

Instructions to candidates

Duration: Two(02) hours

Number of questions: Four(04) essay questions

Mark allocation: 150 mark

Use standard symbols without definition.

Scientific calculators are allowed.

Answer all questions

1.

a. Let $A = \begin{pmatrix} 4 & 3 \\ 5 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 5 & -2 \\ 2 & 1 \end{pmatrix}$ and $C = (1 \quad -2 \quad 5)$. find;

- i. $2A + B$ (04 mark)
- ii. transpose of matrix $C(C^T)$ (02 mark)
- iii. product of matrix A and matrix $B (AB)$ (06 mark)

b. Find the *minors, cofactors, adjacency matrix* and *inverse matrix* of the following matrix D .

$$D = \begin{pmatrix} 1 & 1 & 2 \\ 3 & 1 & 2 \\ -2 & 0 & 3 \end{pmatrix}$$

(20 mark)

c. Use **Cramer's rule** to solve the following system of linear equations.

$$4x - 3y = -10$$

$$6x + 9y = 12$$

(08 mark)

2.

a. Evaluate the following limits.

- i. $\lim_{x \rightarrow 1} (2x^2 + 4x + 1)$ (02 mark)
- ii. $\lim_{x \rightarrow 5} \frac{\sqrt{x+11} - 4}{x-5}$ (04 mark)
- iii. $\lim_{x \rightarrow \infty} \frac{x^{2016} + 2x^{2005} - 5x^{1988} + 1}{2x^{2016} - 3x^{2010} + 7x^{1990} + 8}$ (04 mark)
- iv. $\lim_{x \rightarrow 2} \frac{x^5 - 32}{x - 2}$ (04 mark)

b. Differentiate following functions with respect to x .

i. $y = x^7 + 5x^4 + 3x^2 + 10$ (03 mark)

ii. $y = (x^3 + 2)^{10}$ (03 mark)

iii. $y = xe^{2x}$ (04 mark)

iv. $y = \frac{x^2 + 3}{x^4}$ (05 mark)

c. Let $f(x) = x^3 - 3x^2 + 4x + 1$, then find $f'(1)$ and $f''(1)$. (04 mark)

d. Sketch the graph of $y = 2x^2 - 7x + 3$ by using **first derivative test**. (12 mark)

3.

a. Integrate the following functions with respect to x .

i. $\int (3x^2 + x + 1) dx$ (04 mark)

ii. $\int (2x + 3)^5 dx$ (04 mark)

iii. $\int \frac{4x - 3}{4x^2 - 6x + 1} dx$ (04 mark)

b. Evaluate each of the following definite integrals.

i. $\int_0^3 (x^2 + 1) dx$ (05 mark)

ii. $\int_0^{\frac{\pi}{2}} \sin x dx$ (05 mark)

b. Compute the integral

$$I = \int x \ln 2x dx, \text{ using integration by parts.} \quad (06 \text{ mark})$$

c. Find the area of the region (A) in the figure 01 that is bounded by the curve $y = 1 + 4x - x^2$, the vertical lines $x = 1$, $x = 3$ and x -axis ($y = 0$). (07 mark)

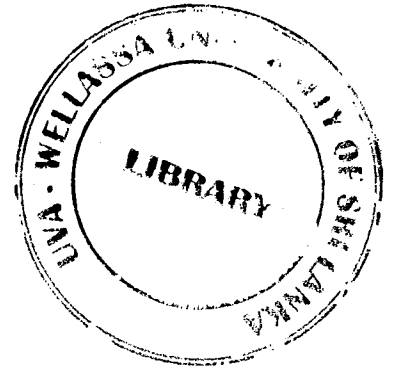
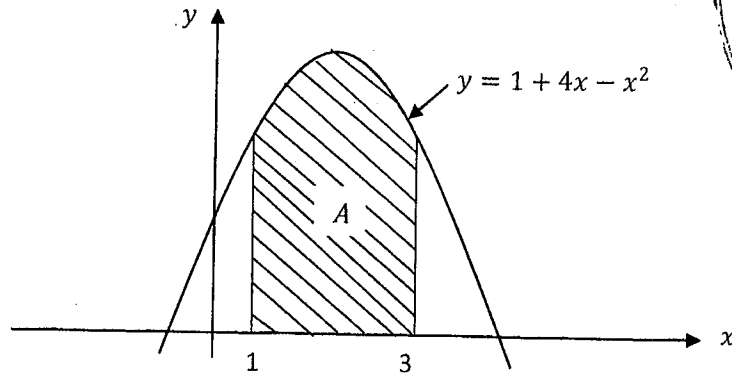


Figure 01: Graph for part (c)



4.

a. Determine the following sequences are **convergent or divergent**.

i. $\left\{ \frac{1}{n} \right\}_{n=1}^{\infty}$

(05 mark)

ii. $\{3n^2\}_{n=1}^{\infty}$

(05 mark)

iii. $\{(-1)^n\}_{n=1}^{\infty}$

(03 mark)

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

i. $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$

(05 mark)

ii. $1 + 3 + 9 + 27 + 81 + \dots$

(02 mark)

c. Let $\underline{u} = \langle 4, 5 \rangle$ and $\underline{v} = \langle 2, 3 \rangle$, then find that;

i. $4\underline{u}$

(02 mark)

ii. $\underline{u} + \underline{v}$

(03 mark)

iii. $2\underline{u} - \underline{v}$

(05 mark)