

61/0

Question Numbers Answered	1st Examiner	2nd Examiner (optional)	3rd Examiner (optional)
1	32½		
2	16		
	48½		
TOTAL			
RESULT			



EXAMINER'S ANSWER BOOK

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The Examiner's Answer Book is a comprehensive guide for the examiner. It contains the answers to all the questions in the examination. The answers are written in a clear and concise manner, and are easy to read. The Examiner's Answer Book is a valuable resource for the examiner, and it is essential for the examiner to have it when marking the examination.

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Q. 1. $x^2 - 12x + 37 = 0$

~~Q. 1~~ $\frac{12 \pm \sqrt{(-12)^2 - 4(1)(37)}}{2(1)}$

$$= \frac{12 \pm \sqrt{144 - 148}}{2}$$

$$= \frac{12 \pm \sqrt{-4}}{2}$$

$$= \frac{12}{2} \pm \frac{\sqrt{4}}{2} \times \sqrt{-1}$$

$$= 6 \pm 1j$$

$$\therefore = (6+j)(6-j)$$

ii $4+5j$

b. i $\frac{(-4+8j)}{2} + \frac{(2+6j)}{2}$

$$= -2+4j + 1+3j$$

$$= -1+7j$$

ii $(p+r)(p-r)$

$$= p^2 - pr + pr - r^2$$

$$= p^2 - r^2$$

$$= (-4+8j)(-4+8j) - (-1-3j)(-1-3j)$$

6

2

$$\begin{aligned}
 &= (6 - 32j - 32j + 64j^2) - (1 + 3j + 3j + 9j^2) \\
 &= (-64j - 48) - (-8 + 6j) \\
 &= -40 - 70j
 \end{aligned}$$

iii

$$\begin{aligned}
 p^2 &= -64j - 48 \\
 r^2 &= -8 + 6j
 \end{aligned}$$

$$\begin{aligned}
 q^2 &= (2 + 6j)(2 + 6j) \\
 &= 4 + 12j + 12j + 36j^2 \\
 &= -32 + 24j
 \end{aligned}$$

$$\begin{aligned}
 \therefore p^2 + q^2 + r^2 &= (-64j - 48) + (-8 + 6j) + (-32 + 24j) \\
 &= -34j - 88
 \end{aligned}$$

iv

$$\begin{aligned}
 &\frac{2+6j}{-1-3j} \\
 &= \frac{(2+6j)(-1+3j)}{(-1-3j)(-1+3j)}
 \end{aligned}$$

$$= \frac{-2 + 6j - 6j + 18j^2}{1 - 3j + 3j - 9j^2}$$

$$= \frac{-20}{4}$$

$$= -5$$

$$1. \frac{2(-4+8j) - 3(-1-3j)}{4(2+6j) + (-4+8j)}$$

$$= \frac{-8+16j+3-9j}{8+24j-4+8j}$$

$$= \frac{-5+7j}{4+32j}$$

$$= \frac{(-5+7j)(4-32j)}{(4+32j)(4-32j)}$$

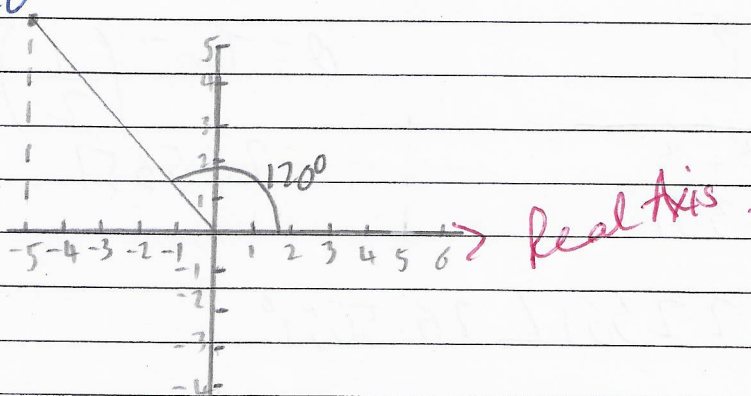
$$= \frac{-20+160j+28j-224j^2}{16+128j-128j-1024j^2}$$

$$= \frac{204+188j}{1040}$$

$$= \frac{51+47j}{260}$$

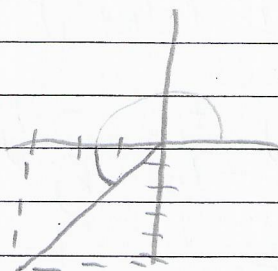
Ci. r = the modulus of the complex number
 θ = the argument of the complex number

ii $r=5$ $\theta=120^\circ$



$$\text{iii } -3-5j$$

$$= r = \sqrt{3^2 + 5^2} \\ = 5.831$$



$$\theta = \tan^{-1} \frac{5}{3}$$

$$= 59.0362$$

$$\theta = 180 + 59.0362 \\ = 239.0262^\circ$$

$$\therefore \text{polar form} = 5.831 \angle 239.0262^\circ$$

d.

$$(2+j)(2+j)(2+j)$$

$$= (4 + 2j + 2j + j^2)(2+j)$$

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

$$= 6 + 3j + 8j + 4j^2$$

$$= \boxed{2 + 11j}$$

$$(2+j)^3$$

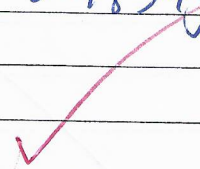
$$r = \sqrt{2^2 + 1^2} \\ = 2.2361$$

$$\theta = \tan^{-1} \left(\frac{1}{2} \right) \\ = 26.5651$$

$$2+j = 2.2361 \angle 26.5651^\circ$$

$$2.2361^3 (\cos 3 \times 26.5651 + j \sin 3 \times 26.5651)$$

$$= 11.1808 (0.1789 + 0.9839j)$$
$$= 2 + 11j$$



5

32½

2.

$$\begin{aligned} \text{a. } 2x + 4 &= -7 \\ 2x &= -11 \\ x &= -5.5 \end{aligned}$$

$$y^2 = 49$$

$$y = 7$$

±

$$\frac{2z-1}{5} = \frac{z}{3}$$

$$6z - 3 = 5z$$

$$1z = 3$$

$$\therefore x = -5.5$$

$$y = 7$$

$$z = 3$$

$$\text{b. } \begin{array}{c|c|c|c|c|c|c|c} x & x & -4 & -3 & 5 & -4 & +(-2) & 5 \\ \hline & -2 & 5 & & 3 & 5 & & 3 \end{array} \quad \begin{array}{c} x \\ -2 \end{array}$$

$$= x(5x + 8) - 3(25 + 12) - 2(-10 + 3x)$$

$$= 5x^2 + 8x - 111 + 20 - 6x$$

$$= 5x^2 + 2x - 91$$

$$\text{roots} = \frac{-2 \pm \sqrt{2^2 - 4(5)(-91)}}{2(5)}$$

$$= \frac{-2 \pm \sqrt{1824}}{10}$$

$$+ = 4.0708$$

$$- = -4.4708$$

$$x = 4.1$$

$$x = -4.5$$

$$d. \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & -3 \\ -3 & 4 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} -5 \\ 4 \\ -7 \end{pmatrix}$$

$$A_1 = \begin{pmatrix} -5 & 2 & 3 \\ 4 & 1 & 3 \\ -7 & 4 & 7 \end{pmatrix}$$

$$= -5(7 - 12) - 2(28 + 21) + 3(16 + 7)$$

$$= -35 + 60 - 56 - 42 + 48 + 21$$

$$A_1 = -4$$

$$A_2 = \begin{pmatrix} 1 & -5 & 3 \\ 3 & 4 & 3 \\ -3 & -7 & 7 \end{pmatrix}$$

$$= 1(28 + 21) + 5(21 + 9) + 3(-21 + 12)$$

$$= 28 + 21 + 105 + 45 - 63 + 36$$

$$A_2 = 172$$

$$A_3 = \begin{pmatrix} 1 & 2 & -5 \\ 3 & 1 & 4 \\ -3 & 4 & -7 \end{pmatrix}$$

$$= 1(-7 - 16) - 2(-21 + 12) - 5(12 + 3)$$

$$= -7 - 16 + 42 - 24 - 60 - 15$$

$$A_3 = -80$$

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & -3 \\ -3 & 4 & 7 \end{pmatrix}$$

$$= 1(7+12) - 2(21-9) + 3(12+3)$$

$$= 7 + 12 - 42 + 18 + 36 + 9$$

2

$$A = 40$$

$$\frac{A_1}{A} = \frac{-4}{40}$$

$$x = -0.1$$

X

$$\frac{A_2}{A} = \frac{172}{40}$$

$$y = 4.3$$

X

$$\frac{A_3}{A} = \frac{-80}{40}$$

$$z = -2$$

✓

i PQ = Impossible ✓

ii $P^2 =$ Impossible ✓

iii $Q^2 = \begin{pmatrix} 3 & -2 \\ 5 & -4 \end{pmatrix} \begin{pmatrix} 3 & -2 \\ 5 & -4 \end{pmatrix}$

$$= \begin{matrix} 9+15 & 4+8 \\ 15+25 & 8+16 \end{matrix}$$

$$= \begin{pmatrix} 24 & 12 \\ 40 & 24 \end{pmatrix} \quad \times$$

iv $R^2 = \begin{pmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{pmatrix} \begin{pmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{pmatrix}$

$$= \begin{matrix} 4+0+10 & 1-3+1 & 36+0-18 \\ 0+0+0 & -3+9-3 & 0+0+0 \\ 10+0+25 & 1-3+1 & -18+0+9 \end{matrix}$$

$$= \begin{pmatrix} 14 & -1 & 18 \\ 0 & 3 & 0 \\ 35 & -1 & -9 \end{pmatrix} \quad \times$$

v. PR = ~~AI~~ Impossible ✓

vi $\begin{pmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{pmatrix} \begin{pmatrix} -1 \\ -3 \\ -5 \end{pmatrix}$

vii $P^T = (-1 \quad -3 \quad -5)$ ✓

viii $Q^T = \begin{pmatrix} 3 & 5 \\ -2 & -4 \end{pmatrix}$ ✓

ix. $P^T R^T = (-1 \quad -3 \quad -5) \begin{pmatrix} 2 & 0 & 5 \\ -1 & 3 & -1 \\ 6 & 0 & -3 \end{pmatrix}$

$(-2 + 1 - 6 \quad 0 - 9 + 0 \quad -25 + 5 + 15)$

$= (-7 \quad -9 \quad -5)$

✗

✗

16