OCR
Oxford Cambridge and RSA

Monday 18 October 2021 – Afternoon

A Level Mathematics B (MEI)

H640/03 Pure Mathematics and Comprehension

Printed Answer Booklet

Time allowed: 2 hours

You must have:
- Question Paper H640/03 (inside this document)
- the Insert (inside this document)
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided in the **Printed Answer Booklet**. If you need extra space use the lined pages at the end of the Printed Answer Booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A (60 marks)

1(a)	
1(b)	
1(c)	
2	
3(a)	

(answer space continued on next page)

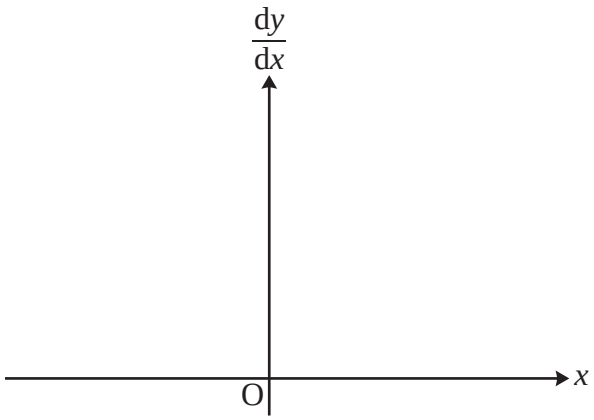
3(a) **(continued)**

3(b)

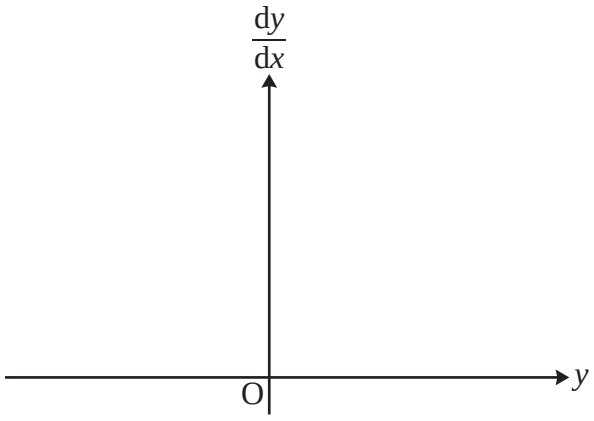
4(a)

4(b)

5(a)(i)



5(a)(ii)



5(b)(i)

5(b)(ii)

$A =$

$k =$

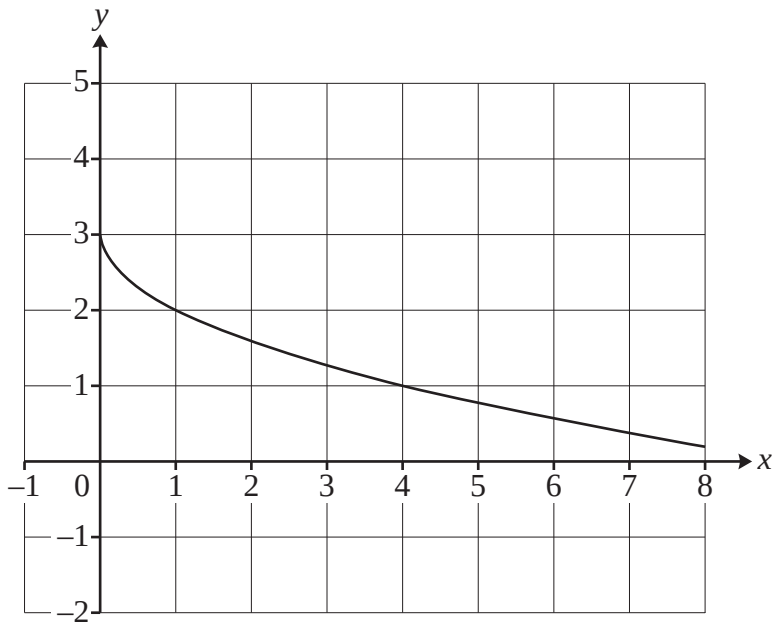
5(b)(iii)

6	

7

8

9(a)



9(b)

(answer space continued on next page)

9(b) **(continued)**

10

10(a)

10(b)

(answer space continued on next page)

10(b) **(continued)**

$A =$

$B =$

11

(answer space continued on next page)

11 **(continued)**

Section B (15 marks)

The questions in this section refer to the article on the Insert. You should read the article before attempting the questions.

12 Show that $\beta = \arctan\left(\frac{1}{3}\right)$, as given in line 15. **[3]**

12	

13 **(a)** Use triangle ABE in **Fig. C2** to show that $\arctan x + \arctan\left(\frac{1}{x}\right) = \frac{\pi}{2}$, as given in line 29. **[1]**

(b) Sketch the graph of $y = \arctan x$. **[1]**

(c) What property of the arctan function ensures that $y > \frac{1}{x} \Rightarrow \arctan y > \arctan\left(\frac{1}{x}\right)$, as given in line 30? **[1]**

13(a)	

13(b)

13(c)

14 **(a)** Show that

$$\arctan\left(\frac{1}{n+1}\right)+\arctan\left(\frac{1}{n^2+n+1}\right)=\arctan\left(\frac{1}{n}\right)\Rightarrow\arctan\left(\frac{1}{2}\right)+\arctan\left(\frac{1}{3}\right)=\arctan 1. \quad \textbf{[1]}$$

(b) Use the arctan addition formula in line 23 to show that

$$\arctan\left(\frac{1}{n+1}\right)+\arctan\left(\frac{1}{n^2+n+1}\right)=\arctan\left(\frac{1}{n}\right), \text{ as given in line 39.} \quad \textbf{[4]}$$

14(a)

14(b)

(answer space continued on next page)

14(b)	**(continued)**

15 Prove that $\arctan 1 + \arctan 2 + \arctan 3 = \pi$, as given in line 41. **[4]**

15

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).