



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)

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FORENAME(S): MOHAMED FARLIN

1	Student Number	1809250/2
2	Title of Examination Paper	MATHEMATICS TEST 2
3	Module Code	M4X00391
4	Date and Time of Examination	10/05/2019 ~~13.30~~ PM
5	Examination Venue	HALL
6	Seat Number	10
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
Q1	
a	12 ✓
b	10 ✓
c	12 ✓
d	1 ✓
e	5 ✓
Q3	
a	18 ✓
b	3 ✓
c	0 ✓
d	1 ✓
Total	62/80 ✓ 77.5 %

2)

a) i) $z_1 + z_2$
 $(2 + 3j) + (5 - 2j)$
 $7 + j$ ✓ ①

1

ii) $z_1 - z_3$
 $(2 + 3j) - (4 + j)$ ✓ ①
 $2 + 3j - 4 - j$
 $-2 + 2j$ ✓ ①

2

iii) $\frac{z_1}{z_2} = \frac{2 + 3j}{5 - 2j}$
 $= \frac{2 + 3j}{5 - 2j} \times \frac{5 + 2j}{5 + 2j}$ ✓ ①

$$= \frac{10 + 4j + 15j + 6j^2}{25 + 10j - 10j - 4j^2}$$

$$j^2 = -1$$

4

$$= \frac{10 + 19j + 6 \times (-1)}{25 - 4 \times (-1)}$$
 ✓ ①

$$= \frac{10 - 6 + 19j}{25 + 4}$$

$$= \frac{4 + 19j}{29}$$
 ✓ ①

$$= \frac{4}{29} + \frac{19}{29}j$$
 ✓ ①

$$iv) \bar{z}_1 + \bar{z}_3 \quad \begin{aligned} (2+3j) &\Rightarrow 2-3j \\ (4+j) &\Rightarrow 4-j \end{aligned}$$

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

$$6-4j$$

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

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

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

$$4+6j+6j+9j^2 + (5-2j) + (4+j)$$

$$4+9 \times (-1) + 12j + (5-2j) + (4+j)$$

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

$$-5+11j+9$$

$$4+11j$$

$$j^2 = -1$$

2) b)

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

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

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

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

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

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

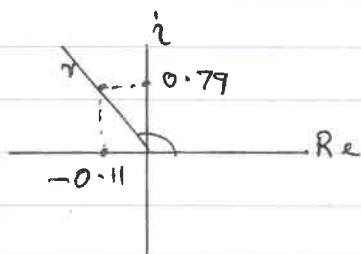
$$x = \frac{-3 \pm \sqrt{495} \sqrt{-1}}{28}$$

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

$$x = \frac{-3}{28} + \frac{22.25}{28}j \quad (\text{or}) \quad x = \frac{-3}{28} - \frac{22.25}{28}j$$

~~not correct~~

$$x = -0.11 + 0.79j \quad (\text{or})$$



$$r = \sqrt{0.11^2 + 0.79^2}$$

$$r = \sqrt{0.012 + 0.624}$$

$$r = \sqrt{0.636} \quad \checkmark$$

$$r = \cancel{0.79} \quad 0.8 \quad \checkmark$$

$$\tan \theta = \frac{0.79}{0.11}$$

$$\theta = \tan^{-1} \frac{0.79}{0.11} \quad \checkmark$$

$$= 82.07^\circ$$

82.07° is a R. Angle

$$\therefore 180^\circ - 82.07^\circ = 97.93^\circ$$

$$\therefore \angle 97.93^\circ \quad \checkmark \quad \textcircled{1}$$

$$r = 0.8$$

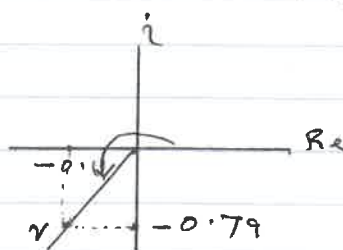
$$\therefore r(\cos \theta + j \sin \theta)$$

$$\cancel{0.8(\cos 82.07^\circ + j \sin 82.07^\circ)}$$

$$\therefore 0.8(\cos 97.93^\circ + j \sin 97.93^\circ)$$

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

$$x = -0.11 - 0.79j$$



$$r = \sqrt{0.11^2 + 0.79^2}$$

$$r = \sqrt{0.012 + 0.624}$$

$$r = \sqrt{0.636}$$

$$r = 0.8$$

$$\tan \theta = \frac{0.79}{0.11}$$

$$\theta = \tan^{-1} \frac{0.79}{0.11}$$

$$= 82.07^\circ$$

82.07° is a R. Angle

$$\therefore 82.07^\circ + 180^\circ = 262.07^\circ$$

$$\therefore \angle 262.07^\circ \quad \checkmark \quad \textcircled{1}$$

$$r = 0.8 \quad \checkmark$$

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

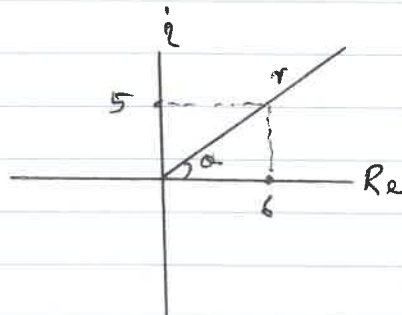
$$0.8(\cos 262.07^\circ + j \sin 262.07^\circ)$$

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

2) c).
i) $(6+5j)^5$

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

$$\begin{aligned} r &= \sqrt{6^2 + 5^2} \\ &= \sqrt{36 + 25} \\ &= \sqrt{61} \\ r &= 7.81 \end{aligned}$$



~~OH~~
~~AH~~
~~OA~~

$$n = 5$$

$$\tan \theta = \frac{5}{6}$$

$$\theta = \tan^{-1} \frac{5}{6}$$

$$= 39.81^\circ$$

$$\therefore n = 5$$

$$\therefore r = 7.81$$

$$\theta = 39.81^\circ$$

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

$$= (7.81)^5 (\cos 5 \times 39.81 + j \sin 5 \times 39.81)$$

$$= \cancel{28057.29} \cancel{(-0.94 + j(-)0.33)}$$

$$= 29057.29 (-0.94 + j(-)0.33)$$

$$= -27313.85 - 9588.9j$$

✓ ①

✓ ①

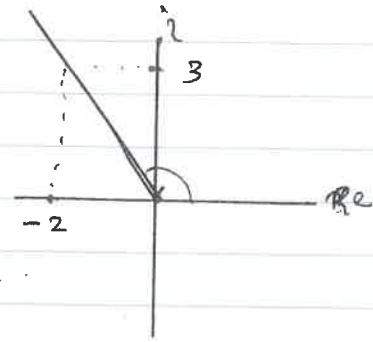
//

2)c)

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

$$\begin{aligned} r &= \sqrt{2^2 + 3^2} \\ &= \sqrt{4 + 9} \\ &= \sqrt{13} \quad \checkmark \\ r &= 3.6 \quad \checkmark \quad \textcircled{1} \end{aligned}$$

4

6

$$n = 7$$

$$\tan \theta = \frac{3}{2}$$

$$\begin{aligned} \theta &= \tan^{-1} 3/2 \\ &= 56.30^\circ \text{ (RA)} \end{aligned}$$

$$\therefore 180^\circ - 56.30^\circ = 123.7^\circ \quad \checkmark \quad \checkmark \quad \textcircled{1}$$

$$n = 7$$

$$r = 3.6$$

$$4\theta = 123.7^\circ$$

$$\begin{aligned} \therefore r^n (\cos n\theta + j \sin n\theta) \\ (3.6)^7 (\cos 7 \cdot 123.7^\circ + j \sin 7 \cdot 123.7^\circ) \quad \checkmark \quad \textcircled{1} \end{aligned}$$

$$7836.41 (-0.83 + 0.56j) \quad \checkmark \quad \textcircled{1}$$

$$-6504.22 + 4388.38j$$

✓ ①

✓ ①

2)

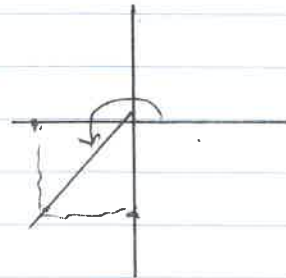
$$d) 1+8j \Rightarrow 1-8j //$$

$$\begin{aligned}
 e) z_1 z_2 z_3 &= \\
 &= (6+j)(2-5j)(1-j) \\
 &= (12-30j+2j-5j^2)(1-j) \\
 &= (12-28j-5 \times -1)(1-j) \\
 &= (12+5-28j)(1-j) \\
 &= (17-28j)(1-j) \\
 &= 17-17j-28j+28j^2 \\
 &= 17-45j+28 \times -1 \\
 &= 17-28-45j \\
 &= -11-45j
 \end{aligned}$$

$$(j^2 = -1)$$

in Polar Form

$$\begin{aligned}
 r &= \sqrt{11^2 + 45^2} \\
 &= \sqrt{121 + 2025} \\
 &= \sqrt{2146} \\
 r &= 46.32
 \end{aligned}$$



$$\tan \theta = \frac{45}{11}$$

$$\theta = \tan^{-1} \frac{45}{11} = 76.26^\circ$$

$$\therefore 76.26 + 180 = 256.26$$

$$\begin{aligned}
 &r (\cos \theta + j \sin \theta) \\
 &46.32 (\cos 256.26 + j \sin 256.26)
 \end{aligned}$$

3)

a)
(i)

AB

$$\begin{bmatrix} 5 & -1 & 6 \\ 7 & 5 & -1 \\ 1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 3 & 1 & 1 \\ 2 & -5 & 4 \\ -3 & 1 & 1 \end{bmatrix}$$

$$15 + (-2) + 18 \quad 5 + 5 + 1 \quad 5 + 4 + 6$$

$$21 + 10 + 3 \quad 7 + 25 + 4 \quad 7 + 20 + 1$$

$$3 + 0 + 6 \quad 1 + 0 + 2 \quad 1 + 0 + 2$$

$$\begin{bmatrix} -5 & 16 & 7 \\ 34 & -19 & 21 \\ -3 & 3 & 3 \end{bmatrix}$$

//

ii) BA

$$\begin{bmatrix} 3 & 1 & 1 \\ 2 & -5 & 4 \\ -3 & 1 & 1 \end{bmatrix} \begin{bmatrix} 5 & -1 & 6 \\ 7 & 5 & -1 \\ 1 & 0 & 2 \end{bmatrix}$$

$$15 + 7 + 1 \quad -3 + 5 + 0 \quad 18 + (-1) + 2$$

$$10 + (-35) + 4 \quad -2 + 25 + 0 \quad 12 + 5 + 8$$

$$-15 + 7 + 1 \quad 3 + 5 + 0 \quad -18 + (-1) + 2$$

$$\begin{bmatrix} 23 & 2 & 19 \\ -21 & -27 & 25 \\ -7 & 8 & -17 \end{bmatrix}$$

//

5

115

3) a)

iii)

AC =

$$\begin{bmatrix} 5 & -1 & 6 \\ 7 & 5 & -1 \\ 1 & 0 & 2 \end{bmatrix} \cdot \begin{bmatrix} 6 & 5 \\ 4 & 3 \\ 2 & 1 \end{bmatrix}$$

$$\begin{matrix} R_c & R_c \\ 3 & 3 \\ \text{Size } 3 \times 2 \end{matrix}$$

$$30 + -4 + 12 \quad 25 + 3 + 6 \quad \checkmark$$

~~25 + 3 + 6~~

$$42 + 20 + 2 \quad 35 + 15 + 7 \quad \checkmark$$

$$6 + 0 + 4 \quad 5 + 0 + 2 \quad \checkmark$$

$$\begin{bmatrix} 38 & 28 \\ 60 & 49 \\ 10 & 7 \end{bmatrix} \quad (\text{Size } 3 \times 2)$$

(iv)

CA =

$$\begin{bmatrix} 6 & 5 \\ 4 & 3 \\ 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 5 & -1 & 6 \\ 7 & 5 & -1 \\ 1 & 0 & 2 \end{bmatrix}$$

Can't calculate as Not Same ^① number of columns and rows.

v.)

|A| =

$$\begin{vmatrix} 5 & -1 & 6 & 5 & -1 \\ 7 & 5 & -1 & 7 & 5 \\ 1 & 0 & 2 & 1 & 0 \end{vmatrix}$$

30 0 -14

50 1 42

$$(50 + 1 + 42) - (30 + 0 + (-14))$$

$$= 93 - 16$$

$$|A| = 77$$

vi) $|B|$

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

15 12 2
-12 2
-15

✓ ①

20

$$|B| = (-25) - 29$$

$$|B| = -54 // \checkmark \text{ ①}$$

vii) $A + B$

$$\begin{bmatrix} 5 & -1 & 6 \\ 7 & 5 & -1 \\ 1 & 0 & 2 \end{bmatrix} + \begin{bmatrix} 3 & 1 & 1 \\ 2 & -5 & 4 \\ -3 & 1 & 1 \end{bmatrix} =$$

$$= \begin{bmatrix} 8 & 0 & 7 \\ 9 & 0 & 3 \\ -2 & 1 & 3 \end{bmatrix} // \text{ ①}$$

10

viii) $A + D =$ Can not calculate as both are not same size. ✓ ①

10

3)

d)

$$5x + 3y + z = 25$$

$$3x - 2y + 3z = 26$$

$$2x + y - 5z = -6$$

$$\begin{bmatrix} 5 & 3 & 1 \\ 3 & -2 & 3 \\ 2 & 1 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 25 \\ 26 \\ -6 \end{bmatrix} \quad \text{①}$$

C)

3)

$$\begin{bmatrix} x & 3 & -4 \\ 4 & 4 & 2 \\ -2 & 5 & (x+2) \end{bmatrix} = 4$$

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