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SWANSEA - ABERTAWE

Examination Answer Books

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Book No.

Total Books
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Programme Title: OME

Year/Level/Stage: Year 1 / Level 4

Examination Paper Title: Mathematics Test 2

Examination Paper Ref No.: _____

Desk Letter/Number: _____

Date: 14 / 03 / 2019

Time: 9 am/pm

Room Name or No.: 206

Instructions to Candidates:

- Please give the information requested above and enter your name in the space provided at the top right of this page. If your answers are to be marked under a scheme whereby the examiners will not know your identity, fold over and seal down the top right-hand corner of the page (using the gummed label provided) in order to conceal your name.
- Commence each answer on a fresh page.
- Do all rough work in the answer book and cross through it.
- No part of this booklet is to be torn out.
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 - be numbered consecutively;
 - be fastened together by the tags available from the invigilator.
- Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the exam room.
- Your answers must be legibly written **IN INK**. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.

Summary of Marks

Question Numbers Answered	1st Examiner	2nd Examiner (optional)	3rd Examiner (optional)
1	28.5		
3	33		
	61.5		
TOTAL			
RESULT			

1) a) i) $x^2 - 12x + 37 = 0$

$$a=1 \quad \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

$$c=37 \quad \frac{12 \pm \sqrt{-4}}{2}$$

$$6 \pm \sqrt{-4}$$

$x = 6 + j4 \quad x = 6 - j4$

ii) $4 + 5j$

b) $p = -4 + 8j \quad q = 2 + 6j \quad r = -1 - 3j$

i) $\frac{p}{2} + \frac{q}{2} = \frac{-4 + 8j}{2} + \frac{2 + 6j}{2} = -2 + 4j + 1 + 3j = -1 + 7j$

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

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

$$(-7 + 5j) \times (-1 + 5j) \quad (-5 + 5j)(-3 + 5j)$$

$$7 - 35j - 5j + 25j^2 \quad 15 - 25j - 15j + 25j^2$$

$$7 - 40j - 25 \quad -10 - 40j$$

$$-18 - 40j$$

iii) $p^2 + q^2 + r^2$

$$(-4 + 8j)(-4 + 8j) + (2 + 6j)(2 + 6j) + (-1 - 3j)(-1 - 3j)$$

$$(16 - 32j - 32j + 64j^2) + (4 + 12j + 12j + 36j^2) + (1 + 3j + 3j + 9j^2)$$

$$16 - 64j - 64 + 4 + 24j - 36 + 1 + 6j - 9$$

$$-80 - 22j - 88 - 34j$$

iv) $\frac{q}{r} = \frac{(2 + 6j)(-3 + 3j)}{(-3 - 3j)(-3 + 3j)} = \frac{(-6 + 6j - 18j + 18j^2)}{(9 - 9j + 9j - 9j^2)} = \frac{-24 - 12j}{18}$

$$v) \frac{2p-3r}{4q+p} = \frac{2(-4+8j)-3(\frac{1}{2}-3j)}{4(2+6j)+(-4+8j)} = \frac{-8+16j+3+9j}{8+24j-4+8j} = \frac{11+25j}{(4+32j)}$$

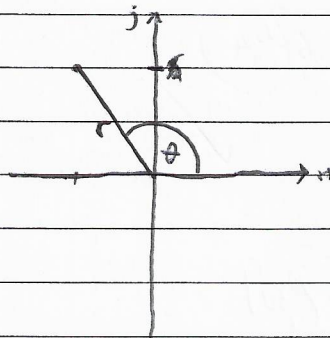
$$= \frac{(11+25j)(4-32j)}{(4+32j)(4-32j)} = \frac{44-352j+100j-800j^2}{16-128j+128j-1024j^2} = \frac{844-252j}{1040} = 0.812-j0.242$$

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

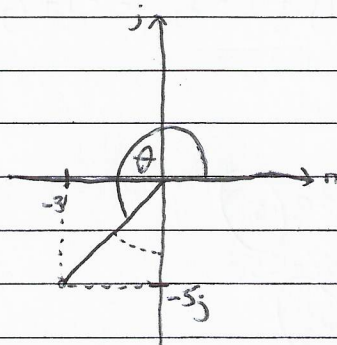
r is the modulus i.e. it is the length of the hypotenuse

θ is the argument, the angle in a clockwise direction away from 0° .

$$ii) r=5 \text{ and } \theta=120^\circ$$



$$iii) -3-5j$$



$$r^2 = a^2 + b^2$$

$$r^2 = 9 + 25$$

$$r^2 = 34$$

$$r = \sqrt{34}$$

$$r = 5.831$$

$$\theta = \tan^{-1} \frac{5}{3} = 59.036^\circ$$

$$270 - 59.036 = 210.964^\circ$$

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

$$(2+j)^3$$

$$(4+2j+2j+\frac{1}{2})(2+j)$$

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

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

$$2.236^3(\cos(3)(26.585) + j\sin(3)(26.585))$$

$$6+3j+8j+\frac{4}{j^2}$$

$$11.179(0.179 + j0.984)$$

$$2+11j$$

$$2.001 + j11.000$$

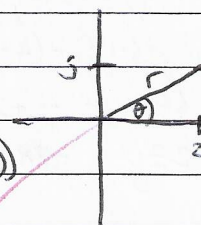
$$\therefore 2+11j$$

$$r^2 = 2^2 + 1^2$$

$$= 5$$

$$r = \sqrt{5} = 2.236$$

$$\theta = \tan^{-1} \frac{1}{2} = 26.565^\circ$$



$$\textcircled{3} \text{ a) i) } \int_0^2 (4x^3 - 6x^2 + 8x - 1) dx$$

$$\left[\frac{4x^4}{4} - \frac{6x^3}{3} + \frac{8x^2}{2} - x \right]$$

$$\left[x^4 - 2x^3 + 4x^2 - x \right]$$

$$\left[(2)^4 - 2(2)^3 + 4(2)^2 - (2) \right] - \left[(0)^4 - 2(0)^3 + 4(0)^2 - (0) \right]$$

$$\left[16 - 16 + 8 - 2 \right] - \left[0 - 0 + 0 - 0 \right]$$

$$= 6$$

4

$$\text{ii) } \int_0^1 (e^{2x} - e^x + 3) dx$$

$$\left[\frac{1}{2} e^{2x} - e^x + 3x \right]$$

$$\left[\frac{1}{2} e^{2(1)} - e^{(1)} + 3(1) \right] - \left[\frac{1}{2} e^{2(0)} - e^{(0)} + 3(0) \right]$$

$$\left[3.695 - 2.718 + 3 \right] - \left[0.5 - 1 + 0 \right]$$

$$\left[3.977 \right] - \left[-0.5 \right]$$

$$3.977 + 0.5 = 4.47$$

4

$$\text{iii) } \int (4 \sin 2x - 3 \cos 4x) dx$$

$$4 \int \sin 2x - 3 \int \cos 4x dx$$

$$4 \left[-\frac{1}{2} \cos 2x \right] - 3 \left[\frac{1}{4} \sin 4x \right]$$

$$-2 \cos 2x - \frac{3}{4} \sin 4x + C$$

3

$$\text{b) } \int x \sin 4x dx$$

$$\text{let } u = x \quad \frac{du}{dx} = \sin 4x$$

$$\frac{du}{dx} = 1 \quad v = -\frac{1}{4} \cos 4x$$

$$\int x \sin 4x dx = -\frac{1}{4} x \cos 4x - \int -\frac{1}{4} \cos 4x$$

$$= -\frac{1}{4} x \cos 4x - \left[-\frac{1}{16} \sin 4x \right]$$

$$= -\frac{1}{4} x \cos 4x + \frac{1}{16} \sin 4x + C$$

8

c) let $u = 5x^2 - 4$ $\therefore \frac{du}{dx} = 10x \rightarrow \frac{du}{10x} = dx$

$$\int_1^2 \frac{10x}{5x^2-4} dx$$

$$\ln 16 = 2.773$$

$$\int_1^2 \frac{10x}{u} dx$$

$$\int_1^2 10x u^{-1} \frac{du}{10x}$$

$$\int_1^2 u^{-1} = \int_1^2 \frac{1}{u}$$

$$= [\ln u] = \ln(5x^2 - 4)$$

$$[\ln(5(2)^2 - 4)] - [\ln(5(1)^2 - 4)]$$

$$[\ln 20 - 4] - [\ln 5 - 4]$$

$$[2.773] - [0]$$

$$= 2.773$$

log 16

d) $\int_5^6 \frac{5x-5}{(x+1)(x-4)} dx$

$$\frac{A(x-4)}{(x+1)} + \frac{B(x+1)}{(x-4)}$$

$$\frac{A}{(x+1)} + \frac{B}{(x-4)}$$

say $x=4$

$$B(4+1) = 5(4)-5$$

$$5B = 15$$

$$B = \frac{15}{5} = 3$$

say $x=-1$

$$A(-1-4) = 5(-1)-5$$

$$-5A = -10$$

$$A = \frac{-10}{-5}$$

$$A = 2$$

$$\therefore \frac{2}{(x+1)} + \frac{3}{(x-4)}$$

$$2 \int \frac{1}{x+1} + 3 \int \frac{1}{x-4}$$

$$[2 \ln(x+1) + 3 \ln(x-4)]$$

$$\therefore [2 \ln(6+1) + 3 \ln(6-4)] - [2 \ln(5+1) + 3 \ln(5-4)]$$

$$[3.892 + 2.079] - [3.584 + 0]$$

$$5.971 - 3.584$$

$$= 2.387 \therefore \underline{\underline{2.39}}$$

$$e) \int \frac{x^2+1}{x^3+3x} dx$$

$$\int (x^2+1)(x^{-3}+3x^{-1}) dx$$

$$\int (x^{-1}+3x+x^{-3}+3x^{-1}) dx$$

$$\int \frac{1}{x} + 3x + \frac{1}{x^3} + \frac{1}{3x} dx$$

$$\left[\ln x + \frac{3x^2}{2} + \ln x^3 + 3 \ln x \right] + C$$

33

Question No.

Examiner Only

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Yn unig y Cwestiwn

Question No.

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Question No.

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