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Sri Lanka Institute of Information Technology

B. Sc. Special Honours Degree/Diploma

in

Information Technology

Final Examination

Year 1, Semester I (2016)

MA140 – Mathematics for Information
Technology

Duration: 3 Hours

April, 2016

Instructions to Candidates:

- Answer **all** the questions in the paper itself.
- Total marks 100.
- This paper contains 9 pages without the cover page.
- Calculators are not allowed.
- Electronic devices retrieving text including electronic dictionaries and mobile phones are not allowed.

Question 01**20 marks**

a) Find the slope of the function $f(x) = 4x^3 - 5x + 6$ at $(-1, 7)$. (4 marks)

b) Find the following indefinite integral $\int (3x^5 + \sqrt{x})dx$. (4 marks)

c) Find the length of the subtending arc if $\theta = \frac{\pi}{3}$ and $r = 9$. (4 marks)

d) Assume that $A = \begin{bmatrix} -1 & 5 \\ 6 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 10 & 4 \\ 3 & 8 \end{bmatrix}$. Find $(A + B)(A - B)$. (4 marks)

e) Assume that $A = \begin{bmatrix} 1 & x \\ -1 & 2 \end{bmatrix}$. If $|A| * A = 5 \begin{bmatrix} 1 & 3 \\ -1 & 2 \end{bmatrix}$ then find the value of x . (4 marks)

Question 02**20 marks**

a) Assume that $A = \begin{bmatrix} 1 & 0 \\ 1 & 2 \end{bmatrix}$. Find $A^3 - 3I$. (4 marks)

- b) Mr. and Mrs. Garcia have a total of \$100,000 to be invested in stocks and bonds. The stocks have a rate of return of 12% per year, while the bonds pay 5% per year respectively. How should the Garcia allocate their resources if they receive an income of \$9200 in the first year? Write 2 equations to solve this problem.

(2 marks)

- c) Write the above 2 equations in matrix form $Ax = b$.

(2 marks)

- d) Find the inverse of the above coefficient matrix (A).

(3 marks)

- e) Using the solution in (d), find how should Mr. and Mrs. Garcia invest money in stocks and bonds?

(3 marks)

- f) Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} 2 & 2 \\ 5 & -1 \end{bmatrix}$. (6 marks)

Question 03**20 marks**

- a) Consider the following function $f(x)$;

$$f(x) = (x - 1)^2 - 2x + 1$$

- i) Find the critical values of the above function. (4 marks)

- ii) Find the intervals in which $f(x)$ is increasing or decreasing. (4 marks)

iii) Draw the graph of $f(x)$ on the interval $[0, 4]$. (6 marks)

iv) Find all relative extrema of the function $f(x)$. (3 marks)

v) Find the absolute extrema on the interval $[0, 4]$. (3 marks)

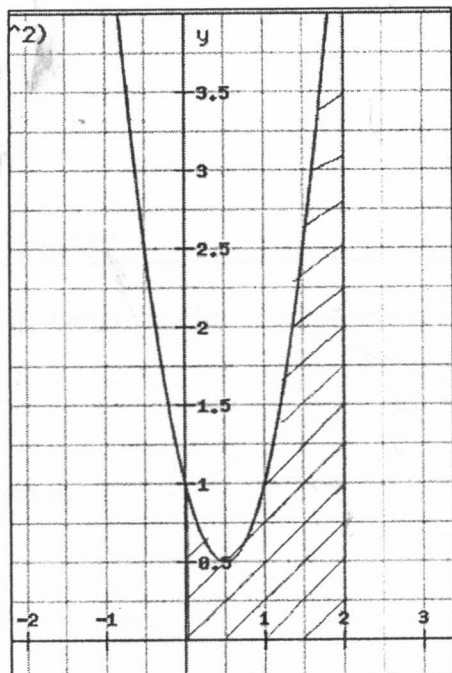
Question 04

20 marks

a) Evaluate the following definite integral $\int_{-3}^2 (x^2 - 3x) + |x - 1| dx$. (6 marks)

b) Following is the graph of $f(x) = (x - 1)^2 + x^2$. Find the colored area.

(6 marks)



c) Use Trapezoidal rule to approximate the value of $\int_0^4 \left(\frac{3x^2-4}{2}\right) dx$ when $n = 4$.

(8 marks)

Question 05**20 marks**

- a) Using Cramer's rule find the solution of the following system of linear equations.

$$5x - 3y + 9z = -47$$

$$2x + 7y = 13$$

$$4x + 5y = -1$$

(6 marks)

b) Find the inverse of the following matrix using elementary row operations.

$$A = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}$$

(10 marks)

c) Using the solution in (b) solve the following system of linear equations.

$$3x + 2z = 40$$

$$2x - 2z = -10$$

$$y + z = 20$$

(4 marks)

End of the Paper