

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JANUARY 2026

CYFNOD ARHOLIADAU
IONAWR 2026

MODULE CODE: GOEN4001

MATHEMATICS TEST 1

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – calculators & formula book

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Show all workings clearly.

QUESTION ONE (35 marks)

a) Find the first derivative of the following functions:

i. $y = 2x^6 - 5x^3 + 4x - 9$ [2]

ii. $y = \frac{4}{x^{\frac{1}{2}}} - \sqrt[5]{x} + \frac{3}{e^2}$ [3]

iii. $y = 4\sin(4x) - 2\cos(5x) + 3\tan\left(\frac{x}{3}\right)$ [3]

iv. $y = 5x^4 e^{2x}$ [4]

v. $y = \frac{3\cos(3x)}{e^{x+5}}$ [4]

vi. $y = \frac{2}{7}(3x^4 + 4x)^3$ [3]

vii. $y = \frac{1}{5}\sqrt[5]{(5x^4 + \sin(2x))}$ [3]

b) The variable w is related to the variables x and y by the following:

$$w = 3x^4y^3 + 5x^3 + 6y^2 + e^{2x} - \cos(3y)$$

Use Partial Differentiation techniques to find following second order Partial Derivatives,

$$(i) \frac{\partial^2 w}{\partial x^2} \quad (ii) \frac{\partial^2 w}{\partial y^2} \quad (iii) \frac{\partial^2 w}{\partial x \partial y} \quad (iv) \frac{\partial^2 w}{\partial y \partial x}$$

[6]

c) If $y = 3e^x + x^2$ show that

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2x^2 - 6x + 2$$

[4]

d) Find the 3rd derivative of:

$$y = x\sin(x)$$

[3]

QUESTION TWO (33 marks)

- a) Express, $\frac{5x+7}{(x+1)(x-3)}$ in partial fractions.

[9]

- b) An engineer is designing a triangular truss ABC. The sides are $AB = 15\text{m}$ and $AC = 10\text{m}$ and the angle at vertex A is 120° . Determine:

1. The length of side BC.
2. The angles at vertices B and C.

[5]

- c) Factorise $x^2 - 11x + 24$, hence solve the following trigonometric equation for $0^\circ \leq x \leq 360^\circ$:

$$\tan^2 x - 11 \tan x + 24 = 0$$

[6]

- d) A curve $y = x^2 - 4x + 3$ and the line $y = 2x + 1$ intersect at the points M and N. By solving these equations simultaneously, find the co-ordinates of M and N.

[6]

- e) Solve the following trigonometric equations for $0^\circ \leq x \leq 360^\circ$:

i. $2 \sin x = 0.75$ [2]

ii. $4 \cos x - 1 = 0$ [3]

iii. $-5 \tan x = 1$ [2]

QUESTION THREE (32 marks)

a) Solve the following equations, using the appropriate method, for x :

i. $\ln(2x - 3) + \ln(3) = \ln(5x + 9)$ [4]

ii. $\log(3x + 2) + \log(x + 1) = \log 15$ [4]

iii. $4^{(x+3)} \times 2^{(2-x)} = 8^{(x+1)}$ [4]

iv. $\frac{6x+1}{3x-2} = \frac{4}{5}$ [3]

v. $\frac{(4x+1)}{5} + \frac{(2x-3)}{3} = \frac{11}{6}$ [3]

b) Factorise completely, the following algebraic expressions:

i. $P^2 - 13P + 42$ [2]

ii. $4b^2 - 49$ [2]

iii. $mn + 5mp + 3nq + 15pq$ [2]

c) Solve the following quadratic equations **by using the factorisation method**:

i. $6m^2 + 17m + 12 = 0$ [2]

ii. $y^2 + 13y + 40 = 0$ [2]

d) Solve the following quadratic equation by using the quadratic formula:

$$3w^2 - 2w - 8 = 0$$

[4]

End