Sri Lanka Institute of Information Technology

B.Sc. Degree
in
Information Technology

Final Examination
Year 1, Semester 1 (2016)
January Intake

Mathematics for Information Technology (N109)

Duration: 3 Hours

Instructions to Candidates:

- This is a closed book examination.
- This paper contains 5 questions on 2 pages without the cover page.
- Answer all questions in the WORKBOOK provided.
- Read all questions before answering.
- The total marks obtainable for this examination is 100.

Question 1 (15 marks)

(a) Consider the function: $f(x) = x^3(3x^2 - 5)$

(i) Find the critical numbers of the above function. (3 marks)

(ii) Find the intervals where $f(x)$ is increasing or decreasing. (2 marks)

(iii) Find the values of $f(x)$ at the relative extrema and inflection points of $f(x)$,if any. (2 marks)

(iv) Sketch the graph of $f(x)$. (1 mark)

(b) Consider the function $f(x) = \frac{x}{x^2+1}$ on *[0,2]*. (7 marks)
Find the absolute extrema of $f(x)$.

Question 2 (15 marks)

(a) Differentiate the following functions. (4 x 2.5 marks)

(i) $f(x) = [\ln(x^2 + 2)]^2$

(ii) $f(x) = \ln\sqrt{x^2 + 4x + 1}$

(iii) $f(x) = xe^{x^2-4}$

(iv) $f(x) = 9x^2e^{-x}$

(b) A group of 50 employees were monitored over a 3-year period. The average performance of employees' P (%) is modeled by, (5 marks)
$P = 9.16 - 30\ln(t + 1)$ where *t* is time (in months) and $0 \le t \le 36$.

What is the rate of change in average performance after 2 years? Interpret your answer.

Question 3 (20 marks)

(a) Find the following integrals. (4 x 2.5 marks)

(i) $\int(4x^2 - 2x + 3)dx$

(ii) $\int\left(\frac{x^3 + 2x - 7}{x}\right)dx$

iii) $\int(x\ln x)dx$

iv) $\int_3^4(3x^2 + 10x - 20)dx$

(b) If $h''(x) = 3x^2 + 2x + 5$, find $h(x)$ given that $h(0) = \frac{1}{3}$ and $h'(0) = 1$. (5 marks)

(c) What is the area under the curve $f(x) = 4 + 3x - x^2$, the $x\ axis$, $x = -1$ and $x = 4$. (5 marks)

Question 4 (20 marks)

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

(b) (i) Find the inverse of the following matrix B, using the formula, (10 marks)

$$B^{-1} = \frac{1}{\det(B)} adj(B)$$

$$B = \begin{bmatrix} 3 & 4 & -3 \\ 3 & -2 & 4 \\ 3 & 2 & -1 \end{bmatrix}$$

(ii) Solve the following system of linear equations with the use of inverse matrix method. Hint: $x = A^{-1}b$ (6 marks)

$$3x + 4y - 3z = 5$$
$$3x - 2y + 4z = 7$$
$$3x + 2y - z = 3$$

Question 5 (30 marks)

(a) Solve the following system of linear equations using the Cramer's rule. (10 marks)

$$3x + 4y - 3z = 5$$
$$3x - 2y + 4z = 7$$
$$3x + 2y - z = 3$$

(b) Solve the following system of linear equations using the Gaussian elimination method. (10 marks)

$$3x + 4y - 3z = 5$$
$$3x - 2y + 4z = 7$$
$$3x + 2y - z = 3$$

(c) Find the inverse of matrix D, using the Gaussian elimination method. (10 marks)

$$D = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 1 \\ 2 & 2 & 3 \end{bmatrix}$$

End of the Question Paper