



Tuesday 20 June 2023 - 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 in	k. 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.

2
Section A (60 marks)

1	
2(a)	
	y . ↑
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	$\longrightarrow x$
	O \\.
	\
2 (b)	
	(answer space continued on next page)

2 (b)	(continued)
3	

4

4	

5(a)	
5(b)	
5(c)	

6(a)(i)	
6(a)(ii)	

6(b)(i)	
6(b)(ii)	
6(b)(iii)	
0(2)(111)	

7	
	(answer space continued on next page)

(continued	.)			

8	
	(answer space continued on next page)

8 (continued)

9(a)(i)	
9(a)(ii)	
9(b)	
9(c)	

9(d)(i)	Gradient					
				,		, , t
	0	5	10	15	20	25
9(d)(ii)						
9(d)(iii)						
9(e)						

10(a)	
10(b)	

15 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.

11	(a)	Evaluate $\sum_{r=1}^{5} r^2$.	[1]
	(b)	Show that Euler's approximate formula, as given in line 13, gives the exact value of	
		$\sum_{r=1}^{5} r^2$.	[2]

i	<i>r</i> =1
11(a)	
11(b)	

10	
12	

13	Prove that Euler's approximate formula, as given in line 13, when applied to	$\sum_{n=1}^{\infty} r^2$	gives exactly
	$\frac{n(n+1)(2n+1)}{\epsilon}.$	r=1	[4]
	0		

13	

[2]

14	Show that the expression given in line 33 simplifies to	$\sum_{r=0}^{n} \frac{1}{r} \approx \ln n + \frac{13}{24}$	$+\frac{6n+5}{12n(n+1)}$, as given in
	line 34.	r=1	[3]

14	

15 The expression given in line 34 is used to calculate $\sum_{r=1}^{6} \frac{1}{r}$.

Show that the error in the result is less than 1.5% of the true value.

19 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).



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