



EASTERN UNIVERSITY, SRI LANKA  
DEPARTMENT OF MATHEMATICS  
FIRST YEAR EXAMINATION IN SCIENCE - 2015/2016  
FIRST SEMESTER (Jul. /Aug., 2017)  
AM 151 – MATHEMATICA

Answer all questions

Time allowed: 02 hours

- 1)
- a) Enter the appropriate Mathematica command for the following parts.
- List down the first 25 odd numbers;
  - Check whether the above numbers are prime or not;
  - Find out the numeric value of the constant  $\pi$  and add 200;
  - Display the approximate value of the last output (part iii);
- b) Simplify the following expressions:
- $$\frac{4}{5(3x-1)} + \frac{9}{10(3x+1)} - \frac{2}{(-9x^2+1)}$$
  - $$(x-1)(x+1)(x^2+1) + 1$$
- c) Factorize the following expressions:
- $$36 + 192p + 160p^2 - 256p^3 + 64p^4 - 84q - 224pq + 112p^2q + 49q^2;$$
  - $$\sin[x]^2 + \cos[x]^2 + \cos[x] - \sin[x].$$
- d) Display the first ten square numbers and triangle numbers in a table format.
- e) Consider the following lists:
- List\_1 = {1, 3, 5, 7, 9};  
List\_2 = {2, 4, 6, 8, 10}.

- i. Combine the above two lists into one list such that the elements of List\_1 come after all those of List\_2.
- ii. Add a new list element " 100 " in the third position of list which you derived in part i.

2)

- a) Find the partial derivatives of  $x^3 + y^2$  with respect to  $x$  and  $y$ .
- b) Find the equation of the tangent line to the curve  $y = 4x^2 - 4$  at the point  $(-1, 0)$  and sketch the graph of the given curve and tangent line in the same axes.
- c) Let  $P = \begin{bmatrix} -8 & -5 & -3 \\ -3 & 9 & 5 \end{bmatrix}$ ,  $Q = \begin{bmatrix} 7 & 5 \\ 4 & 6 \\ 5 & -5 \end{bmatrix}$ ,  $R = \begin{bmatrix} 4 & -8 & -9 \\ 9 & 4 & -6 \\ 7 & 6 & 5 \end{bmatrix}$  and  $S = \begin{bmatrix} -5 & 9 \\ -6 & -5 \end{bmatrix}$ .

Perform each computation below:

- i.  $PQ$ ;
  - ii.  $QPR$ ;
  - iii.  $PQ + S$ ;
- d) Consider the sequence  $\left\{ \frac{n+2}{2^{n+1}} (-2)^{n-1} \right\}$  where  $n = 1$  to  $\infty$ .
    - i. List the first five terms of the sequence.
    - ii. Find the sum of the first five terms of the sequence.
    - iii. Find the sum of the first  $n$  terms of the sequence.
    - iv. Determine whether this series converges or diverges.

3)

- a) Plot the 3D surface that is parameterized by,

$$x = u \cos u (4 + \cos (u + v));$$

$$y = u \sin u (4 + \cos (u + v));$$

$$z = u \sin (\cos (u + v)).$$

Consider the range  $0 \leq u \leq 4\pi$  and  $0 \leq v \leq 2\pi$ .

- b) Find the area between the graphs of  $y = \sin x$  and  $y = \cos x$  on the interval  $[0, 2\pi]$ .

c)

i. Define the function,  $f(y) = \cos(y^2) + e^{1-y^2}$ .

ii. Use the above function to plot the 3D graph with the given options below.

- x range :  $-7 < x < 10$
- y range :  $-3 < y < 8$
- Shading colors : Pink and Green
- Viewing point : 6, -5, 6
- Image size : 400

d) Calculate the volume of the solid bounded between the surfaces  $z = 4x^2 + 4y^2$  and  $z = 16 - 4x^2 - 4y^2$  on the rectangular domain  $[-1, 1] \times [-1, 1]$ .