



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: WILLIAMS

FORENAME(S): MATTHEW

1	Student Number	WIL12811032
2	Title of Examination Paper	MATHEMATICS TEST 1
3	Module Code	GOAC 4006
4	Date and Time of Examination	18/1/2019 12:00 pm
5	Examination Venue	HALL, GOWER COLLEGE
6	Seat Number	20
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	
3	
Q1	
a	2
b	16
c	7
d	10
e	1
Q3	
a	21
b	4
c	3
d	6
e	6
Total	76/80

95%

1. a) $\Delta x = \left(\frac{v + v_0}{2} \right) t$

$$\frac{\Delta x}{t} = \frac{v + v_0}{2} \quad \checkmark \quad \textcircled{1}$$

$$2 \left(\frac{\Delta x}{t} \right) = v + v_0$$

$$\therefore v_0 = 2 \left(\frac{\Delta x}{t} \right) - v$$

When $\Delta x = 500$ $t = 10$ $v = 30$

$$v_0 = 2 \left(\frac{500}{10} \right) - 30 \quad \checkmark \quad \textcircled{1}$$

$$v_0 = 70 \quad v_0 = 70.0 \text{ m/s}$$

b) i) $\frac{5x-2}{3} = \frac{7x+6}{2}$

$$2(5x-2) = 3(7x+6) \quad \checkmark \quad \textcircled{1}$$

$$10x - 4 = 21x + 18 \quad \checkmark$$

$$10x - 21x = 18 + 4 \quad \checkmark \quad \textcircled{1}$$

$$-11x = 22$$

$$x = -\frac{22}{11}$$

$$x = -2 \quad \checkmark \quad \textcircled{1}$$

2

3

$$ii) \frac{x+5}{3} = \frac{x}{6} - \frac{5x-1}{12}$$

$$\frac{x+5}{3} + \frac{5x-1}{12} = \frac{x}{6} \quad \checkmark$$

$$12 \left(\frac{x+5}{3} \right) + 12 \left(\frac{5x-1}{12} \right) = 12 \left(\frac{x}{6} \right) \quad \checkmark \quad ①$$

$$4(x+5) + 5x-1 = 2x \quad \checkmark \quad ②$$

$$4x+20+5x-1 = 2x$$

$$4x+5x-2x = -20+1 \quad ①$$

$$7x = -19$$

$$x = \frac{-19}{7} \quad \checkmark \quad ①$$

$$iii) 2\ln(2x+3) = \ln(x+3) + \ln(x+2)$$

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

$$(2x+3)(2x+3) = (x+3)(x+2) \quad \checkmark \quad ①$$

$$4x^2+6x+6x+9 = x^2+2x+3x+6 \quad \checkmark \quad ①$$

$$4x^2-x^2+6x+6x-2x-3x+9-6=0 \quad \checkmark \quad ①$$

$$3x^2+7x+3=0$$

$$a=3 \quad b=7 \quad c=3$$

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

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

$$x = \frac{-7 \pm \sqrt{13}}{6}$$

$$x = \frac{-7 + \sqrt{13}}{6}$$

$$x = \frac{-7 - \sqrt{13}}{6}$$

$$x = -0.57 \text{ (2dp)}$$

$$x = -1.77 \text{ (2dp)}$$

iv) $5^x \times 8 = 3^{x+4}$

$$\log 5^x + \log 8 = \log 3^{x+4}$$

$$x \log 5 + \log 8 = (x+4) \log 3$$

$$0.7x + 0.9 = 0.48(x+4)$$

$$0.7x + 0.9 = 0.48x + 1.92$$

$$0.7x - 0.48x = 1.92 - 0.9$$

$$0.22x = 1.02$$

$$x = \frac{1.02}{0.22}$$

$$x = 4.64 \text{ (2dp)}$$

c)i) $8z^2 - 5z - 3$

$$8z^2 - 8z + 3z - 3$$

$$\begin{array}{r} 24 \\ 8 \times 3 \end{array}$$

$$8z(z-1) + 3(z-1)$$

$$(8z+3)(z-1)$$

①

①

2

$$ii) 9x^2 - 49y^2$$

$$(3x - 7y)(3x + 7y) \quad \checkmark$$

2

$$ii) xt - xr + yt - yr$$

$$x(t-r) + y(t-r) \quad \checkmark \quad \textcircled{1}$$

$$(x+y)(t-r) \quad \checkmark$$

3

$$d)i) 3x^2 - 5x - 2$$

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

$$\cancel{3x^2 - 3x - 2x - 2 = 0}$$

$$3x(x-1) + 2(x-1) = 0$$

$$\cancel{(3x+2)(x-1) = 0}$$

$$3x^2 - 6x + x - 2 = 0 \quad \checkmark$$

$$3x(x-2) + 1(x-2) = 0$$

$$\textcircled{1} \quad \textcircled{1} \quad (3x+1)(x-2) = 0 \quad \checkmark$$

$$3x+1=0$$

$$3x = -1$$

$$x = -\frac{1}{3} \quad \checkmark$$

\textcircled{1}

$$x-2=0$$

$$x = 2 \quad \checkmark$$

3

$$i) x^2 + 5x + 6 = 0$$

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

$$x(x+2) + 3(x+2) = 0 \quad \checkmark$$

$$\textcircled{1} \quad \textcircled{1} \quad (x+3)(x+2) = 0 \quad \checkmark$$

$$x+3 = 0 \quad \checkmark$$

$$x = -3 \quad \checkmark \quad \textcircled{1}$$

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

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

3

$$ii) x^2 - 81 = 0$$

$$x^2 = 81$$

$$x = \sqrt{81}$$

$$x = 9$$

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

$$x-9 = 0$$

$$x = 9 \quad \checkmark \quad \textcircled{1}$$

$$x+9 = 0$$

$$x = -9 \quad \checkmark \quad \textcircled{1}$$

2

$$iv) 4x^2 + 9x + 5 = 0$$

$$\begin{array}{r} 20 \\ 4 \times 5 \end{array}$$

$$4x^2 + 4x + 5x + 5 = 0$$

$$4x(x+1) + 5(x+1) = 0$$

$$(4x+5)(x+1) = 0 \quad \checkmark$$

$$4x+5 = 0$$

$$4x = -5 \quad \checkmark$$

$$x = -\frac{5}{4} \quad \checkmark \quad \textcircled{1}$$

$$x+1 = 0$$

$$x = -1 \quad \checkmark$$

①

2

$$e) (3x+1)(2x-1) - (x+2)^2 = 5$$

$$(3x+1)(2x-1) - (x+2)(x+2) = 5$$

$$6x^2 - 3x + 2x - 1 - [x^2 + 2x + 2x + 4] = 5 \quad \textcircled{1} \quad \checkmark$$

$$\frac{6}{5} 5x^2 + 3x + 3 = 5 \quad \times$$

$$5x^2 + 3x + 3 - 5 = 0$$

$$5x^2 + 3x - 2 = 0 \quad \times$$

$$5x^2 + 5x - 2x - 2 = 0$$

$$5x(x+1) - 2(x+1) = 0$$

$$(5x-2)(x+1) = 0 \quad \times$$

$$5x-2 = 0$$

$$x+1 = 0$$

$$5x = 2$$

$$x = -1$$

$$x = \frac{2}{5}$$

$\times$

3.a)i) $y = 8x^3 - 2x^2 + 5x - 1$

$$\frac{dy}{dx} = 24x^2 - 4x + 5$$

3

ii) $y = 3(2x+1)^2$

$$\frac{dy}{dx} = 6(2x+1) \times 2$$

$$= 12(2x+1)$$

$$= 24x + 12$$

3

iii) $y = 3\sqrt{x} + \frac{2}{x}$

$$y = x^{\frac{1}{2}} + 2x^{-1}$$

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

3

iv) $y = 4\sin 3x + 2\cos x + \tan 6x$

$$\frac{dy}{dx} = 12\cos 3x - 2\sin x + 6\sec^2 6x$$

3

v) $y = 2x^5 \tan x$

$$u = 2x^5$$

$$v = \tan x$$

$$\frac{du}{dx} = 10x^4$$

$$\frac{dv}{dx} = \sec^2 x$$

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

$$= 2x^5 (\sec^2 x) + \tan x (10x^4)$$

$$= 2x^5 \sec^2 x + 10x^4 \tan x$$

4

$$vi) y = \frac{5\sin 2x}{e^{3x}}$$

$$u = 5\sin 2x \quad v = e^{3x}$$

$$\frac{du}{dx} = 10\cos 2x \quad \frac{dv}{dx} = 3e^{3x}$$

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

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

3

$$vii) y = \sqrt{5x^6 - 2x + 1}$$

$$y = (5x^6 - 2x + 1)^{1/2}$$

$$\frac{dy}{dx} = \frac{1}{2} (5x^6 - 2x + 1)^{-1/2} (30x^5 - 2)$$

2

$$b) y = \sin 3x$$

$$\frac{dy}{dx} = 3\cos 3x$$

$$\frac{d^2y}{dx^2} = -9\sin 3x$$

$$\frac{d^3y}{dx^3} = -27\cos 3x$$

$$\frac{d^4y}{dx^4} = 81\sin 3x$$

4

c) $y = 4x^2 + 5$

$$\frac{dy}{dx} = 8x \quad \checkmark \quad \textcircled{1}$$

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

$$2\left(\frac{d^2y}{dx^2}\right) + 3\left(\frac{dy}{dx}\right) - 2 = 14 + 24x$$

$$2(8) + 3(8x) - 2 = 14 + 24x \quad \checkmark \quad \textcircled{1}$$

$$16 + 24x - 2 = 14 + 24x \quad \checkmark$$

$$\therefore 14 + 24x = 14 + 24x \quad \checkmark \quad \textcircled{1}$$

Hence satisfied

d) $y = -4x + 1$
 $y = x^2 + 6x + 10$

$$x^2 + 6x + 10 = -4x + 1$$

$$x^2 + 6x + 4x + 10 - 1 = 0$$

$$x^2 + 10x + 9 = 0 \quad \checkmark \quad \textcircled{1}$$

$$x^2 + x + 9x + 9 = 0$$

$$x(x+1) + 9(x+1) = 0$$

$$(x+9)(x+1) = 0 \quad \checkmark \quad \textcircled{1}$$

$$x+9=0$$

$$x = -9 \quad \checkmark \quad \textcircled{1}$$

$$x+1=0$$

$$x = -1 \quad \checkmark \quad \textcircled{1}$$

$$y = -4(-9) + 1$$

$$y = 37 \quad \checkmark \quad \textcircled{1}$$

$$y = -4(-1) + 1$$

$$y = 5 \quad \checkmark \quad \textcircled{1}$$

3

6

$$e) z = x^5 + 2x^2y^3 - y^7$$

$$\frac{\partial z}{\partial x} = 5x^4 + 4xy^3 \quad \checkmark \quad (1)$$

$$\frac{\partial^2 z}{\partial x^2} = 20x^3 + 4y^3 \quad \checkmark \quad (1)$$

$$\frac{\partial^2 z}{\partial y \partial x} = 12xy^2 \quad \checkmark \quad (1)$$

$$\frac{\partial z}{\partial y} = 6x^2y^2 - 7y^6 \quad \checkmark \quad (1)$$

$$\frac{\partial^2 z}{\partial y^2} = 12x^2y - 42y^5 \quad \checkmark \quad (1)$$

$$\frac{\partial^2 z}{\partial x \partial y} = 12xy^2 \quad \checkmark \quad (1)$$