



Question Numbers Answered	1st Examiner	2nd Examiner (optional)	3rd Examiner (optional)
1	33		
3	38		
TOTAL	71		
RESULT			

1ai $x^2 - 12x + 37 = 0$ $a=1$ $b=-12$ $c=37$

using the quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\frac{-(-12) \pm \sqrt{(-12)^2 - 4 \times 1 \times 37}}{2} = \frac{+12 \pm \sqrt{144 - 148}}{2}$$

$$= \frac{+12 \pm \sqrt{-4}}{2} = \frac{+12 \pm (\sqrt{4} \sqrt{-1})}{2} \quad (j^2 = -1)$$

$$\text{so: } x = \frac{12 \pm 2j}{2}$$

$$x = 6 \pm j$$

the roots of the quadratic equation are $x = 6+j$
and $x = 6-j$

1aii If one of the roots of a quadratic is $4-5j$,
the other root will be $4+5j$

6

3d $\int \frac{5x-5}{(x+1)(x-4)} dx$

using partial fractions:

$$\frac{5x-5}{(x+1)(x-4)} = \frac{A}{x+1} + \frac{B}{x-4}$$

multiply both sides by $(x+1)(x-4)$ gives

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

if $x = 4$ then $5(4)-5 = B(4+1)$
 $15 = 5B$
 $B = 3$

if $x = -1$ then $5(-1)-5 = A(-1-4)$
 $-10 = -5A$
 $A = 2$

so $\int_5^6 \frac{5x-5}{(x+1)(x-4)} dx = \int_5^6 \frac{2}{x+1} + \frac{3}{x-4} dx$

$$= \int_5^6 \frac{2}{x+1} dx + \int_5^6 \frac{3}{x-4} dx = 2 \int_5^6 \frac{1}{x+1} dx + 3 \int_5^6 \frac{1}{x-4} dx$$

$$\text{so } [2 \ln(x+1) + 3 \ln(x-4)]_5^6$$

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

$$= 2 \ln 7 + 3 \ln 2 - 2 \ln 6 - 3 \ln 1$$

$$= 2.39$$

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

if $y = x^3 + 3x$

then $\frac{dy}{dx} = 3x^2 + 3$

so numerator = $\frac{1}{3}$ x denominator

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

as differential of denominator = numerator

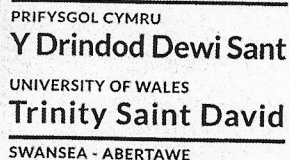
$\int \frac{1}{3} \ln(x^3 + 3x) + C$ ✓

4

38

Question No.

Examiner On



Complete, fold and seal
(see note 1 below)

SURNAME: Mungham

Candidate's Exam Number:

FORENAME(S): Jennifer Louise

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Summary of Marks

1. 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.
2. Commence each answer on a fresh page.
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Question Numbers Answered	1st Examiner	2nd Examiner (optional)	3rd Examiner (optional)
2	~~27~~	.	
TOTAL			
RESULT			

$$2a) \quad 2x + 4 = -7$$

$$y^2 = 49$$

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

$$2x + 4 = -7$$

$$2x = -11$$

$$x = -11/2$$

$$y^2 = 49$$

$$\therefore y = \sqrt{49}$$

$$y = \pm 7$$

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

cross multiply

$$\text{so } 3(2z-1) = 5z$$

$$6z - 3 = 5z$$

$$6z - 5z = +3$$

$$z = 3$$

6

2b if determinant of matrix = 0

then:

$$a \begin{vmatrix} e & f \\ h & i \end{vmatrix} - b \begin{vmatrix} a & f \\ g & i \end{vmatrix} + c \begin{vmatrix} a & e \\ g & h \end{vmatrix} = 0$$

$$\text{so } x(5x+8) - 3(25+12) + 2(-10-3x) = 0$$

$$5x^2 + 8x - 75 - 36 + 20 + 6x = 0$$

$$5x^2 + 8x + 6x - 75 - 36 + 20 = 0$$

$$\underline{5x^2 - 2x - 91 = 0}$$

$$a = 5 \quad b = -2 \quad c = -91$$

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

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

$$= \frac{2 \pm \sqrt{4 + 1820}}{10}$$

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

$$x = 4.7 \quad \text{and} \quad x = -3.9$$

6

$$P = 3 \times 1 \quad Q = 2 \times 2 \quad R = 3 \times 3$$

g)

ci $PQ = (3 \times 1)(2 \times 2)$
= not possible

cii $P^2 = PP = (3 \times 1)(3 \times 1)$
= not possible

ciii $Q^2 = (2 \times 2)(2 \times 2) = \text{possible}$

$$\begin{bmatrix} 3 & -2 \\ 5 & -4 \end{bmatrix} \begin{bmatrix} 3 & -2 \\ 5 & -4 \end{bmatrix} = \begin{bmatrix} 9-10 & -6+8 \\ 15-20 & -10+16 \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 2 \\ -5 & 6 \end{bmatrix}$$

civ $R^2 = RR = (3 \times 3) \times (3 \times 3) = \text{possible}$

$$\begin{bmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{bmatrix} \begin{bmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{bmatrix} = \begin{bmatrix} 4-0+30 & -2-3-6 & 12+0-18 \\ 0+0+0 & 0+9+0 & 0+0+0 \\ 10+0-15 & -5-3+3 & 30+0+9 \end{bmatrix}$$

$$= \begin{bmatrix} 34 & -11 & -6 \\ 0 & 9 & 0 \\ -5 & -5 & 39 \end{bmatrix}$$

cv $PR = (3 \times 1)(3 \times 3)$
= not possible

cvi $RP = (3 \times 3)(3 \times 1) = \text{possible} = 3 \times 1 \text{ matrix}$

$$\begin{bmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{bmatrix} \begin{bmatrix} -1 \\ -3 \\ -5 \end{bmatrix} = \begin{bmatrix} -2+3-30 \\ 0-9+0 \\ -5+3+15 \end{bmatrix} = \begin{bmatrix} -29 \\ -9 \\ 13 \end{bmatrix}$$

vii) $P^T = p$ transposed
 $= [-1 \ -3 \ -5]$

viii) $Q^T = q$ transposed
 $= \begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$

ix) $P^T R^T = (1 \times 3)(3 \times 3) = \text{possible} = 1 \times 3 \text{ matrix}$
 $= [-1 \ -3 \ -5] \begin{bmatrix} 2 & -1 & 6 \\ 0 & 3 & 0 \\ 5 & -1 & -3 \end{bmatrix} =$
 $-2+0-25 \quad 1-9+5 \quad -6+0+15$
 $= [-27 \quad -3 \quad 9]$

$$\begin{aligned}
 d) \quad x + 2y + 3z &= -5 \\
 3x + y - 3z &= 4 \\
 -3x + 4y + 7z &= -7
 \end{aligned}$$

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

coefficients matrix = A

$$\begin{aligned}
 |A| &= 1((1 \times 7) - (-3 \times 4)) - 2((3 \times 7) - (-3 \times 3)) + 3((3 \times 4) - (1 \times -3)) \\
 &= 7 + 12 - 42 - 42 + 12 - 24 + 12 + 9 \\
 &= 37
 \end{aligned}$$

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

$$\begin{aligned}
 |A_1| &= -5(7 + 12) - 2(28 - 21) + 3(16 + 7) \\
 &= -95 - 14 + 69 \\
 &= -40
 \end{aligned}$$

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

$$\begin{aligned}
 |A_2| &= 1(28 - 21) + 5(21 - 9) + 3(21 + 12) \\
 &= 7 + 60 + 99 \\
 &= 166
 \end{aligned}$$

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

$$\begin{aligned}
 |A_3| &= 1(-7 - 16) + 2(-21 + 12) - 5(12 + 3) \\
 &= -23 - 18 - 75 \\
 &= -116
 \end{aligned}$$

$$x = \frac{|A_1|}{|A|} = \frac{-40}{37} = -\frac{40}{37}$$

$$y = \frac{|A_2|}{|A|} = \frac{166}{37} = \frac{166}{37}$$

$$z = \frac{|A_3|}{|A|} = \frac{-116}{37} = -\frac{116}{37}$$

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