



Complete, fold and seal
(see note 2 below)

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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	148413
2	Title of Examination Paper	PPAP
3	Module Code	PCEE 4000 PCPO 4000
4	Date and Time of Examination	19 th May 14:00
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	23
2	7
3	16
4	18
5	11
6	14
7	8
Office Use	97

1.

$$a) y = \frac{1}{3x^4} - 2x^5 - \sqrt{x}$$

$$y = \frac{1x^{-4}}{3} - 2x^5 - x^{\frac{1}{2}} \quad \checkmark$$

$$\frac{dy}{dx} = \frac{-4x^{-5}}{3} - 10x^4 - \frac{x^{-\frac{1}{2}}}{2} \quad \checkmark$$

$$\frac{dy}{dx} = \frac{-4}{3x^5} - 10x^4 - \frac{1}{2\sqrt{x}} \quad \checkmark$$

(4)

$$b) y = \frac{5\cos 2x}{x^4} \quad u = 5\cos 2x \quad \frac{du}{dx} = -10\sin 2x \quad \checkmark$$

$$v = x^4 \quad \frac{dv}{dx} = 4x^3 \quad \checkmark$$

$$\frac{dy}{dx} = \frac{5\cos 2x \times -10\sin 2x - 5\cos 2x \times 4x^3}{(x^4)^2} \quad \checkmark$$

$$\frac{dy}{dx} = \frac{-10x^4 \sin 2x - 20x^3 \cos 2x}{x^8} \quad \checkmark$$

$$\frac{dy}{dx} = \frac{-10x^3 (x \sin 2x + 2 \cos 2x)}{x^8} \quad \checkmark$$

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

(7)

$$c) y = 2\cos(4x^2)$$

$$y = 2\cos(u) \quad u = 4x^2$$

$$\frac{dy}{dx} = -2\sin(u) \quad \frac{du}{dx} = 8x \quad \checkmark$$

$$\frac{dy}{dx} = -2\sin u \times 8x = -16x \sin u$$

$$-16x \sin(4x^2) \quad \checkmark$$

(6)

d) $y = 5x^2 e^{4x}$

$$u = 5x^2 \quad \frac{du}{dx} = 10x \quad \checkmark$$

$$V = e^{4x} \quad \frac{dV}{dx} = 4e^{4x} \quad \checkmark$$

$$\frac{dy}{dx} = 5x^2 \times 4e^{4x} + e^{4x} \times 10x \quad \checkmark$$

$$\frac{dy}{dx} = 20x^2 e^{4x} + 10x e^{4x} \quad \checkmark$$

$$\frac{dy}{dx} = 10x e^{4x} (2x+1) \quad \checkmark$$

(6)

2. $V = 10(2 - 3e^{-4t})$ $t=0 \leftarrow$ initial rate

$$V = 20 - 30e^{-4t} \quad \checkmark$$

$$\frac{dV}{dt} = 120e^{-4t} \quad \checkmark$$

$$\frac{dV}{dt} = 120e^{-4 \times 0} \quad \checkmark$$

$$\frac{dV}{dt} = 120 \text{ V/s} \quad \checkmark$$

(7)

3.

a) $\int_3^4 (20 + 5x^2 - 2x^3) dx$

$$y = 20x^0 + 5x^2 - 2x^3 \quad \checkmark$$

$$\frac{dy}{dx} = \frac{20x^0}{1} + \frac{5x^2}{3} - \frac{2x^4}{4} \quad \checkmark$$

$$\frac{dy}{dx} = 20x + \frac{5x^3}{3} - \frac{x^4}{2} \quad \checkmark$$

$$x=1 \quad 20(4) + \frac{5(4)^3}{3} - \frac{(4)^4}{2} = \frac{176}{3} = 58.67 \checkmark$$

$$x=3 \quad 20(3) + \frac{5(3)^3}{3} - \frac{(3)^4}{2} = 64.5 \checkmark$$

$$\text{Area} = \frac{176}{3} - 64.5 = -5.83 \text{ units}^2 \checkmark$$

(8)

$$6) \int_0^{\pi} (3\sin \frac{1}{2}x - \cos \frac{1}{4}x) dx$$

$$y = 3\sin \frac{1}{2}x - \cos \frac{1}{4}x$$

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

$$\frac{dy}{dx} = -6\cos \frac{x}{2} - 4\sin \frac{x}{4} \checkmark$$

$$x=\pi \quad -6\cos \frac{\pi}{2} - 4\sin \frac{\pi}{4} = -2.83 \checkmark$$

$$x=0 \quad -6\cos 0 - 4\sin 0 = -6 \checkmark$$

$$\text{Area} = -2.83 - -6 = 3.17 \text{ units}^2 \checkmark$$

(8)

$$4. \int \frac{2x+1}{4x(x+2)} dx$$

$$\frac{2x+1}{4x(x+2)} = \frac{A}{4x} + \frac{B}{x+2}$$

$$\frac{2x+1}{4x(x+2)} = \frac{A(x+2)}{4x(x+2)} + \frac{B(4x)}{4x(x+2)} \quad \checkmark$$

$$x = -2 \quad 2(-2)+1 = A(-2+2) + B(4 \times -2)$$

$$-3 = A(0) + -8B$$

$$B = \frac{-3}{-8}$$

$$x = 0 \quad 2(0)+1 = A(0+2) + B(4 \times 0)$$

$$1 = 2A + B(0)$$

$$A = \frac{1}{2}$$

$$\frac{2x+1}{4x(x+2)} = \frac{\frac{1}{2}}{4x} + \frac{\frac{3}{8}}{x+2}$$

$$\frac{dy}{dx} = \frac{1}{2} \times \frac{1}{4} \ln(4x) + \frac{3}{8} \times \frac{1}{1} \ln(x+2) \quad \checkmark$$

$$\frac{dy}{dx} = \frac{1}{8} \ln(4x) + \frac{3}{8} \ln(x+2) \quad \checkmark$$

$$x=3 \quad \frac{1}{8} \ln(4 \times 3) + \frac{3}{8} \ln(3+2) = 0.91415 \quad \checkmark$$

$$x=1 \quad \frac{1}{8} \ln(4 \times 1) + \frac{3}{8} \ln(1+2) = 0.58527 \quad \checkmark$$

$$\text{Area} = 0.91415 - 0.58527 = 0.3289 \text{ units}^2 \quad \checkmark$$

$$5. \int \frac{2x+1}{4x(x+2)}$$

$$\frac{3-1}{4} = 0.5$$

$$h = 0.5$$

$\frac{2x+1}{4x(x+2)}$	1	1.5	2	2.5	3
	$\frac{1}{4}$	$\frac{4}{21}$	$\frac{5}{32}$	$\frac{2}{15}$	$\frac{7}{60}$
	y_0	y_1	y_2	y_3	y_n

$$\frac{0.5}{3} \left(\left(\frac{1}{4} + \frac{7}{60} \right) + 4 \left(\frac{4}{21} + \frac{2}{15} \right) + 2 \left(\frac{5}{32} \right) \right) = 0.3291 \text{ units}^2$$

$$\frac{0.3291 - 0.3289}{0.3291} \times 100 = 0.06\%$$

Percentage
Error

6. ~~Q16~~ 0 <= t < 2 | 2 <= t < 4 | 4 <= t < 6 | 6 <= t < 8 | 8 <= t < 10

f 3 19 24 10 4

xe 1 3 5 7 9 ✓

f_{xe} 3 57 120 70 36 ✓

$$\Sigma f_{xe} = 3 + 57 + 120 + 70 + 36 = 286$$

$$\Sigma f = 60 \text{ in the question}$$

$$\bar{x} = \frac{\Sigma f_{xe}}{\Sigma f} = \frac{286}{60} = \frac{143}{30} = 4.77 \quad \checkmark$$

$f_{xe} - \bar{x}$	42.64	59.53	1.27	49.73	71.57	✓
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$$\Sigma (f_{xe} - \bar{x})^2 = 42.64 + 59.53 + 1.27 + 49.73 + 71.57 = 224.74 \quad \checkmark$$

$$\sigma = \sqrt{\frac{\Sigma (f_{xe} - \bar{x})^2}{\Sigma f}} = \sqrt{\frac{224.74}{60}} = 1.94 \quad \checkmark$$

(14)

7.

a) $P(A) \times P(B) = 0.77 \times 0.81 = 0.6237 \quad \checkmark$

b) $P(\bar{A}) = 0.23$

$P(\bar{B}) = 0.19$

$P(\bar{A}) \times P(\bar{B}) = 0.23 \times 0.19 = 0.0437 \quad \checkmark$

$1 - 0.0437 = 0.9563 \quad \checkmark$

(8)