Q1. Find the angle between the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ if $\vec{a}=2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=3\hat{i}+\hat{j}-2\hat{k}$. **3 Marks**

Q2. Express the matrix $\begin{bmatrix} 0 & \frac{9}{2} & \frac{9}{2} \\ -\frac{9}{2} & 0 & -\frac{3}{2} \\ -\frac{9}{2} & \frac{3}{2} & 0 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix. **3 Marks**

Q3. Find the projection of $\vec{b}+\vec{c}$ on $\vec{a}$ where $\vec{a}=2\hat{i}-2\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-2\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+4\hat{k}$. **3 Marks**

Q4. If $\vec{a}=2\hat{i}-\hat{j}+\hat{k}, \vec{b}=\hat{i}+\hat{j}-2\hat{k}$ and $\vec{c}=\hat{i}+3\hat{j}-\hat{k}$ and the projection of vector $\vec{c}+\lambda\vec{b}$ on vector $\vec{a}$ is $2\sqrt{6}$, then find the value of λ. **3 Marks**

Q5. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=10$ and $\vec{r}\cdot\left(2\hat{i}+3\hat{j}+\hat{k}\right)+4=0$ and passing through the point $(-2,3,1)$. **3 Marks**

Q6. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-\hat{j}-3\hat{k}$, then find the vector $\vec{c}$, given that $\vec{a}\times\vec{c}=\vec{b}$ and $\vec{a}\,.\,\vec{c}=4$. **3 Marks**

Q7. Find the image of the point (1, 2, 3) in the plane x + 2y + 4z = 38. **3 Marks**

Q8. $\vec{a}=\hat{i}+2\hat{j}-3\hat{k}$, $\vec{b}=3\hat{i}-\hat{j}+2\hat{k}$, show that $\left(\vec{a}+\vec{b}\right)$ and $\left(\vec{a}-\vec{b}\right)$ are perpendicular to each other. **3 Marks**

Q9. If $A=\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show the $A^2-5A+7I=0$. Hence find A^{-1}. **3 Marks**

Q10. Find the shortest distance between the following lines: $\vec{r}=3\hat{i}+5\hat{j}+7\hat{k}+\lambda(\hat{i}-2\hat{j}+\hat{k})$ and $\vec{r}=(-\hat{i}-\hat{j}-\hat{k})+\mu(7\hat{i}-6\hat{j}+\hat{k})$. **3 Marks**

Q11. Check whether the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$ are skew or not. **3 Marks**

Q12. A relation R on set A = {1, 2, 3, 4, 5} is defined as R = {(x, y) : $|x^2-y^2|<8$}. Check whether the relation R is reflexive, symmetric and transitive. **3 Marks**

Q13. Find the value of λ, so that the lines $\frac{1-x}{3}=\frac{7y-14}{\lambda}=\frac{z-3}{2}$ and $=\frac{7-7x}{3\lambda}=\frac{y-5}{1}=\frac{6-z}{5}$ are at right angles. Also, find whether the lines are intersecting or not. **4 Marks**

Q14. Find the value of λ for which the following lines are perpendicular to each other: **4 Marks**

$\frac{x-5}{5\lambda+2}=\frac{2-y}{5}=\frac{1-z}{-1}$; $\frac{x}{1}=\frac{y+\frac{1}{2}}{2\lambda}=\frac{z-1}{3}$

Hence, find whether the lines intersect or not.

Q15. Find the value of $\sin\left(\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3}\right)$. **4 Marks**

Q16. If $\tan^{-1}\frac{x-3}{x-4}+\tan^{-1}\frac{x+3}{x+4}=\frac{\pi}{4}$, then find the value of x. **4 Marks**

Q17. Show that the lines $\frac{X+1}{3} = \frac{y+3}{5} = \frac{z+5}{7}$ and $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-6}{5}$ intersect. Also find their point of intersection. **4 Marks**

Q18. If vector $\vec{a}, \vec{b}$ and $\vec{c}$ are such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 3, |\vec{b}| = 5$ and $|\vec{c}| = 7$ find the angle between $\vec{a}$ and $\vec{b}$. **4 Marks**

Q19. Let A = {1, 2, 3,....., 9} and R be the relation in A x A defined by (a, b) R (c, d) if a + d = b + c for (a, b), (c, d) in A x A. Prove that R is an equivalence relation. Also obtain the equivalence class [(2,5)] **4 Marks**

Q20. Solve the following equation for x: **4 Marks**
cos ($\tan^{-1} x$) = sin $\left(\cot^{-1} \frac{3}{4}\right)$