

# Short Course in Mathematics and Analytic Geometry

## Week 7 Exercises

### 1 Matrix Inverse

Find the inverses of the following matrices:

1.  $\begin{bmatrix} 1 & 2 & 5 \\ 8 & 1 & 0 \\ 3 & 5 & 9 \end{bmatrix}$

2.  $\begin{bmatrix} 8 & 0 & 0 \\ 0 & 7 & 0 \\ 0 & 0 & 6 \end{bmatrix}$

3.  $\begin{bmatrix} 3 & 4 & 4 \\ 5 & 7 & 7 \\ 1 & 1 & 1 \end{bmatrix}$

4.  $\begin{bmatrix} 0 & -0.80 & -0.60 \\ 0.80 & -0.36 & 0.48 \\ 0.60 & 0.48 & -0.64 \end{bmatrix}$

### 2 Simultaneous Equations

Find inverse Matrices to solve simultaneous equations in the following problems:

5.  $\begin{cases} 7x - 2y = 3 \\ x + 5y = 9 \end{cases}$

6.  $\begin{cases} x + 2y + 5z = 1 \\ 8x + y = 2 \\ 3x + 5y + 9z = 3 \end{cases}$

7.  $\begin{bmatrix} 1 & 2 & 5 & 1 & 2 \\ 8 & 1 & 0 & -5 & -5 \\ 3 & 5 & 9 & 3 & 9 \\ 1 & 2 & 3 & 4 & -7 \\ -2 & -1 & -9 & 4 & -3 \end{bmatrix} \begin{bmatrix} v \\ w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$

### 3 Eigenvectors and Eigenvalues

8. Given the following matrix:

$$\mathbf{A} = \begin{bmatrix} 2 & -1 & 8 \\ 1 & 3 & 2 \\ 6 & -3 & 1 \end{bmatrix}$$

, find the diagonal matrix mapping  $\mathbf{A} = \mathbf{PDP}^{-1}$  and solve the following:

- a.  $\mathbf{A}^{20}$
- b.  $\exp(\mathbf{A})$
- c.  $\log(\mathbf{A})$
- d.  $\sin(\mathbf{A})$
- e.  $\cos(\mathbf{A})$
- f.  $\exp(\mathbf{A}^2) + \sin(\mathbf{A})$