \vec{c}$ are three vectors, such that $\vec{a}+\vec{b}+\vec{c}=0$, $|\vec{a}|=1, |\vec{b}|=2, |\vec{c}|=3$, then $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ is equal to

(A) 0
(B) –7
(C) 7
(D) 1

Q21 If $\vec{a}$ and $\vec{b}$ are unit vectors then what is the angle between $\vec{a}$ and $\vec{b}$ for $\sqrt{3}\vec{a}-\vec{b}$ to be unit vector?

(A) 60°
(B) 30°
(C) 90°
(D) 45°

Q22 If $|\vec{a}| = 10$, $|\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = 12$, then value of $|\vec{a} \times \vec{b}|$ is

(A) 5 (B) 10
(C) 14 (D) 16

Q23 $If\ |a^{\rightarrow}| = 3, |b^{\rightarrow}| = 4,\ then\ the\ value\ of\ \lambda\ for\ which\ a^{\rightarrow} + \lambda b^{\rightarrow}\ is\ perpendicular\ to\ a^{\rightarrow} - \lambda b^{\rightarrow},\ is$

(A) $\frac{9}{16}$ (B) $\frac{3}{4}$
(C) $\frac{3}{2}$ (D) $\frac{4}{3}$

Q24 If $2\hat{i} + 3\hat{j} - 6\hat{k}, 6\hat{i} - 2\hat{j} + 3\hat{k}, 3\hat{i} - 6\hat{j} - 2\hat{k}$ represent sides of a triangle then the perimeter of the Δ is

(A) 14 (B) 21
(C) 7 (D) 6

Q25 If x and y are two unit vectors and π is the angle between
them, then $\frac{1}{2}|\vec{x} - \vec{y}|$ is equal to

(A) 0 (B) π/2
(C) 1 (D) π/4

Q26 In a parallelogram $\mathrm{ABCD}, |\overrightarrow{\mathrm{AB}}| = \mathrm{a}, |\overrightarrow{\mathrm{AD}}| = \mathrm{b}$ and $|\overrightarrow{\mathrm{AC}}| = \mathrm{c}$, then $\overrightarrow{\mathrm{DB}} \cdot \overrightarrow{\mathrm{AB}}$ has the value

(A) $\frac{1}{2}(\mathrm{a}^2 - \mathrm{b}^2 + \mathrm{c}^2)$
(B) $\frac{1}{4}(\mathrm{a}^2 + \mathrm{b}^2 - \mathrm{c}^2)$
(C) $\frac{1}{3}(\mathrm{b}^2 + \mathrm{c}^2 - \mathrm{a}^2)$
(D) $\frac{1}{2}(3\mathrm{a}^2 + \mathrm{b}^2 - \mathrm{c}^2)$

Q27 If $\vec{a}$ and $\vec{b}$ are two non zero and different vectors such that $|\vec{a} + \vec{b}| = |\vec{b} - \vec{a}|$, then the angle between the vectors $\vec{a}$ and $\vec{b}$ is

(A) π/3 (B) π/4
(C) π/2 (D) π/6

Q28 The value of λ for which the vectors $3i - 6j + k$ and $2i - 4j + \lambda k$ are parallel is

(A) 2/3 (B) 3/2
(C) 5/2 (D) 2/5

Q29 If $\vec{a} = 3\hat{i} + \lambda\hat{j} - \hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + \mu\hat{k}$ are orthogonal and $|\vec{a}| = |\vec{b}|$, then $(\lambda, \mu) =$

(A) $\left(\frac{-31}{12}, \frac{43}{12}\right)$
(B) $\left(\frac{-31}{12}, \frac{41}{12}\right)$
(C) $\left(\frac{31}{12}, \frac{-41}{12}\right)$
(D) $\left(\frac{-31}{12}, \frac{-41}{12}\right)$

Q30 $|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2 =$

(A) $|\vec{a}|^2$ (B) $2|\vec{a}|^2$
(C) $3|\vec{a}|^2$ (D) $4|\vec{a}|^2$

Answer Key

Q1	C
Q2	C
Q3	C
Q4	A
Q5	B
Q6	A
Q7	A
Q8	C
Q9	A
Q10	C
Q11	D
Q12	A
Q13	A
Q14	A
Q15	D
Q16	B
Q17	D
Q18	B
Q19	B
Q20	B
Q21	B
Q22	C
Q23	B
Q24	B
Q25	C
Q26	D
Q27	C
Q28	A
Q29	B
Q30	B

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

$\vec{a}+\vec{b}+\vec{c}=(3+2-1)\vec{i}$
$+(-2-4+2)\vec{j}+(1-3+2)\vec{k}=4\vec{i}$
$-4\vec{j}$

Video Solution:

Q2 Text Solution:

Given $\vec{a}=\hat{i}-2\hat{j}+2\hat{k}$

$\vec{b}=9\hat{a}=\frac{9[\hat{i}-\hat{j}+2\hat{k}]}{\sqrt{1+4+4}}=3(\hat{i}-2\hat{j}+2\hat{k})$

Video Solution:

Q3 Text Solution:

Let $\vec{a}=2\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$

$\Rightarrow \vec{a}\cdot\vec{b}=3$

Now, $|\vec{a}|=\sqrt{6}$ and $|\vec{b}|=\sqrt{6}$

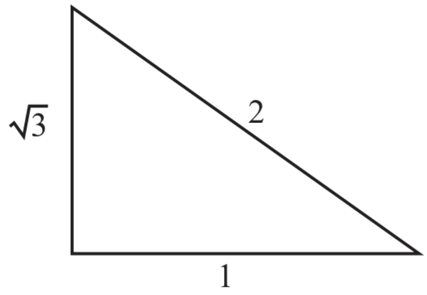
$\therefore|\vec{a}|\cdot|\vec{b}|=6$

$\therefore$ Angle between two vectors

$\cos\theta=\left|\frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|}\right|$

$\therefore \cos\theta=\frac{3}{6}=\frac{1}{2}$

$\therefore \sin\theta=\frac{\sqrt{3}}{2}$



Video Solution:

Q4 Text Solution:

Projection of a long b is $\frac{a\cdot b}{|b|}$.

Projection vector

$=\frac{a\cdot b}{|b|}=\hat{b}=\left(\frac{a\cdot b}{|b|^2}\right)b \quad \left(\because \hat{b}=\frac{1}{|b|}b\right)$

Video Solution:

Q5 Text Solution:

By data $\sqrt{x^2+x^2+x^2}=1 \Rightarrow x=\pm\frac{1}{\sqrt{3}}$

Video Solution:

Q6 Text Solution:

$\because \vec{a}$ and $\vec{b}$ are collinear, then

$\vec{a} = m\vec{b} \Rightarrow \hat{i} - \hat{j} = -2m\hat{i} + km\hat{j}$

$\Rightarrow -2m = 1$ and $km = -1$

$\Rightarrow m = \frac{-1}{2}$ So, $\frac{-k}{2} = -1 \Rightarrow k = 2$

Video Solution:

Q7 Text Solution:

Two vectors can have same magnitude, if the sum of the squares of coefficient of $\hat{i}$, $\hat{j}$ and $\hat{k}$ is same. The vectors $\vec{a} = (2\hat{i} + 3\hat{j} + \hat{k})$ and $\vec{b} = (2\hat{i} + 3\hat{j} - \hat{k})$ and are different vectors having the same magnitude.

Magnitude if Ist vector $= \sqrt{(2)^2 + (3)^2 + (1)^2} = \sqrt{4+9+1}$ and $= \sqrt{14}$

magnitude of IInd vector $= \sqrt{(2)^2 + (3)^2 + (1)^2} = \sqrt{4+9+1}$ $= \sqrt{14}$

i.e., they have same magnitude.

Video Solution:

Q8 Text Solution:

$$\vec{a} \times \vec{b} = 0 \Rightarrow \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -5 \\ m & n & 12 \end{vmatrix} = 0$$

$$=(36 + 5n)\hat{i} - (24 + 5m)\hat{j} + (2n - 3m)\hat{k} = 0$$

$$\Rightarrow 24 + 5m = 0, 36 + 5n = 0$$

$$\Rightarrow m = \frac{-24}{5}, n = \frac{-36}{5}$$

Video Solution:

Q9 Text Solution:

Let $\vec{a} = 60\hat{i} + 3\hat{j}$, $\vec{b} = 40\hat{i} - 8\hat{j}$, $\vec{c} = p\hat{i} - 52\hat{j}$

Now, $\overrightarrow{AB} = \vec{b} - \vec{a} = -20\hat{i} - 11\hat{j}$

$\overrightarrow{AC} = \vec{c} - \vec{a} = (p - 60)\hat{i} - 55\hat{j}$

Points are collinear, then

$\overrightarrow{AB} = k\overrightarrow{AC} \Rightarrow -20\hat{i} - 11\hat{j} = k(p - 60)\hat{i} - 55k\hat{j}$

$\Rightarrow \quad -55k = -11$ and $k(p - 60) = -20$

$\Rightarrow k = \frac{1}{5}$

Hence, $\frac{p-60}{5} = -20 \Rightarrow p - 60 = -100 \Rightarrow p = -40$

Video Solution:

Q10 Text Solution:

$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

$\frac{1}{2} + \frac{1}{2} + \cos^2\gamma = 1 \Rightarrow \gamma = 90^{o}$

Video Solution:

Q11 Text Solution:

Given $\vec{a} + \vec{b} + \vec{c} = 0 \Rightarrow \vec{a} + \vec{b} = -\vec{c}$

squaring on both sides

$\left|\vec{a} + \vec{b}\right|^2 = \left|-\vec{c}\right|^2$

$\left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 + 2\vec{a}\cdot\vec{b} = \left|\vec{c}\right|^2$

$2\vec{a}\cdot\vec{b} = 25 - 25 \Rightarrow \vec{a}\cdot\vec{b} = 0$

Clearly $\vec{a}$ &, $\vec{b}$ are perpendicular to each other

The angle between two vectors is $\frac{\pi}{2}$.

Video Solution:

Q12 Text Solution:

Vectors

$\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ *and* $\vec{b} = 5\hat{i} - 3\hat{j} + \hat{k}$

We know that the projection of $\vec{b}$ *on* $\vec{a}$

$\vec{a} = \frac{\vec{b}\cdot\vec{a}}{|\vec{a}|} = \frac{(5\hat{i}-3\hat{j}+\hat{k})\cdot(2\hat{i}+\hat{j}+2\hat{k})}{\sqrt{(2)^2+(1)^2+(2)^2}} = \frac{10-3+2}{\sqrt{9}}$

$= \frac{9}{3} = 3.$

Video Solution:

Q13 Text Solution:

Since, it is given that line makes equal angles with the coordinate axes.

\ l = m = n

We know, $l^2 + m^2 + n^2 = 1$

$\Rightarrow 3l^2 = 1 \Rightarrow l^2 = \frac{1}{3} \Rightarrow l = \frac{1}{\sqrt{3}}$

(neglect -ve sign because line lies in octane OXYZ)

$\therefore l = m = n = \frac{1}{\sqrt{3}}$

Video Solution:

Q14 Text Solution:

$\overrightarrow{AB} = 5\hat{i} + 3\sqrt{3}\hat{j} + 4\hat{k} - 2\hat{i} - 4\hat{k} = 3\hat{i} + 3\sqrt{3}\hat{j}$

$\overrightarrow{CD} = 2\hat{i} + \hat{k} + 2\sqrt{3}\hat{j} - \hat{k} = 2\hat{i} + 2\sqrt{3}\hat{j}$

$= \frac{2}{3}\left(3\hat{i} + 3\sqrt{3}\hat{j}\right) = \frac{2}{3}\overrightarrow{AB}$

Video Solution:

Q15 Text Solution:

Let $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$. Since $\vec{r} \cdot \hat{i} = \vec{r} . \hat{j} = \vec{r} . \hat{k}$

Also $|\vec{r}| = \sqrt{x^2 + y^2 + z^2} = 3 \Rightarrow \vec{r} = \pm\sqrt{3}, \{By(i)\}$

Hence the required vector $\vec{r} = \pm\sqrt{3}\left(\hat{i} + \hat{j} + \hat{k}\right)$.

Video Solution:

Q16 Text Solution:

$$\left(\vec{a} - 2\vec{b} + 3\vec{c}\right) \cdot \hat{i} = 1 + 4 + 6 = 11$$

Video Solution:

Q17 Text Solution:

Given

$\overrightarrow{OA} = \hat{i} + 2\hat{j} + 3\hat{k}, \overrightarrow{OB} = 2\hat{i} + 5\hat{j} - \hat{k}, \overrightarrow{OC} = -\hat{i} + \hat{j} + 2\hat{k}$

$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \hat{i} + 3\hat{j} - 4k, \overrightarrow{AC} = \overrightarrow{OC} - \overrightarrow{OA} = -2\hat{i} - \vec{j} - \vec{k}$

$$\overrightarrow{AB} \times \overrightarrow{AC} = \begin{vmatrix} i & j & \vec{k} \\ 1 & 3 & -4 \\ -2 & -1 & -1 \end{vmatrix}$$

$= \vec{i}(-3-4) - \vec{j}(-1-8) + \vec{k}(-1+6) = -7\vec{i} + 9\hat{j} + 5\vec{k}$

$\frac{1}{2}|AB \times AC| = \frac{1}{2}\left|7\vec{i} + 9j + 5\vec{i}\right| = \frac{1}{2}\sqrt{155}$

Video Solution:

Q18 Text Solution:

Here $\vec{a} = \hat{i} - 2\hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} + \hat{j} + \hat{k},$

$\vec{c} = -\hat{i} + p\hat{j} + 3\hat{k}$

$\Rightarrow \overrightarrow{AB} = \vec{b} - \vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$

$\overrightarrow{AC} = \vec{c} - \vec{a} = -2\hat{i} + (p+2)\hat{j} + \hat{k}$

$\because$ Points A, B, C are collinear, then $\overrightarrow{AB} = m\overrightarrow{AC}$

$\Rightarrow 2\hat{i} + 3\hat{j} - \hat{k} = m\left(-2\hat{i} + (p+2)\hat{j} + \hat{k}\right)$

$\Rightarrow -2m = 2 \Rightarrow m = -1$

and $m(p+2) = 3 \Rightarrow -p - 2 = 3 \Rightarrow p = -5$

Video Solution:

Q19 Text Solution:

Required vector $= 3\left(l\hat{i} + m\hat{j} + n\hat{k}\right)$

where $l^2 + m^2 + n^2 = 1$

$\Rightarrow \frac{4}{9} + \frac{a^2}{9} + \frac{4}{9} = 1 \Rightarrow \frac{a^2}{9} + \frac{8}{9} = 1 \Rightarrow a^2 = 1 \Rightarrow a = 1 \ (\because a > 0)$

$\therefore$ Required vector $= 3\left(\frac{2}{3}\hat{i} - \frac{1}{3}\hat{j} + \frac{2}{3}\hat{k}\right) = 2\hat{i} - \hat{j} + 2\hat{k}$.

Video Solution:

Q20 Text Solution:

$$\vec{a}+\vec{b}+\vec{c}=0 \Rightarrow \left(\vec{a}+\vec{b}+\vec{c}\right)\cdot\left(\vec{a}+\vec{b}+\vec{c}\right)=0$$

$$\left(\vec{b}\right) \Rightarrow \left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2 + 2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right)=0$$

$$\Rightarrow \vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}=\frac{-1-4-9}{2}=-7$$

Video Solution:

Q21 Text Solution:

$$|a|=|b|=1$$

$$\left|\sqrt{3}a-b\right|=1$$

$$3\left|a^2\right|+\left|b\right|^2-2\sqrt{3}ab=1$$

$$3+1-2\sqrt{3}\cdot ab=1$$

$$-2\sqrt{3}a\cdot b=-3$$

$$ab=\frac{3}{2\sqrt{3}}=\frac{\sqrt{3}}{2}=\frac{\pi}{6}$$

Video Solution:

Q22 Text Solution:

$$\text{WKT } \vec{a}\cdot\vec{b}=\left|\vec{a}\right|\left|\vec{b}\right|\cos\theta$$

$$\Rightarrow \cos\theta=\frac{\vec{a}\cdot\vec{b}}{\left|\vec{a}\right|\left|\vec{b}\right|}=\frac{12}{20}=\frac{3}{5}$$

$$\text{Now, } \sin\theta=\frac{4}{5}$$

$$\therefore \vec{a}\times\vec{b}=\left|\vec{a}\right|\left|\vec{b}\right|\sin\theta$$

$$=10\times2\times\frac{4}{5}$$

$$\left|\vec{a}\times\vec{b}\right|=16$$

Video Solution:

Q23 Text Solution:

Given that, $|a^{\to}|=3, |b^{\to}|=4$ *and* $a^{\to}+\lambda b^{\to}$ *is perpendicular to* $a^{\to}-\lambda b^{\to}$.

$$\therefore \left(\vec{a}+\lambda\vec{b}\right)\cdot\left(\vec{a}-\lambda\vec{b}\right)=0$$

$$\Rightarrow \vec{a}\cdot\vec{a}-\vec{a}\cdot\vec{b}\lambda+\lambda\vec{b}\cdot\vec{a}-\lambda^2\vec{b}\cdot\vec{b}=0$$

$$\Rightarrow \left|\vec{a}\right|^2-\lambda^2\left|\vec{b}\right|^2=0 \Rightarrow \lambda^2=\frac{\left|\vec{a}\right|^2}{\left|\vec{b}\right|^2} \Rightarrow \lambda=\frac{\left|\vec{a}\right|}{\left|\vec{b}\right|}=\frac{3}{4}$$

Video Solution:

Q24 Text Solution:

Let $a = 2\vec{i} + 3\vec{j} - 6\vec{k}, \vec{h} = 6\vec{i} - 2\vec{j} + 3\vec{k}, \vec{c} = 3\vec{i} - 6\vec{j} - 2\vec{k}$

$|a| = \sqrt{4 + 9 + 36} = 7$

$|b| = \sqrt{36 + 4 + 9} = 7$

$|c| = \sqrt{9 + 36 + 4} = 7$

$\therefore$perimeter$= |a| + |k| + |c| = 7 + 7 + 7 = 21$ units

Video Solution:

Q25 Text Solution:

$$\left|x - y\right|^2 = (x - y)\cdot(x - y) = 1 + 1$$

$$- 2|x||y|\cos\pi$$

$$= 2 - 2\cos\pi$$

$$\therefore |x - y|^2 = 4 \Rightarrow |x - y| = 2$$

$$so\ \tfrac{1}{2}|x - y| = 1$$

Video Solution:

Q26 Text Solution:

$$\text{Now}, \overline{AB} + \overline{AB} + \overline{AD} = \overline{AC}$$

$$\Rightarrow |\overline{AB}|^2 + |\overline{AD}|^2 + 2\overline{AB}\cdot\overline{AD} = |\overline{AC}|^2$$

$$\Rightarrow a^2 + b^2 + 2\overline{AB}\cdot\overline{AD} = c^2$$

$$\Rightarrow a^2 + b^2 + 2\overline{AB}\cdot\left(\overline{AB} - \overline{BD}\right) = c^2$$

$$\Rightarrow a^2 + b^2 + 2a^2 - 2\overline{AB}\cdot\overline{BD} = c^2$$

$$\Rightarrow \overline{AB}\cdot\overline{DB} = \frac{3a^2 + b^2 - c^2}{2}$$

Video Solution:

Q27 Text Solution:

$$\left|\vec{a} + \vec{b}\right| = \left|\vec{b} - \vec{a}\right|$$

$$\Rightarrow \left|\vec{a} + \vec{b}\right|^2 = \left|\vec{b} - \vec{a}\right|^2$$

$$\Rightarrow \left|\vec{a}\right|^2 + \left|\vec{b}\right|^2 + 2\vec{a}\cdot\vec{b} = \left|\vec{b}\right|^2 + \left|\vec{a}\right|^2 - 2\vec{a}\cdot\vec{b}$$

$$\therefore \vec{a}\cdot\vec{b} = 0 \Rightarrow a \perp b$$

Video Solution:

Q28 Text Solution:

Let $a = 3a\hat{i} - 6a\hat{j} + ak66,\ ab = 2a\hat{i} - 4a\hat{j} + \lambda a\hat{k}$

By data, *a* is parallel to *b*.

Þ *a* = *kb* for some scalar *k*

$\Rightarrow k = \frac{3}{2},\ k = \frac{3}{2},\ \therefore \lambda = \frac{2}{3}\ (\because k = \frac{3}{2})$

Video Solution:

Q29 Text Solution:

Since $\vec{a}$ and $\vec{b}$ are orthogonal to each other

$\vec{a} \cdot \vec{b} = 0 \quad \Rightarrow 6 + \lambda - \mu = 0$

$\Rightarrow \quad \mu - \lambda = 6 \qquad ....(i)$

Also given that $|\vec{a}| = |\vec{b}|$

$\sqrt{9 + \lambda^2 + 1} = \sqrt{4 + 1 + \mu^2}$

$\therefore 10 + \lambda^2 = 5 + \mu^2$

$\mu^3 - \lambda^2 = 5$

$(\mu - \lambda)(\mu + \lambda) = 5$

$\mu + \lambda = \frac{5}{6} \qquad ....(ii)$

Solving equation (i) and (ii) we get

$\lambda = \frac{-31}{12},\ \mu = \frac{41}{12}$

Video Solution:

Q30 Text Solution:

Let

$\vec{a} = x\hat{i} + y\hat{j} + z\hat{k}$

$|\vec{a}| = \sqrt{x^2 + y^2 + z^2}$

now

$\vec{a} \times \hat{i} = z\hat{j} - y\hat{k}$

$|\vec{a} \times \hat{i}|^2 = y^2 + z^2$

similarly

$|\vec{a} \times \hat{j}|^2 = x^2 + z^2$

$|\vec{a} \times \hat{k}|^2 = x^2 + y^2$

$\therefore |\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2 = 2(x^2 + y^2 + z^2)$

$= 2|\vec{a}|^2$

Video Solution: