



Complete, fold and seal
(see note 2 below)

SURNAME: TCVRR

FORENAME(S): SCOTT ALGRAN

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	TCV19852707
2	Title of Examination Paper	maths (test 2)
3	Module Code	U6TSD
4	Date and Time of Examination	15/05/23 9.38
5	Examination Venue	Tycoch 068860
6	Seat Number	B1
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1	
a	17
b	7
c	4
Q2	
a	16
b	8
c	7
Q3	
a	17
b	0
c	4
Total	80/100

80%
80%
M.L.

Question one

a)

$$i) \frac{1}{2} Z_1 + Z_2 \\ (2+4j) + (5+3j) = \underline{7+7j} \quad \checkmark \quad 1$$

$$ii) \quad \begin{array}{c} 3Z_1 + 2Z_3 \\ \swarrow \quad \searrow \\ 3(2+4j) \quad 2(3+2j) \\ 6+12j \quad 6+4j \end{array} = \underline{12+16j} \quad \checkmark \quad 2$$

$$iii) \quad \begin{array}{c} Z_1 Z_2 \\ (2+4j)(5+3j) \\ 10+20j+6j+12j^2 \\ 10+20j+6j-12 \\ -2+26j \end{array} \quad \begin{array}{c} j^2 = -1 \\ 12j^2 = -12 \end{array} \quad \checkmark \quad 3$$

$$iv) \quad \begin{array}{c} Z_1 + Z_3^2 \\ \downarrow \quad \searrow \\ (2+4j) + (3+2j)(3+2j) \\ 9+6j+6j+4j^2 \\ 9+6j+6j-4 \end{array} \quad \begin{array}{c} j^2 = -1 \\ 4j^2 = -4 \end{array} \quad \checkmark \quad 3$$

$$(2+4j) + (9+12j) = \underline{11+16j} \quad \checkmark$$

$$v) \quad Z_1 Z_2 Z_3$$

$$\begin{array}{c} Z_1 Z_2 \\ (2+4j)(5+3j) \\ 10+20j+6j+12j^2 \\ 10+20j+6j-12 \\ -2+26j \end{array} \quad \begin{array}{c} j^2 = -1 \\ 12j^2 = -12 \end{array} \quad \checkmark \quad 3$$

$$\begin{array}{c} Z_3 \\ (-2+26j)(3+2j) = \\ -6+78j-6j-52 \\ -58+72j \end{array} \quad \checkmark$$

Q1a

17/18

a)

$$V_i \frac{Z_1}{Z_2}$$

$$\frac{2+4j}{5+3j} \times \frac{9-3j}{5-3j} = \frac{10-6j+20j-12j^2}{25+15j-15j-9j^2} \quad j^2 = -1$$

$$\frac{10-6j+20j+12}{25+15j-15j+9}$$

$$\frac{22+14j}{34} = \frac{22}{34} + \frac{14j}{34}$$

b) $(4+5j)^3$

$$r = \sqrt{4^2+5^2} = 6.4$$

$$\theta = \tan^{-1}\left(\frac{5}{4}\right) = 51.3$$

$$n = 3$$

$$r^n (\cos n\theta + j \sin n\theta)$$

$$6.4^3 (\cos 3(51.3) + j \sin 3(51.3))$$

$$-23.5 + 11.5j$$

c)

$$\frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(26)}}{2(2)} \quad \text{Error}$$

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

$$(-8)^2 - 4(2)(26) = -272$$

$$j^2 = -1$$

$$\sqrt{272} = 16.5$$

$$\sqrt{272} = 16.5j$$

error carried forward

$$\frac{-8 \pm 16.5j}{4} = \frac{-8}{4} \pm \frac{16.5j}{4}$$

$$r = \sqrt{\frac{64}{16} + \frac{16.5^2}{16}} = 4.6$$

$$\theta = \tan^{-1}\left(\frac{4.1}{2}\right) \approx 2$$

$$4.6 < 2$$

Question Two

a)

i)

$$\begin{array}{ccc|ccc}
 3 & 2 & 3 & 3 & 2 & \\
 1 & 0 & 2 & 1 & 0 & \\
 3 & 5 & 4 & 3 & 5 &
 \end{array}$$

$0 + 30 + 8 = 38$
 $0 + 12 + 15 = 27$

$$D = 27 - 38 = -11$$

Q2a16/16ii) not possible to find the determinant ✓ 4

$$\text{iii) } \begin{bmatrix} 4 & 5 \\ 1 & 5 \end{bmatrix} \quad D = (4 \times 5) - (1 \times 5) = 15$$

~~(428)~~

iv)

$$3 \times \boxed{3} \quad 3 \times 3$$

↑
can be done

$$\begin{bmatrix} 3 & 2 & 3 \\ 1 & 0 & 2 \\ 3 & 5 & 4 \end{bmatrix} \times \begin{bmatrix} 1 & 2 & 2 \\ 3 & 0 & 5 \\ 1 & 1 & 3 \end{bmatrix} = \text{~~3x3=2x3~~}$$

$$\begin{bmatrix}
 3 \times 1 + 2 \times 3 + 3 \times 1 & 3 \times 2 + 2 \times 0 + 3 \times 1 & 3 \times 2 + 2 \times 5 + 3 \times 3 \\
 1 \times 1 + 0 \times 3 + 2 \times 1 & 1 \times 2 + 0 \times 0 + 2 \times 1 & 1 \times 2 + 0 \times 5 + 2 \times 3 \\
 3 \times 1 + 5 \times 3 + 4 \times 1 & 3 \times 2 + 5 \times 0 + 4 \times 1 & 3 \times 2 + 5 \times 5 + 4 \times 3
 \end{bmatrix}$$

$$AD = \begin{bmatrix} 12 & 9 & 25 \\ 3 & 4 & 8 \\ 22 & 10 & 43 \end{bmatrix}$$

4

Question Two

a)

v) 3×3 3×2
can be done

$$\begin{bmatrix} 3 & 2 & 3 \\ 1 & 0 & 2 \\ 3 & 5 & 4 \end{bmatrix} \times \begin{bmatrix} 4 & 5 \\ 2 & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 \times 4 + 2 \times 2 + 3 \times 0 & 3 \times 5 + 2 \times -2 + 3 \times 1 \\ 1 \times 4 + 0 \times 2 + 2 \times 0 & 1 \times 5 + 0 \times -2 + 2 \times 1 \\ 3 \times 4 + 5 \times 2 + 4 \times 0 & 3 \times 5 + 5 \times -2 + 4 \times 1 \end{bmatrix}$$

AC =

$$\begin{bmatrix} 16 & 14 \\ 4 & 7 \\ 22 & 9 \end{bmatrix}$$

vi) 2×2 3×2

can not be done

$$\text{vii) } \begin{bmatrix} 3 & 2 & 3 \\ 1 & 0 & 2 \\ 3 & 5 & 4 \end{bmatrix} + \begin{bmatrix} 1 & 2 & 2 \\ 3 & 0 & 5 \\ 1 & 1 & 3 \end{bmatrix} = \begin{bmatrix} 3+1 & 2+2 & 2+3 \\ 1+3 & 0+0 & 2+5 \\ 3+1 & 5+1 & 4+3 \end{bmatrix}$$

A + B =

$$\begin{bmatrix} 4 & 4 & 5 \\ 4 & 0 & 7 \\ 4 & 6 & 7 \end{bmatrix}$$

b)
$$\begin{bmatrix} 3 & 2 & 4 \\ 2 & 3 & 3 \\ 5 & 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -5 \\ 2 \\ 3 \end{bmatrix}$$

Q2b8/8

$$D = \begin{array}{ccc|cc} 3 & 2 & 4 & 3 & 2 \\ 2 & 3 & 3 & 2 & 3 \\ 5 & 2 & 5 & 5 & 2 \end{array}$$

$60 + 18 + 20 = 98$ ✓

$91 - 98 = -7$ ✓

$$45 + 30 + 16 = 91$$

$$D_x = \begin{array}{ccc|cc} -5 & 2 & 4 & 3 & 2 \\ 2 & 3 & 3 & 2 & 3 \\ 3 & 2 & 5 & 5 & 2 \end{array}$$

$76 + 30 + 20 = 126$ ✓

$-41 - 126 = -167$ ✓

$-75 + 18 + 16 = -41$ ✓

$$D_y = \begin{array}{ccc|cc} 3 & -5 & 4 & 3 & -5 \\ 2 & 2 & 3 & 2 & 2 \\ 5 & 3 & 5 & 5 & 3 \end{array}$$

$40 + 27 - 50 = 17$ ✓

$-21 - 17 = -38$ ✓

$30 - 75 + 24 = -21$ ✓

$$-75 + 12 + 12 = -51$$

$$D_z = \begin{array}{ccc|cc} 3 & 2 & -5 & 3 & 2 \\ 2 & 3 & 2 & 2 & 3 \\ 5 & 2 & 3 & 5 & 2 \end{array}$$

$27 - -51 = 78$ ✓

$27 + 20 - 20 = 27$ ✓

$$x = \frac{D_x}{D} = \frac{-67}{-7} = 9.6 \text{ ✓}$$

$$y = \frac{D_y}{D} = \frac{-38}{-7} = 5.4 \text{ ✓}$$

$$z = \frac{D_z}{D} = \frac{78}{-7} = -11.1 \text{ ✓}$$

c)

Q2c

7/10

$$m_{11} = (1 \times 3) - (4 \times 3) = -9 \quad \checkmark$$

$$m_{12} = (4 \times 3) - (2 \times 3) = 6 \quad \checkmark$$

$$m_{13} = (4 \times 4) - (2 \times 1) = 14 \quad \checkmark$$

$$m_{21} = (3 \times 3) - (4 \times 0) = 9 \quad \checkmark$$

$$m_{22} = (2 \times 3) - (2 \times 0) = 6 \quad \checkmark$$

$$m_{23} = (2 \times 4) - (2 \times 4) = 2 \quad \checkmark$$

$$m_{31} = (3 \times 3) - (1 \times 0) = 9 \quad \checkmark$$

$$m_{32} = (2 \times 3) - (4 \times 0) = 6 \quad \checkmark$$

$$m_{33} = (2 \times 1) - (4 \times 3) = -10 \quad \checkmark \quad b_{11}$$

$$\begin{bmatrix} -9 & 6 & 14 \\ 9 & 6 & 2 \\ 9 & 6 & -10 \end{bmatrix} \times \begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix} = \begin{bmatrix} -9 & -6 & 14 \\ -9 & 6 & -2 \\ 9 & -6 & -10 \end{bmatrix}$$

$$\text{adj } A = \begin{bmatrix} -9 & -9 & 9 \\ -6 & 6 & -6 \\ 14 & -2 & -10 \end{bmatrix} \quad \checkmark$$

$$A^{-1} = ?$$

$$|A| = ?$$

Question Three

Examiner Only

Q39

17/18

9) i) $\int (2x^4 + 0 - 3x^2 + 5x) dx =$

$$\frac{2x^{4+1}}{4+1} + \frac{x^{0+1}}{0+1} - \frac{3x^{2+1}}{2+1} + \frac{5x^{1+1}}{1+1} + C =$$

$$\frac{2x^5}{5} + \frac{x^1}{1} - \frac{3x^3}{3} + \frac{5x^2}{2} + C =$$

$$\frac{2}{5}x^5 + \frac{1}{1}x^1 - x^3 + \frac{5}{2}x^2 + C$$

ii) $\int (\sin 3x + \cos 5x) dx =$

$$-\frac{1}{3} \cos 3x + \frac{1}{5} \sin 5x + C$$

iii) $\int (1 + 3t) t^2 dt =$

$$\int 1t^2 + 3t^3 dt =$$

$$\frac{1t^{2+1}}{2+1} + \frac{3t^{3+1}}{3+1} + C = \frac{1}{3}t^3 + \frac{3}{4}t^4 + C$$

iv) $\int (2e^x + \frac{1}{x} + \ln 2) dx$

$$2e^x + \ln x + \ln 2 + C$$

v) $\int_0^2 (5x^3 + 2x^2 + 5x - 6) dx$

$$\left[\frac{5x^4}{4} + \frac{2x^3}{3} + \frac{5x^2}{2} - 6x \right]_0^2$$

$$\left[\frac{5(2)^4}{4} + \frac{2(2)^3}{3} + \frac{5(2)^2}{2} - 6(2) \right] - \left[\frac{5(0)^4}{4} + \frac{2(0)^3}{3} + \frac{5(0)^2}{2} - 6(0) \right]$$

$$23.7 - 0 = 23.7$$

Question Three

a)

$$\text{vi. } \int_1^3 (se^{2x} + 2x^2) dx$$

$$\left[\frac{1}{2} se^{2x} + \frac{2x^3}{3} \right]_1^3 \quad \checkmark \quad \underline{\underline{4}}$$

$$\left[2.5e^{2 \times 3} + \frac{2(3)^3}{3} \right] - \left[2.5e^{2 \times 1} + \frac{2(1)^3}{3} \right]$$

~~1026.6~~

1026.6

-

19.1

= 1007.5

✓

b)

f

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

Q3b0/6

$$c) \int 5x \sin x \, dx$$

$$5x \times 5 - \int -\cos x \times 5 \, dx$$

$$5x \times 5 + \sin x \times 5x$$

$$u = 5x \quad \checkmark$$

$$\frac{du}{dx} = \sin x \quad \checkmark \quad \underline{\underline{2}}$$

$$v = -\cos x \quad \checkmark$$

$$\frac{du}{dx} = 5 \quad \checkmark \quad \underline{\underline{2}}$$

Q3c4/8