



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.

Complete, fold and seal
(see note 2 below)

SURNAME: Lewis

FORENAME(S): Robyn

1	Student Number	
2	Title of Examination Paper	TC A2
3	Module Code	PCEE4000
4	Date and Time of Examination	14/05/25 11:15 am
5	Examination Venue	Pembrokeshire College
6	Seat Number	
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	16
2	6
3	8
4	8
5	7
6	10
7	14
8	6
Total	75

1. a $y = 3e^{4x} \sin x$

$$u = 3e^{4x} \quad \downarrow$$

$$4 \times 3e^{4x}$$

$$\frac{du}{dx} = 12e^{4x} \quad \checkmark$$

$$v = 1 \sin x \quad \checkmark$$

~~Part 2~~

$$1 \times 1 \cos(1x)$$

$$\frac{dv}{dx} = 1 \cos(1x) \quad \checkmark$$

$$\frac{dy}{dx} = 3e^{4x} \times 1 \cos(1x) + 1 \sin(1x) \times 12e^{4x}$$

$$3e^{4x} \cos(1x) + 12e^{4x} \sin(1x) \quad \checkmark$$

(5)

1 b. $\frac{x-1}{3e^{2x}}$

$$u = x-1 \quad \downarrow \quad v = 3e^{2x} \quad \checkmark$$

$$1 \times 1 x^{1-1}$$

$$2 \times 3e^{2x}$$

$$\frac{du}{dx} = 1x \quad \checkmark$$

$$\frac{dv}{dx} = 6e^{2x} \quad \checkmark$$

bracket

$$\frac{dy}{dx} = \frac{3e^{2x} \times 1 - (x-1) \times 6e^{2x}}{(3e^{2x})^2}$$

$$\downarrow$$

$$\frac{3e^{2x} - 6e^{2x}(x-1)}{(6e^{4x})}$$

(4)

1C. $y: \sqrt{x} - \frac{1}{\sqrt{x^4}} - \cos 3x$

$1x^{\frac{1}{2}} - 1x^{-4} - \cos 3x$ ✓

$\frac{d}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - -4x1x^{-4-1} - \cancel{13x^0} - 3x1\sin(3x)$ ✓

$\frac{1}{2}x^{-\frac{1}{2}} + 4x^{-5} - 3\sin(3x)$ ✓

$\frac{1}{2\sqrt{x}} + \frac{4}{x^5} - 3\sin(3x)$

(3)

1d $3\sin(2x^4)$

$u = 2x^4$ ✓

$3\sin u$

$\frac{d}{du} = 4x2x^{4-1}$ ✓

$\frac{dy}{dx} = \cancel{13x^0} \cos u = 3\cos u$ ✓

$3\cos 8x^3$ X

(4)

2.

$$12(1 - 2e^{-t})$$

$$\begin{aligned} 12 \times 1 &= 12 \\ 12x - 2e^{-t} &= -24e^{-t} \quad t=0 \end{aligned}$$

$$12 - 24e^{-t} \quad \checkmark$$

$$\frac{dy}{dt} = -1x - 24e^{-t} = 24e^{-t} \quad \checkmark$$

$$24e^{-1 \times 0} \quad \checkmark = 24 \text{ V/s} \quad \checkmark$$

(6)

$$3.9 \quad y = 4x^3 - 21x^2 + 18x + 6$$

$$3 \times 4x^{3-1} - 2 \times 21x^{2-1} + 1 \times 18x^{1-1}$$

$$\frac{dy}{dx} = 12x^2 - 42x + 18 \quad \checkmark$$

$$x = \frac{-(-42) \pm \sqrt{42^2 - 4(12)(18)}}{2(12)}$$

$$x = 3 \quad \checkmark \quad \text{or} \quad \frac{1}{2} \quad \checkmark$$

$$\text{At } x=3 + 4 \times 3^3 - 21 \times 3^2 + 18 \times 3 + 6 = 40 \text{ or } -21 \quad \checkmark$$

$$\text{At } x = \frac{1}{2} + 4 \times \left(\frac{1}{2}\right)^3 - 21 \times \left(\frac{1}{2}\right)^2 + 18 \times \left(\frac{1}{2}\right) + 6 = \frac{41}{4} \quad \left(\frac{1}{2}, \frac{41}{4}\right) \quad \checkmark$$

$$\begin{aligned} 3b. \quad 12x^2 - 42x + 18 &\quad \frac{dy}{dx} = 2 \times 12x^{2-1} - 1 \times 42x^{1-1} \\ 24x^{2-1} - 42x^{1-1} &= 24x - 42 \quad \checkmark \end{aligned}$$

$$\begin{aligned} x &= 3 \quad \checkmark \quad 24 \times 3 - 42 = 30 \text{ minima} \quad \checkmark \\ x &= \frac{1}{2} \quad \checkmark \quad 24 \times \left(\frac{1}{2}\right) - 42 = -30 \text{ maxima} \quad \checkmark \end{aligned}$$

(8)

49. $\int_2^3 (2x^3 - 3x^2 + 2) dx$

$$\left[\frac{2x^{3+1}}{3+1} - \frac{3x^{2+1}}{2+1} + \frac{2x^{0+1}}{0+1} \right]_2^3$$

~~$$\left[\frac{2x^4}{4} - \frac{3x^3}{3} + \frac{2x^1}{1} \right]_2^3$$~~

$$\left[\frac{2x^4}{4} - \frac{3x^3}{3} + \frac{2x^1}{1} \right]_2^3$$

$$\left[\frac{1x^4}{2} - 1x^3 + 2x^1 \right]_2^3$$

~~at 3 $\frac{1x^4}{2}$~~

at 3 $\frac{1x^4}{2} - 1x^3 + 2x^1 = 19.5$

at 2 $\frac{1x^4}{2} - 1x^3 + 2x^1 = 4$

~~19.5 - 4~~
19.5 - 4 = 15.5

(8)

4b

$$\int_0^{\frac{\pi}{4}} (3 \cos 2x - 4 \sin \frac{x}{3}) dx$$

↓

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

$$\text{at } \frac{\pi}{4} \rightarrow \frac{3}{2} \sin 4\left(\frac{\pi}{4}\right) - - \frac{4}{3} \cos - 3\left(\frac{\pi}{4}\right) = 0.943$$

$$\text{at } 0 \rightarrow \frac{3}{2} \sin 4(0) - - \frac{4}{3} \cos - 3(0) = -1.333$$

$$0.943 - -1.333 = 2.28$$

(0)

5

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

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

$$\frac{A(2x-1)+1xB}{1x(2x-1)}$$

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

$$x = 0.5 \quad 2 \times 0.5 + 6 = A(2 \times 0.5 - 1) + 1 \times 0.5 B$$

$$7 = 0.5 B \quad + \quad \frac{7}{0.5} = B \quad \checkmark$$

$$x = 0 \quad 2 \times 0 + 6 = A(2 \times 0 - 1) + 1 \times 0 B$$

$$6 = -1A \quad + \quad \frac{6}{-1} = A \quad \checkmark$$

(7)

$$\int \frac{-1}{1x} + \frac{0.5}{(2x-1)}$$

$$\left[-\frac{1}{1} \ln(1x) + \frac{0.5}{2} \ln(2x-1) \right] \quad \times$$

$$\text{at } 5 \quad + \frac{-1}{1} \ln(1 \times 5) + \frac{0.5}{2} \ln(2 \times 5 - 1) = -1.06013$$

$$\text{at } 2 \quad + \frac{-1}{1} \ln(1 \times 2) + \frac{0.5}{2} \ln(2 \times 2 - 1) = -0.41849$$

$$= \frac{-1.06013 - (-0.41849)}{-0.6416} \quad \times$$

6

$$\frac{2375}{4} \quad n=0.75 \quad \checkmark$$

$$\frac{253}{4} =$$

	2	2.75	3.5	4.25	5	
$\frac{2375}{2(2375-1)}$	$\frac{5}{3}$	$\frac{92}{99}$	$\frac{13}{21}$	$\frac{116}{255}$	$\frac{16}{45}$	$\checkmark$

Simpson's rule

$$\frac{1}{3} \times 0.75 \left[\left(\frac{5}{3} + \frac{16}{45} \right) + 4 \left(\frac{92}{99} + \frac{116}{255} \right) + 2 \left(\frac{13}{21} \right) \right]$$

$$= 2.19927 \quad \checkmark$$

Percentage error

$$\frac{-0.6416 - 2.19927 \times 100}{-0.6416}$$

$$= 442.7790 \quad \times$$

(10)

7.	x	0.75	2.25	3.75	5.25	6.75	Σ	✓
	f	3	13	20	3	1		
	$f \times x$	2.25	29.25	75	15.75	6.75	129	✓
	$f(x - \bar{x})^2$	2.18	37.81	12.35	5.39	2.49	60.975	✓

$$\frac{129}{40} = 3.225 \quad \checkmark$$

$$\sigma = \sqrt{\frac{60.975}{40-1}} = 1.25 \quad \checkmark$$

14

89
 $A = 0.89$
 $B = 0.95$

8
 $A = 0.89 \times 0.95 = 0.85 \quad \checkmark$

8b
 $A = 1 - 0.89 = 0.11 \quad \checkmark$
 $B = 1 - 0.95 = 0.05 \quad \checkmark$

6

~~$0.11 \times 0.05 = 0.0055$~~
 $0.11 \times 0.05 = 0.0055$
 ~~$1 - 0.0055 = 0.9945$~~
 $1 - 0.0055 = 0.9945$
 ~~0.9945~~
 0.9945

rounding
0.006