SIR ARTHUR LEWIS COMMUNITY COLLEGE

ACADEMIC YEAR (2024/2025) – SEMESTER TWO

END OF SEMESTER EXAMINATION

ALTERNATE

COURSE CODE	:	**MAT110**
COURSE TITLE	:	**College Algebra**
LECTURER(S)	:	**Johann Nathaniel**
DATE	:	
TIME	:	
DURATION	:	**2 hours**
STUDENT ID #	:	_____

GENERAL INFORMATION AND INSTRUCTIONS

- Students must sign **IN** and **OUT** on the examination class list.
- Write your **ID number** on **the front page** of this question paper.
- This paper has **8** printed pages.
- This examination consists of **4** questions.
- The total marks for this examination = **51**.
- Answer **ALL** questions clearly, neatly and completely, in **PEN**, in the spaces provided. **Calculators** are allowed.

Question #	Student mark	Moderated Mark	Total
1.			13
2.			15
3.			13
4.			10
TOTAL			**51**

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

INSTRUCTIONS: Answer ALL four questions neatly, clearly and completely, IN PEN, in the spaces provided.

Topic - Higher Order Equations **[Total marks: 13]**

1.

a) Let $f(x) = 3x^3 - 5x^2 - 58x + 40$.

i. Show that $x - 5$ is a factor of $f(x)$. [2]

ii. Hence, use **synthetic division** to completely factorize $f(x)$. [4]

b) Use l**ong division** to find the quotient and remainder when $6x^3 + 7x^2 + 12x - 12$ is divided by $3x - 1$. [3]

c) A polynomial $p(x)$ is defined, in terms of the constant a, by

$$p(x) = x^3 + 16x^2 + 72x - a.$$

When $p(x)$ is divided by $(x + 2)$ the remainder is $-\mathbf{11}$, determine the value of a. [4]

Topic – Matrices **[Total Marks: 15]**

2.

a) You are given

$$\boldsymbol{A} = \begin{pmatrix} -9 & -2 & -4 \\ 3 & 2 & 2 \\ 5 & 1 & 2 \end{pmatrix} \text{ and } \boldsymbol{A^{-1}} = \begin{pmatrix} 1 & 0 & 2 \\ 2 & 1 & 3 \\ -\frac{7}{2} & p & -6 \end{pmatrix}$$

i. Show that $p = -\frac{\mathbf{1}}{\mathbf{2}}$. [3]

ii. Given the system of 3 linear equations,

$$\begin{aligned} -9x - 2y - 4z &= -39 \\ 3x + 2y + 2z &= 5 \\ 5x + y + 2z &= 22 \end{aligned}$$

a. write it in matrix form, [1]

b. and hence, solve the system. [4]

b) Given that

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

i. find the determinant of $\boldsymbol{B}$, using the **cofactor method**. [2]

ii. Hence, using the **diagonal method now** and **Cramer's rule**, find the value of **a only**, in the system $\boldsymbol{B}\begin{pmatrix} a \\ b \\ c \end{pmatrix} = \begin{pmatrix} 3 \\ -16 \\ 15 \end{pmatrix}$. [5]

Topic – Partial Fractions **[Total Marks: 13]**

3.

a) Given that the rational function (or the algebraic fraction) can be decomposed as follows:

$$\frac{6x^2 - 12x + 9}{(x+1)(x-2)(2x-1)} = \frac{A}{x+1} + \quad + \frac{C}{2x-1}$$

i. Fill in the missing partial fraction. [1]

ii. Write the main or basic equation [1]

iii. and solve for $\boldsymbol{C}$ **only**. [4]

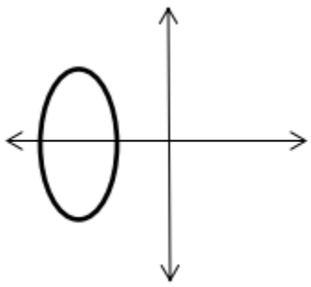
b) Given that a possible main (or basic) equation for the decomposition of the rational function (or algebraic fraction), $\frac{1-x}{(x+1)(x^2+1)}$ is

$$1 - x \equiv D(x^2 + 1) + (Ex + F)(x + 1)$$

find the values of the three unknowns, D, E and F. [7]

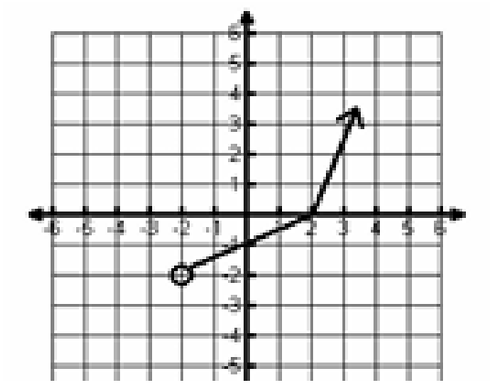
Topic – Functions **[Total Marks: 10]**

4.



a) Does the diagram below represent a function? If not, give a reason and if it represents a function, state whether it is a one-one or a many-one function. [2]

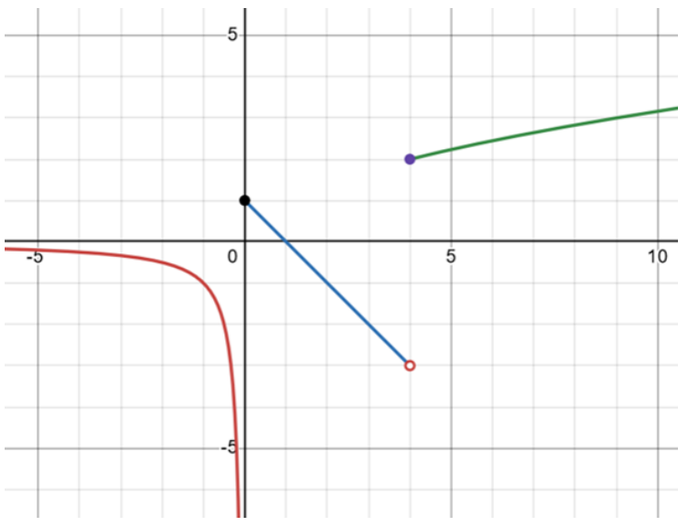
b) State the domain of the function $f(x) = \frac{1}{x + 10}$, using **set-builder notation**. [2]



c) State the range of the function graphed on the left, using **interval notation**. [2]

d) Below is the graph of the piecewise function

$$f(x) = \begin{cases} \frac{1}{x} & if\ x \square 0 \\ g(x) & if\ \ 0 \leq x < 4 \\ h(x) & if\ x \geq \square \end{cases}$$



i. Fill in the 2 boxes above. [2]

ii. State the function $g(x)$.

_____ [1]

iii. Evaluate $f(9)$.

_____ [1]