

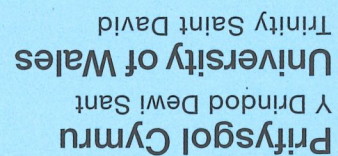
SURNAME: OVANES

FORENAME(S): RHYS

12 Pages

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.**

1	Student Number	1809809
2	Title of Examination Paper	ENGINEERING MATHS
3	Module Code	SGEE4002
4	Date and Time of Examination	13/05/19 9:30 AM
5	Examination Venue	C27
6	Seat Number	9
7	Number of Answer Books handed in	

[illegible]

Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

ENW(AU) CYN TAF:

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

3. Rhaid i'r atebion fod mewn llawysgrifen dda
gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgrifennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyllywr/gwylwyr.

8. Rhaid dychwelyd pob llyfr. Ni chaniad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholliad	
4	Dyddiad ac Amser yr Arholliad	
3	Cod y Modwl	
2	Titl y Papur Arholliad	
1	Rhif Myfyriwr	

(See the other side for English version)

[illegible]

SECTION A:

$$1: 3(4y-3) - 5(2-3y) = 35$$

$$12y - 9 - 10 + 15y = 35$$

$$27y - 19 = 35$$

$$27y = 35 + 19$$

$$y = 54/27$$

$$y = 2$$

5

2:

$$A = \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \quad B = \begin{pmatrix} -1 & 3 \\ 2 & 5 \end{pmatrix}$$

(i) $4B - 2A$

$$4B = \begin{pmatrix} -4 & 12 \\ 8 & 20 \end{pmatrix} \quad 2A = \begin{pmatrix} 6 & 4 \\ 2 & 6 \end{pmatrix}$$

$$\begin{pmatrix} -4 & 12 \\ 8 & 20 \end{pmatrix} - \begin{pmatrix} 6 & 4 \\ 2 & 6 \end{pmatrix} = \begin{pmatrix} -10 & 8 \\ 6 & 14 \end{pmatrix}$$

2

(ii) $A \times B$

$$\begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \times \begin{pmatrix} -1 & 3 \\ 2 & 5 \end{pmatrix} = \begin{pmatrix} 1 & 19 \\ 5 & 18 \end{pmatrix}$$

5

$$\begin{aligned} (3 \times -1) + (2 \times 2) &= 1 \\ (3 \times 3) + (2 \times 5) &= 19 \\ (1 \times -1) + (3 \times 2) &= 5 \\ (1 \times 3) + (3 \times 5) &= 18 \end{aligned}$$

(iii) INVERSE OF MATRIX 'A'

$$A = \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \quad A^{-1} = \frac{1}{|A|} \begin{pmatrix} 3 & -2 \\ -1 & 3 \end{pmatrix}$$

$$\det A = |A| = 9 - 2 = 7$$

$$3. (A) \quad Z_1 = 3 - j5 \quad Z_2 = 2 + j3$$

$$(i) \quad Z_1 - Z_2 \\ = (3 - j5) - (2 + j3) \\ = 1 - j8$$

$$(ii) \quad Z_1 \times Z_2 \\ = (3 - j5) \times (2 + j3) \\ 6 + j9 - j10 - j^2 15 \\ 6 - j - (-1)15 \\ 6 - j + 15 \\ = 21 - j$$

$$(iii) \quad Z_1 = 3 - j5 \quad Z_2 = 2 + j3 \\ \sqrt{3^2 + 5^2} = 5.83 \quad \sqrt{2^2 + 3^2} = 3.6 \\ \tan^{-1}\left(\frac{-5}{3}\right) = -59.03^\circ \quad \tan^{-1}\left(\frac{3}{2}\right) = 56.3^\circ \\ Z_1 = 5.83 \angle -59.03^\circ \quad Z_2 = 3.6 \angle 56.3^\circ$$

$$\frac{Z_1}{Z_2} = \frac{5.83 \angle -59.03^\circ}{3.6 \angle 56.3^\circ} = 1.62 \angle -115.33^\circ$$

$$-0.67 - j1.46$$

$$4. \quad y = 3x^5 - \frac{4}{x^2} + \sqrt{x}$$

$$y = 3x^5 - 4x^{-2} + x^{1/2}$$

$$\frac{dy}{dx} = 15x^4 + 8x^{-3} + \frac{1}{2}x^{-1/2}$$

$$5. \quad \int_2^3 (4 + 5t + 3t^2) dt \\ = \left[4t + \frac{5t^2}{2} + \frac{3t^3}{3} \right]_2^3$$

$$= \left[4t + 2.5t^2 + t^3 \right]_2^3$$

$$= [4 \times 3 + 2.5 \times (3)^2 + (3)^3] - [4 \times 2 + 2.5 \times (2)^2 + (2)^3]$$

$$= (12 + 22.5 + 27) - (8 + 10 + 8)$$

$$= 61.5 - 26$$

$$= 35.5$$

SECTION B:

$$1(a) \quad \frac{6}{(x+1)(x-2)}$$

$$\frac{6}{(x+1)(x-2)} = \frac{A}{(x+1)} + \frac{B}{(x-2)}$$

$$\cancel{(x+1)}\cancel{(x-2)} \times \frac{6}{\cancel{(x+1)}\cancel{(x-2)}} = \cancel{(x+1)}\cancel{(x-2)} \frac{A}{\cancel{(x+1)}} + \cancel{(x+1)}\cancel{(x-2)} \frac{B}{\cancel{(x-2)}}$$

$$6 = A(x-2) + B(x+1)$$

$$\text{Let } x = 2$$

$$6 = A(0) + B(2+1)$$

$$6 = B3$$

$$B = \frac{6}{3} = 2$$

$$\text{Let } x = -1$$

$$6 = A(-1-2) + B(0)$$

$$6 = A(-3)$$

$$A = \frac{6}{-3} = -2$$

$$\frac{6}{(x+1)(x-2)} = \frac{-2}{(x+1)} + \frac{2}{(x-2)}$$

$$= \left[\frac{-2}{1} \ln(x+1) \right] - \left[\frac{2}{1} \ln(x-2) \right]_3^5$$

$$= [-2 \ln(6)] - [2 \ln(1)]$$

$$= (-3.58) - [0]$$

$$= -3.58$$

$$(b) \quad h = \frac{4}{5-3} = \frac{4}{2} = 2$$

$$h = \frac{5-3}{4} = \frac{2}{4} = 0.5$$

x	3	3.5	4	4.5	5
y	-2.77	-3.81	-4.605	-5.24	-5.78
	y ₀	y ₁	y ₂	y ₃	y ₄

$$h = \frac{1}{2} (-2.77 + -5.78) + -3.81 + -4.605 + -5.24$$

$$-4.275 + -3.81 + -4.605 + -5.24$$

$$h = -17.93$$

9
20

$$2. \text{ (a) } L_1 = 4x + 4y - 6 = 0$$

$$L_2 = 3y - 6x = 3$$

$$(a) \text{ (ii) } L_1 : 4x + 4y - 6 = 0$$

$$4x + 4y = 6$$

$$4y = -4x + 6$$

$$y = \frac{-4x + 6}{4}$$

$$y = -x + 1.5$$

$$\text{GRADIENT} = -1 \quad \text{INT} = 1.5$$

(iii) PERPENDICULAR OF L_1 IS $+1/1$ OR 1

$$5x = 1(6) + c$$

$$c = 5 - 6$$

$$c = -1$$

THEREFORE $y = 1x - 1$
OR $y = x - 1$

$$(b) s = t^4 \sin 3t$$

LET $u = t^4$ AND $v = \sin 3t$

$$\frac{du}{dt} = \frac{du}{dx} \cdot 4t^3$$

$$\frac{dv}{dt} = \frac{dv}{dx} \cdot 3 \cos 3t$$

$$(t^4 \times 3 \cos 3t) + (\sin 3t \times 4t^3)$$

$$= 3 \cos 3t^5 + \sin 12t^4$$

$$\text{IF } t = 1.5$$

$$s = 3 \cos 3 \times (1.5)^5 + \sin 12(1.5)^4$$

$$= 3.826$$

$$(c) i = 2(3 - e^{-10t})$$

$$2i = 3 - e^{-10t}$$

$$-e^{-10t} = 2i - 3$$

$$-10t = -\ln(2i - 3)$$

$$10t = \ln(2i - 3)$$

$$t = \frac{\ln(2i - 3)}{10}$$

$$4. \begin{pmatrix} E_1 \\ I_1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 1/2 & 1 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 110 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 \\ 1/60 & 1 \end{pmatrix} \begin{pmatrix} 1 & 40 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 40 \\ 1/60 & 5/3 \end{pmatrix}$$

$$\begin{pmatrix} 1 \times 1 \\ 1 \times 40 \\ 1/60 \times 1 \\ 1/60 \times 40 \end{pmatrix} + \begin{pmatrix} 0 \times 0 \\ 0 \times 1 \\ 1 \times 0 \\ 1 \times 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 40 \\ 0.0167 \text{ or } 1/60 \\ 1.6667 \text{ or } 5/3 \end{pmatrix}$$

CHECK DETERMINANT:

$$(1 \times 5/3) - (1/60 \times 40) = 1.667 - 0.667 = 1?$$

2.

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$$\begin{pmatrix} 1 & 40 \\ 1/60 & 5/3 \end{pmatrix} \begin{pmatrix} 110 \\ 4 \end{pmatrix} = \begin{pmatrix} 270 \\ 8.5 \end{pmatrix} \quad \checkmark$$

$$(1 \times 110) + (40 \times 4) =$$

$$\left(\frac{1}{60} \times 110\right) + \left(\frac{5}{3} \times 4\right) =$$

$$1.8333 + 6.6667$$

$$E_1 = 270V \quad \checkmark \quad I_1 = 8.5A \quad \checkmark$$

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