Answer

Solve Question 21.

Cramer's rule

Let the system is
$$a_1x + b_1y + c_1z = d_1$$
$$a_2x + b_2y + c_2z = d_2$$
$$a_3x + b_3y + c_3z = d_3$$

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \quad D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \quad D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}$$

$$D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$ then $$x = \frac{D_x}{D}, \quad y = \frac{D_y}{D}, \quad z = \frac{D_z}{D}$$

Let $x = \sin\alpha$, $y = \cos\beta$, $z = \tan\gamma$

Then the system becomes

$$x + 2y + 3z = 0$$

$$2x + 5y + 3z = 0$$

$$-x - 5y + 5z = 0$$

$$D = \begin{vmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ -1 & -5 & 5 \end{vmatrix} = -1 \neq 0, \quad D_x = \begin{vmatrix} 0 & 2 & 3 \\ 0 & 5 & 3 \\ 0 & -5 & 5 \end{vmatrix} = 0$$

$$D_y = \begin{vmatrix} 1 & 0 & 3 \\ 2 & 0 & 3 \\ -1 & 0 & 5 \end{vmatrix} = 0, \quad D_z = \begin{vmatrix} 1 & 2 & 0 \\ 2 & 5 & 0 \\ -1 & -5 & 0 \end{vmatrix} = 0$$

So, $x = \frac{D_x}{D} = 0$, $y = \frac{D_y}{D} = 0$, $z = \frac{D_z}{D} = 0$

Then $x = \sin\alpha = 0$, $0 \le \alpha \le 2\pi$

$\Rightarrow \alpha = 0, \pi, 2\pi \rightarrow$ Three possible solution

$y = \cos\beta = 0$, $0 \le \beta \le 2\pi$

$\Rightarrow \beta = \pi/2, 3\pi/2 \rightarrow$ Two possible solution

$z = \tan\gamma = 0$, $0 \le \gamma \le 2\pi$

$\Rightarrow \gamma = 0, \pi, 2\pi \rightarrow$ Three possible solution.

Thus total number of possible solution of the non-linear system is $3 \times 2 \times 3 = 18$

Likes: 0 **Dislikes: 0**