1. If the four points, whose position vectors are $3\hat{i}-4\hat{j}+2\hat{k}$, $\hat{i}+2\hat{j}-\hat{k}$, $-2\hat{i}-\hat{j}+3\hat{k}$ and $5\hat{i}-2\alpha\hat{j}+4\hat{k}$ are coplanar, then α is equal to

(1) $\frac{73}{17}$
(2) $-\frac{107}{17}$
(3) $-\frac{73}{17}$
(4) $\frac{107}{17}$

2. Let $\vec{a}=3\hat{i}+\hat{j}-\hat{k}$ and $\vec{c}=2\hat{i}-3\hat{j}+3\hat{k}$. If $\vec{b}$ is a vector such that $\vec{a}=\vec{b}\times\vec{c}$ and $\left|\vec{b}\right|^2=50$, then $\left|72-\left|\vec{b}+\vec{c}\right|^2\right|$ is equal to __________.

3. Let $\left|\vec{a}\right|=2$, $\left|\vec{b}\right|=3$ and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $\left|\left(\vec{a}+2\vec{b}\right)\times\left(2\vec{a}-3\vec{b}\right)\right|^2$ is equal to

(1) 441
(2) 482
(3) 841
(4) 882

4. If $(2,3,9)$,$(5,2,1)$,$(1,\lambda,8)$ and $(\lambda,2,3)$ are coplanar, then the product of all possible values of λ is

(1) $\frac{21}{2}$
(2) $\frac{59}{8}$
(3) $\frac{57}{8}$
(4) $\frac{95}{8}$

5. Let $\vec{a}=\alpha\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}-\alpha\hat{k}, \alpha>0$. If the projection of $\vec{a}\times\vec{b}$ on the vector $-\hat{i}+2\hat{j}-2\hat{k}$ is 30, then α is equal to

(1) $\frac{15}{2}$
(2) 8
(3) $\frac{13}{2}$
(4) 7

6. If $\vec{a}$ and $\vec{b}$ are unit vectors and $\left(\vec{a}+3\vec{b}\right)$ is perpendicular to $\left(7\vec{a}-5\vec{b}\right)$ and $\left(\vec{a}-4\vec{b}\right)$ is perpendicular to $\left(7\vec{a}-2\vec{b}\right)$, then the angle between $\vec{a}$ and $\vec{b}$ (in degrees) is _________.

7. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three vectors such that $\left|\vec{a}\right|=\sqrt{3}$, $\left|\vec{b}\right|=5$, $\vec{b}\bullet\vec{c}=10$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$. If $\vec{a}$ is perpendicular to the vector $\vec{b}\times\vec{c}$, then $\left|\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right|$ is equal to ____________.

8. If the points P and Q are respectively the circumcenter and the orthocentre of a ΔABC, then $\overrightarrow{PA}+\overrightarrow{PB}+\overrightarrow{PC}$ is equal to _______

(1) $2\overrightarrow{QP}$
(2) $2\overrightarrow{PQ}$
(3) $\overrightarrow{PQ}$
(4) $\overrightarrow{QP}$

9. Let $\vec{a}=2\hat{i}+3\hat{j}+4\hat{k}$, $\vec{b}=\hat{i}-2\hat{j}-2\hat{k}$ and $\vec{c}=-\hat{i}+4\hat{j}+3\hat{k}$. If $\vec{d}$ is a vector perpendicular to both $\vec{b}$ and $\vec{c}$, and $\vec{a}\cdot\vec{d}=18$, then $\left|\vec{a}\times\vec{d}\right|^2$ is equal to

(1) 640
(2) 680
(3) 720
(4) 760

10. Let $\vec{a}=2\hat{i}-7\hat{j}+5\hat{k}$, $\vec{b}=\hat{i}+\hat{k}$ and $\vec{c}=\hat{i}+2\hat{j}-3\hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r}\times\vec{a}=\vec{c}\times\vec{a}$ and $\vec{r}\cdot\vec{b}=0$, then $\left|\vec{r}\right|$ is equal to:

(1) $\frac{11}{7}\sqrt{2}$
(2) $\frac{11}{7}$
(3) $\frac{11}{5}\sqrt{2}$
(4) $\frac{\sqrt{914}}{7}$

11. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors such that $\left|\vec{a}\right|=\sqrt{31}$, $4\left|\vec{b}\right|=\left|\vec{c}\right|=2$ and $2\left(\vec{a}\times\vec{b}\right)=3\left(\vec{c}\times\vec{a}\right)$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $\left(\frac{\vec{a}\times\vec{c}}{\vec{a}\cdot\vec{b}}\right)^2$ is equal to _____ .

12. Let PQR be a triangle. The points A, B and C are on the sides QR, RP and PQ respectively such that $\frac{QA}{AR}=\frac{RB}{BP}=\frac{PC}{CQ}=\frac{1}{2}$. Then $\frac{\text{Area}(\Delta PQR)}{\text{Area}(\Delta ABC)}$ is equal to

(1) 4
(2) 1
(3) 2
(4) $\frac{5}{2}$

13. Let $\vec{a}=\alpha\hat{i}+3\hat{j}-\hat{k}$, $\vec{b}=3\hat{i}-\beta\hat{j}+4\hat{k}$ and $\vec{c}=\hat{i}+2\hat{j}-2\hat{k}$ where $\alpha,\beta\in R$ be three vectors. If the projection of $\vec{a}$ on $\vec{c}$ is $\frac{10}{3}$ and $\vec{b}\times\vec{c}=-6\hat{i}+10\hat{j}+7\hat{k}$, then the value of $\alpha+\beta$ equal to

(1) 3
(2) 4
(3) 5
(4) 6

14. Let $\vec{a}$ and $\vec{b}$ be the vectors along the diagonal of a parallelogram having area $2\sqrt{2}$. Let the angle between $\vec{a}$ and $\vec{b}$ be acute. $\left|\vec{a}\right|=1$ and $\left|\vec{a}\cdot\vec{b}\right|=\left|\vec{a}\times\vec{b}\right|$. If $\vec{c}=2\sqrt{2}\left(\vec{a}\times\vec{b}\right)-2\vec{b}$, then an angle between $\vec{b}$ and $\vec{c}$ is

(1) $\frac{-\pi}{4}$
(2) $\frac{5\pi}{6}$
(3) $\frac{\pi}{3}$
(4) $\frac{3\pi}{4}$

15. Let $\vec{a}=\hat{i}+5\hat{j}+\alpha\hat{k}$, $\vec{b}=\hat{i}+3\hat{j}+\beta\hat{k}$ and $\vec{c}=-\hat{i}+2\hat{j}-3\hat{k}$ be three vectors such that, $\left|\vec{b}\times\vec{c}\right|=5\sqrt{3}$ and $\vec{a}$ is perpendicular to $\vec{b}$. Then the greatest amongst the values of $\left|\vec{a}\right|^2$ is ________.

16. Let $\vec{a}=2\hat{i}-3\hat{j}+4\hat{k}$ and $\vec{b}=7\hat{i}+\hat{j}-6\hat{k}$ If $\vec{r}\times\vec{a}=\vec{r}\times\vec{b}$, $\vec{r}\cdot\left(\hat{i}+2\hat{j}+\hat{k}\right)=-3$, then $\vec{r}\cdot\left(2\hat{i}-3\hat{j}+\hat{k}\right)$ is equal to:

(1) 12
(2) 8
(3) 13
(4) 10

17. Let $\vec{a}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+5\hat{k}$. If $\vec{r}\times\vec{a}=\vec{b}\times\vec{r}$, $\vec{r}\cdot\left(\alpha\hat{i}+2\hat{j}+\hat{k}\right)=3$ and $\vec{r}\cdot\left(2\hat{i}+5\hat{j}-\alpha\hat{k}\right)=-1, \alpha\in R$, then the value of $\alpha+\left|\vec{r}\right|^2$ is equal to :

(1) 9
(2) 15
(3) 13
(4) 11

18. Let the position vectors of points 'A' and 'B' be $\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+\hat{j}+3\hat{k}$, respectively. A point 'P' divides the line segment AB internally in the ratio $\lambda:1(\lambda>0)$. If O is the origin and $\overrightarrow{OB}\cdot\overrightarrow{OP}-3\left|\overrightarrow{OA}\times\overrightarrow{OP}\right|^2=6$ then λ is equal to

19. Let the vectors $(2+a+b)\hat{i}+(a+2b+c)\hat{j}-(b+c)\hat{k}$, $(1+b)\hat{i}+2b\hat{j}-b\hat{k}$ and $(2+b)\hat{i}+2b\hat{j}+(1-b)\hat{k}$, $\forall a,b,c\in R$ be co-planar. Then which of the following is true?

(1) $2b=a+c$
(2) $3c=a+b$
(3) $a=b+2c$
(4) $2a=b+c$

20. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero non-coplanar vectors. Let the position vectors of four points A, B, C and D be $\vec{a}-\vec{b}+\vec{c}$, $\lambda\vec{a}-3\vec{b}+4\vec{c}$, $-\vec{a}+2\vec{b}-3\vec{c}$ and $2\vec{a}-4\vec{b}+6\vec{c}$ respectively. If $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$ are coplanar, then λ is :

21. Let A, B, C be three points whose position vectors respectively are: $\vec{a}=\hat{i}+4\hat{j}+3\hat{k}$ $\vec{b}=2\hat{i}+\alpha\hat{j}+4\hat{k}$, $\alpha\in R$ $\vec{c}=3\hat{i}-2\hat{j}+5\hat{k}$ If α is the smallest positive integer for which $\vec{a}$, $\vec{b}$, $\vec{c}$ are non-collinear, then the length of the median, $\triangle ABC$, through A is:

(1) $\frac{\sqrt{82}}{2}$
(2) $\frac{\sqrt{62}}{2}$
(3) $\frac{\sqrt{69}}{2}$
(4) $\frac{\sqrt{66}}{2}$

22. Let $\lambda\in\mathbb{Z}$, $\vec{a}=\lambda\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=3\hat{i}-\hat{j}+2\hat{k}$. Let $\vec{c}$ be a vector such that $\left(\vec{a}+\vec{b}+\vec{c}\right)\times\vec{c}=\vec{0}$, $\vec{a}\cdot\vec{c}=-17$ and $\vec{b}\cdot\vec{c}=-20$. Then $\left|\vec{c}\times\left(\lambda\hat{i}+\hat{j}+\hat{k}\right)\right|^2$ is equal to

(1) 46
(2) 53
(3) 62
(4) 49

23. Let the plane $x+3y-2z+6=0$ meet the co-ordinate axes at the points A, B, C. If the orthocenter of the triangle ABC is $\left(\alpha, \beta, \frac{6}{7}\right)$, then $98(\alpha+\beta)^2$ is equal to __________.

24. Let O be the origin and the position vector of the point P be $-\hat{i}-2\hat{j}+3k$. If the position vectors of the points A, B and C are $-2\hat{i}+\hat{j}-3k$, $2\hat{i}+4\hat{j}-2k$ and $-4\hat{i}\ \hat{}\ +2\hat{j}-k$ respectively, then the projection of the vector $\overrightarrow{OP}$ on a vector perpendicular to the vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$ is

(1) 3
(2) $\frac{8}{3}$
(3) $\frac{7}{3}$
(4) $\frac{10}{3}$

25. Let $\vec{a}=6\hat{i}+9\hat{j}+12\hat{k}$, $\vec{b}=\alpha\hat{i}+11\hat{j}-2\hat{k}$ and $\vec{c}$ be vectors such that $\vec{a}\times\vec{c}=\vec{a}\times\vec{b}$ If $\vec{a}\cdot\vec{c}=-12$, and $\vec{c}\cdot\left(\hat{i}-2\hat{j}+\hat{k}\right)=5$ then $\vec{c}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)$ is equal to _______

26. If $\vec{a}=\hat{i}+2\hat{k}$, $\vec{b}=\hat{i}+\hat{j}+\hat{k}$, $\vec{c}=7\hat{i}-3\hat{j}+4\hat{k}$, $\vec{r}\times\vec{b}+\vec{b}\times\vec{c}=\vec{0}$ and $\vec{r}\cdot\vec{a}=0$ then $\vec{r}\cdot\vec{c}$ is equal to:

(1) 34
(2) 12
(3) 36
(4) 30

27. Let $\vec{u}=\hat{i}-\hat{j}-2\hat{k}$, $\vec{v}=2\hat{i}+\hat{j}-\hat{k}$, $\vec{v}\cdot\vec{w}=2$ and $\vec{v}\times\vec{w}=\vec{u}+\lambda\vec{v}$, then $\vec{u}\cdot\vec{w}$ is equal to

(1) 1
(2) $\frac{3}{2}$
(3) 2
(4) $-\frac{2}{3}$

28. Let $\vec{a}=\hat{i}-\hat{j}+2\hat{k}$ and let $\vec{b}$ be a vector such that $\vec{a}\times\vec{b}=2\hat{i}-\hat{k}$ and $\vec{a}\cdot\vec{b}=3$. Then the projection of $\vec{b}$ on the vector $\vec{a}-\vec{b}$ is:

(1) $\frac{2}{\sqrt{21}}$
(2) $2\sqrt{\frac{3}{7}}$
(3) $\frac{2}{3}\sqrt{\frac{7}{3}}$
(4) $\frac{2}{3}$

29. Let $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{c}$ be a vector such that $\vec{a}\times\left(\vec{b}+\vec{c}\right)=\vec{0}$, then the value of $3\left(\vec{c}\cdot\vec{a}\right)$ is equal to _______.

30. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three non-coplanar vectors such that $\vec{a}\times\vec{b}=4\vec{c}$, $\vec{b}\times\vec{c}=9\vec{a}$ and $\vec{c}\times\vec{a}=\alpha\vec{b}$, $\alpha>0$
If $\left|\vec{a}\right|+\left|\vec{b}\right|+\left|\vec{c}\right|=36$, then α is equal to _______.