

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JANUARY 2025

CYFNOD ARHOLIADAU
IONAWR 2025

MODULE CODE: GOEN4001

MATHEMATICS TEST 1

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – calculators & formula book

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QUESTION ONE (35 marks)

a) Find the first derivative of the following functions:

i. $y = 3x^4 + 5x^3 + 4x^2 + 7x - 10$

[2]

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

[3]

iii. $y = 2\sin(2x) + 3\cos(3x) + \frac{1}{5}\tan(5x)$

[3]

iv. $y = 7x^3 \sin(5x)$

[4]

v. $y = \frac{2\sin(5x)}{3e^{5x}}$

[4]

vi. $y = 5(2x^3 + 4)^3$

[3]

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

[3]

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

$$w = 5x^5 + 4x^2y^4 + 3y^3 + \sin(x) - 5$$

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 $y = \cos(2x) + x^2$ show that

$$\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 4y = 4x^2 - 8x + 8 \sin(2x) + 2$$

[4]

d) Find the 3th derivative of:

$$y = xe^{2x}$$

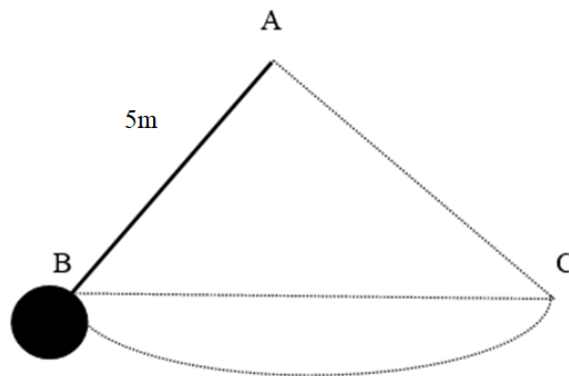
[3]

QUESTION TWO (33 marks)

- a) Express, $\frac{3x-4}{(x+2)(x-5)}$ in partial fractions.

[10]

- b) A pendulum of length 5m swings from point B to point C, creating an angle at point A of 100° . Calculate the horizontal distance between point B and point C.



[4]

- c) Factorise $x^2 - 6x + 8$, hence solve the following trigonometric equation for $0^\circ \leq x \leq 360^\circ$:

$$\tan^2 x - 6 \tan x + 8 = 0$$

[6]

- d) A curve $y = x^2$ and the line $y = x + 20$ 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. $\sin x = 0.6$

[2]

ii. $7 \cos x = 6$

[3]

iii. $-3 \tan x = 2$

[2]

QUESTION THREE (32 marks)

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

i. $\ln(x^2 + 2x) = \ln(3) + \ln(x + 1)$ [4]

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

iii. $5^{(x+2)} \times 2^{(2-x)} = 3^{(x+3)}$ [4]

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

v. $\frac{(3x-2)}{4} + \frac{(x+5)}{2} = \frac{7}{3}$ [3]

b) Factorise completely, the following algebraic expressions:

i. $z^2 - 12z + 35$ [2]

ii. $m^2 - 121$ [2]

iii. $kl + 2km + 5nl + 10nm$ [2]

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

i. $4p + 11p + 6 = 0$ [2]

ii. $s^2 + 16s + 63 = 0$ [2]

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

$$3x^2 + 4x - 10 = 0$$

[4]

End