



Prifysgol Cymru  
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## 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: Greuch

FORENAME(S): Charlie

|   |                                  |                            |
|---|----------------------------------|----------------------------|
| 1 | Student Number                   | 20855640<br><del>804</del> |
| 2 | Title of Examination Paper       | Mathematics<br>test 1      |
| 3 | Module Code                      | G10EN4001                  |
| 4 | Date and Time of Examination     | 20/01/24<br>09:33          |
| 5 | Examination Venue                | Hill house                 |
| 6 | Seat Number                      | 06                         |
| 7 | Number of Answer Books handed in | 1                          |

| List the numbers of the questions you have attempted | Office Use   |
|------------------------------------------------------|--------------|
| Q1                                                   | <del>7</del> |
| a                                                    | 11           |
| b                                                    | 5            |
| c                                                    | 4            |
| d                                                    | 0            |
| Q2 a                                                 | 10           |
| b                                                    | 4            |
| c                                                    | 6            |
| d                                                    | 1            |
| e                                                    | 6            |
| Q3 a                                                 | 9            |
| b                                                    | 4            |
| c                                                    | 4            |
| d                                                    | 4            |
| Total                                                | 68%          |

L2

RK  
68%

(Gweler yr ochr arall am y fersiwn Cymraeg)

Question 1

a)

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

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

(2)

ii)

$y = \frac{1}{5x} + \frac{1}{5\sqrt{x}} - 2\pi x$

$$\frac{dy}{dx} = x^{-3} + x^{-3/5} - 2\pi x$$

$$\frac{dy}{dx} = -3x^{-4} + -\frac{3}{5}x^{-8/5} - 2\pi$$

(3) (2)

iii)

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

$$\frac{dy}{dx} = 4 \cos(2x) - 9 \sin(3x) + \frac{1}{5} \sec(5x)$$

(2)

iv)

$y = 7x^3 \sin 5x$

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

(4)

$$u = 7x^3$$
$$\frac{du}{dx} = 21x^2$$

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

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

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

$$u = 2 \sin(5x)$$
$$\frac{du}{dx} = 10 \cos(5x)$$
$$v = \frac{1}{3}e^{5x}$$
$$\frac{dv}{dx} = \frac{1}{3}5e^{5x}$$

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

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

Q1

20/35

Q1a

11

$$y = 15(2x^3 + 4)^{1/3}$$

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

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

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

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

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

$$\frac{dw}{dx} = 25x^4 + 8xy^4 + 1 \cos(x)$$

$$\text{i) } \frac{\partial^2 w}{\partial x^2} = 100x^3 + 8y^4 - 1 \cos(x)$$

$$\text{iii) } \frac{\partial^2 w}{\partial x \partial y} = 32xy^3$$

$$\frac{dw}{dy} = 16x^2y^3 + 9y^2$$

$$\text{ii) } \frac{\partial^2 w}{\partial y^2} = 48x^2y^2 + 18y$$

$$\text{iv) } \frac{\partial^2 w}{\partial y \partial x} = 32xy^3$$

\* Sorry about the layout of my answers.

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

$$\frac{dy}{dx} = -2 \sin(2x) + 2x \quad \checkmark$$

$$\frac{d^2y}{dx^2} = -4 \cos(2x) + 2 \quad \checkmark$$

4

4

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

LHS:

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

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

\*cancel each other

$$\underline{4x^2 - 8x + 8 \sin(2x) + 2} \quad \checkmark$$

$$\underline{LHS = RHS} \quad \checkmark$$

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

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

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

$$\frac{d^3y}{dx^3} = 8e^{2x}$$

Q1d

0

Question 2

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

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

$$\begin{aligned} 3x-4 &= A(x-5) + B(x+2) \\ \text{let } x=5 \quad 3(5)-4 &= A(5-5) + B(5+2) \\ 11 &= A(0) + B(7) \\ B &= \frac{11}{7} \\ B &= 1.57 \end{aligned} \quad \checkmark$$

$$\begin{aligned} \text{let } x=-2 \quad 3(-2)-4 &= A(-2-5) + B(-2+2) \\ -10 &= A(-7) + B(0) \\ A &= \frac{-10}{-7} \\ A &= 1.43 \end{aligned} \quad \checkmark$$

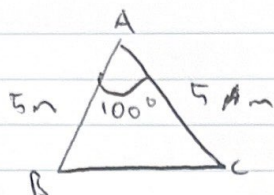
$$\frac{3x-4}{(x+2)(x-5)} = \frac{1.43}{(x+2)} + \frac{1.57}{(x-5)} \quad \checkmark$$

Q2  
27/33  
Q2a

10  
=

10

b)



Sx

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)} \quad \checkmark$$

$$\text{Length } ac = \frac{ac}{\sin(100^\circ)}$$

$$\text{Length } abc = \frac{5}{\sin(100^\circ)} \quad \checkmark$$

$$\text{Length } ac = \frac{5}{0.1736} \approx 28.79 \text{ m}$$

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

$$bc^2 = 5^2 + 5^2 - 2(5)(5) \cos(100^\circ)$$

$$bc^2 = 58.68 \quad \checkmark$$

$$bc = \sqrt{58.68}$$

$$bc = 7.66 \text{ m} \quad \checkmark$$

c)  $x^2 - 6x + 8$

$$(x-4)(x-2) \quad \checkmark$$

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

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

$$\tan x - 4 = 0$$

$$\tan x = 4$$

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

$$x = 75.96^\circ$$

$$x = 75.96^\circ + 180^\circ$$

$$x = 259.96^\circ$$

$$x = 75.96^\circ, 259.96^\circ$$

or ...

Q2b

4

(4)

Q2c

(6)

(6)

$$\tan x - 2 = 0$$

$$\tan x = 2$$

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

$$x = 63.43$$

$$x = 63.43 + 180$$

$$x = 243.43$$

$$x = 63.43^\circ, 243.43^\circ \quad \text{well done!}$$

d)  $y = x^2$

$$y = x + 20$$

$$x^2 = x + 20 \quad \checkmark$$

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

$$x^2 - x - 20 = 0 \quad \checkmark \quad \textcircled{1}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \checkmark$$

$$x = \frac{1 \pm \sqrt{1^2 - 4(1)(-20)}}{2(1)} \quad \checkmark$$

$$x = 4.94 \quad \checkmark$$

or

$$x = -3.94 \quad \checkmark$$

$$y = x^2$$

$$y = 4.94^2$$

$$y = 24.40$$

$$(24.40, 24.40) \quad \checkmark$$

~~$$y = x + 20$$~~

~~$$y = 4.94 + 20$$~~

~~$$y =$$~~

~~$$(24.94, 24.94) \quad \checkmark$$~~

Q29

1

2) -

i)  $\sin x = 0.6$

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

$x = 36.87 \rightarrow x = 36.87 + 180 = 216.87$

$x = 36.87^\circ, 216.87^\circ$

| S    | A    |
|------|------|
| +180 |      |
| +180 | -360 |
| T    | C    |

Q22

(1)

6

ii)  $7 \cos x = 6$

$\cos x = \frac{6}{7}$

$x = \cos^{-1}(0.86)$

$x = 30.68 \rightarrow x = 360 - 30.68 = 329.32$

$x = 30.68^\circ, 329.32^\circ$

(3)

iii)  $-3 \tan x = 2$

$\tan x = \frac{2}{-3}$

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

$x = -30.96$  not an answer.

$x = 180 - 30.96$

$x = 149.04 \rightarrow x = 360 - 149.04 = 210.96$

$x = 149.04^\circ, 210.96^\circ$

(2)

Question 3

a)

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

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

$$x^2 + 2x = 3x + 3$$

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

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

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

$$x = 2.3$$

$$\text{or } x = -1.3 \quad \text{this is not a solution}$$

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

$$(x+3)(2x+1) = (3x-1)^2 \quad \text{2 missing}$$

$$2x^2 + x + 6x + 3 = 9x^2 - 6x + 1$$

$$2x^2 + 7x + 3 = 9x^2 - 6x + 1$$

$$2x^2 + 4x + 4 = 0$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(2)(4)}}{2(2)}$$

$$x = 2.33$$

$$\text{or } x = -1.33$$

$$\log(2.33+3) + \log(4.66+1) = 2 \log(6.99-1)$$

$$1.48 = 1.52$$

$$\log(5.33) + \log(5.66) = 2 \log(5.99)$$

Q3

21/32

Q3a

9

$$\text{ii)} 5^{(x+1)} \times 2^{(2-x)} = 3^{(x+1)}$$

$$(x+1) \log 5 + (2-x) \log 2 = (x+1) \log 3$$

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

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

$$-x^2 + x - 1 = 0$$

$$-x^2 + 2x - x - 1 = 0 \quad 3 - 1$$

$$-x^2 + x - 1 = 0 \quad + x^2 = 1$$

$$x = \frac{-1 \pm \sqrt{1-4(-1)(1)}}{2(-1)}$$

$$x = \frac{-1 \pm \sqrt{5}}{-2}$$

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

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

$$(x+2)(2-x) = x+3 \quad \times$$

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

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

$$-x^2 - x + 1 = 0$$

$$-x^2 - x + 1 = 0$$

$$x = \frac{-1 \pm \sqrt{1-4(-1)(1)}}{2(-1)}$$

$$x = 1.37$$

$$\text{or } x = -0.61$$

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

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

$$20x+8 = 6x-9 \quad \checkmark$$

$$20x-6x = -9-8$$

$$14x = -17$$

$$x = \frac{-17}{14}$$

$$x = -1.21 \quad \checkmark$$

(3)

$$\text{v) } \left( \frac{3x-2}{4} + \frac{x+5}{2} = \frac{7}{3} \right) \times 8$$

$$2(3x-2) + 4(x+5) = \left(\frac{7}{3}\right)8 \quad \checkmark$$

$$6x-4+4x+20 = 18.6 \quad \checkmark$$

$$10x = 18.6+4-20$$

$$10x = 2.6 \quad \checkmark$$

$$x = \frac{2.6}{10}$$

$$x = 0.26 \quad \checkmark$$

(3)

b)  $z^2 - 12z + 35$

i)

$(z-5)(z-7)$  ✓

↓

Check

$z^2 - 7z - 5z + 35$  ✓

$$\begin{array}{r} 1 \times -35 \\ 5 \times -7 \end{array}$$

Q3b

4

ii)  $m^2 - 121$

$(m+11)(m-11)$  ✓

(2)

iii)  $kl + 2km + 5nl + 10nm$

~~$(k+l) + 2(k+m) + 5(n+l) + 10(n+m)$~~

$k(l+2m) + n(5l+10m)$  ✗

$(k+n)(6l+12m)$  ✗

(0)

c)

i)  $4p + 11p + 6 = 0$

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

$4p+3=0$

$4p = -3$

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

$p = -0.75$  ✓

$p+2=0$

or  $p = -2$

$p = -2$  ✓

$$\begin{array}{r} 1 \times 24 \\ 2 \times 12 \\ 3 \times 8 \end{array}$$

$$\begin{array}{r} 24 \\ 3 \times 8 \\ 4 \times 6 \\ 11 \end{array}$$

$$\begin{array}{r} 24 \\ 2 \times 12 \\ 3 \times 8 \\ 4 \times 6 \end{array}$$

(2)

Q3c

4

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

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

(2)

$$\begin{array}{l} 1 \times 63 \\ 3 \times 21 \\ 7 \times 9 \end{array}$$

$$s+7=0$$

$$s = -7$$

or

$$s+9=0$$

$$s = -9$$

$$s = -7$$

$$s = -9$$

$$\text{d) } 3x^2 + 4x - 10 = 0$$

(3)

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

(4)

4/4

$$x = 1.28$$

$$\text{or } x = -2.61$$