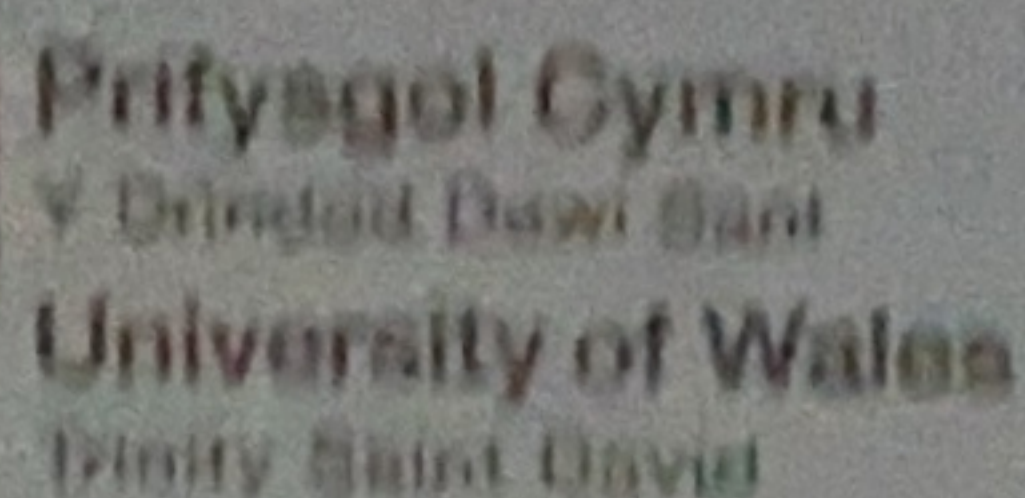




100 100

ATKINS

GEORGE

Examination Answer Books

12 August

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.

1	Student Number	P144281
2	Title of Examination Paper	Maths
3	Module Code	ACDA 4008
4	Date and Time of Examination	12/3/20
5	Examination Venue	IQ 208
6	Seat Number	
7	Number of Answer Books handed in	

[illegible]

(Gweler yr ochr arall am y hysbenn Gymraeg)

i) $f(x) = 6x^{-3} + 2$
 $f'(x) = -18x^{-4}$

7.5

ii) $f(x) = -4xe^{2x} - 9x$

7.5

$f'(x) = -8xe^{2x} - 4e^{2x} - 9$

$u = -4x$ $v = e^{2x}$
 $\frac{du}{dx} = -4$ $\frac{dv}{dx} = 2e^{2x}$

$u \frac{dv}{dx} + v \frac{du}{dx}$

iii) $f(x) = \sin(5x^3 + x^2)$

$f'(x) = \cos(5x^3 + x^2) \times (15x^2 + 2x)$

7.5

$u = 5x^3 + x^2$ $y = \sin(u)$
 $\frac{du}{dx} = 15x^2 + 2x$ $\frac{dy}{du} = \cos(u)$

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

$= \cos(u) \times (15x^2 + 2x)$
 $= \cos(5x^3 + x^2) \times (15x^2 + 2x)$

iv) $f(x) = \frac{(5x+3)^2}{(3x^2+2x)}$

$f'(x) = ?$

$y = \frac{u}{v}$ $\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$

$u = (5x+3)^2$

$u = g^2$ $g = 5x+3$
 $\frac{du}{dg} = 2g$ $\frac{dg}{dx} = 5$

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

$\frac{du}{dx} = 10g$
 $\frac{du}{dx} = 50x + 30$

$v = 3x^2 + 2x$

$\frac{dv}{dx} = 6x + 2$

$$f'(x) = \frac{(3x^2+2x)(50x+30) - (5x+3)^2(6x+2)}{(3x^2+2x)^2}$$

$$f'(x) = \frac{(3x^2+2x)(50x+30) - (5x+3)^2(6x+2)}{(3x^2+2x)^2}$$

$$f'(x) = \frac{50x+30}{3x^2+2x} - \frac{(5x+3)^2(6x+2)}{(3x^2+2x)^2}$$

$$(2.5)$$

$$\begin{array}{r} 25 \\ 275 \\ \hline 30 \end{array}$$

$$2) \quad y = 2x^3 - 9x^2 + 12x$$

$$\frac{dy}{dx} = 6x^2 - 18x + 12$$

Stationary points happen when $\frac{dy}{dx} = 0$.

$$0 = 6x^2 - 18x + 12$$

$$a=6 \quad b=-18 \quad c=12$$

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

$$x = \frac{18 \pm \sqrt{(-18)^2 - (4 \times 6 \times 12)}}{12}$$

$$x = \frac{18 \pm \sqrt{324 - 288}}{12}$$

$$x = \frac{18 + \sqrt{36}}{12}$$

or

$$x = \frac{18 - \sqrt{36}}{12}$$

$$x = 2$$

or

$$x = 1$$

Substitute into $y = 2x^3 - 9x^2 + 12x$

$$\begin{aligned} y &= 2(2)^3 - 9(2)^2 + 12(2) \\ y &= 16 - 36 + 24 \\ y &= 4 \end{aligned}$$

$$(2, 4)$$

~~8~~

$$\begin{aligned} y &= 2(1)^3 - 9(1)^2 + 12(1) \\ y &= 2 - 9 + 12 \\ y &= 5 \end{aligned}$$

$$(1, 5)$$

$$\text{Max} = (1, 5) \quad \text{Min} = (2, 4)$$

$$\frac{10}{10}$$

3.) $\int (12x^3 - 4x^{-2}) dx = \frac{12x^4}{4} - \frac{-4x^{-1}}{-1} + C$

$= 3x^4 - \frac{4}{x} + C$

3

ii) $\int \frac{e^x}{1+e^x} dx$

0

iii) $\int (\frac{2}{x} + 4 + \ln 3) dx = \underline{2 \ln(x) + 4x + 3 \ln(3) - 3 + C}$

2

05
30

$$4) I = \int_3^6 (3x^2 + x^3) dx$$

$$I = \frac{3x^3}{3} + \frac{x^4}{4} + C \Big|_3^6$$

$$I = \left((6)^3 + \frac{(6)^4}{4} \right) - \left((3)^3 + \frac{(3)^4}{4} \right)$$

$$I = \left(216 + \frac{1296}{4} \right) - \left(27 + \frac{81}{4} \right)$$

$$\frac{10}{10}$$

$$I = 540 - 47.25$$

$$I = 492.75$$

5.) $z_1 = \frac{3-2j}{2+j}$ $z_2 = \frac{3+2j}{1-2j}$ $z_1 - z_2 = ?$

$$z_1 = \frac{3-2j}{2+j} \times \frac{2-j}{2-j}$$

$$z_2 = \frac{3+2j}{1-2j} \times \frac{1+2j}{1+2j}$$

$$z_1 = \frac{(3-2j)(2-j)}{(2+j)(2-j)}$$

$$z_2 = \frac{(3+2j)(1+2j)}{(1-2j)(1+2j)}$$

$$z_1 = \frac{6-3j-2j+2j^2}{4+2j-2j-j^2}$$

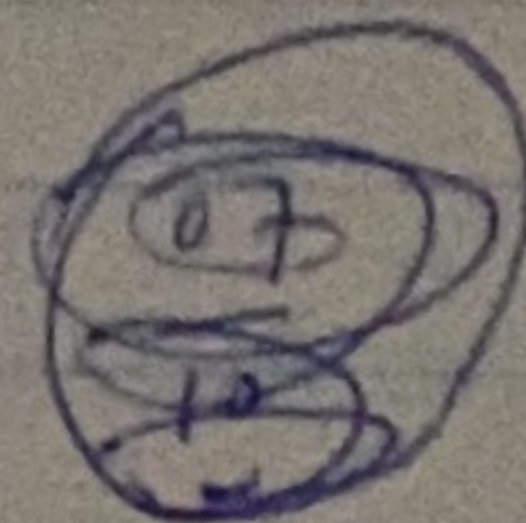
$$z_2 = \frac{3+6j+2j+4j^2}{1+2j-2j-4j^2}$$

$$z_1 = \frac{6-2-5j}{4+1}$$

$$z_2 = \frac{3-4+8j}{1+4}$$

$$z_1 = \frac{3-5j}{5}$$

$$z_2 = \frac{-1+8j}{5}$$



$$z_1 - z_2 = \left(\frac{3}{5} - j\right) - \left(-\frac{1}{5} + \frac{8j}{5}\right)$$

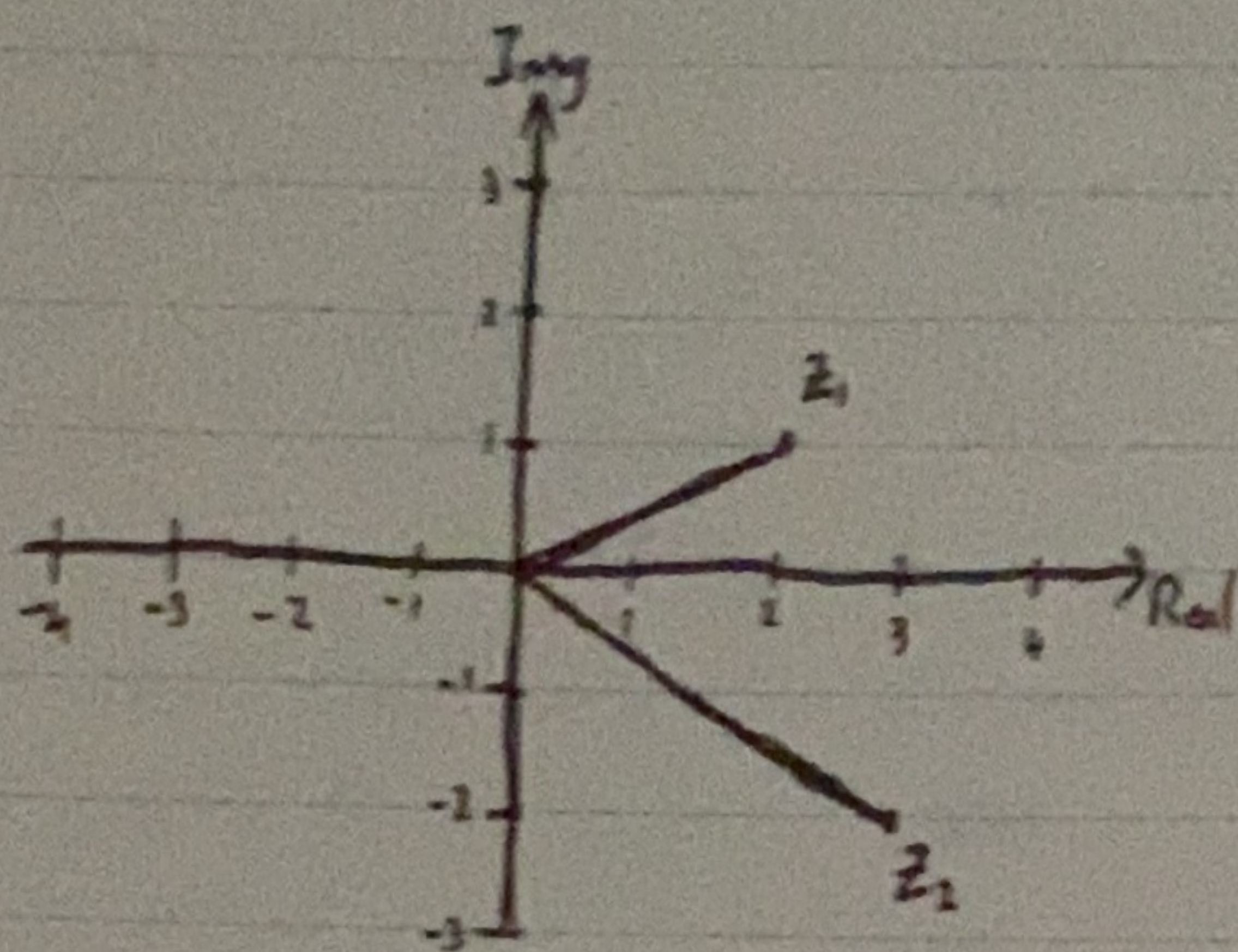
$$z_1 - z_2 = \frac{4}{5} - \frac{13j}{5}$$

2

3

$$z_1 - z_2 = \frac{4-13j}{5}$$

ii) $z_1 = 2 + j$ $z_2 = 3 - 2j$



(5)

$$\begin{aligned} |z_1| &= \sqrt{2^2 + 1^2} & \theta z_1 &= \tan^{-1} \frac{1}{2} & |z_2| &= \sqrt{3^2 + 2^2} & \theta z_2 &= \tan^{-1} \frac{-2}{3} \\ |z_1| &= \sqrt{5} & \theta z_1 &= 26.57^\circ & |z_2| &= \sqrt{13} & \theta z_2 &= -33.69^\circ \end{aligned}$$

$$z_1 = \sqrt{5} \angle 26.57^\circ \quad z_2 = \sqrt{13} \angle -33.69^\circ$$

iii)

(6)

$$iv) \quad 0 = x^2 - 4x + 13$$

$$a = 1 \quad b = -4 \quad c = 13$$

or

$$x = \frac{4 \pm \sqrt{4^2 - 4 \times 1 \times 13}}{2}$$

$$x = \frac{4 \pm \sqrt{16 - 52}}{2}$$

$$x = \frac{4 \pm \sqrt{-36}}{2}$$

$$x = \frac{4 \pm \sqrt{-1} \sqrt{36}}{2}$$

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

$$x = \frac{4 + 6j}{2}$$

or

$$x = \frac{4 - 6j}{2}$$

$$x = 2 + 3j$$

$$x = \cancel{2 + 3j} \quad 2 - 3j$$

$$r = \sqrt{2^2 + 3^2}$$

$$r = \sqrt{13}$$

$$\theta = \tan^{-1} \frac{3}{2}$$

$$\theta = 56.31$$

$$x = \sqrt{13} (\cos(56.31) + j \sin(56.31))$$

or

$$x = \sqrt{13} (\cos(56.31) - j \sin(56.31))$$

$$\frac{18}{20}$$

$$5$$