



Prifysgol Cymru
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LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
MAY 2026

CYFNOD ARHOLIADAU
MAI 2026

MODULE CODE: GOEN4001

MATHEMATICS TEST 2

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – calculators & formula book

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Show all workings clearly.

Question One (33 marks)

a) Given the following complex numbers:

$$Z_1 = 3 + 7j, \quad Z_2 = 4 + 5j, \quad Z_3 = 2 + 6j$$

Calculate the following, expressing your answers in rectangular form:

1. $Z_1 + Z_2$ [1]

2. $Z_2 + 3Z_3$ [2]

3. $Z_2^2 + Z_3$ [3]

4. $Z_1 Z_2 Z_3$ [4]

5. $\frac{Z_1}{Z_2}$ [5]

6. Simplify the following expression in algebraic form only: [3]

$$\frac{Z_1^2 - Z_2^2}{Z_1^2 - Z_1 Z_2}$$

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

$$2x^2 - 6x + 9 = 0$$

Hence, verify one of your solutions by substitution into the original equation.

[9]

c) Use de Moivre's theorem to calculate $(5 + 3j)^6$, giving your answers in rectangular form.

[6]

Question Two (33 marks)

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

Find:

1. The Determinant of A [3]
2. The Determinant of C [1]
3. AB [3]
4. AD [4]
5. CD [1]
6. Given the following matrix: [5]

$$\omega = \begin{bmatrix} x & 3 & -4 \\ 4 & 4 & 2 \\ -2 & 5 & (x+2) \end{bmatrix}$$

Solve for x if the determinant of $\omega = 4$.

- b) Find the Inverse of the following matrix

$$A = \begin{bmatrix} 6 & 3 & 1 \\ 2 & 0 & 5 \\ 4 & 2 & 3 \end{bmatrix}$$

[10]

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

$$2x - y - 2z = -2$$

$$-x + y + z = 0$$

$$x - 2y + z = 8$$

[6]

Question Three (34 marks)

a) Integrate the following:

1. $\int x(2x^3 + 3x^2 - 3x + 5) dx$ [3]

2. $\int (\sin 3x + \cos 5x + (3x + 1)(4x + 3)) dx$ [3]

3. $\int_0^3 (4x^3 + 3x^2 + 2x - 3) dx$ [3]

4. $\int_1^2 (e^{2x} + 2x^3 + 7) dx$ [3]

5. $\int_1^4 (\sqrt{x} - 3)(\sqrt{x} + 5) dx$ [4]

6. $\int_0^2 \frac{x+1}{x^2+3x+2} dx$ [4]

b) Using the substitution method (let $u = 4x^2 - 5$) find:

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

[6]

c) Use Integration 'by Parts' to find $\int x^2 e^x dx$.

Hence find the value of $\int_0^1 x^2 e^x dx$

[8]

END