



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)

81%

SURNAME: Shafie Pour Motlagh

FORENAME(S): Reza

1	Student Number	1810478
2	Title of Examination Paper	Mathematics Test 1
3	Module Code	M4X00391
4	Date and Time of Examination	16/1/19 12:00
5	Examination Venue	Vivian Hall
6	Seat Number	G027
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	35
2	26
3	30
Total	65



1) a) $\frac{\Delta x}{t} = \left(\frac{V + V_0}{2} \right) t$ for V_0

$$2. \frac{\Delta x}{t} = \frac{V + V_0}{2} \cdot 2$$

$$2 \left(\frac{\Delta x}{t} \right) = \frac{V + V_0}{-V}$$

$$2 \left(\frac{\Delta x}{t} \right) - V = V_0$$

$$V_0 = 2 \left(\frac{500}{10} \right) - 30$$

$$V_0 = 2(50) - 30$$

$$V_0 = 100 - 30$$

$$V_0 = 70.0$$

2

b) i) $\frac{5x-2}{3} = \frac{7x+6}{2}$

$$2(5x-2) = 3(7x+6)$$

$$10x-4 = 21x+18$$

$$-11x-4 = 18$$

$$\frac{-11x}{-11} = \frac{22}{-11}$$

$$x = -2$$

3

ii) $\frac{4(x+5)}{3} = \frac{2x}{6} - \frac{(5x-1)}{12}$

$$4(x+5) = 2x - (5x-1)$$

$$4x+20 = 2x-5x+1$$

$$7x+20 = 1$$

$$\frac{7x}{7} = \frac{-19}{7}$$

$$x = -2.71$$

4

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

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

$$4x^2 + 6x + 6x + 9 = x^2 + 5x + 6$$

$$4x^2 + 12x + 9 = x^2 + 5x + 6$$

$$3x^2 + 12x + 9 = 5x + 6$$

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

$$3x^2 + 7x + 3 = 0$$

~~$$3x^2 + 7x + 3 = 0$$~~

$$x = \frac{-7 \pm \sqrt{7^2 - 4(3)(3)}}{2(3)}$$

$$x = -0.57 \text{ or } \frac{-7 + \sqrt{13}}{6}$$

$$x = -1.77 \text{ or } \frac{-7 - \sqrt{13}}{6}$$

iv) $5^x \times 8 = 3^{x+4}$

$$x \log 5 + \log 8 = (x+4) \log(3)$$

$$.7(x) + 0.9 = (x+4)(.48)$$

$$.7x + .9 = (.48x) + (1.92)$$

$$-.48x \quad -.48x$$

$$.22x + .9 = 1.92$$

$$.22x = 1.02$$

$$\frac{.22}{.22} \quad \frac{1.02}{.22}$$

$$x = 4.64$$

c) i) $8z^2 - 5x - 3$

$$(8z+3)(z-1)$$

ii) $9x^2 - 49y^2$
 $(3x+7y)(3x-7y)$

iii) $xt - xr + yt - yr$
 $x(t-r) + y(t-r)$
 $(x+y)(t-r)$

d) i) $3x^2 - 5x = 2$
 $3x^2 - 5x - 2 = 0$
 $(3x+1)(x-2)$
 $x = -\frac{1}{3} \quad x = 2$

3

ii) $x^2 + 5x + 6 = 0$
 $(x+3)(x+2)$
 $x = -3 \quad x = -2$

3

iii) $x^2 - 81 = 0$
 $(x+9)(x-9)$
 $x = -9 \quad x = 9$

2

iv) $4x^2 + 9x + 5 = 0$
 $(4x+5)(x+1)$
 $x = -\frac{5}{4} \quad x = -1$

2

e) $(3x+1)(2x-1) - (x+2)^2 = 5$
 $6x^2 - x - 1 - x^2 + 4 = 5$
 $5x^2 - x - 5 = 5$
 $5x^2 - x - 10 = 0$

$5x^2 - x = 10$
 $x(5x-1) = 10$
 $5x^2 - x - 10 = 0$
 $x = 1.52 \quad x = -1.32$

X

2*) a) $16x^2 + 3x - 8 = 0$

$$\frac{-3 \pm \sqrt{3^2 - 4(16)(-8)}}{2(16)}$$

$$x = 0.62 \text{ or } \frac{-3 + \sqrt{521}}{32}$$

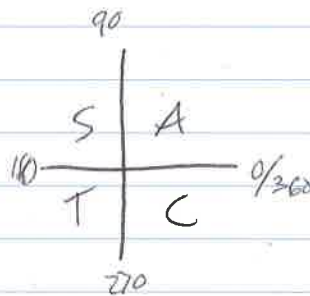
$$x = -0.81 \text{ or } \frac{-3 - \sqrt{521}}{32}$$

b) i) $\tan x = 7$

$$x = \tan^{-1}(7)$$

$$x = 34.99^\circ$$

$$x = 214.99^\circ$$



ii) $-3 \cos x = 2$

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

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

$$x = 131.81^\circ$$

$$x = 228.19^\circ$$

iii) $5 \sin x = 4$

$$\sin x = \frac{4}{5}$$

$$x = \sin^{-1}\left(\frac{4}{5}\right)$$

$$x = 53.13^\circ$$

$$x = 126.87^\circ$$

c) $x^2 + 7x + 10$

$$(\tan x + 2)(\tan x + 5)$$

$$\tan x = -2$$

$$x = \tan^{-1}(-2) \quad x = \tan^{-1}(-5)$$

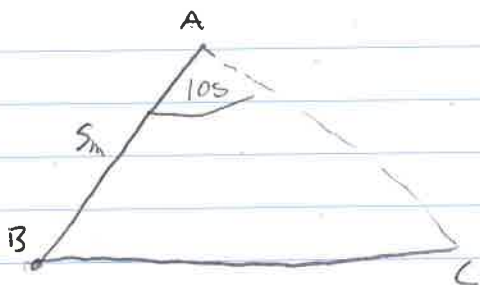
$$x = 63.43^\circ$$

$$x = 78.69^\circ$$

$$x = 243.43^\circ$$

$$x = 258.69^\circ$$

d)



$$\frac{9}{\sin(105)} = \frac{5}{\sin(C)}$$

$$\overline{BC} = 6.42$$

X

e)

$$\frac{3\sin x + 5}{\cot x} = 2$$

$$\frac{3\sin x + 5}{2} = \frac{2(\cot x)}{2}$$

$$\cot x = \frac{3\sin x + 5}{2}$$

2

3) a) i) $y = 8x^3 - 2x^2 + 5x + 1$
 $\frac{dy}{dx} = 24x^2 - 4x + 5$

2

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

$$y = (6x+1)^2$$

$$y = 6x^2 + 1$$

$$\frac{dy}{dx} = 12x$$

X

ii) $y = 3\sqrt{x} + \frac{2}{x}$

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

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

X

1

iv) $y = 4\sin 3x + 2\cos x + \tan 6x$

~~$\frac{dy}{dx} = 12\cos 3x - 2\sin x + 6\sec^2 6x$~~

$\frac{dy}{dx} = 12\cos 3x - 2\sin x + 6\sec^2 6x$ ✓

3

v) $y = 2x^5 \tan x$

$\frac{dy}{dx} = 2x^5(\sec^2 x) + \tan x(10x^4)$ ✓

4

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

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

3

vii) $y = \sqrt{5x^6 - 2x + 1}$

$\frac{dy}{dx} = \frac{1}{2}(5x^6 - 2x + 1)^{-1/2}(30x^5 - 2)$ ✓

1

b) $y = \sin 3x$

$\frac{dy}{dx} = 3\cos 3x$ ✓

$\frac{d^2y}{dx^2} = -9\sin 3x$ ✓

$\frac{d^3y}{dx^3} = +27\cos 3x$ ✗

$\frac{d^4y}{dx^4} = -81\sin 3x$ ✗

2

c)

$$y = 4x^2 + 5$$

$$\frac{dy}{dx} = 8x$$

$$\frac{dy}{dx^2} = 8$$

$$2(8) + 3(8x) - 2 = 14 + 24x$$

$$24x + 16 - 2 = 14 + 24x$$

↓

$$24x + 14 = 14 + 24x$$

3

d)

$$y = -4x + 1 \quad (1)$$

$$y = x^2 + 6x + 10 \quad (2)$$

$$\begin{array}{r} x^2 + 6x + 10 \\ + 4x + 1 \\ \hline \end{array}$$

$$x^2 + 10x + 11$$

$$x^2 + 10x + 9$$

$$(x+9)(x+1)$$

$$x = -9 \quad x = -1$$

$$y = 37 \quad y = 5$$

$$y = -4(-9) + 1$$

$$y = 36 + 1$$

$$y = -4(-1) + 1$$

$$y = 5$$

6

e)

$$z = x^5 + 2x^2y^3 - y^2$$

$$\frac{dz}{dx} = 5x^4 + 4xy^3$$

$$\frac{d^2z}{dx^2} = 20x^3 + 4y^3$$

$$\frac{dz}{dy} = 6x^2y^2 - 2y$$

$$\frac{d^2z}{dy^2} = 12x^2y - 2$$

$$\frac{dz}{dx} = 5x^4 + 4xy^3$$

$$\frac{d^2z}{dx^2} = 20x^3 + 4y^3$$

$$\frac{dz}{dy} = 6x^2y^2 - 2y$$

$$\frac{d^2z}{dy^2} = 12x^2y - 2$$

$$\frac{dz}{dx} = 5x^4 + 4xy^3$$

$$\frac{d^2z}{dx^2} = 20x^3 + 4y^3$$

$$\frac{dz}{dy} = 6x^2y^2 - 2y$$

$$\frac{d^2z}{dy^2} = 12x^2y - 2$$

$$\frac{dz}{dx} = 5x^4 + 4xy^3$$

$$\frac{d^2z}{dx^2} = 20x^3 + 4y^3$$

5

Question No.

Examiner Only



12 Pages

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.**

60%

SURNAME: Hernandez Moseque

FORENAME(S): Omaira

1	Student Number	1802664
2	Title of Examination Paper	Mathematics
3	Module Code	M4X00391
4	Date and Time of Examination	18/01/19
5	Examination Venue	Vivian Hall
6	Seat Number	6006
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
21 2	27 21
Total	48

(Gweler yr ochr arall am y fersiwn Cymraeg)



Question one

$$a) \Delta x = \left(\frac{v + v_0}{2} \right) t$$

$$\Delta x = 500 ; t = 10 ; v = 30$$

$$\frac{\Delta x}{t} = \frac{v + v_0}{2} \Rightarrow$$

$$\frac{2 \cdot 500}{10} - 30 = v_0$$

$$\frac{\Delta x}{t} \cdot 2 = v + v_0$$

$$\frac{1000}{10} - 30$$

$$\frac{2 \Delta x}{t} - v = v_0$$

$$\frac{1000 - 300}{10} = v_0$$

$$v_0 = 70 \cdot 0$$

$$b) i) \frac{5x-2}{3} = \frac{7x+6}{2} \Rightarrow 2 \cdot (5x-2) = 3 \cdot (7x+6) =$$

$$= 10x-4 = 21x+18 =$$

$$= -4-18 = 21x-10x$$

$$-22 = 11x \Rightarrow x = \frac{-22}{11} = -2$$

$$ii) \frac{x+5}{3} = \frac{x}{6} - \frac{5x-1}{12}$$

$$\left[\frac{(x+5)}{3} = \frac{x}{6} - \frac{(5x-1)}{12} \right] \cdot (12)$$

$$4x + 20 = 2x - (5x-1)$$

$$20 + 1 = -5x + 2x - 4x$$

$$21 = -7x$$

$$-x = \frac{21}{7} ; x = -3$$

$$ii) 2\ln(2x+3) = \ln(x+3) + \ln(x+2)$$

$$\cancel{\ln}(2x+3)^2 = \cancel{\ln}(x+3) \cdot (x+2)$$

$$(2x+3)^2 = (x+3) \cdot (x+2)$$

$$4x^2 + 2 \cdot (2x \cdot 3) + 9 = x^2 + 2x + 3x + 6$$

$$4x^2 + 12x + 9 = x^2 + 5x + 6$$

$$\downarrow$$

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

$$\downarrow$$

$$(x+3)$$

$$x = -3$$

$$(x+2)$$

$$x = -2$$

take all onto 1 side

$$iv) 5^x \cdot 8 = 3^{x+4}$$

$$\log 5^x \cdot 8 = \log 3^{x+4}$$

$$\log 5^x + \log 8 = \log 3^{x+4}$$

$$x \cdot \log 5 + \log 8 = (x+4) \cdot \log 3$$

$$x \cdot 0.70 + 0.90 = (x+4) \cdot 0.48$$

$$0.70x + 0.90 = 0.48x + 1.92$$

$$0.70x - 0.48x = 1.92 - 0.90$$

$$0.22x = 1.02$$

$$\boxed{x = 4.63}$$

$$c) i) 8z^2 - 5z - 3$$

$$(z-1)(8z+3)$$

$$ii) 9x^2 - 49y^2 =$$

$$(x+3)^2 (y-7)^2$$

$$iii) xt - xr + yt - yr$$

$$x(t-r) + y(t-r)$$

$$\therefore (t-r)(x+y)$$

$$d) i) 3x^2 - 5x - 2$$

$$\frac{3 \cdot (3x^2 - 5x - 2)}{3} = \frac{(3x)^2 - 5 \cdot (3x) - 6}{3}$$

$$\frac{(3x-6)(3x+1)}{3} = (x-2)(3x+1)$$

solwe
//

$$ii) x^2 + 5x + 6 = 0$$

$$(x+3)(x+2)$$

$$iii) x^2 - 81$$

$$(x-9)(x+9)$$

iv) $4x^2 + 9x + 5$

$$\frac{4 \cdot (4x^2) + (9x) + 5}{4} = \frac{(4x)^2 + 9(4x) + 20}{4}$$

$$\frac{(4x+5)(4x+4)}{4} = (4x+5)(x+1) \quad \checkmark$$

e) $(3x+1) \cdot (2x-1) - (x+2)^2 = 5$

$$6x^2 - 3x + 2x - 1 - x^2 - 4x - 4 = 5$$

$$5x^2 - 5x - 10 = 0$$

$$\frac{-(-5) \pm \sqrt{(-5)^2 - 4 \cdot 5 \cdot (-10)}}{2 \cdot 5} = \begin{cases} x=2 \\ x=-1 \end{cases} \quad \checkmark$$

QUESTION 2

a) $16x^2 + 3x - 8 = 0$

$$\frac{-3 \pm \sqrt{(3)^2 - 4 \cdot 16 \cdot (-8)}}{2 \cdot 16} = \frac{-3 \pm \sqrt{9 - (-512)}}{2 \cdot 16} =$$

$$x = -0.62 \quad x = -0.81 \quad \checkmark$$

b) i) $\tan x = 0.7$

$$x = \tan^{-1} 0.7 \quad \checkmark$$

$$x = 34.99^\circ \quad \checkmark$$

$$180^\circ + 34.99^\circ = 214.99^\circ \quad \checkmark$$

↓

$\tan$ is positive on the first and third quadrant

∴

ii) $-3 \cos x = 2$

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

$$-x = \cos^{-1} \frac{2}{3}$$

$$x = -\cos^{-1} \frac{2}{3}$$

$$x = -48.19^\circ \quad \checkmark$$

$$180 + (-48.19) = 131.81^\circ$$

$\cos$ is negative on the second and third quadrant

$$\text{iii) } 5 \sin x = 4$$

$$x = \sin^{-1} \frac{4}{5}$$

$$x = 53,13^\circ$$

→ sin is positive
in the first and
second quadrant

$$180^\circ - 53,13^\circ = 126,87^\circ$$

$$\text{c) } x^2 + 7x + 10$$

$$(x+5)(x+2)$$

$$\tan(x+5) + \tan(x+2) = 0$$

$$\tan(x+5) = 0$$

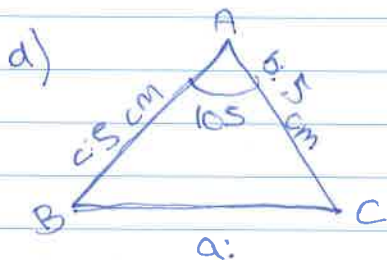
$$x = \tan^{-1}(-5)$$

$$x = -78,69^\circ$$

$$\tan(x+2) = 0$$

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

$$x = -63,43^\circ$$



$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$a^2 = 5^2 + 5^2 - 2 \cdot 5 \cdot 5 \cdot \cos 105$$

$$a^2 = 41,94$$

$$a = \sqrt{41,94}$$

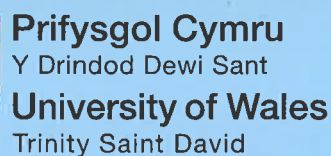
$$a = 6,476 \text{ m}$$

$$e) \frac{3\sin x + 5}{\cot x} = 2$$

$$\frac{3\sin x + 5}{2} = \cot x$$

Question No.

Examiner Only



12 Pages

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 cannot read more 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: Parry

FORENAME(S): Christian

1	Student Number	1808165
2	Title of Examination Paper	Mathematics 1
3	Module Code	MA4X00391
4	Date and Time of Examination	18/01/19
5	Examination Venue	Vivian hall
6	Seat Number	6046
7	Number of Answer Books handed in	

[illegible]

68%



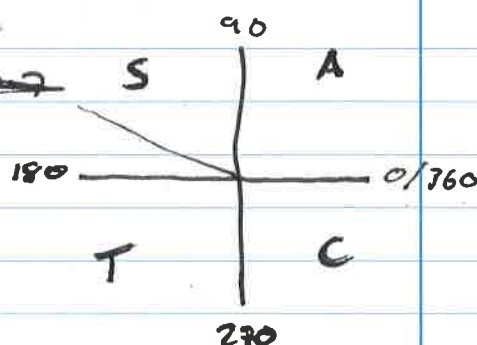
2) a b c
a) $16x^2 + 3x - 8 = 0$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-3 \pm \sqrt{3^2 - 4 \times 16 \times -8}}{2 \times 16} = \underline{\underline{0.620}}$$

$$\frac{-3 - \sqrt{3^2 - 4 \times 16 \times -8}}{2 \times 16} = \underline{\underline{-0.807}}$$

b) i) ~~$\sec^2 \tan x = 0.7$~~ ~~$\sec^2 x = 0.7$~~

i) $\tan x = 0.7$
 $\tan^{-1}(0.7) = 34.992$
 $180 + 34.992 = \underline{\underline{214.99}}$



ii) $-3 \cos x = 2$ $\frac{2}{3} = \cos x$ $\cos^{-1}(\frac{2}{3}) = 48.19$
 ~~$\sin x$~~ ~~$\cos^{-1}(2)$~~
 $270 + 48.19 = \underline{\underline{318.19}}$

iii) $5 \sin x = 4$ $\frac{4}{5}$ $\sin^{-1}(\frac{4}{5}) = 53.13$
 $90 + 53.13 = \underline{\underline{143.13}}$

c) $x^2 + 7x + 10 = (x + 5)(x + 2)$

$$x^2 + 2x + 5x + 10$$

$(x + 5)(x + 2)$
 $x = -5$ $x = -2$
 ~~777777~~

$$\tan^2 - 5 + 7 \tan - 5 + 10 = 0$$

$$\tan^2 - 2 + 7 \tan - 2 + 10 = 0$$

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

$$a^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \times \cos(105)$$

$$a^2 = 62.94 \quad \text{so} \quad \sqrt{62.94} = \underline{7.93\text{m}}$$

e) $2 = \frac{3\sin x + 5}{\cot x} \quad \text{so} \quad \cot x = \frac{3\sin x + 5}{2}$

$$\cot x = \frac{1}{\tan(x)} \quad \text{and} \quad \tan x = \frac{\sin x}{\cos x}$$

$$\frac{1}{\frac{\sin x}{\cos x}} = \frac{3\sin x + 5}{2}$$

3)

a) i) $y = 8x^3 - 2x^2 + 5x - 1$

$$\frac{dy}{dx} = \underline{24x^2 - 4x + 5}$$

ii) $y = 3(2x + 1)^2 = (6x + 3)^2 = \overbrace{(6x + 3)(6x + 3)}$

$$36x^2 + 18x + 18x + 9 = 36x^2 + 36x + 9$$

$$\frac{dy}{dx} = \underline{72x + 36}$$

iii) $y = \sqrt[3]{x + \frac{2}{x}}$ $3x^{\frac{1}{2}} + 2x^{-1}$

$$\frac{dy}{dx} = \underline{1.5x^{-1/2} - 2x^{-2}}$$

iv) $y = 4 \sin 3x + 2 \cos x + \tan 6x$

$$\frac{dy}{dx} = \underline{12 \cos 3x - 2 \sin x + 6 \sec^2 6x}$$

v) $y = 2x^5 \tan x$ $\frac{du}{dx} = 10x^4$ $\frac{dv}{dx} = \sec^2 x$

$$\frac{dy}{dx} = u \left(\frac{dv}{dx} \right) + v \left(\frac{du}{dx} \right) = \underline{2x^5 (\sec^2 x) + \tan x (10x^4)}$$

vi) $y = \frac{5 \sin 2x}{e^{3x}}$ $\frac{du}{dx} = 10 \cos 2x$ $\frac{dv}{dx} = 3e^{3x}$

$$\frac{dy}{dx} = \frac{v \left(\frac{du}{dx} \right) - u \left(\frac{dv}{dx} \right)}{v^2} = \underline{\frac{e^{3x} (10 \cos 2x) - 5 \sin 2x (3e^{3x})}{(e^{3x})^2}}$$

Vii) $y = \sqrt{5x^6 - 2x + 1} = (5x^6 - 2x + 1)^{1/2}$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} = \frac{1}{2} (5x^6 - 2x + 1)^{-1/2} \times (30x^5 - 2) \checkmark$$

2

b) $y = \sin 3x$

$$\frac{dy}{dx} = 3 \cos 3x \checkmark$$

$$\frac{d^2y}{dx^2} = -9 \sin 3x \checkmark$$

$$\frac{d^3y}{dx^3} = -27 \cos 3x \checkmark$$

$$\frac{d^4y}{dx^4} = \underline{\underline{27 \sin 3x}} \checkmark$$

4

c) $y = 4x^2 + 5$

$$2 \left(\frac{d^2y}{dx^2} \right) + 3 \left(\frac{dy}{dx} \right) - 2 = 14 + 24x$$

$$\frac{dy}{dx} = 8x \quad \frac{d^2y}{dx^2} = 8$$

$$\text{so } \underline{\underline{2(8) + 3(8x) - 2 = 14 + 24x}} \checkmark$$

3

d) ① $y = -4x + 1$

② $y = x^2 + 6x + 10$

cancel x out

$$① \times 6 = ⑥y = -24x + 6$$

$$③ \times 4 = ④y = 4x^2 + 24x + 40$$

$$\text{Put ③ into ④ } 10y = 4x^2 - 24x + 24x + 40 + 6$$

$$10y = 4x^2 + 46$$

$$10y - 46 = 4x^2$$

$\div 4$

$$\frac{10y - 46}{4} = x^2$$

$$2.5y - 11.5 = x^2$$

$$\sqrt{x} = 3.39$$

$$y = -4 \times 3.39 + 1 = -12.56$$

$$y = 3.39^2 + 6 \times 3.39 + 10 = 41$$

X

$$e) Z = x^5 + 2x^2y^3 - y^7$$

$$\frac{\partial Z}{\partial x} = 5x^4 + 4xy^3$$

$$\frac{\partial Z}{\partial y} = 2x^2 \cdot 3y^2 - 7y^6$$

$$\frac{\partial^2 Z}{\partial x^2} = 20x^3 + 4y^3$$

$$\frac{\partial^2 Z}{\partial y^2} = 2x^2 \cdot 6y - 42y^5$$

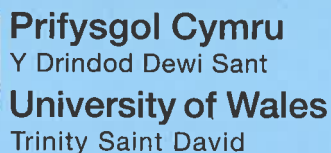
$$\frac{\partial^2 Z}{\partial y \partial x} = 4x \cdot 3y^2$$

$$\frac{\partial^2 Z}{\partial x \partial y} = 4x \cdot 3y^2$$

6

Question No.

Examiner Only



**Complete, fold and seal
(see note 2 below)**

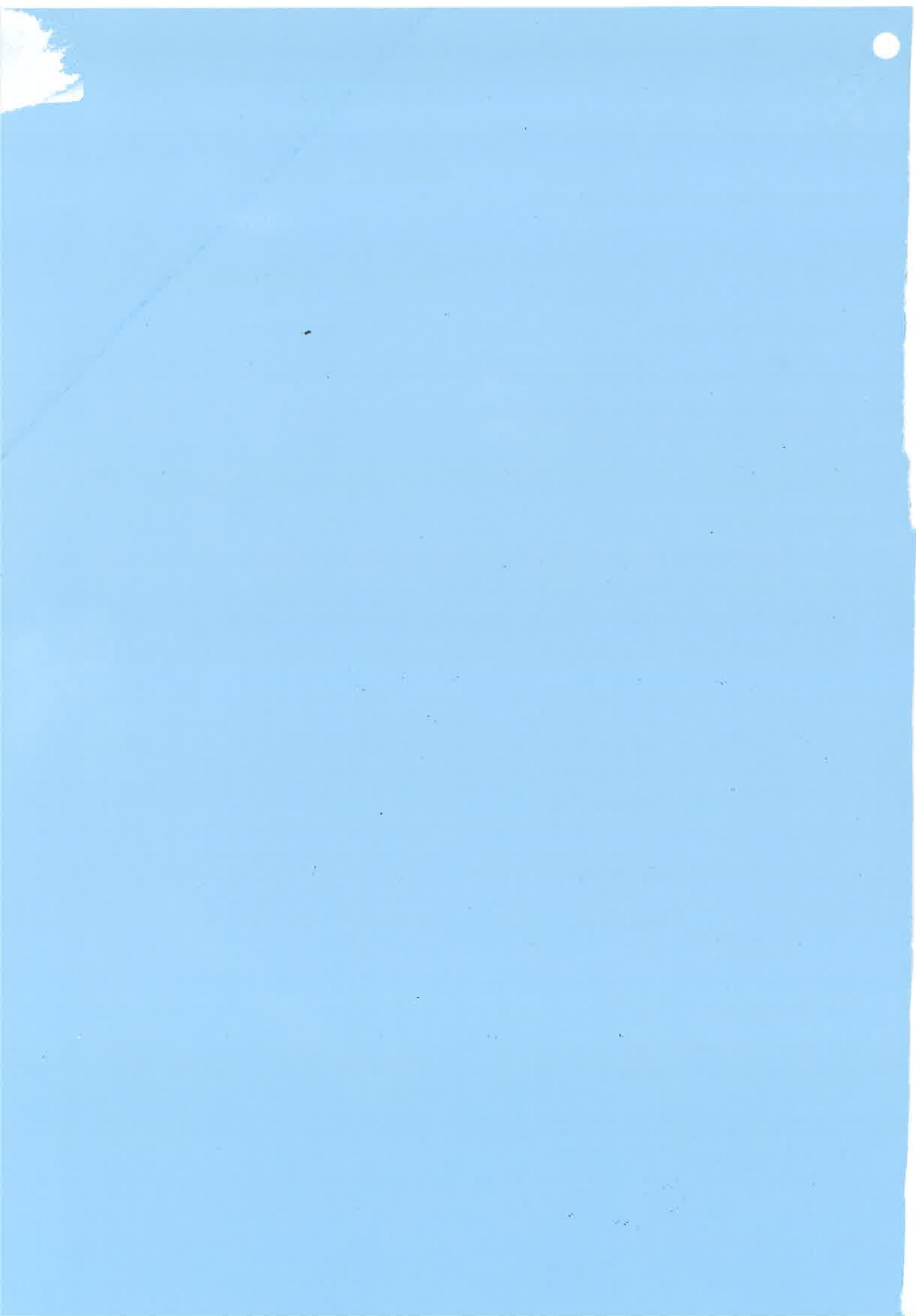
FORENAME(S): ALEXANDER JAMES

12 Pages

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	R002
2	Title of Examination Paper	Mathematics
3	Module Code	M4X00391
4	Date and Time of Examination	11th 10th 3:00
5	Examination Venue	1A 103
6	Seat Number	R002
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	32
2	20
Total	52



i a) $\int (x^3 + 2x)(x^2 - 4x) dx$

$$= \int (x^5 - 4x^4 + 2x^3 - 8x^2) dx = \frac{x^6}{6} - \frac{4x^5}{5} + \frac{2x^4}{4} - \frac{8x^3}{3} + C$$

$$= \frac{x^6}{6} - \frac{4x^5}{5} + \frac{x^4}{2} - \frac{8x^3}{3} + C$$

6

ii b) $\int (x^4 + 4x)^3 - 2x + 4 \cos 5x dx$

$$u = x^4 + 4x$$

$$\frac{du}{dx} = 4x^3 + 4$$

$$\int \frac{u^3 - 2x + 4 \cos 5x}{4x^3 + 4} dx$$

$$dx = \frac{du}{4x^3 + 4}$$

$$(x^4 + 4x)(x^4 + 4x)(x^4 + 4x) \quad (x^4 + 4x)(x^4 + 4x)$$

$$x^{16} \quad x^8 + 4x^5 + 4x^5 + 16x^2$$

$$x^8 + 8x^5 + 16x^2 \quad x(x^4 + 4x)$$

$$= x^{12} + 8x^9 + 16x^6 + 4x^{10} + 32x^6 + 64x^3$$

$$= x^{12} + 12x^9 + 48x^6 + 64x^3$$

$$\therefore \int x^{12} + 12x^9 + 48x^6 + 64x^3 - 2x + 4 \cos 5x$$

$$= \int x^{12} + 12x^9 + 48x^6 + 64x^3 dx - \int 2x dx + \int 4 \cos 5x$$

$$= \left(\frac{x^{13}}{13} + \frac{12x^{10}}{10} + \frac{48x^7}{7} + \frac{64x^4}{4} + C \right) - \frac{2x^2}{2} + \frac{4}{5} \sin 5x$$

$$= \frac{x^{13}}{13} + \frac{6x^{10}}{5} + \frac{48x^7}{7} + 16x^4 - x^2 + \frac{4}{5} \sin 5x + C$$

6

iii) $\int_0^5 (3x^2 - 1)(x + 5) dx = \int_0^5 3x^3 + 15x^2 - x - 5 dx$

$$= \left[\frac{3x^4}{4} + \frac{15x^3}{3} - \frac{x^2}{2} - 5x \right]_0^5$$

$$= \left[\frac{4225}{4} \right] - [0] = \underline{\underline{1056.25}}$$

4

$$\begin{aligned}
 \text{iv } \int_0^1 (e^x + 2)(e^{2x} + 1) dx &= \int_0^1 e^{3x} + e^x + 2e^{2x} + 2 dx \\
 &= \left[\frac{e^{3x}}{3} + e^x + e^{2x} + 2x \right]_0^1 \\
 &= [16.469] - [0] = 16.46918357 \\
 &= \underline{\underline{16.47}} \text{ 2 d.p.} \quad \checkmark
 \end{aligned}$$

5

$$\text{b i. } \int x \cos 2x \, dx$$

$$u = x \quad v = \frac{1}{2} \sin 2x$$

$$u' = 1 \quad v' = \cos 2x$$

$$\therefore \frac{x \sin 2x}{2} - \int \cos 2x \, dx$$

$$= \frac{x \sin 2x}{2} - \left[\frac{1}{2} \sin 2x \right]$$

$$= \frac{x \sin 2x}{2} - \frac{1}{2} \sin 2x$$

$$= \underline{\underline{\frac{\sin 2x}{2} (x - 1)}} \quad + \checkmark$$

3

$$\text{ii } \int 2x \ln x \, dx$$

$$u = \frac{1}{x} \quad v = x^2$$

$$u' = \ln x \quad v' = 2x$$

$$\therefore x - \int x^2 \ln x$$

$$\begin{aligned}
 x - \int 2x \, dx &= x - x^2 \\
 &= \underline{\underline{-x}} \quad \times
 \end{aligned}$$

Ci) $\int \frac{21x^2 + 4x}{7x^3 + 2x^2 - 1} dx = \cancel{\ln x} (21 + 4)$

~~$7x^3 + 2x^2 + 0x - 1$~~ X

ii) $\int \frac{5}{7x+2} dx = \int 5(7x+2)^{-1} dx$

$= 5 \int (7x+2)^{-1} dx$ $u = 7x+2$
 $u' = 7$

$= 5 \int u^{-1} \frac{du}{7}$

$dx = \frac{du}{7}$

$= 5 \int \frac{1}{7u} du$

$= 5 \int 7u^{-1} du = \frac{5}{7} \left[\ln(u) \right] = \frac{5}{7} \ln(7x+2) + C$

iii

$$\int \frac{x^2}{3x^3+1} dx$$

$$u = x^2$$

$$\frac{du}{dx} = 2x \text{ or } \frac{2\sqrt{u}}{2u^{1/2}}$$

$$\therefore \int \frac{u}{3u^{3/2}+1} \frac{du}{2u^{1/2}}$$

$$\therefore \int \frac{u}{2u^{1/2}(3u^{3/2}+1)} du = \int \frac{u}{6u^3+2u^{1/2}} du$$

$$= \int \frac{u}{2} (3u^{-3} + u^{-1/2}) du$$

X

d. $\int \frac{\ln x}{x(1+\ln x)^2} dx$ $u = 1 + \ln x$ $\ln x = u - 1$
 $\frac{du}{dx} = \frac{1}{x}$
 $dx = du \cdot x$

$\therefore \int \frac{\ln x}{x(1+\ln x)^2} dx = \int \frac{u-1}{u^2} du$
 $= \int (u-1)u^{-2} du$
 $= \int u^{-1} - u^{-2} du$
 $= \ln(u) + \frac{1}{u} + C$
 $= \ln(1+\ln x) + \frac{1}{(1+\ln x)} + C$ ✓

4

e. $\int \frac{1}{2} \sin^5 x \cos x dx$ $u = \sin x$
 $\frac{du}{dx} = \cos x$
 $dx = \frac{du}{\cos x}$

$\int \frac{1}{2} u^5 du$
 $= \frac{1}{2} \int u^5 du$
 $= \frac{1}{2} \left[\frac{u^6}{6} \right] du$
 $= \frac{u^6}{12} + C = \frac{\sin^6 x}{12} + C$ ✓

3

2a. $z_1 = 2 + 3j$ $z_2 = 5 - 2j$ $z_3 = 4 + j$

i. $z_1 + z_2 = 2 + 3j + 5 - 2j$
 $= \underline{\underline{7 + j}}$

ii. $z_1 - z_3 = 2 + 3j - 4 - j$
 $= \underline{\underline{-2 + 2j}}$

iii. $\frac{z_1}{z_2} = \frac{2 + 3j}{5 - 2j}$

iv. $\overline{z_1} + \overline{z_3} = \sqrt{2^2 + 3^2} + \sqrt{4^2 + 1}$
 $= \underline{\underline{4 + \sqrt{13}}}$

v. $(z_1)^2 + z_2 + z_3 = (2 + 3j)(2 + 3j) + 5 - 2j + 4 + j$
 $= 4 + 6j + 6j + 9j^2 + 9 - j$ as $j^2 = -1$
 $= 13 + 11j - 9$
 $= \underline{\underline{4 + 11j}}$

b. $14x^2 = -3x - 9$

$$14x^2 + 3x + 9 = 0$$

$$a = 14$$

$$b = 3$$

$$c = 9$$

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

$$= \frac{-3 \pm \sqrt{9 - 4(14)(9)}}{28}$$

$$= \frac{-3 \pm \sqrt{-495}}{28}$$

$$= \frac{-3 \pm \sqrt{495} \sqrt{-1}}{28}$$

$$= \frac{-3 \pm 3\sqrt{55} j}{28}$$

continued on
next page.

c.
i.

$$r = \sqrt{6^2 + 5^2}$$

$$= \sqrt{61}$$

$$\theta = \tan^{-1}(5/6)$$

$$= 39.8$$

$$r^n (n \cos \theta + nj \sin \theta) = \sqrt{61}^5 = 5($$

$$= \sqrt{61}^5 (5 \cos 39.8 + 5j \sin 39.8)$$

$$= 29061.93(3.84 + 3.20j) \times$$

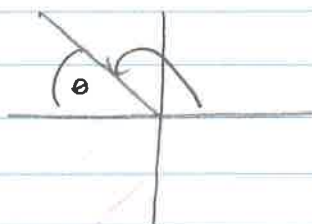
$$= 111620.85 + 93017.376j$$

2

ii

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

$$= \sqrt{13}$$



$$\theta = \tan^{-1}(3/2)$$

$$= 56.3$$

$$180 - 56.3 = \underline{123.7}$$

$$n = 7$$

$$= \sqrt{13}^7 (7 \cos(123.7) + 7j \sin(123.7))$$

$$= 7921.4 (-3.88 + 5.8j) \times$$

$$= -30735.03 + 46102.55j$$

2

d. 8

$$e. z_1 = 6+j \quad z_2 = 2-5j \quad z_3 = 1-j$$

$$z_1 z_2 z_3$$

$$(6+j)(2-5j)(1-j)$$

$$12 - 30j + 2j - 5j^2$$

$$12 - 28j + 5 = 17 - 28j$$

$$(17-28j)(1-j)$$

$$\underline{17 + 28j}$$

3

$$17 + 28j$$

$$r = \sqrt{17^2 + 28^2}$$

$$= 32.76$$

$$\theta = \tan^{-1}(28/17)$$

$$= 58.74^\circ$$

polar form $17 + 28j = \underline{\underline{32.76(\cos 58.74 + j \sin 58.74)}}$

2 b
cont.

$$r = \sqrt{\left(-\frac{3}{28}\right)^2 + \left(\frac{3\sqrt{55}}{28}\right)^2}$$

$$= \frac{3\sqrt{14}}{14}$$

$$\theta = \tan^{-1} \frac{\frac{3\sqrt{55}}{28}}{+3/28} = \tan^{-1} \frac{0.79}{-0.12}$$

$$= 81.36$$

$$180 - 81.36 = \theta = 98.64^\circ$$

$\therefore$ polar form $\underline{\underline{0.80(\cos(98.64) + j \sin(98.64))}}$

1 answer

2



12 Pages

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: Patrick

FORENAME(S): Wesley

1	Student Number	1701708
2	Title of Examination Paper	Mathematics
3	Module Code	M4X00391
4	Date and Time of Examination	10/5/19 3pm
5	Examination Venue	IQ 103
6	Seat Number	2044
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
2	31
3	4
Total	35

(Gweler yr ochr arall am y fersiwn Cymraeg)



2

$$a) \quad z_1 = 2+3j \quad z_2 = 5-2j \quad z_3 = 4+j$$

$$i) \quad z_1 + z_2$$

$$2+3j+5-2j$$

$$7+j$$

$$ii) \quad z_1 - z_3$$

$$(2+3j) - (4+j)$$

$$2+3j-4-j$$

$$-2+2j$$

$$iii) \quad \frac{z_1}{z_2}$$

$$\frac{(2+3j)}{(5-2j)} \rightarrow \frac{(2+3j)}{(5-2j)} \times \frac{(5+2j)}{(5+2j)} \rightarrow \frac{(2+3j)(5+2j)}{(5-2j)(5+2j)}$$

$$\frac{10+4j+15j+6j^2}{25+10j-10j-4j^2} \rightarrow \frac{10+19j+6j^2}{25-4j^2} \rightarrow \frac{4}{29} + \frac{19j}{29}$$

$$iv) \quad \overline{z_1} + \overline{z_3} \text{ conjugate}$$

$$2-3j+5+2j$$

$$7-j$$

$$v) \quad (z_1)^2 + z_2 + z_3$$

$$(2+3j)(2+3j) + 5-2j + 4+j$$

$$4+12j+9j^2+5-2j+4+j$$

$$4+11j$$

$$a=x \quad b=y$$

Question No.

Examiner On

2b) Express Pol Form

$$14x^2 = -3x - 9$$

$$14x^2 + 3x + 9 = 0$$

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

$$x = \frac{-3 \pm \sqrt{(-3)^2 - 4(14)(9)}}{2(14)}$$

$$x = \frac{-3 \pm \sqrt{9 - 504}}{28}$$

$$x = \frac{-3 \pm \sqrt{-495}}{28}$$

$$x = \frac{-3 \pm \sqrt{9 - 504}}{28}$$

$$x = \frac{-3 \pm 22.25j}{28}$$

$$x = \frac{-3 \pm \sqrt{9 - 504}}{28}$$

$$x = \frac{-3 + 22.25j}{28}$$

$$x = \frac{-3 - 22.25j}{28}$$

$$x = \frac{-3 \pm \sqrt{-495}}{28}$$

$$x = 0.688$$

$$x = 0.908$$

$$x = \frac{-3}{28} + \frac{22.25j}{28}$$

$$x = \frac{-3}{28} - \frac{22.25j}{28}$$

Pol Form

$$x = 0.107 + 0.795j \quad x = 0.107 - 0.795j$$

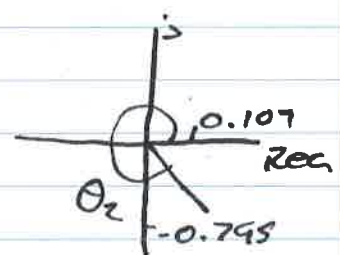
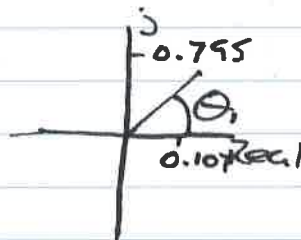
$$r = \sqrt{a^2 + b^2}$$

$$r = \sqrt{0.107^2 + 0.795^2}$$

$$r = \sqrt{0.011 + 0.632}$$

$$r = \sqrt{0.643}$$

$$r = 0.802$$



$$\theta_1 = \tan^{-1} \frac{0.795}{0.107} = 82.334^\circ$$

$$\theta_2 = 360 - 82.334 = 277.666^\circ$$

+ Pol Form $r(\cos \theta + j \sin \theta)$

$$0.802(\cos(82.334) + j \sin(82.334))$$

- Pol Form

$$0.802(\cos(277.666) + j \sin(277.666))$$

C) DMT - $r^n(\cos n\theta + j\sin\theta) \rightarrow \text{rec form}$

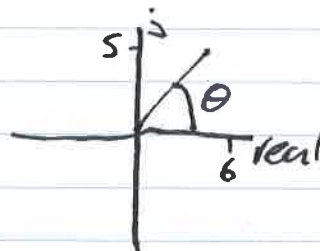
i) $(6+5j)^5$

$$r = \sqrt{6^2 + 5^2} \quad \theta = \tan^{-1} \frac{5}{6}$$

$$r = \sqrt{36 + 25} \quad \theta = 39.806^\circ$$

$$r = \sqrt{61}$$

$$r = 7.81$$



DMT

$$7.81^5 (\cos(5 \times 39.806) + j\sin(5 \times 39.806))$$

$$29057 (\cos(199.03) + j\sin(199.03))$$

$$29057 (-0.9454 - 0.326j)$$

$$-27458.865 - 9472.582j$$

6

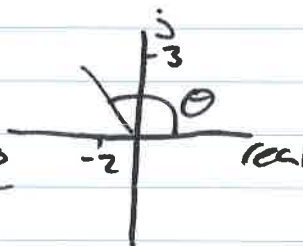
ii) $(-2+3j)^7$

$$r = \sqrt{-2^2 + 3^2} \quad \theta = \tan^{-1} \frac{3}{-2}$$

$$r = \sqrt{4 + 9} \quad \theta = 56.31^\circ$$

$$r = \sqrt{13} \quad \theta = 180 - 56.31 = 123.69^\circ$$

$$r = 3.606$$



DMT

$$3.606^7 (\cos(7 \times 123.69) + j\sin(7 \times 123.69))$$

$$7928.3 (\cos(165.83) + j\sin(165.83))$$

$$7928.3 (-0.97 + 0.245j)$$

$$-7690.451 + 1942.434j$$

2

d) $1-8j$

e) $z_1 = 6+j$ $z_2 = 2-5j$ $z_3 = 1-j$

$z_1 z_2 z_3$ in Pol form

$$(6+j)(2-5j)(1-j)$$

$$12-30j+2j-5j^2 \times (1-j)$$

$$(17-28j)(1-j)$$

$$17-17j-28j+28j^2$$

$$\underline{-11-45j}$$

$$r = \sqrt{-11^2 + 45^2}$$

$$r = \sqrt{121 + 2025}$$

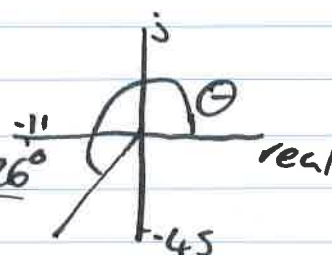
$$r = \sqrt{2146}$$

$$r = 46.32$$

$$\theta = \tan^{-1} \frac{45}{11}$$

$$\theta = 76.26$$

$$\theta = 180 + 76.26 = \underline{\underline{256.26^\circ}}$$



$$46.32 (\cos(256.26) + j \sin(256.26))$$

$$R \begin{pmatrix} C & \times & R \\ \downarrow & & \downarrow \end{pmatrix} C$$

3

iii) cannot be calculated - AC $\times$
 viii) cannot be calculated - A+D $\checkmark$

v) |A|

$$5(5 \times 2 + 1 \times 0) + 1(7 \times 2 - 1 \times 1) + 6(7 \times 0 - 5 \times 1)$$

$$\cancel{5(10) + 1(14 - 1) + 6(-5)} \quad 5(10) + 1(13) + 6(-5)$$

$$\cancel{50 + 13 + 30}$$

$$50 + 13 - 30$$

$$\boxed{33}$$

$$\boxed{33} \times$$

vi) |B|

$$3(-5 \times 1 - 4 \times 1) - 1(2 \times 1 - 4 \times -3) + 1(-2 \times 1 + 5 \times -3)$$

$$3(-5 - 4) - 1(2 + 12) + 1(-2 - 15)$$

$$3(-9) - 1(14) + 1(-17)$$

$$-27 - 14 - 17$$

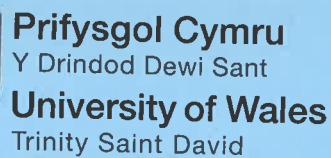
$$\boxed{-54} \checkmark$$

vii) A+B

$$\begin{pmatrix} 8 & 0 & 7 \\ 9 & 0 & -3 \\ -2 & 1 & 3 \end{pmatrix} \checkmark$$

Question No.

Examiner Only



**Complete, fold and seal
(see note 2 below)**

SURNAME: Robinson

FORENAME(S): Steffan Rhys

Examination Answer Books

12 Pages

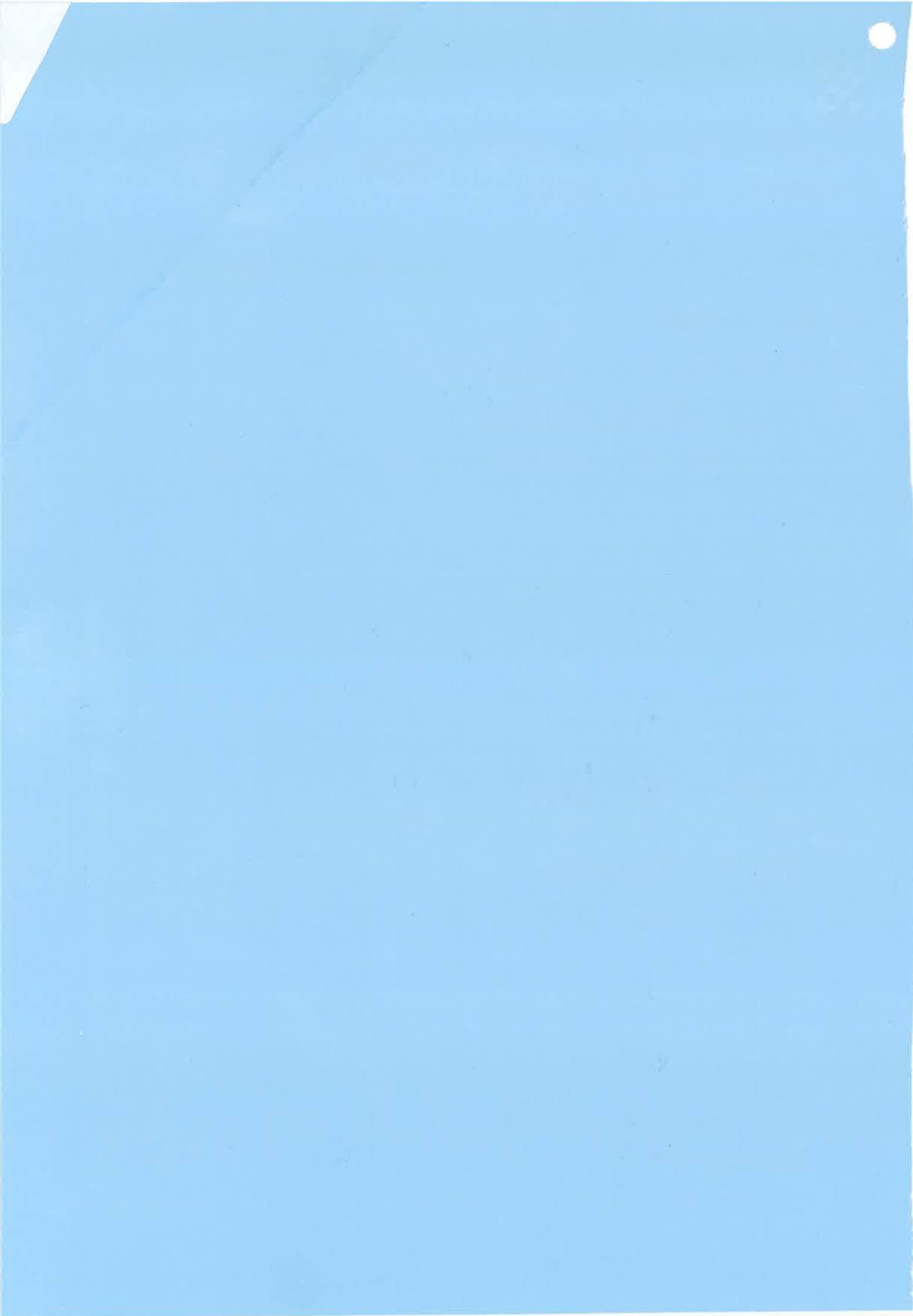
Instructions to Candidates

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.**

1	Student Number	1801468
2	Title of Examination Paper	Mathematics
3	Module Code	M4x00391
4	Date and Time of Examination	3pm 10/5/19
5	Examination Venue	1Q103
6	Seat Number	R021
7	Number of Answer Books handed in	1, 2

List the numbers of the questions you have attempted	Office Use
1	21
2	14
Total	35

(Gweler yr ochr arall am y fersiwn Cymraeg)



1) a) (i) $\int (x^2 + 2x)(x^2 - 4x) dx = \int x^5 - 4x^4 + 2x^3 - 8x$

$$= \frac{x^6}{6} - \frac{4x^5}{5} + \frac{2x^4}{4} - 8x + C$$

(ii) $\int (x^4 + 4x)^3 - 2x + 4\cos 5x dx \Rightarrow (x^4 + 4x)^3 = x$

$$\begin{aligned} (x^4 + 4x) x^8 + 4x^5 + 4x^5 + 16x^2 &= \\ x^{12} + 4x^9 + 4x^9 + 16x^6 + 4x^9 + 16x^6 + 16x^6 + 16x^3 &= \\ x^{12} + 12x^9 + 48x^6 + 16x^3 &= \end{aligned}$$

$$\int x^{12} + 12x^9 + 48x^6 + 16x^3 - 2x + 4\cos 5x dx$$

$$= \frac{x^{13}}{13} + \frac{12x^{10}}{10} + \frac{48x^7}{7} + \frac{16x^4}{4} - \frac{2x^2}{2} + \frac{4}{5}\sin 5x$$

$$= \frac{x^{13}}{13} + \frac{12x^{10}}{10} + \frac{48x^7}{7} + 4x^4 - x^2 + \frac{4}{5}\sin 5x + C$$

(iii) $\int_0^5 (3x^2 - 1)(x + 5) dx = \int_0^5 3x^3 + 15x^2 - x - 5$

$$\left[\frac{3x^4}{4} + \frac{15x^3}{3} - \frac{x^2}{2} - \frac{5x}{1} \right]_0^5 \left[\frac{3(5)^4}{4} + \frac{15(5)^3}{3} - \frac{(5)^2}{2} - \frac{5(5)}{1} \right] - 0$$

$$= 1056.25 - 0$$

$$= 1056.25$$

(iv) $\int_0^1 (e^x + 2)(e^{2x} + 1) dx = \int e^{3x} + e^x + 2e^{2x} + 2$

$$\left[\frac{1}{3}e^{3x} + e^x + \frac{2}{2}e^{2x} + 2x \right]_0^1 \left[\frac{1}{3}e^{3(1)} + e^{(1)} + e^{2(1)} + 2 \right] - 0$$

$$= 18.8025169 = 18.8$$

b)

$$(i) \int 5x \cos 2x$$

$$u = 5x \quad \frac{du}{dx} = 5$$

$$v = \cos 2x \quad \frac{dv}{dx} = -2 \sin 2x$$

$$uv - \int v \frac{du}{dx}$$

$$(5x)(\cos 2x) - \int (\cos 2x)(5)$$

$$= 5x \cos 2x - \left(\frac{1}{2} \sin 2x\right)(5x)$$

$$= 5x \cos 2x - \frac{5}{2} x \sin 2x + C$$

$$(ii) \int 2x \ln x \, dx$$

$$uv - \int v \frac{du}{dx}$$

$$u = 2x \quad du = 2$$

$$v = \ln x \quad dv = \frac{1}{x}$$

$$(2x)(\ln x) - \int \ln x (2)$$

$$(2x)(\ln x) - \frac{1}{x} (2)$$

$$2x \ln x - \frac{2}{x} = 2 \ln x - 2 + C$$

c)

$$(i) \int \frac{2x^2 + 4x}{7x^3 + 2x^2 - 1} \, dx = \ln(7x^3 + 2x^2 - 1) + C$$

$$(ii) \int \frac{5}{7x+2} \, dx = 5 \int \frac{1}{7x+2} = 5 \ln(7x+2) + C$$

$$(iii) \int \frac{x^2}{3x^3+1} \, dx = \ln(3x^3+1) + C$$

$$d) \int \frac{\ln x}{x(1+\ln x)^2} \, dx$$

$$\int \frac{\ln x}{x(u)^2} = \frac{du}{x^{-1}}$$

$$u = 1 + \ln x$$

$$\frac{du}{dx} = \frac{1}{x} (x^{-1})$$

$$du/x^{-1} = dx$$

$$e) \int \frac{1}{2} \sin^5 x \cos x \, dx \rightarrow \frac{1}{2} \int u^5 \cos x \frac{du}{\cos x}$$

$$u = \sin x$$

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

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

$$= \frac{1}{2} \int u^5 du$$

$$\frac{1}{2} \int \frac{u^6}{6} du$$

$$\frac{1}{2} \int \frac{\sin^6 x}{6} du + c$$

3

$$z_1 = 2 + 3j \quad z_2 = 5 - 2j \quad z_3 = 4 + j$$

$$j^2 = -1$$

2.

$$\begin{aligned} \text{a) } & z_1 + z_2 \\ \text{(i) } & (2 + 3j) + (5 - 2j) \\ & = \underline{7 + j} \end{aligned}$$

$$\begin{aligned} \text{(ii) } & z_1 - z_3 \\ & (2 + 3j) - (4 + j) \\ & = \underline{-2 + 2j} \end{aligned}$$

$$\begin{aligned} \text{(iii) } \frac{z_1}{z_2} &= \frac{2 + 3j}{5 - 2j} = \frac{(2 + 3j) \times (5 + 2j)}{(5 - 2j)(5 + 2j)} = \frac{10 + 4j + 15j + 6j^2}{25 + 10j - 10j - 4j^2} \dots \\ &= \frac{10 + 4j + 15j + 6j^2}{25 + 10j - 10j - 4j^2} \dots \end{aligned}$$

$$\begin{aligned} & 10 + 4j + 15j + 6j^2 + 25 + 10j - 10j - 4j^2 \\ & 35 + 19j - 2 \\ & \underline{33 + 19j} \end{aligned}$$

$$\text{(iv) } \bar{z}_1 + \bar{z}_3$$

$$\begin{aligned} & (2 - 3j) + (4 - j) \\ & = \underline{6 - 4j} \end{aligned}$$

$$\begin{aligned} \text{(v) } & (z_1)^2 + z_2 + z_3 \\ & z_1 z_1 + z_2 + z_3 \end{aligned}$$

$$\begin{aligned} & (2 + 3j)(2 + 3j) \\ & 4 + 6j + 6j + 9j^2 \\ & 4 + 12j - 9 \end{aligned}$$

$$(z_1)^2 = -5 + 12j$$

$$\begin{aligned} (z_1)^2 + z_2 + z_3 &= (-5 + 12j) + (5 - 2j) + (4 + j) \\ &= \underline{4 + 11j} \end{aligned}$$

$$\begin{aligned} \text{b) } & 14x^2 = -3x - 9 \\ & 14x^2 + 3x + 9 = 0 \end{aligned}$$

$$\begin{array}{r} 11/5 \\ 126/3 \\ 1126 \\ 262 \\ 9 \times 4 \end{array}$$

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

$$\frac{-3 \pm \sqrt{3^2 - 4(14)(9)}}{2(14)}$$

$$\begin{aligned} + &= \\ - &= \end{aligned}$$

$$z_1 = 6+j \quad z_2 = 2-5j \quad z_3 = 1-j$$

e) $z_1 z_2 z_3$

$$(6+j)(2-5j)(1-j) =$$

$$(12 - 30j + 2j - 5j^2)(1-j) =$$

$$12 - 12j - 30j + 30j^2 + 2j - 2j^2 + 5j^2 - 5j$$

$$17 - 45j + 30j^2 - 2j^2$$

$$-30 - 2(-1)$$

$$-30 + 2$$

$$= -28$$

$$\underline{-11 - 45j}$$



3

Question No.

Examiner On