



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	1708442/1
2	Title of Examination Paper	Mathematics Test 2
3	Module Code	GOAC4006
4	Date and Time of Examination	11/5/18 2pm
5	Examination Venue	Main Hall Gower College
6	Seat Number	13
7	Number of Answer Books handed in	1

Complete, fold and seal
(see note 2 below)

SURNAME:

Hughes

FORENAME(S):

Iwan, Paul

List the numbers of the questions you have attempted	Office Use
Q1	
a	20
b	4
c	0
d	7
Q3	
a	8
b	6
c	8
d	1
e	1
f	5
Total	60/80

Test 2

75%

Q1.

a i

$$AB \quad A = \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix} \quad B = \begin{pmatrix} 2 & 1 & 4 \\ 8 & 7 & 3 \\ -5 & 0 & 1 \end{pmatrix}$$

$$6 + -16 + 15 = 5$$

$$3 - 14 + 0 =$$

$$12 + -6 + 3$$

$$10 + 32 - 5$$

$$5 + 28 + 0$$

$$20 + 12 + 1$$

$$4 + 24 - 20$$

$$2 + 21 + 0$$

$$8 + 69 + 4$$

$$\begin{pmatrix} 5 & -11 & 3 \\ 37 & 33 & 33 \\ 8 & 23 & 21 \end{pmatrix} = AB.$$

(5)

10

✓

a ii

$$B \begin{pmatrix} 2 & 1 & 4 \\ 8 & 7 & 3 \\ -5 & 0 & 1 \end{pmatrix} A \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix}$$

$$6 + 5 + 8$$

$$-4 + 4 + 12$$

$$-6 + 1 + 16$$

$$24 + 35 + 6$$

$$-16 + 28 + 9$$

$$-24 + 7 + 12$$

$$-15 + 0 + 12$$

$$10 + 0 + 3$$

$$15 + 0 + 4$$

$$\begin{pmatrix} 19 & 12 & 11 \\ 65 & 21 & -5 \\ -13 & 13 & 19 \end{pmatrix} = BA.$$

✓

(5)

a. iii

AC

$$A = \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix} \quad C = \begin{pmatrix} 1 & 2 \\ 4 & 2 \\ 1 & 3 \end{pmatrix}$$

$$3 \cdot 8 - 3$$

$$6 \cdot 4 - 9$$

$$5 + 16 + 1$$

$$10 + 8 + 3$$

$$2 + 12 + 4$$

$$4 + 6 + 12$$

$$\begin{pmatrix} -8 & -7 \\ 22 & 21 \\ 18 & 22 \end{pmatrix} = AC$$

6

✓

a. iv

$$C = \begin{pmatrix} 1 & 2 \\ 4 & 2 \\ 1 & 3 \end{pmatrix} \quad A = \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix}$$

~~NOT~~ \$ CA = \text{NOT POSSIBLE}

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a. v

|A|

$$A = \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix} \quad \begin{matrix} -24 + 9 - 40 = -55 \\ 48 - 4 - 45 = -1 \\ -1 - (-55) = 54 \end{matrix}$$

$$|A| = 54.$$

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vi. $|B|$

$$B = \begin{pmatrix} 2 & 1 & 4 & 2 & 1 \\ 8 & 7 & 3 & 8 & 7 \\ -5 & 0 & 1 & -5 & 0 \end{pmatrix}$$

$$-140 + 0 + 8 = -132$$

$$14 + -15 + 0 = -1$$

$$-1 - -132 = 131.$$

$$|B| = 131.$$

vii. $A + B$

$$A + B = \begin{pmatrix} 5 & -1 & 1 \\ 13 & 11 & 4 \\ -3 & 3 & 5 \end{pmatrix}$$

viii. $C + D = \text{NOT POSSIBLE.}$

b.
$$\begin{cases} 4(3x + 2y = 10) \\ 3(4x + 3y = 13) \end{cases} \Rightarrow \begin{cases} 12x + 8y = 40 \\ 12x + 9y = 39 \end{cases}$$

$$3x + (2x - 1) = 10$$

$$3x + -2 = 10$$

$$3x = 10 + 2$$

$$3x = 12$$

$$x = \frac{12}{3}$$

$$x = 4.$$

$$\begin{array}{r} 8y = 40 \\ - \quad 9y = 39 \\ \hline \end{array}$$

$$-1y = 1$$

$$y = \frac{1}{-1}$$

$$y = -1.$$



C.

0

✓

d.

$$\begin{aligned} 3x + 2y - z &= 17 \\ 2x - y + 4z &= -5 \\ 5x - y - z &= 6 \end{aligned}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 17 \\ -5 \\ 6 \end{bmatrix}$$

$$A = \begin{pmatrix} 3 & 2 & -1 \\ 2 & -1 & 4 \\ 5 & -1 & -1 \end{pmatrix}$$

$$D = \begin{pmatrix} 3 & 2 & -1 & 3 & 2 \\ 2 & -1 & 4 & 2 & -1 \\ 5 & -1 & -1 & 5 & -1 \end{pmatrix}$$

$5 - 12 - 4 = -11$

$$3 + 40 + 2 = 45$$

$$45 - -11 = 56$$

$$D = 56.$$

$$D_1 = \begin{pmatrix} 17 & 2 & -1 & 17 & 2 \\ -5 & -1 & 4 & -5 & -1 \\ 6 & -1 & -1 & 6 & -1 \end{pmatrix}$$

$6 - 68 + 10 = -52$

$$17 + 48 - 5 = 60$$

$$60 - -52 = 112$$

$$D_1 = 112.$$

$$D_2 = \begin{pmatrix} 3 & 17 & -1 & 3 & 17 \\ 2 & -5 & 4 & 2 & -5 \\ 5 & 6 & -1 & 5 & 6 \end{pmatrix}$$

$25 + 72 - 34 = 63$

$$15 + 340 - 12 = 343$$

$$343 - 63 = 280$$

$$D_2 = 280$$

d. Continued →

3
2

$$-85 + 15 + 24 = -46.$$

B D3.

$$\begin{pmatrix} 3 & 2 & 17 \\ 2 & -1 & -5 \\ 5 & -1 & 6 \end{pmatrix} \begin{pmatrix} 3 & 2 \\ 2 & -1 \\ 5 & -1 \end{pmatrix}$$

$$-18 - 50 - 34 = -102$$

$$-102 - (-46) = -56 \quad \textcircled{1}$$

$$D3 = -56.$$

$$x = \frac{D_1}{D} = \frac{112}{56} = 2. \quad \checkmark \quad \textcircled{1}$$

$$y = \frac{D_2}{D} = \frac{280}{56} = 5 \quad \checkmark \quad \textcircled{1}$$

$$z = \frac{D_3}{D} = \frac{-56}{56} = -1. \quad \checkmark \quad \textcircled{1}$$

4
✓

Q3.

Q3

a. $z_1 = 5 + 3j$ $z_2 = 2 - 7j$

i. $z_1 + z_2$

$$(5 + 3j) + (2 - 7j) \checkmark$$

$$7 - 4j$$

$$z_1 + z_2 = 7 - 4j \checkmark \textcircled{1}$$

~~Rectangular form~~ $= 7 - 4j$

ii. $z_1 - z_2$

$$(5 + 3j) - (2 - 7j)$$

$$3 + 10j$$

$$z_1 - z_2 = 3 + 10j \checkmark \textcircled{1}$$

~~Rectangular form~~ $= 3 + 10j$

iii. $\frac{z_1}{z_2}$

$$\frac{5 + 3j}{2 - 7j} \times \frac{2 + 7j}{2 + 7j} \checkmark \textcircled{1}$$

$$\frac{(5 + 3j)(2 + 7j)}{(2 - 7j)(2 + 7j)} = \frac{10 + 35j + 6j + 21j^2}{4 + 14j - 14j - 49j^2}$$

continued. $\rightarrow$

$$\frac{-11 + 41j}{53} \checkmark$$

$$\frac{z_1}{z_2} = \frac{-11}{53} + \frac{41}{53}j \checkmark \textcircled{1}$$

iv. $(z_1)^2 \times (z_2)$.

$$(z_1)^2$$

$$(5+3j)(5+3j)$$

$$25 + 15j + 15j + 9j^2 = 16 + 30j \checkmark \textcircled{1}$$

$$(16+30j)(2-7j)$$

$$32 - 112j + 60j - 210j^2 = 242 - 52j \checkmark \textcircled{1}$$

$$(z_1)^2 \times (z_2) = 242 - 52j \checkmark \textcircled{1}$$

b. $12x^2 + 7 = -5x$

$$12x^2 + 5x + 7 = 0$$

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

$$x = \frac{-12 \pm \sqrt{5^2 - 4(12 \times 7)}}{2 \times 12} = \frac{-12 \pm \sqrt{25 - 336}}{24}$$

error carried forward

$$\frac{-12 \pm \sqrt{311} \sqrt{-1}}{24} \quad \textcircled{1}$$

$$\frac{-12 \pm 17.6}{24} \quad \textcircled{1}$$

$$-0.5 \pm 0.73j \quad \checkmark \quad \textcircled{1}$$

$$-0.5 + 0.73j \quad \checkmark \quad \textcircled{1}$$

$$-0.5 - 0.73j \quad \textcircled{1}$$

Answer in Polar Form: for $-0.5 + 0.73j$:

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

$$r = \sqrt{(-0.5)^2 + 0.73^2}$$

$$r = 0.88 \quad \checkmark \quad \textcircled{1}$$

$$\theta = \tan^{-1} \frac{b}{a} = \tan^{-1} \frac{0.73}{-0.5} = -55.6^\circ$$

$$-0.5 + 0.73j = 0.88 \angle -55.6^\circ$$

b. continued →

6
✓

Answer in Polar Form for $-0.5 - 0.73j$.

$$r = \sqrt{(-0.5)^2 + (-0.73)^2} = 0.88.$$

$$\theta = \tan^{-1} \frac{-0.73}{-0.5} = 55.6^\circ$$

①
error carried
forward

$$-0.5 - 0.73j = 0.88 \angle 55.6^\circ$$

C.

i. $(5 + 7j)^6$

$$r = \sqrt{5^2 + 7^2} = 8.6 \checkmark \textcircled{1}$$

$$\theta = \tan^{-1} \frac{7}{5} = 54.5^\circ \checkmark \textcircled{1}$$

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

$$(8.6)^6 (\cos 6 \times 54.5 + j \sin 6 \times 54.5) \checkmark \textcircled{1}$$

$$404567 (0.84 + -0.54j) \checkmark$$

$$339836.3 - 218466.2j \checkmark$$

①

①

8
✓

ii. $(-1 + 3j)^5$

$$r = \sqrt{(-1)^2 + 3^2} = 3.16 \checkmark \textcircled{1}$$

$$\theta = \tan^{-1} \frac{3}{-1} = \cancel{-71.57} \textcircled{-71.57}$$

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

$$(3.16)^5 (\cos 5 \times \textcircled{-71.57} + j \sin 5 \times \textcircled{-71.57}).$$

$$315.1 (0.999 + 0.038j) \checkmark$$

$$\textcircled{314.78} + \textcircled{11.97j} \checkmark$$

d. 'Castastion' $\checkmark \textcircled{1}$

e. $5 - 3j = 5 + 3j \checkmark \textcircled{1}$

$\frac{1}{\checkmark}$

$\frac{1}{\checkmark}$

f. $z_1 z_2 z_3$

$$z_1 = 2+3j, \quad z_2 = 3-6j, \quad z_3 = -1+j$$

$$z_1 z_2 = (2+3j)(3-6j) = 6 - 12j + 9j - 18j^2$$

$$= 24 - 3j$$

$$z_1 z_2 z_3 = (24-3j)(-1+j) = -24 + 24j + 3j - 3j^2$$

$$= -21 + 27j$$

Exp $-21 + 27j$ in Polar form:

$$r = \sqrt{a^2 + b^2} = \sqrt{(-21)^2 + 27^2} = 34.2$$

$$r = 34.2$$

$$\theta = \tan^{-1} \frac{b}{a} = \tan^{-1} \frac{27}{-21} = -52.1^\circ$$

$$\theta = -52.1^\circ$$

$$z_1 z_2 z_3 \text{ in Polar Form} = 34.2 \angle -52.1^\circ$$