



EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

FIRST EXAMINATION IN SCIENCE - 2014/2015

FIRST SEMESTER (Aug./Sept., 2016)

AM 151 - MATHEMATICA

(Proper & Repeat)

Answer all questions

Time : Two hours

(a) i. Evaluate $\int_1^4 (2 - 3x + 5x^2) dx$.

ii. Evaluate $\lim_{x \rightarrow \infty} \frac{x^2 + 2x - 3}{\sqrt{x^8 - x}}$.

iii. Compute the first seven derivatives of $f(x) = \cos x$. What is the 200th derivative of f ?

(b) Define the function, $g(t) = t^4 + 2t^2 + 4000$ in *Mathematica*.

i. Evaluate the above function at $t = 200$.

ii. Evaluate $g'(t)$, for $t = -3, -2, 0, 10, 50$.

(c) i. Determine the solution of the following equations:

$$4a - b + 3c = 1;$$

$$2a + b + c = 0;$$

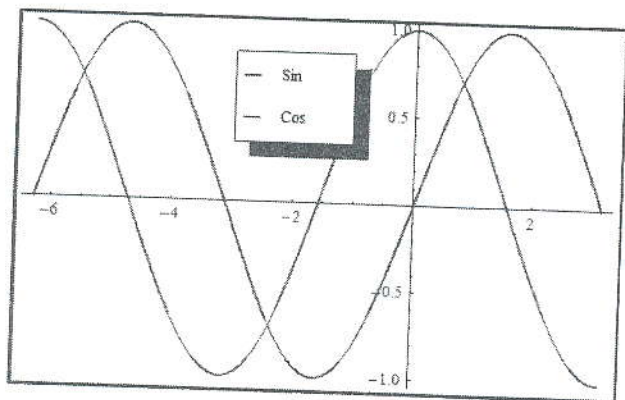
$$a - 3b + 2c = -1.$$

ii. Simplify the given expression $\frac{4 - \frac{2-x}{x}}{\frac{1}{1+x}}$.

iii. Factor $\sin x^2 + \tan x^2$.

2. (a) i. Plot the 3D graph of $f(x, y) = 3x + 4y - 3$ and $g(x, y) = 10 \sin(x)$ the color of blue and red respectively on a same axes between the $-5 \leq x \leq 5$ and $-2 \leq y \leq 2$.

ii. Plot the graph for $\sin x$ and $\cos x$ between the range of -2π to 2π with the indication as follows:



iii. Plot the graph of the function, $f(x) = \begin{cases} \frac{1}{x-2}, & \text{if } x \neq 2; \\ 1, & \text{if } x = 2. \end{cases}$

(b) Consider the following lists:

$$List1 = 2, 4, 6, 8, 10, 12, 14;$$

$$List2 = z, y, x, w, v, u, t, s, 10.$$

- i. Combine the above two lists into one list such that the elements of $List1$ are placed after all those of $List2$.
- ii. Add a new list element "r" in the third position of the list which you derived in part i.
- iii. Display all the elements from the $List1$ and $List2$ (without repetition).
- iv. Add a new element "m" instead of "w" from the list which you derived in part iii.

(c) Suppose a curve C is defined by the parametric equation $x = t^2$, $y = t^3 - 3t$.

- Plot the curve.
- Find the equations of the tangent lines to the curve at the point $(3, 0)$.
- Plot the tangent lines at the point $(3, 0)$.

(a) Consider the sequence $\left\{ (-2)^{n-1} \frac{n+2}{2^n+1} \right\}_{n=1}^{\infty}$.

- List the first six terms of the sequence.
- Find the sum of the first six terms of the sequence.
- Find the sum of the first n terms of the sequence.
- Determine whether the sequence converges.

(b) Display an output as follows using *Mathematica* expressions and commands.

	R	R1	R2	R3
1	1	2	0	2
2	2	4	3	5
3	3	6	8	10
4	4	8	16	17
5	5	10	24	26
6	6	12	35	37
7	7	14	48	50
8	8	16	63	65
9	9	18	80	82
10	10	20	99	101

(c) Let $A = \begin{pmatrix} 2 & 7 & -2 & 5 \\ 6 & 8 & 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 5 \\ 4 & 0 \\ 3 & 2 \\ 1 & 3 \end{pmatrix}$.

- Find the determinant of matrix A and B .
- Find its inverse if it exists.