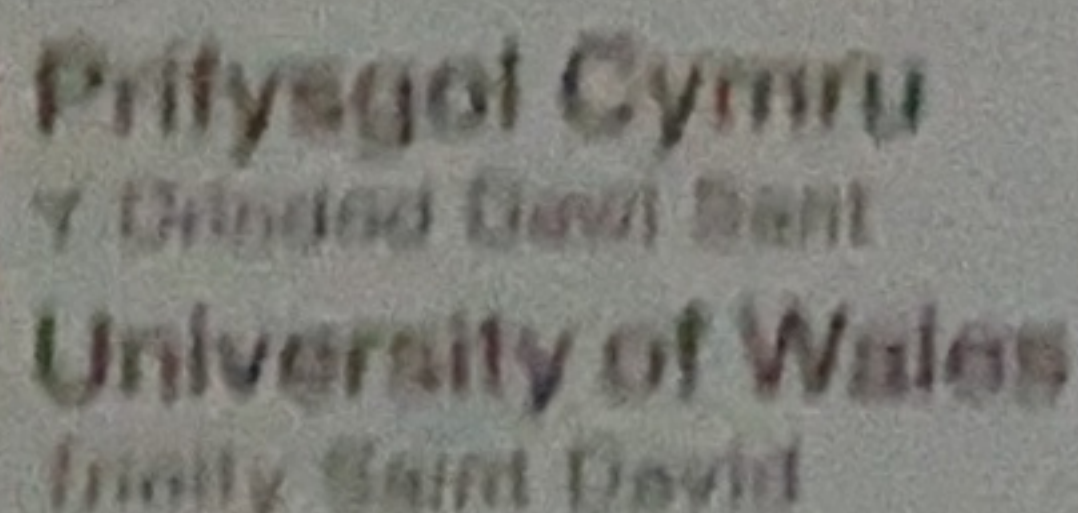




12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided in 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 is 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).
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1	Student Number	1907676
2	Title of Examination Paper	Mathematics
3	Module Code	ADCA4008
4	Date and Time of Examination	09.30
5	Examination Venue	10.208
6	Seat Number	
7	Number of Answer Books Handled in	

[illegible]

$$1.) f(x) = 6x^3 + 2$$

(15)

$$f'(x) = 18x^2$$

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

(5)

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

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

(75)

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

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

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

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

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

$$\frac{du}{dx} = 10(5x+3)$$

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

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

(2)

$$f'(x) = \frac{10(5x+3)(3x^2+2x) - (6x+2)(5x+3)^2}{(3x^2+2x)^2}$$

$\frac{19}{30}$

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

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

$$\text{when } \frac{dy}{dx} = 0$$

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

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

$$\frac{18 \pm \sqrt{18^2 - 4 \times 6 \times 12}}{2 \times 6}$$

$$\frac{18 \pm \sqrt{36}}{12}$$

$$\left(\frac{18}{12} \right)$$

$$x = 2 \text{ and } 1$$

$$y = 2(2)^3 - 9(2)^2 + 12(2) \\ = 4$$

$$y = 2(1)^3 - 9(1)^2 + 12(1) \\ = 5$$

$$\text{maximum} = (1, 5)$$

$$\text{minimum} = (2, 4)$$

$$3.) \int (12x^3 - 4x^{-2}) dx$$

$$= 3x^4 + 4x^{-1} + C$$

10

$\frac{21}{30}$

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

$$= e^x \ln|1+e^x| + C$$

1

$$iii) \int \left(\frac{2}{x} + 4 + \ln 3 \right) dx$$

$$= 2\ln|x| + 4x + \ln(3) + C$$

$$= 2\ln|x| + 4x + x\ln(3) + C$$

10

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

$$= \left[x^3 + \frac{1}{4} x^4 \right]_3^6$$

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

$$= 540 - 47.25$$

$$I = 492.75 \text{ or } \frac{1971}{4}$$

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

5) $Z_1 = \frac{3-2j}{2+j}$

$Z_2 = \frac{3+2j}{1-2j}$

~~$Z_1 \cdot Z_2$~~ $\frac{3-2j}{2+j} \times \frac{1-2j}{1-2j} = \frac{3-8j-4}{4-3j} = \frac{-1-8j}{4-3j}$

$\frac{3+2j}{1-2j} \times \frac{2+j}{2+j} = \frac{-4+7j}{4-3j}$

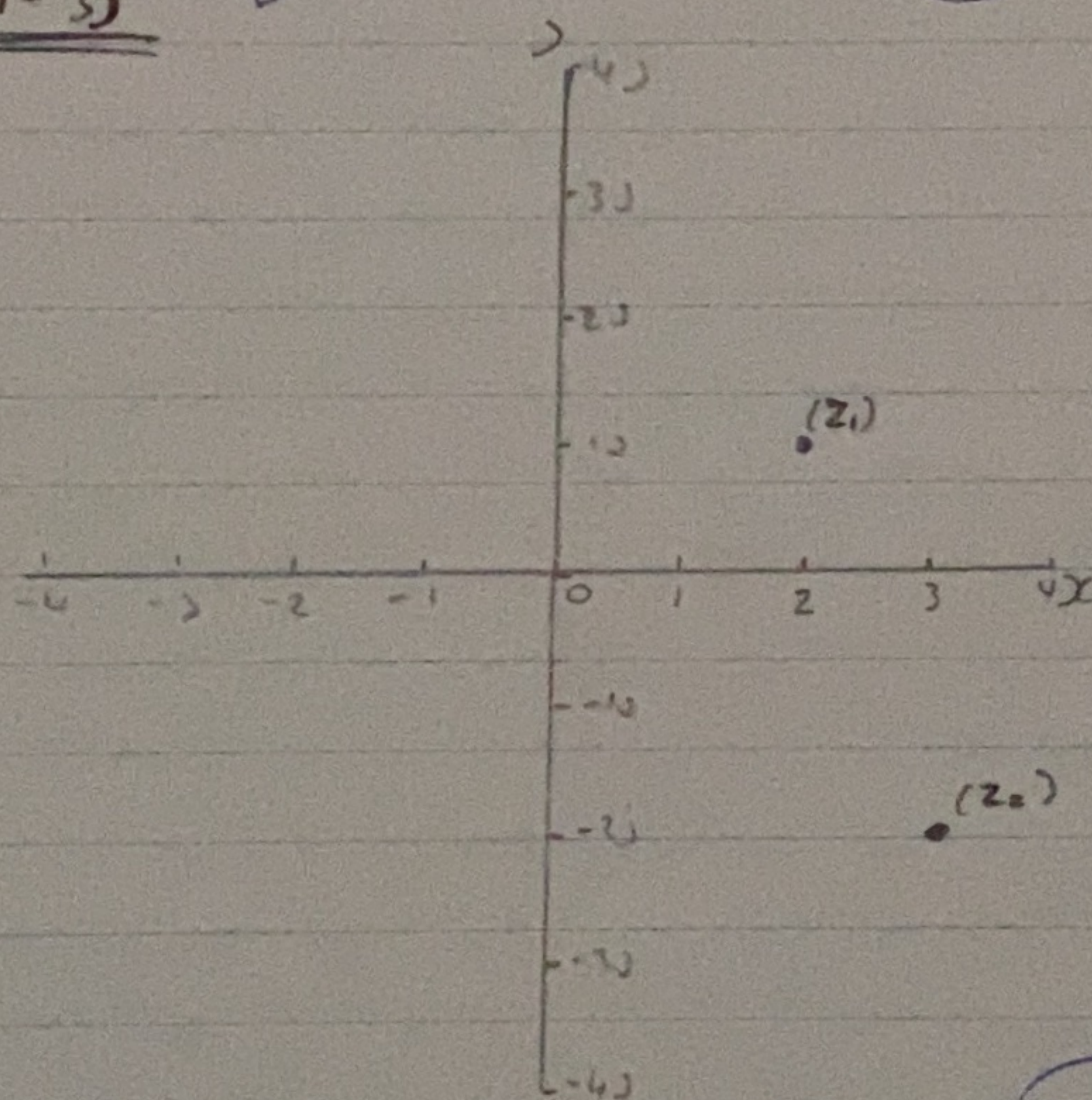
$\frac{-1-8j}{4-3j} - \frac{-4+7j}{4-3j}$

$Z_1 - Z_2 = 1-3j$ ✓

2

2

ii)



1

$Z_1 = (2+1j)$

$Z_2 = (3-2j)$

$$\text{iii) } z = (\sqrt{3} + j)^8$$

$$= (\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)(\sqrt{3} + j)$$

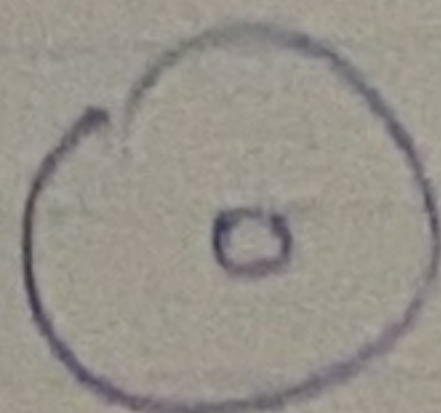
$$= (2 + 2\sqrt{3}j)(2 + 2\sqrt{3}j)(2 + 2\sqrt{3}j)(2 + 2\sqrt{3}j)$$

$$= (-8 + 8\sqrt{3}j)(-8 + 8\sqrt{3}j)$$

~~$$= 64 - 128\sqrt{3}j - 128\sqrt{3}j + 192$$~~

$$= 64 - 128\sqrt{3}j - 128\sqrt{3}j + 192$$

$$z = -128 - 128\sqrt{3}j$$



$$\text{iv) } z^2 - 4z + 13 = 0$$

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

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

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

$$z = \frac{4 \pm \sqrt{-36}}{2} \quad \boxed{\sqrt{-36} = 6j} \quad \sqrt{-36} = \sqrt{-1} \times \sqrt{36} = 6j$$

$$z = 2 + 3j$$

$$x = 2 + 3j \text{ and } 2 - 3j$$

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

~~$$= \sqrt{13} \angle 56.3^\circ$$~~

$$= \sqrt{13} \angle 0.48 \text{ or } \sqrt{13} \angle -0.98$$

