

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
MAY 2025

CYFNOD ARHOLIADAU
MAI 2025

MODULE CODE: GOEN4001

MATHEMATICS TEST 2

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Show all workings clearly

Equipment or materials required – calculators & formula book

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Question One (34 Marks)

a) If $A = \begin{bmatrix} 2 & 0 & 3 \\ 1 & 8 & 3 \\ 0 & 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 5 & 0 \\ 1 & 3 & 6 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 4 \\ 2 & -5 \\ 3 & 1 \end{bmatrix}$ and $D = \begin{bmatrix} 2 & 4 \\ -3 & 8 \end{bmatrix}$

- i. The Determinant of A [4]
- ii. The Determinant of C [1]
- iii. The Determinant of D [2]
- iv. AB [4]
- v. BC [3]
- vi. DC [1]
- vii. $A + D$ [1]

b) Find the Inverse of the following matrix:

$$A = \begin{bmatrix} 2 & 4 & 1 \\ 1 & 4 & 7 \\ 0 & 5 & 2 \end{bmatrix}$$

[10]

c) Use Cramer's Rule to solve the following system of simultaneous equations:

$$3x - 2y + z = 2$$

$$x - 3y + 2z = 1$$

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

[8]

Question Two (34 Marks)

a) Given the following complex numbers:

$$Z_1 = 3 + 4j, \quad Z_2 = 5 + 3j, \quad Z_3 = 2 + 6j$$

Calculate the following, expressing your answers in rectangular form:

- i. $Z_1 + Z_2$ [1]
- ii. $2Z_2 + 3Z_3$ [2]
- iii. $Z_1^2 + Z_3$ [3]
- iv. $Z_1 Z_2 Z_3$ [4]
- v. $|Z_1 Z_2 Z_3|$ [3]
- vi. $\frac{Z_1}{Z_2}$ [5]

b) Solve the following quadratic equation, expressing your answers in Polar Form:

$$5x^2 - 8x + 5 = 0$$

[9]

c) Use de Moivre's theorem to calculate $(3 + 4j)^4$, giving your answers in rectangular form.

[7]

Question Three (32 Marks)

a) Integrate the following:

i. $\int (25x^4 + 12x^2 + 6x - 10) \, dx$ [4]

ii. $\int (\sin 7x + 6\cos 3x + 5e^{5x}) \, dx$ [3]

iii. $\int \frac{10\theta^4 + 2}{2\theta^5 + 2\theta + \pi} \, d\theta$ [2]

iv. $\int \left(\frac{16}{f} + \ln(e^2) + 3 \right) df$ [2]

v. $\int_1^5 (2x^3 + 5x^2 + 3x - 9) \, dx$ [4]

vi. $\int_0^4 \left(2e^{2x} + \sin \frac{x}{2} \right) dx$ [3]

b) Using the substitution method, let $u = 4x^3 + 9$ find :

$$\int x^2 (4x^3 + 9)^5 dx$$

[6]

c) Use Integration 'by Parts' to find

$$\int 5x e^{5x} \, dx$$

[8]

END