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9709/22

May/June 2024

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

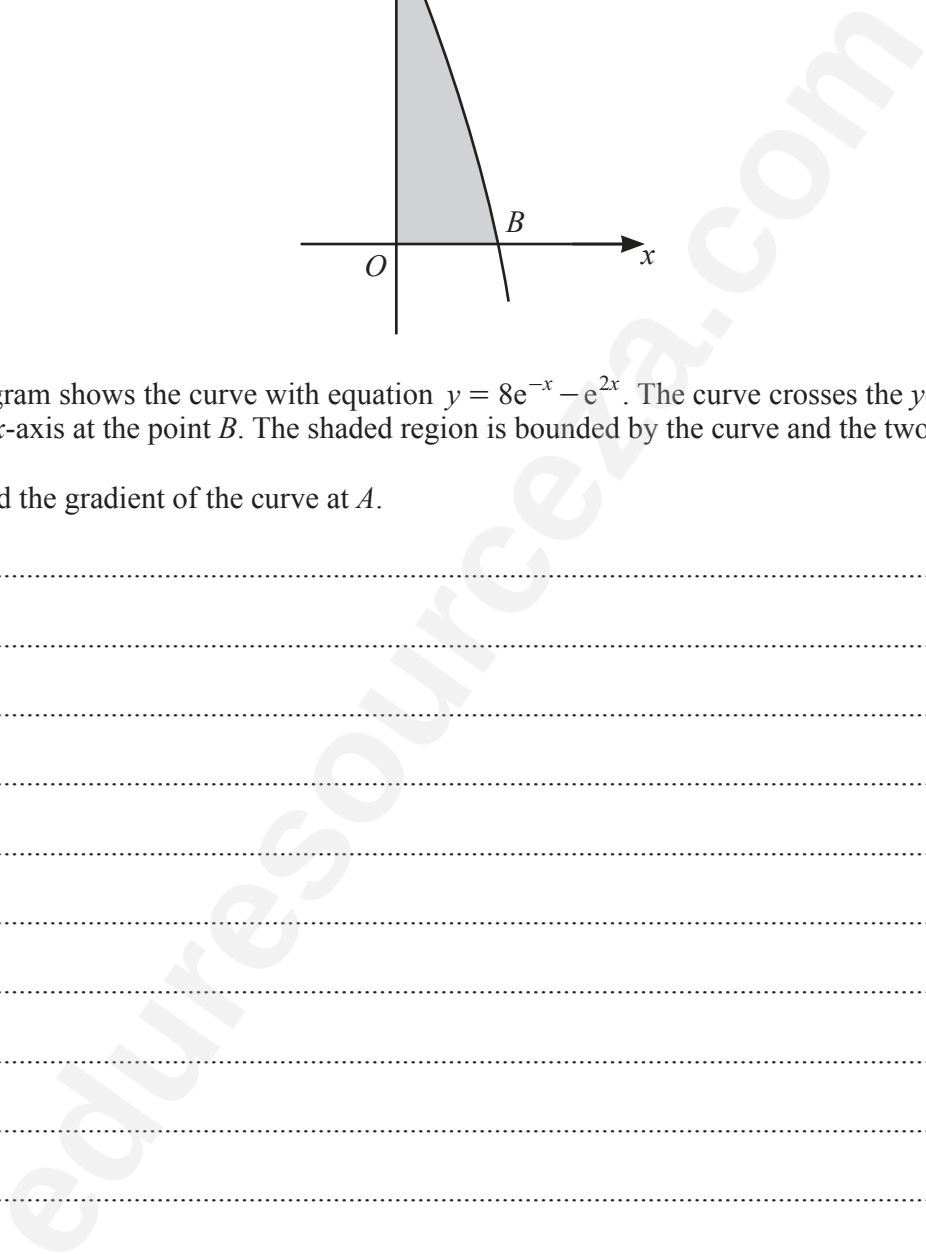
This document has **16** pages. Any blank pages are indicated.

[4]

[illegible]

- [4]

[illegible]



(a) Find the gradient of the curve at A . [3]

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- [5]

[illegible]

- 4

$$x = 4 \cos^2 t, \quad y = \sqrt{3} \sin 2t,$$

for values of t such that $0 < t < \frac{1}{2}\pi$.

Find the equation of the normal to the curve at the point for which $t = \frac{1}{6}\pi$. Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. [7]

This image shows a blank sheet of white paper with horizontal ruling lines. A diagonal watermark, "eduresourceza.com", is visible across the page. The watermark is light gray and spans from the bottom left towards the top right. There are approximately 20 horizontal lines on the page.

Handwriting practice area with horizontal dotted lines.

5

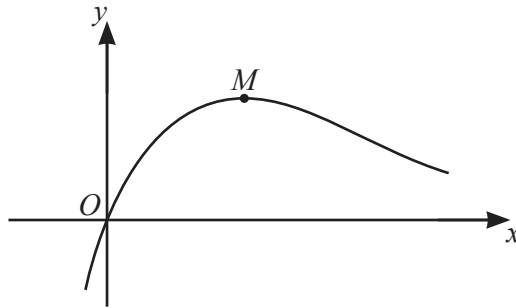
[3]

[illegible]

- [5]

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6



The diagram shows the curve with equation $y = \frac{\ln(2x+1)}{x+3}$. The curve has a maximum point M .

- (a) Find an expression for $\frac{dy}{dx}$. [2]

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- (b) Show that the x -coordinate of M satisfies the equation $x = \frac{x+3}{\ln(2x+1)} - 0.5$. [2]

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- (c) Show by calculation that the x -coordinate of M lies between 2.5 and 3.0 . [2]

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- (d) Use an iterative formula based on the equation in part (b) to find the x -coordinate of M correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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[2]

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[5]

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- (c) Find $\int 8 \sin^2 \frac{1}{2} x \operatorname{cosec}^2 x \, dx$. [3]

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