



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:

Claringbold

FORENAME(S):

Bradley

1	Student Number	
2	Title of Examination Paper	Mathematics Test 1
3	Module Code	GOEN4001
4	Date and Time of Examination	19/01/26 14:00
5	Examination Venue	Tychock
6	Seat Number	A3
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	
2	
3	
Q1	29✓
Q2	33✓
Q3	31✓
Total	93/100

12

93%



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u)

$$i) \frac{dy}{dx} = 12x^5 - 15x^2 + 4$$

2

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

$$\frac{dy}{dx} = -2x^{-3} - \frac{1}{3}x^{-\frac{4}{3}}$$

2

$$iii) \frac{dy}{dx} = 16\cos(4x) + 10\sin(5x) + 3\sec^2\left(\frac{x}{3}\right)$$

Q1a

$$iv) u = 3x^4 + 4x \quad 5x^4$$

$$y = \frac{2}{7}u \quad e^{2x}$$

21/22

$$\frac{du}{dx} = 20x^3$$

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

4

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

$$\frac{dy}{dx} = 5x^4(2e^{2x}) + e^{2x}(20x^3)$$

$$v) u = 3\cos(3x)$$

$$v = e^x + 5$$

$$\frac{du}{dx} = -4\sin(3x)$$

$$\frac{dv}{dx} = e^x$$

4

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

$$\frac{dy}{dx} = \frac{(e^x + 5)(-4\sin(3x)) - 3\cos(3x)(e^x)}{(e^x + 5)^2}$$

$$vi) y = \frac{1}{7}u^3$$

$$u = 3x^4 + 4x$$

$$\frac{dy}{dx} = \frac{3}{7}u^2$$

$$\frac{du}{dx} = 12x^3 + 4$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$\frac{dy}{dx} = \frac{3}{7} (3x^4 + 4x)^2 \cdot (12x^3 + 4)$$

$$\frac{dy}{dx} = \frac{3}{7} (12x^3 + 4)(3x^4 + 4x)^2$$

vii) $y = \frac{1}{5} (5x^4 + \sin(2x))^{\frac{1}{5}}$

$$u = 5x^4 + \sin(2x)$$

$$y = \frac{1}{5} (u)^{\frac{1}{5}}$$

$$\frac{du}{dx} = 20x^3 + 2\cos(2x)$$

$$\frac{dy}{du} = \frac{1}{25} u^{-\frac{4}{5}}$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$\frac{dy}{dx} = \frac{1}{25} (5x^4 + \sin(2x))^{-\frac{4}{5}} \cdot (20x^3 + 2\cos(2x))$$

i) b) $w = 3x^4 y^3 + 5x^3 + 6y^2 + e^{2x} - \cos(3y)$

$$\frac{dw}{dx} = 12x^3 y^3 + 15x^2 + ??$$

$$\frac{\partial^2 w}{\partial x^2} = 36x^2 y^3 + 30x + ??$$

$$\frac{\partial^2 w}{\partial x^2 \partial y^2} = 36x^3 y^2$$

$$\frac{\partial w}{\partial y} = 9x^4 y^2 + 12y + ??$$

$$\frac{\partial^2 w}{\partial y^2} = 18x^4 y + 12 + ??$$

$$\frac{\partial^2 w}{\partial y^2 \partial x^2} = 36x^3 y^2$$

Q1b

4/6

1) c) $\frac{dy}{dx} = 3e^x + 2x$

$\frac{d^2y}{dx^2} = 3e^x + 2$

~~$3e^x + 2 = 3(e^x + 2) + 2y$~~

$3e^x + 2 - 3(3e^x + 2x) + 2y = (3e^x + x^2)$

$3e^x + 2 - 9e^x - 6x + 2y = (6e^x + 2x^2)$

$3e^x + 2 + 6e^x + 2x^2 - 9e^x - 6x$

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

Q1C

4/4

4

1) d) $y = x \sin(x)$

~~$\frac{dy}{dx} =$~~

~~$u = x$~~

~~$\frac{du}{dx} = 1$~~

~~$v = \sin(x)$~~

~~$\frac{dv}{dx} = \cos(x)$~~

~~$\frac{dy}{dx} = x(\cos(x)) + \sin(x)(1)$~~

~~$\frac{d^2y}{dx^2} =$~~

$y' = \cos(x)$

$y'' = -\sin(x)$

$y''' = -\cos(x)$

$y'''' = \sin(x)$

x 0

Q1d

0/3

2) a)

$$\left[\frac{5x+7}{(x+1)(x-3)} = \frac{A}{x+1} + \frac{B}{x-3} \right] (x+1)(x-3)$$

$$5x+7 = A(x-3) + B(x+1)$$

$$\text{Let } x = -1$$

$$5(-1)+7 = A(-1-3) + B(-1+1)$$

$$2 = A(-4) + B(0)$$

$$\frac{2}{-4} = A$$

$$A = -0.5$$

$$\text{Let } x = 3$$

$$5(3)+7 = A(3-3) + B(3+1)$$

$$22 = A(0) + B(4)$$

$$\frac{22}{4} = B$$

$$B = 5.5$$

$$\frac{5x+7}{(x+1)(x-3)} = \frac{-0.5}{x+1} + \frac{5.5}{x-3}$$

2) b)

$$\begin{aligned} BC^2 &= AC^2 + AB^2 - 2(AC)(AB)\cos A \\ &= 10^2 + 15^2 - 2(10)(15)\cos 120 \\ &= 475 \end{aligned}$$

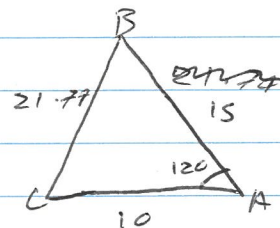
$$BC = \sqrt{475} = 21.79 \approx 22 \text{ m}$$

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b}$$

$$\frac{\sin(120)}{21.79} = \frac{\sin(B)}{10}$$

$$\sin B = \frac{10 \sin(120)}{21.79} = 0.397$$

$$B = \sin^{-1}(0.397) = 23.39^\circ$$

Q233/33Q2a9/9Q2b5/5

$$C = 180 - (120 + 23.39) = 36.61^\circ$$

c) $x^2 - 11x + 24$

$$1 \times 24 = 24$$

$$\begin{array}{cc} 1 & 2 \\ 24 & 12 \end{array} \begin{array}{c} 3 \\ 8 \end{array}$$

$$x^2 - 8x - 3x + 24$$

$$(x^2 - 8x) + (-3x + 24)$$

$$x(x-8) - 3(x-8)$$

$$= (x-3)(x-8)$$

$$\tan^2 x - 11 \tan x + 24 = 0$$

$$\text{let } \tan x = y$$

$$\therefore y^2 - 11y + 24 = 0$$

$$(y-3)(y-8) = 0$$

When:

$$y-3=0$$

$$y=3$$

when

$$y-8=0$$

$$y=8$$

$$\text{let } y = \tan x$$

$$\tan x = 3$$

$$x = \tan^{-1}(3) = 71.57^\circ$$

$$x = 180 + 71.57 = 251.57^\circ$$

$$\tan x = 8$$

$$x = \tan^{-1}(8) = 82.87^\circ$$

$$x = 180 + 82.87 = 262.87^\circ$$

Q2c

6/6

2) d) $x^2 - 4x + 3 = 2x + 1$ ✓
 $x^2 - 4x - 2x + 3 - 1 = 0$ ✓
 $x^2 - 6x + 2 = 0$ ✓

$a = 1 \quad b = -6 \quad c = 2$ ✓

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

$\therefore \frac{6 \pm \sqrt{(-6)^2 - 4(1)(2)}}{2(1)}$ ✓

$+$ = 5.65 ✓

$-$ = 0.35 ✓

Let $x = 5.65$ ✓

$y = 2(5.65) + 1 = 12.3$ ✓

Let $x = 0.35$ ✓

$y = 2(0.35) + 1 = 1.7$ ✓

$(5.65, 12.3)$ ✓

$(0.35, 1.7)$ ✓

2) e)

i) $2 \sin x = 0.75$ ✓

$\sin x = \frac{0.75}{2}$ ✓

$x = \sin^{-1}\left(\frac{0.75}{2}\right) = 22.02^\circ$ ✓

$x = 180 - 22.02 = 157.98^\circ$ ✓

ii) ~~$4 \cos x = 1$~~

$4 \cos x - 1 = 0$ ✓

$4 \cos x = 1$ ✓

$\cos x = \frac{1}{4}$ ✓

$x = \cos^{-1}\left(\frac{1}{4}\right) = 75.52^\circ$ ✓

$x = 360 - 75.52 = 284.48^\circ$ ✓

Q2d

6/6

Q2e

7/7

$$\text{iii)} \quad -5 \tan x = 1 \quad \checkmark$$

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

$$x = \tan^{-1}\left(-\frac{1}{5}\right) = -11.3^\circ \quad \underline{\underline{2}}$$

$$x = 180 - 11.3 = 168.7^\circ \quad \checkmark$$

$$x = 360 - 11.3 = 348.7^\circ \quad \checkmark$$

3) a) i) $\ln(2x-3) + \ln(3) = \ln(5x+9)$

$$\ln(2x-3)(3) = \ln(5x+9)$$

$$(2x-3)(3) = 5x+9$$

$$6x-9 = 5x+9$$

$$6x-5x-9-9$$

$$x-18=0$$

$$x=18$$

Q3

31/32

Q3a

18/18

ii) $\log(3x+2) + \log(x+1) = \log 15$

$$\log(3x+2)(x+1) = \log 15$$

$$(3x+2)(x+1) = 15$$

$$3x^2 + 3x + 2x + 2 = 15$$

$$3x^2 + 5x + 2 = 15$$

$$3x^2 + 5x + 2 - 15 = 0$$

$$3x^2 + 5x - 13 = 0$$

$$a = 3 \quad b = 5 \quad c = -13$$

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

$$\frac{-5 \pm \sqrt{5^2 - 4(3)(-13)}}{2(3)}$$

$$+ = 1.4$$

$$- = -3.07 \quad \leftarrow \text{Not a solution}$$

$$x = 1.4$$

$$iii) 4^{(x+3)} \times 2^{(2-x)} = 8^{(x+1)}$$

$$\log(4^{(x+3)} \times 2^{(2-x)}) = \log 8^{(x+1)}$$

$$\log 4^{(x+3)} + \log 2^{(2-x)} = \log 8^{(x+1)}$$

$$(x+3)\log 4 + (2-x)\log 2 = (x+1)\log 8$$

$$(x+3)0.6 + (2-x)0.3 = (x+1)0.9$$

$$0.6x + 1.8 + 0.6 - 0.3x = 0.9x + 0.9$$

$$0.6x - 0.3x - 0.9x = 0.9 - 0.6 - 1.8$$

$$-0.6x = -1.5$$

$$x = \frac{-1.5}{-0.6} = 2.5$$

4

$$iv) \frac{6x+1}{3x-2} = \frac{4}{5}$$

$$5(6x+1) = 4(3x-2)$$

$$30x+5 = 12x-8$$

$$30x-12x = -8-5$$

$$18x = -13$$

$$x = \frac{-13}{18} = -0.7222$$

3

$$v) \left(\frac{4x+1}{5} + \frac{2x-3}{3} = \frac{11}{6} \right) \times 30$$

$$6(4x+1) + 10(2x-3) = 5(11)$$

$$24x+6 + 20x-30 = 55$$

$$44x-24 = 55$$

$$44x = 55+24$$

$$44x = 79$$

$$x = \frac{79}{44} = 1.795$$

3

3) b)

i) $p^2 - 13p + 42$

$$1 \times 42 = 42$$

1	2	3	6
42	21	14	7

Q3b

$p^2 - 7p - 6p + 42$

$(p^2 - 7p) + (-6p + 42)$

$p(p - 7) - 6(p - 7)$

$(p - 6)(p - 7)$

2/1

6/6

ii) $4b^2 - 49$

$(2b - 7)(2b + 7)$

2/1

iii) $mn + 5mp + 3nq + 15pq$

$(mn + 5mp) + (3nq + 15pq)$

$m(n + 5p) + 3q(n + 5p)$

$(m + 3q)(n + 5p)$

2/1

3) c)

i) $6m^2 + 17m + 12 = 0$

$6 \times 12 = 72$

1	2	3	4	6	8
72	36	24	18	12	9

Q3c

$6m^2 + 9m + 8m + 12 = 0$

~~$(6m^2 + 12) + (9m + 8m) = 0$~~

~~$6m(m^2 + 2) +$~~

4/4

$(6m^2 + 9m) + (8m + 12) = 0$

$3m(2m + 3) + 4(2m + 3) = 0$

$(3m + 4)(2m + 3) = 0$

When

$3m + 4 = 0$

$3m = -4$

$m = \frac{-4}{3}$

When

$2m + 3 = 0$

$2m = -3$

$m = \frac{-3}{2}$

ii) $y^2 + 13y + 40 = 0$

$$1 \times 40 = 40$$

$$\begin{matrix} 1 & 2 & 4 & 5 \\ 40 & 20 & 10 & 8 \end{matrix}$$

$$y^2 + 8y + 5y + 40 = 0$$

$$(y^2 + 8y) + (5y + 40) = 0$$

$$y(y + 8) + 5(y + 8) = 0$$

$$(y + 5)(y + 8) = 0$$

When

$$y + 5 = 0$$

$$y = -5$$

When

$$y + 8 = 0$$

$$y = -8$$

3) d) $3w^2 - 2w - 8 = 0$

$$a = 3 \quad b = -2 \quad c = -8$$

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

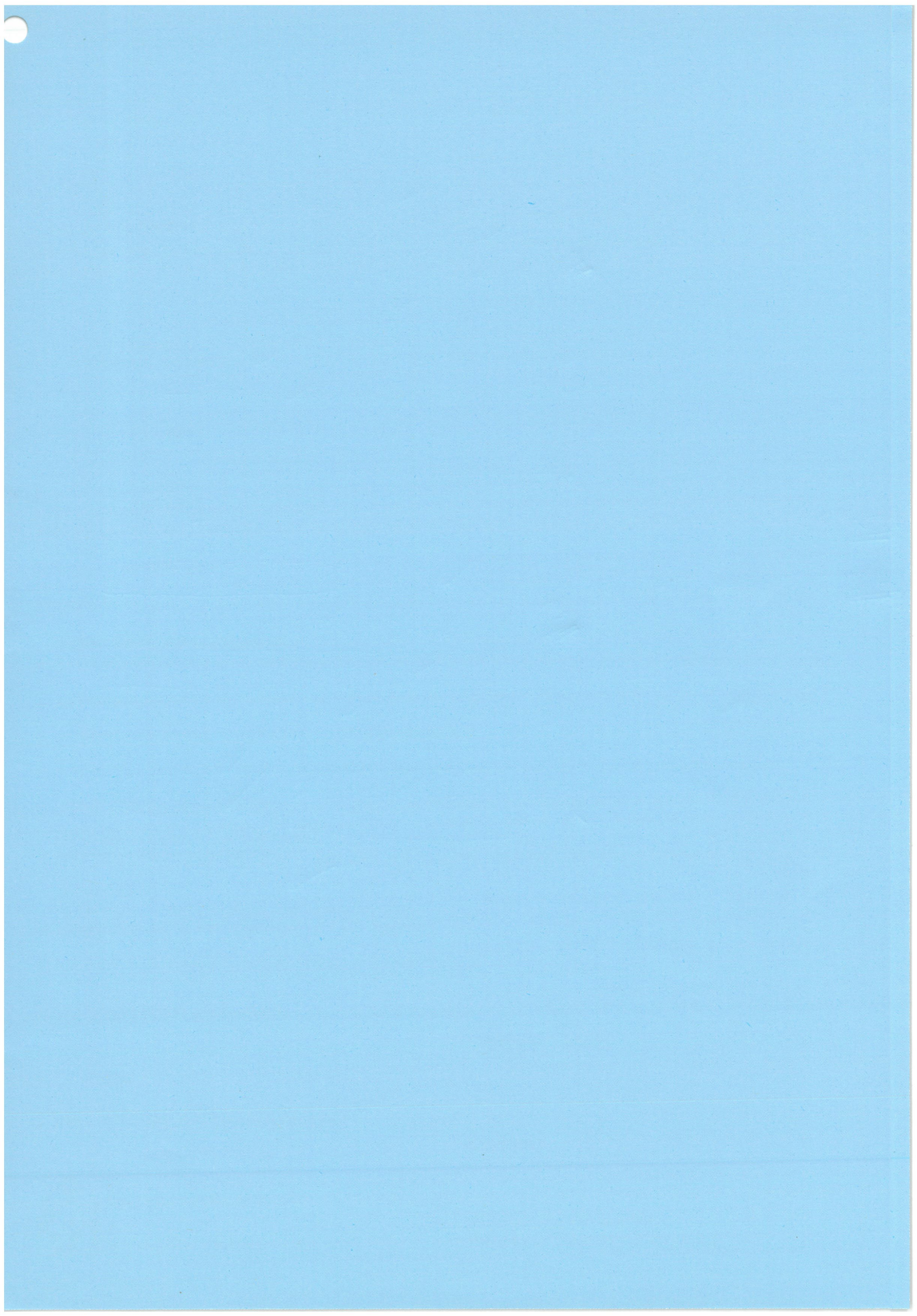
$$\frac{2 \pm \sqrt{(-2)^2 - 4(3)(-8)}}{2(3)}$$

$$\begin{aligned} + &= 2 \\ - &= -\frac{4}{3} \end{aligned} \quad \text{not a solution}$$

$$\text{or } w = 2$$

Q3d

314



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

- Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
- Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwrch ef a'i seilio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
- Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.
- Ysgrifennwch eich atebion mewn Inc.
- Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
- Ni ddylid rhwngo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
- Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/gwylwyr.
- Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

Llenwch, plygwrch a seliwch
(gweler nodyn 2 isod)

CYFENW: _____

ENW(AU) CYNTAF: _____

1	Rhif Myfyriwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

Rhestwch rifau'r cwestiynau a ymgeisiwyd gennych	At Dibenion y Swyddfa
Cyfanswm	

(See the other side for English version)