



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Complete, fold and seal
(see note 2 below)

SURNAME: Alesawi

FORENAME(S): Turki

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	TCA 2
3	Module Code	PCEE4000
4	Date and Time of Examination	14 May 2025
5	Examination Venue	Pembrokeshire College
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	22
2	6
3	8
4	16
5	14
6	12
7	14
8	8
Total	100

second Marked
22/05/2025

1.

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

$u = 3e^{4x} \checkmark$

$v = \sin x \checkmark$

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

$$= 3e^{4x} (4 \sin x + \cos x) \checkmark$$

(6)

b) $y = \frac{x-1}{3e^{2x}}$

$u = x-1$

$v = 3e^{2x}$

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

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

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

(6)

c) $y = x^{\frac{1}{2}} - x^{-4} - \cos 3x$

$$\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} + 4x^{-5} + 3 \sin 3x \checkmark$$

$$= \frac{1}{2\sqrt{x}} + \frac{4}{x^5} + 3 \sin 3x \checkmark$$

(4)

d) $y = 3 \sin(2x^4)$

$u = 2x^4 \checkmark$

$\frac{du}{dx} = 8x^3 \checkmark$

$$\frac{dy}{dx} = 3(8x^3) \cos(2x^4) \checkmark$$

$$= 24x^3 \cos(2x^4) \checkmark$$

(6)

2. $v = 12 - 24e^{-t} \checkmark$

initial value

$$\frac{dv}{dt} = -(-24)e^{-t} \checkmark = 24e^{-t} \checkmark$$

initial rate when $t=0$

$$\frac{dv}{dt} = 24 e^{-(0)} = 24 \text{ V/sec} \checkmark$$

6

3. $y = 4x^3 - 21x^2 + 18x + 6$

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

$$12x^2 - 42x + 18 = 0 \checkmark (\div 6)$$

$$2x^2 - 7x + 3 = 0 \checkmark$$

$$x = \frac{-7 \pm \sqrt{(-7)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

$$= \frac{-7 \pm 5}{4}$$

$$x_1 = \frac{-7+5}{4} = \frac{-2}{4} = -\frac{1}{2} \checkmark$$

$$y_1 = 4(-\frac{1}{2})^3 - 21(-\frac{1}{2})^2 + 18(-\frac{1}{2}) + 6 = -21 \checkmark$$

$$\left(-\frac{1}{2}, -21\right) \checkmark$$

$$x_2 = \frac{-7-5}{4} = \frac{-12}{4} = -3 \checkmark$$

$$y_2 = 4(-3)^3 - 21(-3)^2 + 18(-3) + 6 = -102 \checkmark$$

$$\left(-3, -102\right) \checkmark$$

b) $\frac{d^2y}{dx^2} = 24x - 42 \checkmark$

$$x = 3 \Rightarrow \frac{d^2y}{dx^2} = 24(3) - 42 = 30 > 0 \text{ minima} \checkmark$$

$$x = -\frac{1}{2} \Rightarrow \frac{d^2y}{dx^2} = 24(-\frac{1}{2}) - 42 = -30 < 0 \text{ maxima} \checkmark$$

(8)

$$\begin{aligned}
 4. a) \int_2^3 (2x^3 - 3x^2 + 2) dx &= \left[2 \times \frac{x^4}{4} - 3 \times \frac{x^3}{3} + 2x \right]_2^3 \\
 &= \left[\frac{x^4}{2} - x^3 + 2x \right]_2^3 = \left[\frac{3^4}{2} - 3^3 + 2 \times 3 \right] - \left[\frac{2^4}{2} - 2^3 + 2 \times 2 \right] \\
 &= 19.5 - 4 = 15.5 \text{ unit}^2
 \end{aligned}$$

(8)

$$\begin{aligned}
 b) \int_0^{\frac{\pi}{4}} (3 \cos(2x) - 4 \sin(\frac{x}{3})) dx \\
 &= \left[\frac{3}{2} \sin(2x) + 4 \times 3 \cos(\frac{x}{3}) \right]_0^{\frac{\pi}{4}} \\
 &= \left[\frac{3}{2} \sin \frac{2\pi}{4} + 12 \cos \frac{\pi}{12} \right] - \left[\frac{3}{2} \sin 0 + 12 \cos 0 \right] \\
 &= 13.091 - 12 = 1.091 \text{ unit}^2
 \end{aligned}$$

(8)

$$5. \int_2^5 \frac{2x+6}{x(2x-1)} dx$$

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

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

$$2x+6 = A(2x-1) + Bx$$

$$\begin{aligned}
 x=0 \Rightarrow 6 &= A(0-1) = -1 \times A \\
 6 &= -A \Rightarrow A = -6
 \end{aligned}$$

$$x = \frac{1}{2} \Rightarrow 2 \times \frac{1}{2} + 6 = \frac{1}{2} B$$

$$7 = \frac{1}{2} B \Rightarrow B = 2 \times 7 = 14$$

$$\int_2^5 \frac{2x+6}{x(2x-1)} dx = \int_2^5 \left(\frac{-6}{x} + \frac{14}{2x-1} \right) dx$$

$$= \left[-6 \ln x + \frac{14}{2} \ln(2x-1) \right]_2^5$$

$$= \left[-6 \ln 5 + 7 \ln(9) \right] - \left[-6 \ln 2 + 7 \ln 3 \right]$$

$$= 2.1925 \text{ unit}^2$$

6. $\int_2^5 \frac{2x+6}{x(2x-1)} dx$

$$h = \frac{5-2}{4} = \frac{3}{4} = 0.75$$

x	2	2.75	3.5	4.25	5
$\frac{2x+6}{x(2x-1)}$	$5/3$	$92/99$	$13/21$	$116/255$	$16/45$
	y_0	y_1	y_2	y_3	y_n

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

$$= 2.1993$$

$$\text{Percentage error} = \frac{2.1925 - 2.1993}{2.1925} \times 100$$

$$= -0.31\%$$

(14)

(12)

7.

x	0.75	2.25	3.75	5.25	6.75	Σ
f	3	13	20	3	1	40
$f \times x$	2.25	29.25	75	15.75	6.75	129
$f(x-\bar{x})^2$	18.377	12.358	5.513	12.302	12.426	60.976

$$\text{mean } \bar{x} = \frac{129}{40} = 3.225$$

$$\sigma = \sqrt{\frac{60.976}{40-1}} = 1.25$$

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$$8. \quad P(A) = 0.89, \quad P(B) = 0.95$$

$$a) \quad P(\text{connection}) = P(A) \times P(B) \\ = 0.89 \times 0.95 = 0.85$$

$$b) \quad P(\bar{A}) = 1 - 0.89 = 0.11$$

$$P(\bar{B}) = 1 - 0.95 = 0.05$$

$$P(\overline{\text{connection}}) = P(\bar{A}) \times P(\bar{B})$$

$$= 0.11 \times 0.05 = 0.0055$$

$$P(\text{connection}) = 1 - P(\overline{\text{connection}})$$

$$= 1 - 0.0055$$

$$= 0.9945$$

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