



UNIVERSITY OF RUHUNA
DEPARTMENT OF MATHEMATICS

BACHELOR OF SCIENCE (GENERAL) DEGREE (LEVEL II)
INDUSTRIAL MATHEMATICS
IMT 2b2β: Mathematical Computing

Assignment No: 05

Semester I, 2012

1. Position (in meters) of a moving particle as a function of time (in seconds) is given by :

$$\underline{r} = (3t^2 - 3)\underline{i} + (4 - 7t)\underline{j} + (-t^3)\underline{k}$$

Find the coordinates of the positions of the particle at the start of the motion and at time $t = 2$ s. Also, determine the linear distances of the positions of the particle from the origin of the coordinate system at these time instants.

2. Let O be the origin. The position vectors of points A , B and C are given by:

$$\begin{aligned}\underline{r}_1 &= -2\underline{i} + \underline{j} \\ \underline{r}_2 &= 5\underline{i} + 3\underline{j} + \underline{k} \\ \underline{r}_3 &= -2\underline{j} + 7\underline{k}\end{aligned}$$

Use Maxima to find followings:

- (i) $\underline{OA}$
- (ii) $\underline{AC}$
- (iii) $\underline{AB}$
- (iv) $(\underline{r}_1 \times \underline{r}_2) \times \underline{r}_3$
- (v) $\underline{r}_1 \times (\underline{r}_2 \times \underline{r}_3)$
- (vi) $\underline{r}_1 \cdot (\underline{r}_2 \times \underline{r}_3)$
- (vi) $\underline{r}_2 \cdot (\underline{r}_3 \times \underline{r}_1)$

3. (a) (i) Create a 4×4 identity matrix.
(ii) Create a diagonal matrix of size 4 with diagonal element 2.
(b) Let

$$M_1 = \begin{pmatrix} 1 & 4 & -8 \\ 2 & 1 & 3 \\ -4 & 3 & 9 \end{pmatrix} \text{ and } M_2 = \begin{pmatrix} 3 & 1 & 2 \\ 1 & 9 & 4 \\ -1 & 5 & 8 \end{pmatrix}$$

be two matrices. Input these matrices and do followings:

- (i) Find $M_1 + M_2$.
 - (ii) Find $M_1 - M_2$.
 - (iii) Find $5.M_1$.
 - (iv) Find $M_1.M_2$.
 - (v) Find M_1^5 .
 - (vi) Find the inverse of $M_1 + M_2$.
 - (vii) Find the transpose of $M_1 + M_2$.
 - (viii) Find the determinant of $M_1 + M_2$.
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4. (i) Find eigenvalues and eigenvectors of $\begin{pmatrix} 1 & 1 \\ -2 & 4 \end{pmatrix}$.
- (ii) Find eigenvalues and eigenvectors of $\begin{pmatrix} 10 & -18 \\ 6 & -11 \end{pmatrix}$.
- (iii) Find eigenvalues and eigenvectors of $\begin{pmatrix} 2 & -1 \\ -4 & 2 \end{pmatrix}$.
- (iv) Find eigenvalues and eigenvectors of $\begin{pmatrix} 2 & -1 \\ 5 & -2 \end{pmatrix}$.
- (v) Find eigenvalues and eigenvectors of $\begin{pmatrix} 5 & 4 & 2 \\ 4 & 5 & 2 \\ 2 & 2 & 2 \end{pmatrix}$.
- (vi) Find eigenvalues and eigenvectors of $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{pmatrix}$.
- (vi) Find eigenvalues and eigenvectors of $\begin{pmatrix} 2 & 0 & 1 & -3 \\ 0 & 2 & 10 & 4 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \end{pmatrix}$.
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