



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)

SURNAME: SPRATT

FORENAME(S): JONATHAN
JAMES

1	Student Number	~~SPRATT JONATHAN~~ 1707685/1
2	Title of Examination Paper	MATHEMATICS TEST 2
3	Module Code	GOAC 4006
4	Date and Time of Examination	11/05/18 14.00
5	Examination Venue	MAIN HALL GOWER COLLEGE
6	Seat Number	14
7	Number of Answer Books handed in	2

List the numbers of the questions you have attempted	Office Use
Q1	
a	20
b	4
c	3
d	7
Q3	
a	7
b	9
c	10
d	1
e	1
f	7
Total	69/80

Test 2

86%

(3)

a)

i) $z_1 + z_2$

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

$$7 - 4j \quad \times$$

ii) $z_1 - z_2$

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

$$3 - 4j \quad \checkmark \quad \textcircled{1}$$

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

$$\frac{(5+3j)(2+7j)}{(2-7j)(2+7j)} \quad \checkmark \quad \textcircled{1}$$

$$\frac{10 + 35j + 6j + 21j^2}{4 + 14j - 14j - 49j^2} \quad \checkmark \quad \textcircled{1}$$

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

$$\frac{-11}{53} + \frac{41}{53}j \quad \checkmark \quad \textcircled{1}$$

$$-0.2 + 0.77j$$

Q37✓

(3)

a) iv)

$$z_1^2 \times z_2$$

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

$$(25 + 15j + 15j + 9j^2)(2-7j) \quad \checkmark \textcircled{1}$$

$$(16 + 30j)(2-7j) \quad \checkmark \textcircled{1}$$

$$32 - 112j + 60j - 210j^2$$

$$242 - 52j \quad \checkmark \textcircled{1}$$

b)

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

$$\begin{matrix} a & b & c \\ 12x^2 + 5x + 7 = 0 \end{matrix}$$

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

$$x = \frac{-5 \pm \sqrt{5^2 - 4(12)(7)}}{2 \times 12} \quad \checkmark \textcircled{1}$$

$$x = \frac{-5 \pm \sqrt{25 - 336}}{24} \quad \checkmark \textcircled{1}$$

$$x = \frac{-5}{24} \pm \frac{17.64j}{24} \quad \checkmark \textcircled{1}$$

$$x = -0.2 + 0.7j \quad \checkmark \textcircled{1}$$

or

$$x = -0.2 - 0.7j \quad \checkmark \textcircled{1}$$

3)

b)

$$\begin{array}{cc} x & y \\ a & b \\ -0.2 & + 0.7j \end{array}$$

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

$$r = \sqrt{0.04 + 0.49}$$

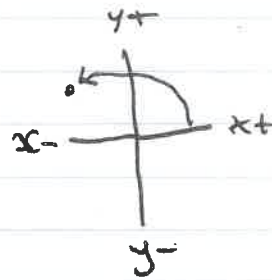
$$r = \sqrt{0.53}$$

$$r = 0.73 \quad \checkmark \textcircled{1}$$

$$\theta = \tan^{-1} \frac{b}{a}$$

$$\theta = \tan^{-1} \frac{0.7j}{-0.2}$$

$$\theta = -74.05.$$



$$180 - 74.05 = 105.95 \quad \checkmark \textcircled{1}$$

$$0.73 \angle 105.95^\circ \quad \checkmark \textcircled{1}$$

$$\begin{array}{cc} a & b \\ -0.2 & - 0.7j \end{array}$$

$$r = \sqrt{(-0.2)^2 + (-0.7)^2}$$

$$r = \sqrt{0.04 + 0.49}$$

$$r = 0.73 \quad \checkmark \textcircled{1}$$

$$\theta = \tan^{-1} \frac{-0.7}{-0.2}$$

$$\theta = 74.05.$$

$$0.73 \angle 74.05^\circ$$

(3)

$$b) -0.2 + 0.7j = 0.73 \angle 105.95^\circ$$

$$\text{or} \\ -0.2 - 0.7j = 0.73 \angle 74.05^\circ$$

c)

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

$$r = \sqrt{(5)^2 + (7)^2}$$

$$r = \sqrt{74}$$

$$r = 8.6$$

$$\theta = \tan^{-1} \frac{7}{5}$$

$$\theta = 54.46^\circ$$

$$= 8.6 \angle 54.46^\circ = r^n (\cos n\theta + j \sin n\theta)$$

$$= 8.6^6 (\cos 6 \times 54.46^\circ + j \sin 6 \times 54.46^\circ)$$

$$= 404567.2 (0.836 + (-0.548)j)$$

$$= 338218.18 - 221702.82j$$

10
✓

3

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

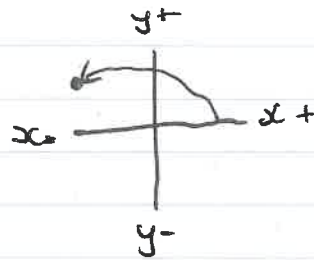
$$r = \sqrt{(-1)^2 + (3)^2}$$

$$r = \sqrt{10} \quad \checkmark$$

$$r = 3.16 \quad \checkmark \textcircled{1}$$

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

$$\theta = -71.56.$$



$$180 - 71.56 = 108.44. \quad \checkmark \textcircled{1}$$

$$3.16 \angle 108.44^\circ$$

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

$$3.16^5 (\cos 5 \times 108.44 + j \sin 5 \times 108.44) \quad \checkmark \textcircled{1}$$

$$315.09 (-0.99 + (-0.03j)) \quad \checkmark$$

$$-311.93 - 9.45j$$

 $\checkmark \textcircled{1}$
 $\checkmark \textcircled{1}$

d) "rectangular form" also known as cartesian form. $\checkmark \textcircled{1}$

 $\checkmark$

③ e) $5-3j$ conjugate = $5+3j$ ✓ ①

f) $z_1 = 2+3j$ $z_2 = 3-6j$ $z_3 = -1+j$

$$(2+3j)(3-6j) \times (-1+j)$$

$$(6-12j+9j-18j^2)(-1+j) \cdot \checkmark \text{ ①}$$

$$(24-3j)(-1+j) \checkmark \text{ ①}$$

$$-24+24j+3j-3j^2 \checkmark$$

$$\overset{a}{-21} + \overset{b}{27}j \checkmark \text{ ①}$$

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

$$r = \sqrt{441 + 729}$$

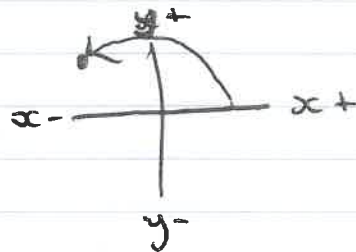
$$r = 34.2 \checkmark \text{ ①}$$

$$\theta = \tan^{-1} \frac{27}{-21}$$

$$\theta = -52.1$$

$$180 - 52.1 = 127.9^\circ \checkmark \text{ ①}$$

$$-21+27j = 34.2 \angle 127.9^\circ$$



1

a) AB .

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

$$3 \times 2 + -2 \times 8 + -3 \times -5 = 5$$

$$3 \times 1 + -2 \times 7 + -3 \times 0 = -11$$

$$3 \times 4 + -2 \times 3 + -3 \times 1 = 3$$

$$5 \times 2 + 4 \times 8 + 1 \times -5 = 37$$

$$5 \times 1 + 4 \times 7 + 1 \times 0 = 33$$

$$5 \times 4 + 4 \times 3 + 1 \times 1 = 33$$

$$2 \times 2 + 3 \times 8 + 4 \times -5 = 8$$

$$2 \times 1 + 3 \times 7 + 4 \times 0 = 23$$

$$2 \times 4 + 3 \times 3 + 4 \times 1 = 21$$

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

5

5

✓

✓

✓

✓

✓

✓

✓

✓

①

a)

$$\text{ii) } \begin{pmatrix} 2 & 1 & 4 \\ 8 & 7 & 3 \\ -5 & 0 & 1 \end{pmatrix} \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix}$$

$$2 \times 3 + 1 \times 5 + 4 \times 2 = 19 \quad \checkmark$$

$$2 \times -2 + 1 \times 4 + 4 \times 3 = 12 \quad \checkmark$$

$$2 \times -3 + 1 \times 1 + 4 \times 4 = 11 \quad \checkmark$$

$$8 \times 3 + 7 \times 5 + 3 \times 2 = 65 \quad \checkmark$$

$$8 \times -2 + 7 \times 4 + 3 \times 3 = 21 \quad \checkmark$$

$$8 \times -3 + 7 \times 1 + 3 \times 4 = -5 \quad \checkmark$$

$$-5 \times 3 + 0 \times 5 + 1 \times 2 = -13 \quad \checkmark$$

$$-5 \times -2 + 0 \times 4 + 1 \times 3 = 13 \quad \checkmark$$

$$-5 \times -3 + 0 \times 1 + 1 \times 4 = 19 \quad \checkmark$$

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

⑤

5
✓

iii) AC

$$1) a) \begin{pmatrix} 3 & -2 & -3 \\ 5 & 4 & 1 \\ 2 & 3 & 4 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 4 & 2 \\ 1 & 3 \end{pmatrix}$$

$$3 \times 1 + -2 \times 4 + -3 \times 1 = -8 \quad \checkmark$$

$$3 \times 2 + -2 \times 2 + -3 \times 3 = -7 \quad \checkmark$$

$$5 \times 1 + 4 \times 4 + 1 \times 1 = 22 \quad \checkmark$$

$$5 \times 2 + 4 \times 2 + 1 \times 3 = 21 \quad \checkmark$$

$$2 \times 1 + 3 \times 4 + 4 \times 1 = 18 \quad \checkmark$$

$$2 \times 2 + 3 \times 2 + 4 \times 3 = 22 \quad \checkmark$$

$$AC = \begin{pmatrix} -8 & -7 \\ 22 & 21 \\ 18 & 22 \end{pmatrix} \quad \textcircled{3} \quad \checkmark$$

iv) NOT POSSIBLE. $\checkmark$ $\textcircled{1}$

$$(-24) + 9 + (-40) = -55$$

$$\checkmark) \left| \begin{array}{ccc|cc} 3 & -2 & -3 & 3 & -2 \\ 5 & 4 & 1 & 5 & 4 \\ 2 & 3 & 4 & 2 & 3 \end{array} \right| \quad \checkmark \quad \textcircled{2}$$

$$48 + (-4) + (-45) = -1 \quad \checkmark$$

$$-1 - (-55) = 54 \quad \checkmark$$

$$|A| = 54 \quad \checkmark$$

①

Question No.

Examiner Only

a) vi)

$$\begin{vmatrix} 2 & 1 & 4 \\ 8 & 7 & 3 \\ -5 & 0 & 1 \end{vmatrix} \begin{vmatrix} 2 & 1 \\ 8 & 7 \\ -5 & 0 \end{vmatrix} \checkmark$$

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

$$14 + (-15) + 0 = -1 \checkmark$$

$$-1 - (-132) = 131 \checkmark \textcircled{2}$$

$$|B| = 131.$$

vii)

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

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

viii)

NOT POSSIBLE $\checkmark \textcircled{1}$

b)

$$a) 3x + 2y = 10 \checkmark \textcircled{1}$$

$$b) 4x + 3y = 13 \checkmark$$

$$a) \times 4 = 12x + 8y = 40 \checkmark \textcircled{1}$$

$$b) \times 3 = 12x + 9y = 39 \checkmark$$

$$0 - 1y = 1 \checkmark$$

4

✓

① b)

$$-1y = 1$$

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

$$y = -1$$

 $\therefore$

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

$$3x = 10 + 2$$

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

$$x = 4$$

$$y = -1$$

$$x = 4$$

c)

$$F = \begin{vmatrix} (x+1) & -5 & -6 \\ -1 & 4 & 2 \\ -3 & 2 & (x+1) \end{vmatrix} \begin{vmatrix} (x+1) & -5 \\ -1 & 4 \\ -3 & 2 \end{vmatrix}$$

$$72 + 4(x+1) + 5(x+1) =$$

$$4(x+1)(x+1) + 30 + 12 =$$

$$4(x+1)(x+1) + 30 + 12 =$$

$$4(x^2 + x + x + 1) + 42$$

$$4x^2 + 8x + 4 + 42$$

$$4x^2 + 8x + 46$$

$$72 + 4(x+1) + 5(x+1)$$

$$72 + 4x + 4 + 5x + 5 = 81 + 9x$$

$$4x^2 + 8x + 46 - 81 + 9x = 0$$

$$4x^2 - 7x - 35 = 0$$

method mark

error carried forward

4

3

1

Question No.

Examiner Only

c)

$$4x^2 - 7x - 35 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4(a)(c)}}{2a}$$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(4)(-35)}}{2 \times 4}$$

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$$x = -3.9$$

or

$$x = 2.2$$

error carried forward

①

$$d) \begin{pmatrix} 3x + 2y - z & x & 17 \\ 2x - y + 4z & y & -5 \\ 5x - y - z & z & 6 \end{pmatrix}$$

$$5 + (-12) + (-4) = -11$$

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

$$3 + 40 + 2 = 45 \checkmark$$

$$|D| = 45 - (-11) = 56 \checkmark \textcircled{1}$$

$$|D| = 56$$

$$6 + (-68) + 10 = -52$$

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

$$17 + 48 + (-5) = 60 \checkmark$$

$$60 - (-52) = 112 \checkmark$$

$$D_1 = 112 \checkmark \textcircled{1}$$

2
✓

①

$$25 + 72 + (-34) = 63$$

d)

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

$$15 + 340 + (-12) = 343$$

$$343 - 63 = 280$$

$$D_2 = 280$$

$$(-65) + 15 + 24 = -46$$

$$D_3 = \begin{vmatrix} 3 & 2 & 17 \\ 2 & -1 & -5 \\ 5 & -1 & 6 \end{vmatrix} \begin{vmatrix} 3 & 2 \\ 2 & -1 \\ 5 & -1 \end{vmatrix}$$

$$(-18) + (-50) + (-34) = -102$$

$$-102 - (-46) = -56$$

$$D_3 = -56$$

$$x = \frac{D_1}{D} = \frac{112}{56} = 2$$

$$y = \frac{D_2}{D} = \frac{280}{56} = 5$$

$$z = \frac{D_3}{D} = \frac{-56}{56} = -1$$