

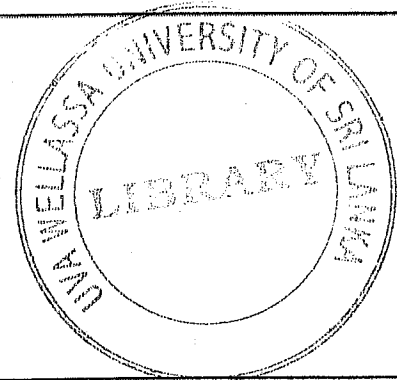
Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
100 level 2nd Semester Examination – Dec./Jan. 2017/18
CST 111-2 Discrete Mathematics I



Instructions to candidates:

- No. of pages : Three (03)
No. of questions : Four (04) essay questions
Time allocation : Two (02) hours
Marks allocation : 100 mark
Scientific calculators are allowed.

Answer All Questions.



1.

- a. Let $A = \begin{pmatrix} 4 & 8 \\ 3 & 6 \end{pmatrix}$, $B = \begin{pmatrix} 5 & 2 \\ 3 & 4 \end{pmatrix}$ and $C = \begin{pmatrix} 0 & 2 \\ 7 & -8 \end{pmatrix}$ then find ;
- i. $3A - 2B$ (2 mark)
 - ii. transpose of matrix $2C$ (3 mark)
 - iii. Product of A and B (AB) (3 mark)
- b. Let $P = \begin{pmatrix} 4 & 1 & 3 \\ 6 & 0 & 2 \\ 7 & 5 & 0 \end{pmatrix}$, find the
- i. determinant of P . (3 mark)
 - ii. minors, cofactors, adjoint matrix and hence obtain the inverse of matrix P . (7 mark)
- c. Solve the following system of linear equations using **Cramer's Rule** method.
- $$\begin{aligned} 3x + 4y &= 6 \\ 5x + 3y &= -1 \end{aligned}$$
- (7 mark)

2.

- a. Differentiate the following functions with respect to x .
- i. $y = 2x^4 - 3x^2 + 5x - 2$ (2 mark)
 - ii. $y = \ln(4x^3 + 2x^2 - 3x + 2)$ (2 mark)
 - iii. $y = \sin 3x + \cos 2x - \tan x$ (3 mark)
 - iv. $y = \frac{x^3 - 2x^2 + 5x - 4}{(x-2)^2}$ (3 mark)
 - v. $y = e^{2x+5} \ln(3x^2 + 7x + 2)$ (3 mark)

b. Find the first derivative $\left(\frac{dy}{dx}\right)$ of the equation $y^2 + 6x^2y + 3x^2 + 5y = 4$.
(5 mark)

c. Find the stationary points of $y = 2x^3 + 3x^2 - 12x + 7$ and obtain whether the points are maximum or minimum, hence sketch the graph.
(7 mark)

3.

a. Integrate the following functions with respect to x .

i. $\int (2x^4 + 3x^2 + 9) dx$ (2 mark)

ii. $\int (3x + 2)^2 dx$ (2 mark)

iii. $\int \tan x dx$ (2 mark)

iv. $\int \frac{12x^2 + 4x + 5}{(4x^3 + 2x^2 + 5x + 9)} dx$ (2 mark)

v. $\int \sin 4x \cos 2x dx$ (2 mark)

b. Evaluate the following definite integrals.

i. $\int_{-1}^2 (x^3 - 5x^2 + 2x + 7) dx$ (3 mark)

ii. $\int_1^3 x \ln x dx$ (3 mark)

iii. $\int_0^5 (3x^2 - 5x + 3)(e^x) dx$ (4 mark)

c. Find the area of the region (A) in Figure 01 bounded by $y = x^2$ and $y = 2x + 3$.
(5 mark)

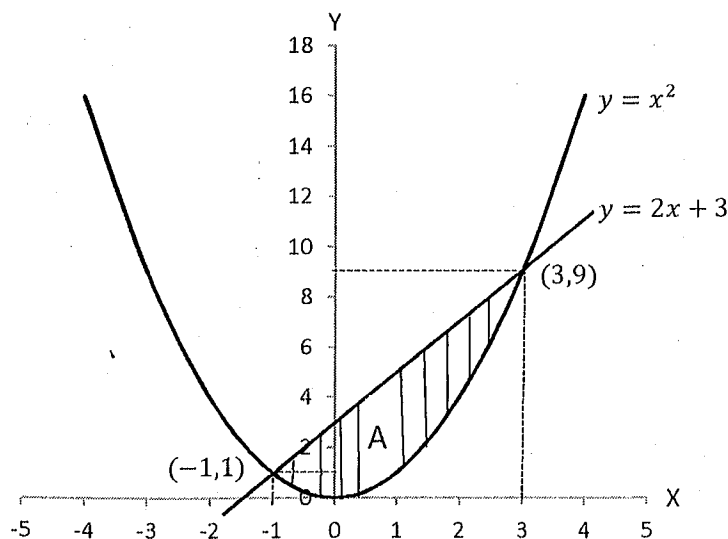


Figure 01: Graph of $y = x^2$ and $y = 2x + 3$

4.

a. Evaluate the following limits.

i. $\lim_{x \rightarrow 1} (x + 4)^2$ (2 mark)

ii. $\lim_{x \rightarrow 1} \frac{x^4 - 6x^2 + 5x + 7}{x^2 + 3x + 1}$ (2 mark)

iii. $\lim_{x \rightarrow 3} \frac{x^4 - 81}{x - 3}$ (3 mark)

iv. $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$ (3 mark)

b. Write down the term indicated in given series and find the sum up to the indicated term in each and every series separately.

i. $2 + 8 + 14 + 20 + \dots$; (10th term) (2 mark)

ii. $\frac{1}{2} + \frac{3}{4} + 1 + \frac{5}{4} + \dots$; (12th term) (2 mark)

iii. $3 + 3\sqrt{3} + 9 + 9\sqrt{3} + \dots$; (9th term) (2 mark)

iv. $2 - \frac{3}{2} + \frac{9}{8} - \frac{27}{32} + \dots$; (6th term) (2 mark)

c. Determine whether each of the following series are convergent or divergent.

If it is convergent determine its value.

i. $S_n = \frac{n(n+1)}{2}$ (3 mark)

ii. $S_n = \frac{3}{4} - \frac{1}{2n} - \frac{1}{2(n+1)}$ (4 mark)

