



Complete, fold and seal
(see note 2 below)

SURNAME: Pritchard

FORENAME(S): Kyran Tyler

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.

1	Student Number	
2	Title of Examination Paper	Eng Maths
3	Module Code	SGEE4002
4	Date and Time of Examination	7/3/22 2:35
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

[illegible]

1) $15(3x+2) - 8(2-4x) = 125$

$$45x + 30 - 16 + 32x = 125$$

$$77x + 14 = 125$$

$$77x = 111$$

$$x = \frac{111}{77} = 1.44 \quad \checkmark$$

5

2) (i) $4A - 3B$

$$\begin{pmatrix} 12 & -4 \\ 20 & 4 \end{pmatrix} - \begin{pmatrix} 6 & -9 \\ 6 & 1 \end{pmatrix} = \begin{pmatrix} 6 & 5 \\ 14 & 3 \end{pmatrix}$$

1

(ii) BC

$$\begin{pmatrix} 2 & -3 \\ 2 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 4 & -3 & 2 \\ 2 & 3 & 4 \end{pmatrix}$$

$$C_{11} = (2 \times 4) + (-3 \times 2) = 2$$

$$C_{12} = (2 \times -3) + (-3 \times 3) = -15$$

$$C_{13} = (2 \times 2) + (-3 \times 4) = -8$$

$$C_{21} = (2 \times 4) + (1 \times 2) = 10$$

$$C_{22} = (2 \times -3) + (1 \times 3) = -3$$

$$C_{23} = (2 \times 2) + (1 \times 4) = 8$$

$$\begin{pmatrix} 2 & -15 & -8 \\ 10 & -3 & 8 \end{pmatrix}$$

4

(iii) $A^{-1} \begin{pmatrix} 3 & -1 \\ 5 & 1 \end{pmatrix} (3 \times 1) - (-1 \times 5) = 8 = \frac{1}{8}$

$$\frac{1}{8} \times \begin{pmatrix} 1 & 1 \\ -5 & 3 \end{pmatrix} = \begin{pmatrix} 1/8 & 1/8 \\ -5/8 & 3/8 \end{pmatrix} \quad \checkmark$$

5

3) $y = 5x^3 - \frac{3}{x^4} + 4\sqrt{x}$

$$\frac{dy}{dx} = 15x^2 - 3x^{-4} + \frac{1}{4}x^{-3/4} = 15x^2 + 12x^{-5} + \frac{1}{4}x^{-3/4}$$

3

$$4) \quad Z_1 = r = \sqrt{5^2 + 4^2} = 6.40 \quad \checkmark \quad = 6.40 \angle -38.66^\circ$$

$$\theta = \tan^{-1}\left(\frac{4}{5}\right) = 38.66^\circ \quad \checkmark$$

$$Z_2 = r = \sqrt{3^2 + 5^2} = 5.83 \quad \checkmark \quad \checkmark \quad \checkmark$$

$$\theta = \tan^{-1}\left(\frac{5}{3}\right) = 59.04^\circ = 5.83 \angle 59.04^\circ$$

$$(i) \quad Z_1 Z_2 = 6.40 \times 5.83 \angle -38.66 + 59.04 = 37.31 \angle 20.38^\circ$$

$$(ii) \quad \frac{Z_1}{Z_2} = \frac{6.40}{5.83} \angle -38.66 - 59.04 = 1.098 \angle -97.7^\circ$$

$$5) \quad \int_0^{\pi/2} (4 \cos 2x - 6 \sin 3x) dx$$

$$\left[\frac{4}{2} \sin 2x - -\frac{6}{3} \cos 3x \right]_0^{\pi/2}$$

$$\left[\frac{4}{2} \sin(2 \cdot \frac{\pi}{2}) - -\frac{6}{3} \cos(3 \cdot \frac{\pi}{2}) \right] - \left[\frac{4}{2} \sin 0 - -\frac{6}{3} \cos 0 \right]$$

$$[0 - 0] - [0 - (-2)]$$

$$[0] - [2] = -2 \quad \checkmark$$

8

36
40

1) (i)

$$7I_1 + 8(I_1 + I_2) = 12$$

$$7I_1 + 8I_1 + 8I_2 = 12$$

$$15I_1 + 8I_2 = 12 \quad (1)$$

$$14I_2 + 8(I_1 + I_2) = 8$$

$$14I_2 + 8I_1 + 8I_2 = 8$$

$$8I_1 + 22I_2 = 8 \quad (2)$$

$$I_1 = 12 \quad 8$$

$$\frac{8 \quad 22}{15 \quad 8} = \frac{200}{266} = 0.75$$

$$I_2 = \frac{15 \quad 12}{8 \quad 8} = \frac{24}{266} = 0.09$$

$$\textcircled{1} \times 8 \quad 15I_1 + 8I_2 = 12 \quad = \quad 120I_1 + 64I_2 = 96$$

$$\textcircled{2} \times 15 \quad 8I_1 + 22I_2 = 8 \quad = \quad 120I_1 + 330I_2 = 120$$

$$266I_2 = 24$$

$$I_2 = \frac{24}{266} = 0.09$$

$$\text{Sub into } \textcircled{1} \quad 15I_1 + 8(0.09) = 12$$

$$12 - 0.72 = 15I_1$$

$$\frac{11.28}{15} = I_1$$

$$I_1 = 0.75$$

20
20

4) (i) a) $y = \frac{2e^{6x}}{\sin 3x}$

let $u = 2e^{6x}$ $v = \sin 3x$
 $\frac{du}{dx} = 12e^{6x}$ $\frac{dv}{dx} = 3 \cos 3x$

$$\frac{dy}{dx} = \frac{(\sin 3x)(12e^{6x}) - (2e^{6x})(3 \cos 3x)}{(\sin 3x)^2}$$

$$\frac{dy}{dx} = \frac{12xe^{5x} \sin 3x - (3) 2e^{6x} \cos 3x}{(\sin 3x)^2}$$

b) $y = 6 \cos(3x - 5)$

let $u = 3x - 5$ $v = 6 \cos u$
 $\frac{du}{dx} = 3$ $\frac{dv}{du} = -6 \sin u$

$$\frac{dy}{dx} = 3(-6 \sin u) = -18 \sin(3x - 5)$$

(ii) $y = 3x^3 + 4x^2 - 2x - 5$

$$\frac{dy}{dx} = 9x^2 + 8x - 2 \quad \text{if } \frac{dy}{dx} = 0$$

$$0 = 9x^2 + 8x - 2$$

$$\frac{dy}{dx} = \frac{-8 \pm \sqrt{8^2 - (4)(9)(-2)}}{2(9)}$$

$$x = 0.20 \quad \text{or} \quad -1.09$$

$$\frac{dy}{dx} = 18x + 8$$

$$y = 3(0.20)^3 + 4(0.20)^2 - 2(0.20) - 5 = 2.184 \quad \text{OR} \quad \text{min. value}$$

$$y = 3(-1.09)^3 + 4(-1.09)^2 - 2(-1.09) - 5 = -11.45 \quad \text{OR} \quad \text{max. value}$$

$$\frac{d^2 y}{dx^2} = 2.184 \quad \text{it is the minimum?}$$

$$\frac{d^2 y}{dx^2} = -11.45 \quad \text{it is the maximum?}$$

2) let $u = (3x+5)^4$ $\frac{du}{dx} = 3$ $dx = \frac{1}{3} du$

$$\left[\frac{1}{3} \times \frac{1}{u^4} \right] \times$$

$$\frac{1}{20}$$