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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.

Complete, fold and seal
(see note 2 below)

SURNAME: RAMADHAN

FORENAME(S): NARIMAN

1	Student Number	RAM20849142
2	Title of Examination Paper	MATHEMATICS TEST 1
3	Module Code	GOEN4001
4	Date and Time of Examination	20/01/2025 9:30
5	Examination Venue	TYCOCH- HILL HOUSE
6	Seat Number	134
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
Q1 a	21
b	5
c	2
d	0
Q2 a	10
b	2
c	3
d	6
e	6
Q3 a	12
b	6
c	2
d	4
Total	79/100

(Gweler yr ochr arall am y fersiwn Cymraeg)

RK

79%

a) $y = 3x^4 + 5x^3 + 4x^2 + 7x - 10$

i.

$$\frac{dy}{dx} = 12x^3 + 15x^2 + 8x + 7 \quad 2_{//}$$

Q 1

28/35

ii.

$$y = 2\sin(2x) + 3\cos(3x) + \frac{1}{5}\tan(5x)$$

$$\frac{dy}{dx} = 4\cos 2x - 9\sin 3x + \sec^2 5x \quad 3_{//}$$

Q 1a

21/22

iii.

$$y = \frac{1}{x^3} + \frac{1}{\sqrt[5]{x^2}} - 2\pi x$$

$$y = x^{-3} + x^{-2/5} - 2\pi x$$

$$\frac{dy}{dx} = -3x^{-4} - \frac{2}{5}x^{-7/5} - 2\pi \quad 2_{//}$$

iv.

$$y = 7x^3 \sin(5x)$$

$$u = 7x^3 \rightarrow \frac{du}{dx} = 21x^2 \quad 4_{//}$$

$$v = \sin(5x) \rightarrow \frac{dv}{dx} = 5\cos 5x$$

$$\frac{dy}{dx} = u \left(\frac{dv}{dx} \right) + v \left(\frac{du}{dx} \right)$$

$$\frac{dy}{dx} = 7x^3 (5\cos 5x) + \sin(5x) (21x^2)$$

$$\frac{dy}{dx} = 35x^3 \cos 5x + 21x^2 \sin 5x$$

V. $y = \frac{2 \sin(5x)}{3e^{5x}}$

$u = 2 \sin 5x \rightarrow \frac{du}{dx} = 10 \cos 5x$

$v = 3e^{5x} \rightarrow \frac{dv}{dx} = 15e^{5x}$

$\frac{dy}{dx} = \frac{v \left(\frac{du}{dx} \right) - u \left(\frac{dv}{dx} \right)}{v^2}$

$\frac{dy}{dx} = \frac{3e^{5x} (10 \cos 5x) - (2 \sin 5x) (15e^{5x})}{(3e^{5x})^2}$

$\frac{dy}{dx} = \frac{30e^{5x} \cos 5x - 30e^{5x} \sin 5x}{(3e^{5x})^2}$

Vi. $y = 5(2x^3 + 4)^3$

$\frac{dy}{dx} = 15(2x^3 + 4)^2 (6x^2)$

$\frac{dy}{dx} = 90x^2 (2x^3 + 4)^2$

Vii $y = \sqrt[3]{(x^4 + 5)^2}$

$y = (x^4 + 5)^{2/3}$

$\frac{dy}{dx} = \frac{2}{3} (x^4 + 5)^{-1/3} (4x^3)$

$\frac{dy}{dx} = \frac{8}{3} x^3 (x^4 + 5)^{-1/3}$



Question No.

Examiner Only

b) $w = 5x^5 + 4x^2y^2 + 3y^3 + \sin(x) - 5$

$$\frac{\partial w}{\partial x} = 25x^4 + 8xy^2 + \cos x \quad \frac{\partial w}{\partial y} = 8x^2y + 6y^2$$

$$\frac{\partial^2 w}{\partial x^2} = 100x^3 + 8y^2 - \sin x \quad \frac{\partial^2 w}{\partial y^2} = 8x^2 + 12y$$

$$\frac{\partial^2 w}{\partial x \partial y} = 16xy$$

Correct method
error carried
forward

$$\frac{\partial^2 w}{\partial y \partial x} = 16xy$$

Correct method
error carried
forward

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

Show that $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 4x^2 - 8x + 8\sin 2x + 2$

$$\frac{dy}{dx} = -2\sin 2x + 2x$$

$$\frac{d^2y}{dx^2} = -4\cos 2x + 2$$

$$(-4\cos 2x + 2) - 4(-2\sin 2x + 2x) + 4y$$

$$-8\cos 2x + 8\sin 2x - 8x + 4y$$

$$d) \quad y = x e^{2x}$$

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

$$\frac{d^2y}{dx^2} = 4x e^{2x} \quad \checkmark$$

$$\frac{d^3y}{dx^3} = 8x e^{2x} \quad \checkmark$$

Q2

$$a) \quad \frac{3x-4}{(x+2)(x-5)}$$

$$\left(\frac{3x-4}{(x+2)(x-5)} = \frac{A}{x+2} + \frac{B}{x-5} \right) \times (x+2)(x-5)$$

$$3x-4 = A(x-5) + B(x+2)$$

$$x-5 = 0 \Rightarrow x = 5 \quad \checkmark$$

$$3(5)-4 = A(5-5) + B(5+2) \quad \checkmark$$

$$11 = 7B \Rightarrow B = \frac{11}{7} = 1.57 \quad \checkmark$$

$$x+2 = 0 \Rightarrow x = -2 \quad \checkmark$$

$$3(-2)-4 = A(-2-5) + B(-2+2) \quad \checkmark$$

$$-10 = -7A \Rightarrow A = \frac{-10}{-7} = 1.42 \quad \checkmark$$

$$\therefore \text{So, } \frac{3x-4}{(x+2)(x-5)} = \frac{1.42}{x+2} + \frac{1.57}{x-5} \quad \checkmark$$

Q1

0/3

Q2

27/33

Q2a

10/10

$$b) \quad BC^2 = AB^2 + AC^2 - 2(AB)(AC) \cos A$$

$$= (5)^2 + (5)^2 - 2(5)(5) \cos 100^\circ$$

$$AB^2 = 633.6$$

$$AB = 25.1 \text{ m}$$

Q2b

~~Q~~2/4

$$c) \quad x^2 - 6x + 8$$

$$\tan^2 x - 6 \tan x + 8 = 0$$

Q2c

3/6Sol

$$x^2 - 6x + 8 = 0$$

$$(x - 2)(x - 4) = 0 \quad \checkmark$$

$$\tan x - 2 = 0 \quad \checkmark$$

$$\tan x = 2 \quad \checkmark$$

$$x = \tan^{-1}(2) = 63.4^\circ \Rightarrow 180^\circ + 63.4^\circ = 243.4^\circ$$

$$\tan x - 4 = 0 \quad \checkmark$$

$$\tan x = 4 \quad \checkmark$$

$$x = \tan^{-1}(4) = 76^\circ \Rightarrow 180^\circ + 76^\circ = 255.9^\circ$$

error carried
forward.

d)

$$y = x^2$$

$$y = x + 20$$

$$x^2 = x + 20 \quad \checkmark$$

$$x^2 - x - 20 = 0 \quad \checkmark$$

b //

~~XXXXXXXXXX~~

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(-20)}}{2(1)}$$

$$= \frac{1 \pm \sqrt{81}}{2} = \frac{1 + 9}{2} = 5 \quad \checkmark$$

$$= \frac{1 - 9}{2} = -4 \quad \checkmark$$

$$y = (5)^2 = 25 \quad \checkmark \quad (5, 25) \quad \checkmark$$

$$y = (-4)^2 = 16 \quad \checkmark \quad (-4, 16) \quad \checkmark$$

Q2d

6/6

e)

i. $\sin x = 0.6$

$x = \sin^{-1}(0.6) \checkmark$

$x = 36.8^\circ \rightarrow 180^\circ - 36.8^\circ = 143.2^\circ \checkmark$

ii. $7 \cos x = 6$

$\cos x = \frac{6}{7} \checkmark$

$x = \cos^{-1}\left(\frac{6}{7}\right) \checkmark$

$x = 31.0^\circ \rightarrow 360^\circ - 31.0^\circ = 329^\circ \checkmark$

iii. $-3 \tan x = 2$

$\tan x = \frac{2}{-3} \checkmark$

$x = \tan^{-1}\left(\frac{2}{-3}\right) \checkmark$

$x = -33.6^\circ \rightarrow 180^\circ + (-33.6^\circ) = 146.4^\circ \checkmark$

Q2e6/7

Q3

a)

i

$$\ln(x^2 + 2x) = \ln(3) + \ln(x+1)$$

$$\ln(x^2 + 2x) = \ln(3)(x+1)$$

$$x^2 + 2x = 3x + 3$$

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

$$x^2 - x - 3 = 0$$

~~XXXXXXXXXX~~

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{1 \pm \sqrt{(-1)^2 - 4(1)(-3)}}{2}$$

$$= \frac{1 + \sqrt{13}}{2} = \frac{1 + 3.6}{2} = \frac{4.6}{2}$$

$$\text{or } \frac{1 - 3.6}{2} = -1.3 \quad \text{Not a valid solution}$$

Q3

24/32

Q3a

12/18

ii. $\log(x+3) + \log(2x+1) = 2\log(3x-1)$

$\log(x+3)(2x+1) = \log(6x-2)$ X

$(x+3)(2x+1) = (6x-2)$

$2x^2 + x + 6x + 3 = 6x - 2$

$2x^2 + x + 6x + 3 - 6x + 2 = 0$

$2x^2 + x + 5 = 0$ error carried forward

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{(1)^2 - 4(2)(5)}}{4}$

$= \frac{-1 \pm \sqrt{\quad}}{4} = ?$

iii. $5^{(x+2)} \times 2^{(2-x)} = 3^{(x+3)}$

~~$\log 5^{(x+2)} \times \log 2^{(2-x)} = \log 3^{(x+3)}$~~

$\log 5^{(x+2)} \times \log 2^{(2-x)} = \log 3^{(x+3)}$ ✓

$(x+2)\log 5 + (2-x)\log 2 = (x+3)\log 3$

$(x+2)(0.70) + (2-x)(0.30) = (x+3)(0.48)$ 4

$0.70x + 1.4 + 0.6 - 0.30x = 0.48x + 1.44$

$0.70x + 1.4 + 0.6 - 0.30x - 0.48x - 1.44 = 0$

$-0.08x + 0.56 = 0$

$-0.08x = -0.56$

$x = \frac{-0.56}{-0.08} = 7$

$$i. v. \quad \frac{5x+2}{2x-3} = \frac{3}{4}$$

$$4(5x+2) = 3(2x-3) \quad \checkmark$$

$$20x+8 = 6x-9 \quad \checkmark$$

$$20x+8-6x+9 = 0 \quad \checkmark$$

$$14x+17 = 0 \quad \checkmark$$

$$4x = -17$$

$$x = \frac{-17}{4} = -4.25$$

$$v. \quad \frac{(3x-2)}{4} + \frac{(x+5)}{2} = \frac{7}{3} \quad \checkmark$$

$$\frac{6x-4+4x+20}{8} = \frac{7}{3} \quad \checkmark$$

$$3(6x-4+4x+20) = 56 \quad \checkmark$$

$$18x-12+12x+60 = 56 \quad \checkmark$$

$$3x-8 = 0$$

$$3x = 8$$

$$x = \frac{8}{3} = 2.6$$

b)

$$i. (2-5)(2-7) \quad \underline{\underline{2}}$$

$$ii. (m-11)(m+11) \quad \underline{\underline{2}}$$

$$iii. K(1+2m) + 5n(1+2m) \quad \underline{\underline{2}}$$

$$(K+5n)(1+2m)$$

c) i

$$4p+11p+6=0$$

$$(2p+2)(2+3)=0$$

$$2p+2=0 \quad \times \underline{\underline{0}}$$

$$2p=-2$$

$$p = \frac{-2}{2} = -1$$

$$2+3=5$$

ii

$$s^2 + 16s + 63 = 0$$

$$(x+9)(x+7)=0$$

$$x+9=0 \quad \underline{\underline{2}}$$

$$x=-9$$

$$x+7=0$$

$$x=-7$$

Q3b6/6Q3c2/4

d) $3x^2 + 4x - 10 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(4) \pm \sqrt{(4)^2 - 4(3)(-10)}}{2(3)}$$

$$= \frac{-4 \pm \sqrt{136}}{6} = \frac{-4 \pm 11.6}{6} = 1.26$$

$$\text{or } \frac{-4 - 11.6}{6} = -2.6$$

Q3d

4/4