OCR
Oxford Cambridge and RSA

Thursday 20 June 2024 – Afternoon

A Level Mathematics B (MEI)

H640/03 Pure Mathematics and Comprehension

Printed Answer Booklet

Time allowed: 2 hours

AB

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 **16** pages.

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

Section A (60 marks)

1	
2(a)	
	$f^{-1}(x) =$
	Domain of inverse function:
2(b)	

3	
4	

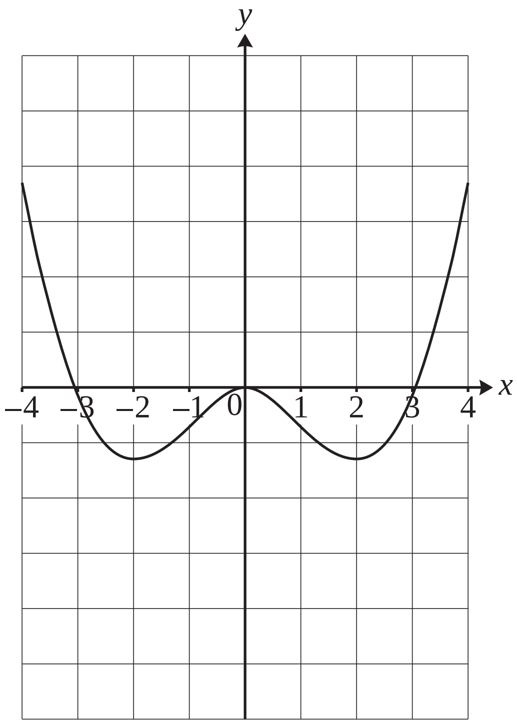
5

6	
7	

8(a)	
8(b)	

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

10



11(a)

11(b)	
11(c)	

12(a)	
	(answer space continued on next page)

12(a)	**(continued)**
12(b)	

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.

13 Substitute appropriate values of t_1 and t_2 to verify that $t_1 t_2$ gives the correct value for the y-coordinate of the point of intersection of the tangents at the points A and B in **Fig. C1**. **[1]**

13	

14 Substitute appropriate values of t_1 and t_2 to verify that the expression $t_1^2 + t_2^2 + t_1 t_2 + \frac{1}{2}$ gives the correct value for the y-coordinate of the point of intersection of the normals at the points A and B in **Fig. C2**. **[1]**

14	

15 **(a)** Show that, for the curve $y = ax^2 + bx + c$, the equation of the tangent at the point with x-coordinate t is $y = (2at + b)x - at^2 + c$. **[3]**

(b) Hence show that for the curve with equation $y = ax^2 + bx + c$, the tangents at two points, P and Q, on the curve cross at a point which has x-coordinate equal to the mean of the x-coordinates of points P and Q, as given in lines 11 to 14. **[3]**

15(a)	
15(b)	

16 Show that the expression $a\left(\frac{x_P + x_Q}{2}\right)^2 + b\left(\frac{x_P + x_Q}{2}\right) + c - a\left(\frac{x_P - x_Q}{2}\right)^2$ is equivalent to $ax_P x_Q + b\left(\frac{x_P + x_Q}{2}\right) + c$, as given in lines 15 and 16. **[2]**

16	

17 Show that, for the curve $y = x^2$, the equation of the normal at the point (t, t^2) is $y = -\frac{x}{2t} + t^2 + \frac{1}{2}$, as given in line 27. **[3]**

17	

18 A student is investigating the intersection points of tangents to the curve $y = 6x^2 - 7x + 1$. She uses software to draw tangents at pairs of points with x-coordinates differing by 5.

Find the equation of the curve that all the intersection points lie on. **[2]**

18

DO NOT WRITE IN THIS SPACE

EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.