



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: Raymond

FORENAME(S): Heather - Gloria - Jane

1	Student Number	
2	Title of Examination Paper	TC A2
3	Module Code	PCEE 4000 / DEPO4000
4	Date and Time of Examination	17/5/23 4pm
5	Examination Venue	Pembs College
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	19
2	1
3	8
4	10
6	12
5	14
7	14
8	8
Total	86 ✓

second marker
D.A.L.
18/05/23

1. d) $y = \frac{2}{x^3} + \sqrt{x} - x$

$$y = 2x^{-3} + x^{\frac{1}{2}} - 1x^1 \quad (\text{ax}^n) \quad \checkmark$$

$$\frac{dy}{dx} = 2 \times -3x^{-3-1} + \frac{1}{2}x^{\frac{1}{2}-1} - 1 \times 1x^{1-1} (\text{max}^{n-1}) \quad \checkmark$$

$$\frac{dy}{dx} = -6x^{-4} + \frac{1}{2}x^{-\frac{1}{2}} - 1x^0$$

$$\frac{dy}{dx} = -6x^{-4} + \frac{1}{2\sqrt{x}} - 1 \quad \checkmark$$

3 ✓

a) $y = 5e^{2x} \cos x$

$$u = 5e^{2x} \quad v = 1 \cos x$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$\frac{du}{dx} = 10e^{2x} \quad \checkmark \quad \frac{dv}{dx} = -\sin x \quad \checkmark$$

$$\frac{dy}{dx} = 5e^{2x} \times -1 \sin x + 1 \cos x \times 10e^{2x}$$

$$\frac{dy}{dx} = -5e^{2x} \sin x + 10e^{2x} \cos x \quad \checkmark$$

6 ✓

$$\frac{dy}{dx} = 5e^{2x} (-\sin x + 2 \cos x) \quad \checkmark$$

c) $y = 5 \sin(x^3)$

$$u = 1x^3 \quad \frac{du}{dx} = 3x^2 \quad \checkmark$$

$$y = 5 \sin(u) \quad \checkmark$$

$$\frac{dy}{dx} = 5 \times 3x^2 \cos(u)$$

$$\frac{dy}{dx} = 15x^2 \cos(x^3) \quad \checkmark$$

6 ✓

$$1. b) y = \frac{2-3x}{x+1}$$

$$u = 2-3x$$

$$v = 1x+1$$

$$\frac{du}{dx} = -3 \times 1x^{1-1}$$

$$\frac{dv}{dx} = 1 \times 1x^{1-1}$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$\frac{du}{dx} = -3 \quad / \quad \frac{dv}{dx} = 1 \quad \checkmark$$

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

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

$$\frac{dy}{dx} = \frac{-6x - 5}{x^2 + 1}$$

$$2. v = 12(1 - 7e^{-3t})$$

$$v = 12 - 84e^{-3t}$$

$$\frac{dv}{dt} = -84 \times -3 e^{-3-1} \quad (\text{max}^{n-1})$$

$$\frac{dv}{dt} = 252 e^{-4t}$$

at initial rate of growth of voltage $t = 0$

so,

$$\frac{dv}{dt} = 252 e^{0t} = 252 \text{ V/s}$$

$$3(a) \quad y = 2x^3 - 15x^2 - 84x + 16$$

$$\frac{dy}{dx} = 2 \times 3x^{3-1} - 15 \times 2x^{2-1} - 84 \times 1x^{1-1} \quad (\text{max } n^{-1})$$

$$\frac{dy}{dx} = 6x^2 - 30x - 84 \quad \checkmark \quad (ax^2 + bx + c)$$

$$x = \frac{-1b \pm \sqrt{1b^2 - 4ac}}{2a} \quad \begin{matrix} a=6 \\ b=-30 \\ c=-84 \end{matrix}$$

$$x = \frac{-(-30) \pm \sqrt{(-30)^2 - 4 \times 6 \times -84}}{2 \times 6} \quad \checkmark$$

$$x = 7 \quad \checkmark \quad x = -2 \quad \checkmark$$

$$y = 2 \times (7)^3 - 15 \times (7)^2 - 84 \times (7) + 16 = -621 \quad \checkmark$$

$$y = 2 \times (-2)^3 - 15 \times (-2)^2 - 84 \times (-2) + 16 = 108 \quad \checkmark$$

Location of turning points (7, -621) (-2, 108) $\checkmark$

$$3(b) \quad \frac{dy}{dx} = 6x^2 - 30x - 84$$

$$\frac{d^2y}{dx^2} = 6 \times 2x^{2-1} - 30 \times 1x^{1-1} = 12x - 30 \quad \checkmark$$

$$\text{When } x = 7 \quad 12 \times (7) - 30 = 54 > 0 \text{ minima} \quad \checkmark$$

$$\text{When } x = -2 \quad 12 \times (-2) - 30 = -54 < 0 \text{ maxima} \quad \checkmark \quad (8)$$

$$4(a) \int_1^4 (1+3x+5x^2) dx \quad \left(\int ax^n dx \right)$$

$$\int_1^4 (1x^0 + 3x^1 + 5x^2) dx \quad \left(\frac{ax^{n+1}}{n+1} + c \right)$$

$$\left[\frac{1x^{0+1}}{0+1} + \frac{3x^{1+1}}{1+1} + \frac{5x^{2+1}}{2+1} \right]_1^4$$

$$= x + \frac{3}{2}x^2 + \frac{5}{3}x^3$$

$$\text{When } x=4 = (4) + \frac{3}{2} \times (4)^2 + \frac{5}{3} (4)^3 = 134.667$$

$$\text{When } x=1 = (1) + \frac{3}{2} \times (1)^2 + \frac{5}{3} (1)^3 = 4.167$$

$$134.667 - 4.167 = \underline{130.50 \text{ units}^2}$$

⑧

4(b)

$$\int_0^{\pi/2} (5 \cos \frac{1}{3}x - 2 \sin x) dx$$

$$\left[\frac{5}{\frac{1}{3}} \sin \frac{1}{3}x - -\frac{2}{1} \cos x \right]_0^{\pi/2} \left(\frac{a}{n} \sin nx + c \right)$$

$$= \left[\frac{5}{3} \sin \frac{x}{3} + 2 \cos x \right]_0^{\pi/2} \times$$

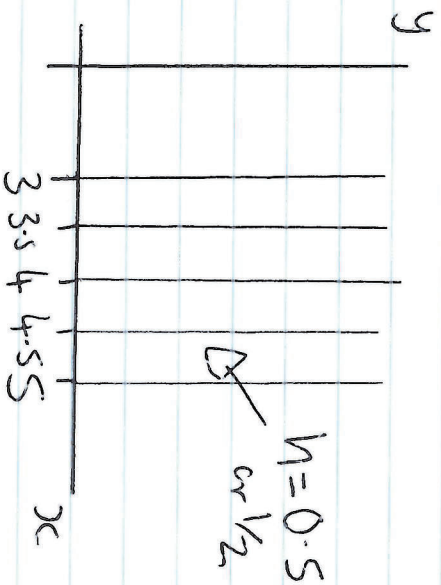
$$\text{When } x = \pi/2 \quad \frac{5}{3} \sin \frac{1}{3} \times \frac{\pi}{2} + 2 \cos \frac{\pi}{2} =$$

$$0.833 \quad \times$$

4(b) when $x = 0$ $\frac{5}{3} \sin \frac{1}{3} \times 0 + 2 \cos 0 = 2$ ✓
 ccm. ②

$$0.833 - 2 = \underline{\underline{-1.17 \text{ units}^2}}$$

6.
$$\int_3^5 \frac{19x-5}{2x(x-1)} dx$$



x	3	3.5	4	4.5	5
$\frac{19x-5}{2x(x-1)}$	$\frac{13}{3}$	$\frac{123}{35}$	$\frac{71}{24}$	$\frac{23}{9}$	$\frac{9}{4}$ ✓

$$\frac{1}{3} \times \frac{1}{2} \times \left(\left(\frac{13}{3} + \frac{9}{4} \right) + 4 \times \left(\frac{123}{35} + \frac{23}{9} \right) + 2 \left(\frac{71}{24} \right) \right)$$

$$\underline{\underline{6.1290}} = \underline{\underline{6.1299}} \quad \checkmark$$

$$\text{percentage error} = \frac{6.1291 - 6.1299}{6.1291} \times 100 = \underline{\underline{0.01\%}} \quad \checkmark$$

⑫

8(a) in series $A = 0.97$ $B = 0.89$

probability of a $= 0.97 \times 0.89 = \underline{\underline{0.86}}$ ✓
connection

8(b) in parallel $\bar{A} = 1 - 0.97 = 0.03$

$$\bar{B} = 1 - 0.89 = 0.11$$

$$0.03 \times 0.11 = \frac{33}{10000} \text{ or } 3.3 \times 10^{-3}$$

probability of $= 1 - \frac{33}{10000} = 0.9967$ ✓

or connection

$$= \underline{\underline{1}} \quad \checkmark$$

⑧ ✓