

**Complete, fold and seal**  
(see note 2 below)

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## 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                   |                   |
| 2 | Title of Examination Paper       |                   |
| 3 | Module Code                      | SGEE4002          |
| 4 | Date and Time of Examination     | 7/3/2022<br>2:30. |
| 5 | Examination Venue                |                   |
| 6 | Seat Number                      |                   |
| 7 | Number of Answer Books handed in |                   |

[illegible]

Q1)  $15(3x+2) - 8(2-4x) = 125$

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

$$77x + 14 = 125$$

$$77x = 125 - 14$$

$$77x = 111$$

$$x = \frac{111}{77}$$

$$x = 1.442 \text{ (3 d.p.)}$$

5.

Q2) i)  $\begin{pmatrix} 12 & -4 \\ 20 & 4 \end{pmatrix} - \begin{pmatrix} 6 & -9 \\ 6 & 3 \end{pmatrix} = \begin{pmatrix} 6 & 5 \\ 14 & 1 \end{pmatrix}$

2

ii)  $\begin{pmatrix} 2 & -3 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 4 & -3 & 2 \\ 2 & 3 & 4 \end{pmatrix} =$

0.

iii)  $A^{-1} = \frac{1}{15} \begin{pmatrix} 3 & -1 \\ 5 & 1 \end{pmatrix} = \begin{pmatrix} 3/15 & -1/15 \\ 5/15 & 1/15 \end{pmatrix}$

0.

$$3 \times 5 = 15$$

Q3)  $y = 5x^3 - \frac{3}{x^4} - 4\sqrt{x}$

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

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

4.

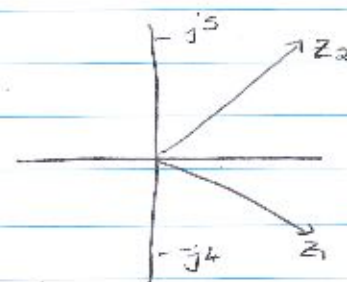
Q4)  $z_1 = 5 - j4$ ,  $z_2 = 3 + j5$

$$r = \sqrt{5^2 + 4^2}$$

$$= 6.403$$

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

$$= 5.831$$



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

$$= 38.66^\circ$$

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

$$= 59.03^\circ$$

Carrying on Question 4.

i)  $Z_1 Z_2$

$$= (6.403 \times 5.835) \angle (38.66 + 59.036)$$

$$= 37.3622 \angle 97.696. \quad \times$$

$$\begin{aligned} \text{ii) } \frac{Z_1}{Z_2} &= \frac{6.403 \angle 38.66}{37.3622 \angle 97.696} = \frac{6.403 \angle 38.66}{5.835 \angle 59.036} \\ &= \frac{6.403}{5.835} \angle (38.66 - 59.036) \\ &= 1.097 \angle -20.376 \quad \times \end{aligned}$$

$$\begin{aligned} \text{Q5) } \int_0^{\pi/2} (4 \cos 2x - 6 \sin 3x) dx &= \left[ 4 \sin 2x - 6 \cos 3x \right]_0^{\pi/2} \\ &= \left[ 2 \sin x - 6 \cos 3x \right]_0^{\pi/2} \quad \times \end{aligned}$$

$$= [2 \sin(\pi/2) - 6 \cos(3\pi/2)] - [2 \sin(0) - 6 \cos(3 \times 0)]$$

$$= (-5.925) - (-6) \quad \text{-----}$$

$$= 0.075 \text{ (3 d.p.)} \quad \times$$

0

17/40

$$\begin{aligned} 1) \quad 12 &= 15I_1 + 8I_2 & - \textcircled{1} \\ 8 &= 8I_1 + 22I_2 & - \textcircled{2} \end{aligned}$$

$$I_1 = \begin{vmatrix} 12 & 8 \\ 8 & 22 \end{vmatrix} \quad \checkmark$$

$$I_2 = \begin{vmatrix} 12 & 15 \\ 8 & 8 \end{vmatrix} \quad \times$$

$$= \frac{(12 \times 22) - (8 \times 8)}{(15 \times 22) - (8 \times 8)}$$

$$= \frac{(12 \times 8) + (15 \times 8)}{(15 \times 22) - (8 \times 8)}$$

$$= \frac{264 + 64}{330 - 64}$$

$$= \frac{96 + 120}{330 - 64}$$

$$= \frac{328}{394}$$

$$= \frac{216}{394}$$

$$= 0.832 \quad \times$$

$$= 0.548 \quad \checkmark$$

$$\begin{aligned} ii) \quad 12 &= 15I_1 + 8I_2 \\ 8 &= 8I_1 + 22I_2 \end{aligned}$$

$$\begin{aligned} &\times 8 & - \textcircled{1} \times 8 \\ &\times 15 & - \textcircled{2} \times 15 \end{aligned}$$

$$96 = 120I_1 + 64I_2$$

$$- 120 = 120I_1 + 330I_2$$

$$- 24 = - 266I_2$$

$$- 24 = - 266I_2$$

$$266I_2 = 24$$

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

$$I_2 = 0.0902 \quad \checkmark$$

$$\text{Sub } I_2 = 0.0902 \text{ into } \textcircled{1}$$

$$15I_1 + 8(0.0902) = 12$$

$$15I_1 + 0.7216 = 12$$

$$15I_1 = 12 - 0.7216$$

$$I_1 = \frac{11.2784}{15}$$

$$I_1 = 0.7519 \quad \times$$

$$\frac{6}{0.02}$$

Q2) 40 ~~(32 + 55)~~

at a = 1

for a = 1

Q3)

| $x$              | $f$ | $xf$                                     | $f(x - \bar{x})$  |
|------------------|-----|------------------------------------------|-------------------|
| 5                | 24  | 120                                      | <del>-518.4</del> |
| 15               | 42  | 630                                      | -487.2            |
| 25               | 58  | 1450                                     | -92.8             |
| 35               | 42  | 1470                                     | 352.8             |
| 45               | 22  | 990                                      | 404.8             |
| 55               | 12  | 660                                      | 340.8             |
| $\Sigma f = 200$ |     | <del><math>\Sigma xf = 5320</math></del> | $\Sigma = 0$      |

$$\bar{x} = \frac{5320}{200} = 26.6$$

i) Switch A  $\sim 0.45$   
Switch B  $\sim 0.85$

a)  $P(A) + P(B)$   
 $P(0.45) + (0.85)$   
 $= 1$

Carrying on question ~~B.3.7~~ b)

$$P(\text{neither}) = 0.45 + 0.15 \\ = 0.6 \quad \times$$

~~P(correct) = 1 -~~

0

$\frac{4}{20}$

Q4) a)  $y = \frac{2e^{6x}}{\sin 3x} = y \sin 3x = 2e^{6x} \quad \times$

~~differentiate~~

~~differentiate~~

0

~~differentiate~~