

2024

MATHEMATICS

Paper : SEC0301403

Programming in Mathematica

Full Marks : 30

Time : 1½ hrs

*The figures in the margin indicate full marks for the questions*1. Answer the following questions : 1×5=5

a) What is a computer algebra system ?

b) What will be the output of

In [1] := x = Solve [$y^2 - 3y + 2 == 0$, y]

c) What is wrong in the following command

In [1] := x = Plot $\left[x \cos \left[\frac{10}{x} \right] \right]$ d) Write the command for the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

e) Produce the following table :

{1, 4, 9, 16, 25, 36, 49, 64, 81, 100}

*Table[{x, {x^2, x^3, x^4, x^5}}]*2. Answer **any five** of the following questions : 2×5=10

a) Write a command to find the sum

1+3+5+7+.....+99

*Sum[x, {x, 1, 99}]*b) Define the function $f(x) = x^3 + \sin x$ and find $f(3)$.

c) Write the commands to draw the lines

 $f(x) = 4x + 1$, $g(x) = -x + 4$ and $h(x) = 9x - 8$ for $0 \leq x \leq 2$.

Contd.

12.

d) Write a command to draw the surface $z = e^{-(x^2+y^2)}$ for $-2 \leq x, y \leq 2$

e) Write a command to produce the table :

n	$n^2/2$
1	0.5
2	2
3	4.5

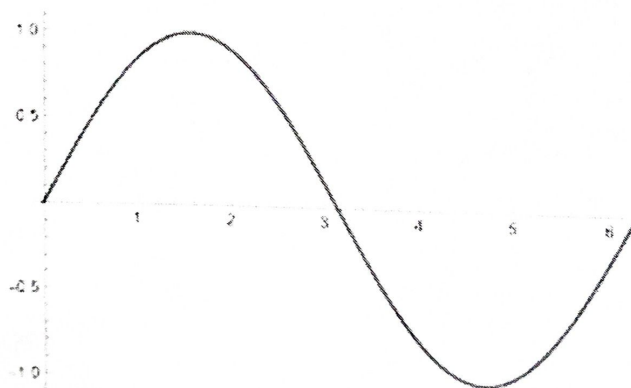
f) Write the commands to draw the graphs of $f(x) = 1 - x$, $g(x) = x^2$ and $f(x) \times g(x)$ together.

g) Let $M = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$. Write a command that produces

$M^2, M^3, \dots, M^{10}$.

h) Write the commands to produce first 50 terms of the fibonacci sequence.

i) Write the command for



j) Write a command to display the graphs of $\sin(2x)$ and $\frac{1}{2}\cos(5x)$ together in the region $0 \leq x \leq 2\pi$.

3. Answer **any three** of the following questions : $5 \times 3 = 15$

- a) Write the command to draw a sphere of radius 1 using its parametric equations.
- b) Write the commands to display a 4×4 invertible matrix, its transpose, determinant, sum of diagonal entries, inverse, eigen values and eigenvectors.
- c) Animate the graphs of $\sin(2x + a)$ and $\cos(x + a)$ using dashed and tick curves for them respectively. Also label the curves.
- d) Consider the graphs of $\sin x$, $\cos x$, $\sin x - \cos x$, $\sin x + \cos x$ in the region $-\pi \leq x \leq \pi$. Display these graphs in a row and grids.
- e) Using circle, construct Graphics showing the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ together with the co-ordinate axes.
- f) Make a plot of the piecewise function below

$$f(x) = \begin{cases} 0 & x < 0 \\ \frac{x^2}{2} & 0 \leq x < 1 \\ -x^2 + 3x - \frac{3}{2} & 1 \leq x < 2 \\ \frac{1}{2}(3-x)^2 & 2 \leq x < 3 \\ 0 & 3 \leq x \end{cases}$$
