## Monday 18 October 2021 - Afternoon <br> A Level Mathematics B (MEI)

H640/03 Pure Mathematics and Comprehension

## Printed Answer Booklet

Time allowed: $\mathbf{2}$ 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 $\square$ Candidate number $\square$

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)

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## 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 .


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 $y=\arctan x$.
(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 ?

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| 13(b) |  |
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14 (a) Show that

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

(b) Use the arctan addition formula in line 23 to show that
$\arctan \left(\frac{1}{n+1}\right)+\arctan \left(\frac{1}{n^{2}+n+1}\right)=\arctan \left(\frac{1}{n}\right)$, as given in line 39 .

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| 14(b) | (continued) |
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15 Prove that $\arctan 1+\arctan 2+\arctan 3=\pi$, as given in line 41 .


## 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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