

Using Matrices to Solve Simultaneous Equations

1. Find the determinants and inverses (if they exist), of the following matrices;

a) $\begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}$

d) $\begin{pmatrix} 2 & -1 \\ -5 & 4 \end{pmatrix}$

g) $\begin{pmatrix} 1 & -2 & 3 \\ 1 & -1 & 2 \\ -2 & 4 & -5 \end{pmatrix}$

b) $\begin{pmatrix} 4 & 9 \\ 3 & 7 \end{pmatrix}$

e) $\begin{pmatrix} 2 & -6 \\ -3 & 9 \end{pmatrix}$

h) $\begin{pmatrix} 1 & -2 & -3 \\ 2 & -1 & -4 \\ 3 & -3 & -5 \end{pmatrix}$

c) $\begin{pmatrix} 3 & -5 \\ -4 & 7 \end{pmatrix}$

f) $\begin{pmatrix} 5 & -3 \\ 10 & -5 \end{pmatrix}$

i) $\begin{pmatrix} 1 & -2 & -1 \\ 2 & 1 & 5 \\ 3 & -2 & 3 \end{pmatrix}$

2. By finding the appropriate inverse matrices, find the solutions of the following;

a) $\begin{cases} 2x + 3y = -1 \\ 3x - 2y = 18 \end{cases}$

c) $\begin{cases} 5x - 4y = 25 \\ -3x + y = 6 \end{cases}$

e) $\begin{cases} 2x - 3y + 4z = 7 \\ x - 2y + 3z = 5 \\ 3x - 5y + 2z = 2 \end{cases}$

b) $\begin{cases} -3x + 2y = 13 \\ -5x + 4y = 23 \end{cases}$

d) $\begin{cases} 3x - 5y = 71 \\ 4x + 7y = 40 \end{cases}$

f) $\begin{cases} 3x - 2y + z = -29 \\ 4x - y + 3z = -37 \\ -x + 5y - z = 24 \end{cases}$

ANSWERS

1. a) 2, $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{1}{2} \end{pmatrix}$

b) 1, $\begin{pmatrix} 7 & -9 \\ -3 & 4 \end{pmatrix}$

c) 1, $\begin{pmatrix} 7 & 5 \\ 4 & 3 \end{pmatrix}$

d) 3, $\begin{pmatrix} \frac{4}{3} & \frac{1}{3} \\ \frac{5}{3} & \frac{2}{3} \end{pmatrix}$

e) 0, no inverse

2. a) $x = 4, y = -3$

b) $x = -3, y = 2$

c) $x = -7, y = -15$

f) 5, $\begin{pmatrix} -1 & \frac{3}{5} \\ -2 & 1 \end{pmatrix}$

g) 1, $\begin{pmatrix} -3 & 2 & -1 \\ 1 & 1 & 1 \\ 2 & 0 & 1 \end{pmatrix}$

h) 6, $\begin{pmatrix} -\frac{7}{6} & -\frac{1}{6} & \frac{5}{6} \\ -\frac{1}{3} & \frac{2}{3} & -\frac{1}{3} \\ -\frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \end{pmatrix}$

i) 2, $\begin{pmatrix} \frac{13}{2} & 4 & -\frac{9}{2} \\ \frac{9}{2} & 3 & -\frac{7}{2} \\ -\frac{7}{2} & -2 & \frac{5}{2} \end{pmatrix}$

d) $x = 17, y = -4$

e) $x = 1, y = 1, z = 2$

f) $x = -7, y = 3, z = -2$