



Examination Answer Books

12 Pages

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	TCA1
3	Module Code	PCEE4000
4	Date and Time of Examination	15/11/25 11:15
5	Examination Venue	Pembroke College
6	Seat Number	
7	Number of Answer Books handed in	1

	List the numbers of the questions you have attempted	1
		2
		3
		4
		5
		6
		7
		8
		9
	Total	44

Second Market
50/11/25
12/10/25

Complete, fold and seal
(see note 2 below)

SURNAME:

Lewis

FORENAME(S):

Robyn

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$2\pi\sqrt{LC} \times f_0 = 1$$

$$2\pi\sqrt{LC} = \frac{1}{f_0}$$

$$\sqrt{LC} = \frac{1}{2\pi f_0}$$

$$L = \frac{1}{f_0 - 2\pi f_0 C}$$

2.1

$$5(2-2x) - 4(5-2x) - 2 = 0$$

$$10 - 5x - 20 + 8x - 2 = 0$$

$$-10 + 3x - 2 = 0$$

$$-12 + 3x = 0$$

$$3x = -12$$

$$x = -\frac{12}{3} = -4$$

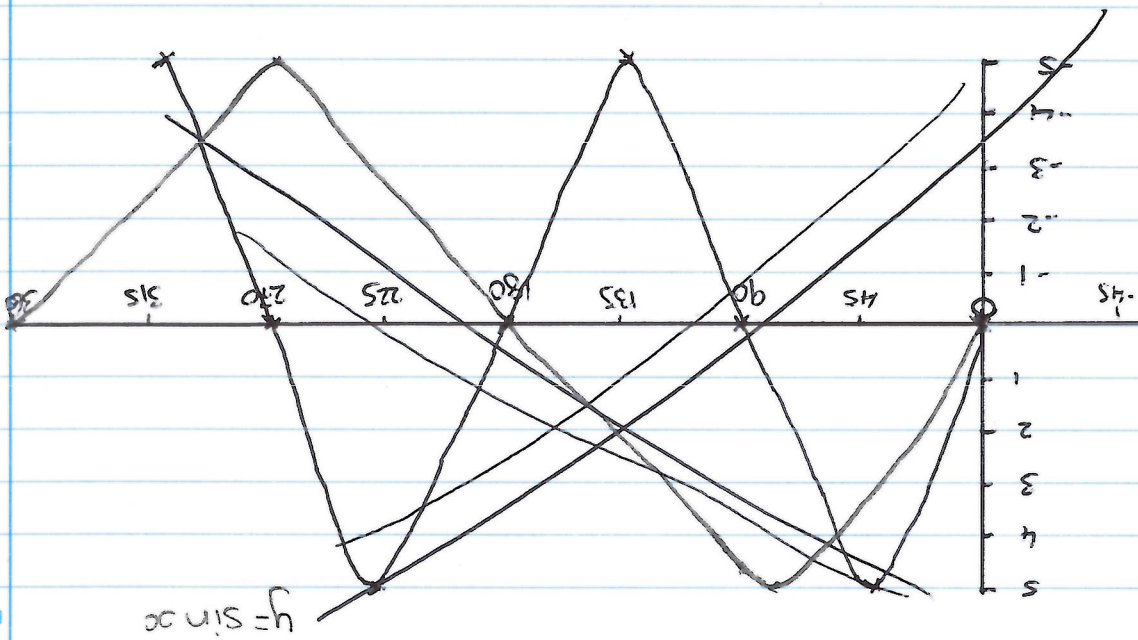
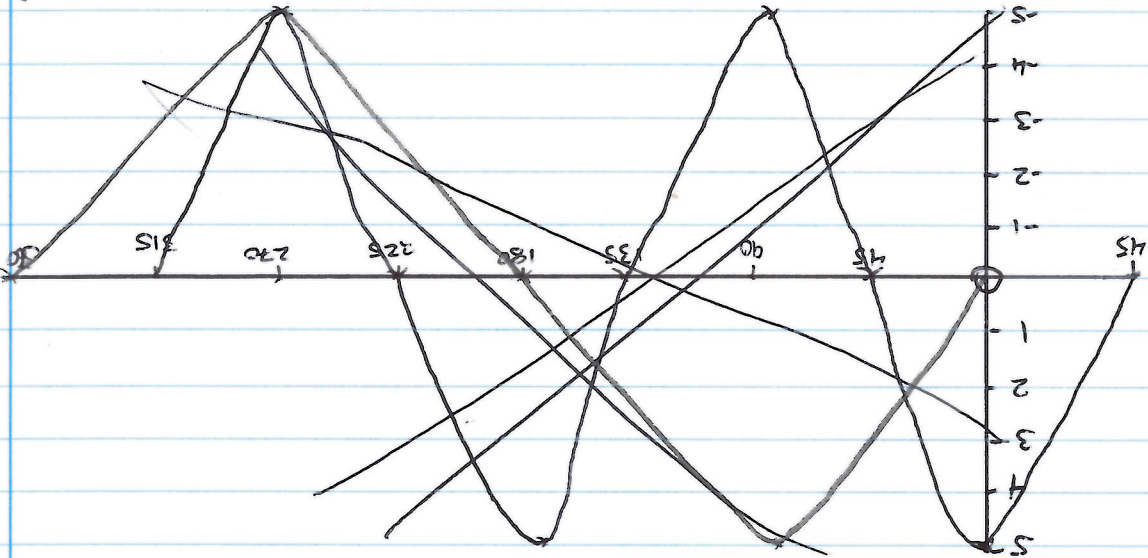
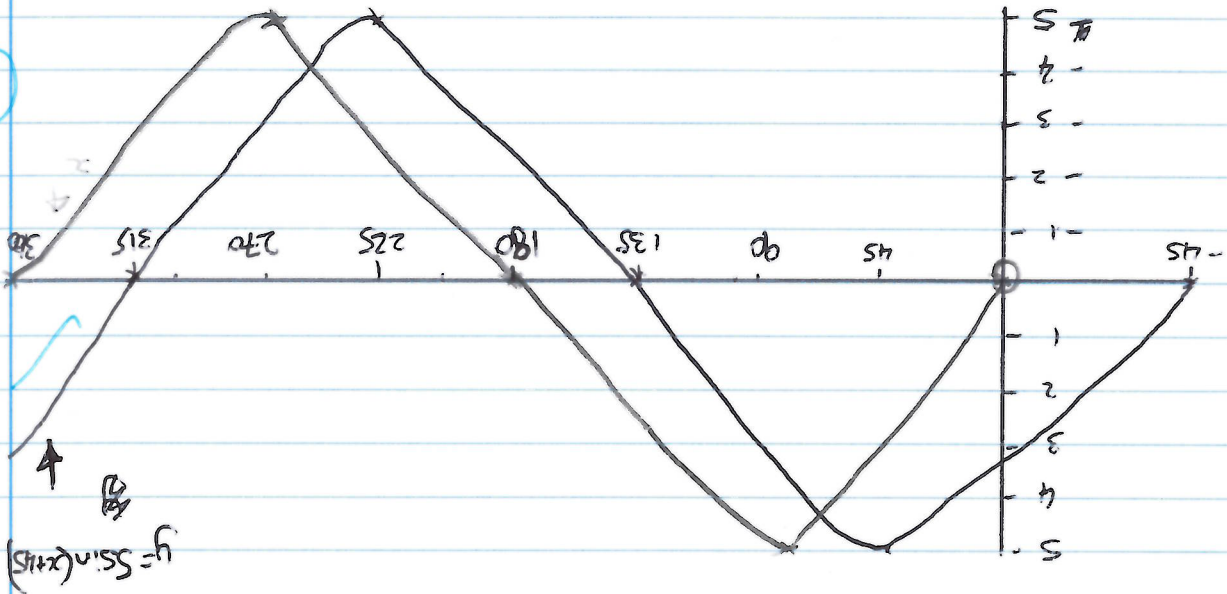
$$x = -4$$

2

1

2.1

9



4 2

4 !

$$z_1 = 4 + j \text{ and } z_2 = 2 - 4j$$

$$z_1 - z_2$$

$$(4 + j) - (2 - 4j)$$

$$2 + 5j$$

4 !! z₁ z₂

$$(4 + j) \times (2 - 4j)$$

$$\begin{aligned} & 8 - 16j + 2 - 4j^2 \\ & 10 - 16j + 4 \end{aligned}$$

$$\frac{z_1}{z_2} = \frac{4 + j}{2 - 4j} \times \frac{2 + 4j}{2 + 4j} = \frac{4 + 16j + 2 + 4j^2}{4 - 16j + 4j^2}$$

$$\frac{6 + 16j + 2}{4 - 16j + 4j^2} = \frac{8 + 16j + 2}{4 - 16j + 4j^2}$$

$$\frac{6 + 16j + 2}{4 - 16j + 4j^2} \rightarrow \frac{8 + 16j + 2}{4 - 16j + 4j^2}$$

4 !!!

4 14

$$(2j)^5$$

$$(4 + j)^5$$

$$\sqrt{4^2 + 1^2}$$

$$\sqrt{17}$$

$$\frac{4}{1} \angle \tan^{-1} \frac{1}{4}$$

$$\frac{4}{1} = 14.036$$

$$\sqrt{17} \angle 14.036$$

1

2

2

stop

5.

5!

$$A = \begin{pmatrix} 2 & 0 \\ -1 & 3 \end{pmatrix} \quad B = \begin{pmatrix} 4 & 1 \\ -2 & 4 \end{pmatrix}$$

$$4A - 2B$$

$$4 \begin{pmatrix} 2 & 0 \\ -1 & 3 \end{pmatrix} - 2 \begin{pmatrix} 4 & 1 \\ -2 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 8 & 0 \\ -4 & 12 \end{pmatrix} - \begin{pmatrix} 8 & 2 \\ -4 & 8 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 0 \\ -2 & 4 \end{pmatrix}$$

AB

$$\begin{pmatrix} -1 & 3 \\ 2 & 0 \end{pmatrix} \times \begin{pmatrix} 4 & 1 \\ -2 & 4 \end{pmatrix}$$

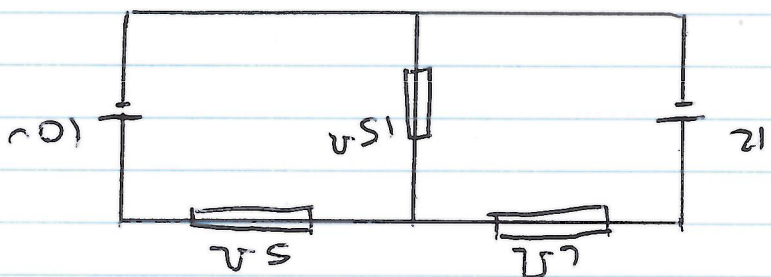
$$\begin{pmatrix} \boxed{\begin{matrix} -1 \times 4 \\ 3 \times -2 \end{matrix}} & \boxed{\begin{matrix} -1 \times 1 \\ 3 \times 4 \end{matrix}} \\ \boxed{\begin{matrix} 2 \times 4 \\ 0 \times -2 \end{matrix}} & \boxed{\begin{matrix} 2 \times 1 \\ 0 \times 4 \end{matrix}} \end{pmatrix}$$

$$\begin{pmatrix} 8+0 & -4-6 \\ 2+0 & -1+12 \end{pmatrix} \quad \begin{pmatrix} 8 & -10 \\ 2 & 11 \end{pmatrix}$$

4



505



$$\begin{aligned}
 I_1 & \\
 12 &= I_1 \times 2 + (I_1 + I_2) \times 15 \\
 12 &= 2I_1 + 15I_1 + 15I_2 \\
 12 &= 17I_1 + 15I_2 \\
 10 &= 5I_2 + 15I_1 + 15I_2 \\
 10 &= 20I_2 + 15I_1
 \end{aligned}$$

$$\begin{aligned}
 15 \\
 21 \\
 12 \\
 10
 \end{aligned}$$

$$\begin{aligned}
 15 \\
 20
 \end{aligned}$$

$$\begin{aligned}
 12 \\
 10 \\
 15 \\
 21 \\
 12
 \end{aligned}$$

$$\begin{aligned}
 15 \\
 10 \\
 12 \\
 20 \\
 10
 \end{aligned}$$

$$\begin{aligned}
 12 \\
 10 \\
 15 \\
 21 \\
 12
 \end{aligned}$$

$$\begin{aligned}
 15 \\
 10 \\
 12 \\
 20 \\
 10
 \end{aligned}$$

$$15 \times 12 = 180$$

$$180 + 210 = 390$$

$$10 \times 20 = 200$$

$$15 \times 12 = 180$$

$$380 \div 1 = 380$$

$$390 \div 1 = 390$$

$$\begin{aligned}
 18 \\
 390 \\
 10 \\
 12 \\
 21
 \end{aligned}$$

$$\begin{aligned}
 10 \\
 380 \\
 15 \\
 20 \\
 12
 \end{aligned}$$

$$380 \div 1 = 380$$

8

Question No.

$$S_n = \frac{2}{n} (2a + (n-1)d)$$

d increase
n = length
a = orig

26 m deep hole

~~$$18 \times \frac{26}{2} = (26-1)(26-1)$$~~

~~$$S_{26} = \frac{26}{2}$$~~

$$S_{26} = \frac{26}{2} (2 \times 65 + (26-1) \times 7.25)$$

$$2 \times 65 = 130$$

$$26-1 = 25$$

$$2 \quad 130 \times 25 + 7.25 \times 25 = 23562.50$$

$$\frac{26}{2} (23562.50) = 306312.50$$

9.

$$a, r, n-1$$

$$a = 10$$

$$n = 4$$

$$10r^{n-1} = 300$$

~~$$r^3 = 30$$~~

$$r = \sqrt[3]{30}$$

$$1^{st} \text{ Speed} = \sqrt[3]{30} = 1 \text{ rev/min}$$

$$2^{nd} \text{ Speed} = \sqrt[3]{30}^{2-1} = 3.11 \text{ rev/min}$$

$$3^{rd} \text{ Speed} = \sqrt[3]{30}^{3-1} = 9.65 \text{ rev/min}$$

$$4^{th} \text{ Speed} = \sqrt[3]{30}^{4-1} = 30 \text{ rev/min}$$

QDP