1. Write the position vector of the point which divides the join of points with position vectors $\overrightarrow{3a} - \overrightarrow{2b}$ and $\overrightarrow{2a} + \overrightarrow{3b}$ in the ratio 2 : 1.

2. Write the number of vectors of unit length perpendicular to both the vectors 18 $a = 2\hat{i} + \hat{j} + 2\hat{k}$ and $b = \hat{j} + \hat{k}$.

3. Find the vector equation of the plane with intercepts 3, −4, and 2 on the x, y and z-axis, respectively.

4. If $x \in N$ and $\begin{bmatrix} x+3 & -2 \\ -3x & 2x \end{bmatrix} = 8$, then find the value of x.

5. Use elementary column operation $C_2 \rightarrow C_2 + 2C_1$ in the following matrix equation:
$\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$

6. Write the number of all possible matrices of order 2×2 with each entry 1,2 or 3.

7. Evaluate :
$$\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x + \cos x}\, dx$$

8. Evaluate :
$$\int_0^{\frac{3}{2}} |x \cos \pi x|\ dx$$

9. In a game, a man wins ₹5 for getting a number greater than 4 and loses ₹1 otherwise, when a fair die is thrown. The man decided to throw a die thrice but to quit as and when he gets a number greater than 4. Find the expected value of the amount he wins/loses.

10. A bag contains 4 balls. Two balls are drawn at random (without replacement) and are found to be white. What is the probability that all balls in the bag are white?

11. Find :

$$\int \frac{x^2}{x^4 + x^2 - 2}\, dx$$

12. If $x = a \sin 2t(1 + \cos 2t)$ and $y = b \cos 2t(1 - \cos 2t)$, find $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$.

13. Find the coordinates of the point where the line through the points $A(3, 4, 1)$ and $B(5, 1, 6)$ crosses the xz plane. Also find the angle which this line make with the XZ plane.

14. Find :

$$\int (3x + 1)\sqrt{4 - 3x - 2x^2}\, dx$$

15. The equation of tangent at $(2, 3)$ on the curve $y^2 = ax^3 + b$ is $y = 4x - 5$. Find the values of a and b.

16. A trust invested some money in two type of bonds. The first bond pays 10% interest and second bond pays 12% interest. The trust received ₹2 ,800 as interest. However,if trust had interchanged money in bonds, they would have got ₹100 less as interest. Using matrix method, find the amount invested by the trust. Interest received on this amount will be given to Helpage India as donation. Which value is reflected in this question?