



Prifysgol Cymru  
Y Drindod Dewi Sant  
University of Wales  
Trinity Saint David

## Examination Answer Books

12 Pages

### Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

Complete, fold and seal  
(see note 2 below)

SURNAME: ALEXANDER

FORENAME(S): CHRISTIAN

|   |                                  |                    |
|---|----------------------------------|--------------------|
| 1 | Student Number                   | ALE19849605        |
| 2 | Title of Examination Paper       | Mathematics Test 1 |
| 3 | Module Code                      | GOEN4001           |
| 4 | Date and Time of Examination     | 20/1/25<br>9.30am  |
| 5 | Examination Venue                | HILL HOUSE         |
| 6 | Seat Number                      | C4                 |
| 7 | Number of Answer Books handed in | 1                  |

| List the numbers of the questions you have attempted | Office Use |
|------------------------------------------------------|------------|
| Q1                                                   |            |
| a                                                    | 20         |
| b                                                    | 5          |
| c                                                    | 3          |
| d                                                    | 0          |
| Q2a                                                  | 10         |
| b                                                    | 4          |
| c                                                    | 6          |
| d                                                    | 6          |
| e                                                    | 7          |
| Q3a                                                  | 15         |
| b                                                    | 6          |
| c                                                    | 4          |
| d                                                    | 4          |
| Total                                                | 90         |

L2

90%

(Gweler yr ochr arall am y fersiwn Cymraeg)

1a- i)  $y = 3x^4 + 5x^3 + 4x^2 + 7x - 10$

$$\frac{dy}{dx} = 12x^3 + 15x^2 + 8x + 7$$

i) (2)

ii)  $y = \frac{1}{x^3} + \frac{1}{\sqrt{x^2}} - 2\pi x$

$$y = x^{-3} + x^{-\frac{1}{2}} - 2\pi x$$

$$\frac{dy}{dx} = -3x^{-4} - \frac{1}{2}x^{-\frac{3}{2}} - 2\pi$$

ii) (3)

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

$$\frac{dy}{dx} = 4 \cos 2x - 9 \sin 3x + \sec^2 5x$$

iii) (3)

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

$$u = 7x^3 \quad v = \sin(5x)$$

$$\frac{du}{dx} = 21x^2$$

$$\frac{dv}{dx} = 5 \cos 5x$$

iv) (4)

$$\frac{dy}{dx} = \sin 5x (21x^2) + 7x^3 (5 \cos 5x)$$

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

$$u = 2 \sin 5x$$

$$v = 3e^{5x}$$

$$\frac{du}{dx} = 10 \cos 5x$$

$$\frac{dv}{dx} = 15e^{5x}$$

$$\frac{dy}{dx} = \frac{3e^{5x} (10 \cos 5x) - 2 \sin 5x (15e^{5x})}{(3e^{5x})^2}$$

↓  
PTO

Q 1

28/35

Q1a

20/22

v)

$$\frac{3e^{\sec(10\cos 5x)} - 2 \sin 5x (15e^{\sec(10\cos 5x)})}{9e^{10x}}$$

v) (4)

vi)

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

$$\frac{dy}{dx} = 15(2x^3 + 4)^2 (6x^2)$$

vi) (3)

$$\frac{dy}{dx} = 90x^2(2x^3 + 4)^2$$

vii)

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

$$y = (x^4 + 5)^{\frac{2}{3}}$$

vii) (1)

$$\frac{dy}{dx} = \left(\frac{2}{3}\right)(x^4 + 5)^{-\frac{1}{3}}$$

1b)

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

$$\frac{dw}{dx} = \frac{\partial w}{\partial x}$$

$$25x^4 + 8xy^4 + \cos x$$

$$\frac{dw}{dy} = \frac{\partial w}{\partial y}$$

$$16x^2y^3 + 9y^2$$

$$\frac{d^2w}{dx^2} =$$

$$100x^3 + 8y^4$$

$$\frac{d^2w}{dy^2} =$$

$$48x^2y^2 + 18y$$

$$\frac{d^2w}{dxdy} =$$

$$32xy^3$$

$$\frac{d^2w}{dxdy} =$$

$$32xy^3$$

1c)  $y = \cos(2x) + x^2$  show

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

$$\frac{dy}{dx} = -2\sin 2x + 2x \quad \frac{d^2y}{dx^2} = 4\cos 2x + 2$$

$$\therefore \text{LHS} = 4\cos 2x - 4(-2\sin 2x + 2x) + 4y =$$

$$4x^2 - 8x + 8\sin(2x) + 2$$

$$\therefore \text{LHS} =$$

$$4\cos 2x + 2 - 4(-2\sin 2x + 2x) + 4y = 4x^2 - 8x + 8\sin(2x) + 2$$

$$\text{LHS} = \text{RHS} = 0$$

$$\text{LHS} - \text{RHS} = 0 \quad \text{or}$$

$$\text{LHS} = \text{RHS}$$

Q1b

5/6

b) (5)

Q1c

3/4

c) (3)

1 d) 3rd Deriv of:

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

$$\frac{dy}{dx} = \cancel{2e^{2x}} \quad 2xe^{2x}$$

$$\frac{d^2y}{dx^2} = \cancel{2e^{2x}} \quad 4xe^{2x}$$

$$\frac{d^3y}{dx^3} = \cancel{4e^{2x}} \quad 8xe^{2x} \quad \times$$

2 a)

$$\frac{3x-4}{(x+2)(x-5)} = \frac{A}{x+2} + \frac{B}{x-5} \quad \checkmark$$

$$\frac{3x-4}{(x+2)(x-5)} = \frac{A(x+2)(x-5)}{(x+2)(x-5)} + \frac{B(x+2)(x-5)}{(x+2)(x-5)}$$

$$3x-4 = A(x-5) + B(x+2)$$

$\therefore$  let  $x$  be 5

$$3(5)-4 = A(5-5) + B(5+2)$$

$$15-4 = 7B$$

$$11 = 7B$$

$$B = \frac{11}{7}$$

$$B = 1.57$$

let  $x$  be -2

$$3(-2)-4 = A(-2-5) + B(-2+2)$$

$$-6-4 = -7A$$

$$-10 = -7A$$

$$A = \frac{-10}{-7}$$

$$A = 1.43$$

Q1d

0/3

Q2

33/33

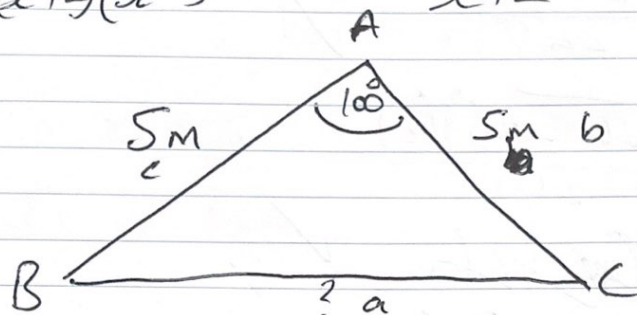
Q2a

10/10

$$\frac{3x-4}{(x+2)(x-5)} = \frac{A}{x+2} + \frac{B}{x-5} \quad \checkmark$$

$$\frac{3x-4}{(x+2)(x-5)} = \frac{1.43}{x+2} + \frac{1.57}{x-5} \quad \checkmark$$

2b)



Q2b

4/4

$$a^2 = b^2 + c^2 - 2bc \cos(A) \quad \checkmark$$

$$a^2 = 5^2 + 5^2 - 2(5)(5) \cos 100 \quad \checkmark$$

$$a^2 = 25 + 25 - 50 \cos 100 \quad \checkmark$$

$$a^2 = 58.68$$

$$a = \sqrt{58.68}$$

$$a = \underline{7.66 \text{ m}} \quad \checkmark$$

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

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

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(8)}}{2(1)}$$

$$x = \frac{6 \pm 4}{2}$$

$$(\tan x - 4)(\tan x - 2)$$

$$\tan x = 4$$

$$x = \tan^{-1}(4)$$

$$x = 75.96^\circ$$

$$x = 75.96 + 180 =$$

$$x = 255.96^\circ$$

$$\tan x = 2$$

$$x = \tan^{-1}(2)$$

$$x = 63.43^\circ$$

$$x = 63.43 + 180$$

$$x = 243.43^\circ$$

2d)  $y = x^2$   $y = x + 20$

Q2d

$$x^2 = x + 20$$

$$x^2 - x - 20 = 0$$

$$(x-5)(x+4) = 0$$

$$x = 5 \quad x = -4$$

$$y = 5 + 20$$

$$y = -4 + 20$$

$$y = 25$$

$$y = 16$$

$$M(5, 25)$$

$$N(-4, 16)$$

6/6

2e)  
i)

$$\sin x = 0.6$$

$$x = \sin^{-1}(0.6)$$

$$x = 36.87^\circ$$

$$180 - 36.87 = 143.13^\circ$$

Q2e

7/7

ii)

$$7 \cos x = 6$$

$$x = \cos^{-1}\left(\frac{6}{7}\right)$$

$$x = 31.00^\circ$$

$$x = 360 - 31 = 328.99^\circ$$

iii)

$$-3 \tan x = 2$$

$$x = \tan^{-1}\left(\frac{2}{3}\right)$$

$$x = 33.69$$

not solution

$$x = 180 - 33.69 = 146.31$$

$$x = 360 - 33.69 = 326.31$$

3.9  
i)

$$\ln(x^2 + 2x) = \ln(3) + \ln(x+1)$$

$$\ln(x^2 + 2x) = \ln(3) + \ln(x+1) \quad \checkmark$$

$$x^2 + 2x = (3)(x+1)$$

$$x^2 + 2x = 3x + 3 \quad \checkmark$$

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

$$x^2 - x - 3 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{1^2 - 4(1)(-3)}}{2(1)}$$

$$x = 2.3 \quad \checkmark$$

$$x = -1.3 \quad \checkmark \text{ not solution}$$

Q3

29/32

(4)

Q3a

15/16

$$\text{ii) } \log(x+3) + \log(2x+1) = 2 \log(3x-1)$$

$$\log(x+3)(2x+1) = 2 \log(3x-1)$$

$$(x+3)(2x+1) = 2(3x-1)$$

$$2x^2 + 1x + 6x + 3 = 6x - 2 \quad (1)$$

$$2x^2 + x + 6x - 6x = -3 - 2$$

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

$$2x^2 + 6x - 6x + x + 3 + 2 = 0$$

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

$$\frac{-1 - \sqrt{39}i}{4} \quad \times$$

$$\frac{-1 + \sqrt{39}i}{4} \quad \times$$

$$\text{iii)} \quad 5^{(x+2)} \times 2^{(2-x)} = 3^{(x+3)} \quad (4)$$

$$\log 5 (x+2) + \log 2 (2-x) = \log 3 (x+3)$$

$$(x+2)(0.7) + (2-x)(0.3) = 0.48(x+3)$$

$$0.7x + 1.4 + 0.6 - 0.3x = 0.48x + 1.44$$

$$0.7x - 0.3x - 0.48x = 1.44 - 1.4 - 0.6$$

$$-0.08x = -0.56$$

$$x = \frac{-0.56}{-0.08}$$

$$x = 7$$

$$\text{iv)} \quad \frac{5x+2}{2x-3} = \frac{3}{4}$$

$$x = 5x + 2 \quad (4) = 2x - 3 \quad (3)$$

$$\text{or } 20x + 8 = 6x - 9$$

$$\text{to } 20x - 6x = -8 - 9$$

$$14x = -17$$

$$x = -1.21$$

$$v) \quad \frac{3x-2}{4} + \frac{x+5}{2} = \frac{7}{3}$$

$$\left( \frac{3x-2}{4} + \frac{x+5}{2} = \frac{7}{3} \right) \times 12 \checkmark$$

$$2(3x-2) + 4(x+5) = 18.67 \quad \textcircled{3}$$

$$6x - 4 + 4x + 20 = 18.67$$

$$6x + 4x = 18.67 - 20 + 4$$

$$10x = 2.67$$

$$x = 0.267 \checkmark$$

$$3) \text{ bi) } z^2 - 12z + 35$$

$$(z-7)(z-5) \checkmark$$

$$\text{ii) } m^2 - 121$$

$$(m+11)(m-11) \checkmark$$

$$\text{iii) } kl + 2km + 5nl + 10nm$$

$$k(l+2m) + 5n(l+2m)$$

$$(k+5n)(l+2m)$$

$$(5n+k)(l+2m) \checkmark$$

3 ci)

$$4p^2 + 11p + 6 = 0$$

$$(4p + 3)(p + 2) = 0$$

$$p = \frac{-3}{4}$$

$$p = -2$$

Q3C

4/4

$$\text{ii) } s^2 + 16s + 63 = 0$$

$$(s + 7)(s + 9) = 0$$

$$s = -7$$

$$s = -9$$

Q3D

d)

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

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-4 \pm \sqrt{4^2 - 4(3)(-10)}}{2(3)}$$

$$\frac{-2 + \sqrt{34}}{3}$$

$$= 1.28$$

$$\frac{-2 - \sqrt{34}}{3}$$

$$= -2.61$$

4/4