

STUDENT ID#: _____

SIR ARTHUR LEWIS COMMUNITY COLLEGE
PRE-COLLEGE (CAPE)
2024 – 2025 ACADEMIC YEAR - SEMESTER I
END OF SEMESTER EXAMINATION

COURSE TITLE : BASIC ALGEBRA & FUNCTIONS
COURSE CODE : MAT138
LECTURER : F. Johann NATHANIEL
DATE : 17th December 2024
TIME : 9 a.m. – 11 a.m.
DURATION : 2 HRS

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

- 1. Write your **student’s ID number** on all the work you hand in.
- 2. This paper consists of two (2) sections.
- 3. Answer ***all*** the questions in section A and SECTION B.
- 4. Write in BLACK or BLUE pen.
- 5. Show all calculations and working.
- 6. **Only NON-PROGRAMMABLE calculators are permitted.**
- 7. Do **not** use correction fluid.

Question #	Maximum Mark	Student Mark
1.	6	
2.	11	
3.	9	
4.	9	
5.	8	
6.	9	
TOTAL (SECTION A)	52	

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A – STRUCTURED QUESTIONS

INSTRUCTIONS: Answer **ALL SIX** questions neatly, clearly and completely in the spaces provided.

1. (a) Let ***p*** and ***q*** be any two propositions. Complete the truth table below for the proposition, $\sim p \rightarrow [q \vee (p \wedge \sim r)]$.

<i>p</i>	<i>q</i>	<i>r</i>	$\sim p$	$\sim r$	$(p \wedge \sim r)$	$q \vee (p \wedge \sim r)$	$\sim p \rightarrow [q \vee (p \wedge \sim r)]$
T	T	T					
T	T	F					
T	F	T					
F	T	T					
T	F	F					
F	T	F					
F	F	T					

[6]

2. (a) Prove the statement: “If *m* and *n* are **consecutive odd** integers, then (*m* + *n*) is divisible by 4.”

[3]

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(b) Use Mathematical Induction to prove the statement,

$$\sum_{r=1}^n r(2^r) = 2 + (n-1)(2^{n+1})$$

for $n \in \mathbb{N}$.

[8]

3. The cubic function $f(x) = 6x^3 + ax^2 - 6x + b$ is divisible by $2x + 1$ and has a remainder of -24 when divided by $(x - 1)$. Calculate the values of a and b . [9]

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4.

(a) Write the following expression in the form $k\sqrt{3}$, where k is an integer.

$$\frac{90}{\sqrt{3}} - \sqrt{6} \times \sqrt{8} - (2\sqrt{3})^3$$

[4]

(b) A rectangle has area 12 cm^2 and length $(2 + \sqrt{7}) \text{ cm}$. Find its width in the form $a + b\sqrt{7}$, where a and b are integers.

[5]

5. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be the function $f(x) = 2x + 5$. Prove that $f(x)$ is bijective. [8]

6.

(a) The function $f(x) = \frac{4}{x-2}, x \in \mathbb{R}, x \neq 2$.

i. Find an expression for $f^{-1}(x)$. [4]

ii. State the domain of $f^{-1}(x)$. [1]

(b) The function g is defined as

$$g(x) = x^2 - 8x + 10, x \in \mathbb{R}, x \geq k.$$

Determine the values of a and b given that

$$g(x) \equiv (x - a)^2 + b.$$

[3]

(c) Given that $g^{-1}(x)$ exists, state the least value of k . [1]

SECTION B – MULTIPLE CHOICE ANSWERS

[Total Marks: 15]

INSTRUCTIONS: Answer each question from the multiple choice paper by writing the letter of your selection below.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

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OVERFLOW SHEET OR SCRAP WORK

INSTRUCTIONS: If you use this sheet to continue a question(s), (i.e. as overflow), write the question number of that question(s) CLEARLY on the sheet.

