



## Cambridge International AS & A Level

CANDIDATE  
NAME

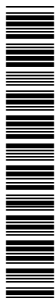
CENTRE  
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**MATHEMATICS**

**9709/21**

Paper 2 Pure Mathematics 2

**October/November 2020**

**1 hour 15 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

### INSTRUCTIONS

- 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.

### INFORMATION

- 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 **12** pages. Blank pages are indicated.

1 Given that

$$\ln(2x + 1) - \ln(x - 3) = 2,$$

find  $x$  in terms of  $e$ .

[4]

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2 The polynomial  $p(x)$  is defined by

$$p(x) = x^3 + ax^2 + bx + 16,$$

where  $a$  and  $b$  are constants. It is given that  $(x + 2)$  is a factor of  $p(x)$  and that the remainder is 72 when  $p(x)$  is divided by  $(x - 2)$ .

Find the values of  $a$  and  $b$ .

[5]

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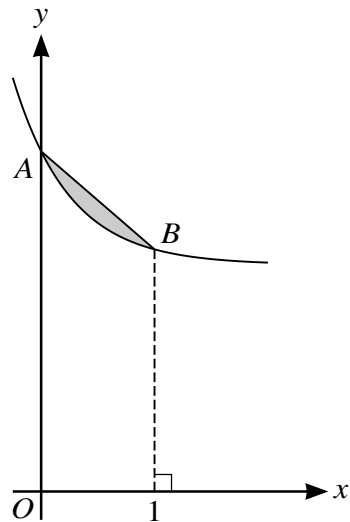
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The diagram shows the curve  $y = 2 + e^{-2x}$ . The curve crosses the  $y$ -axis at the point  $A$ , and the point  $B$  on the curve has  $x$ -coordinate 1. The shaded region is bounded by the curve and the line segment  $AB$ .

Find the exact area of the shaded region. [5]

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- 4 (a) Solve the equation  $|2x - 5| = |x + 6|$ . [3]

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- (b) Hence find the value of  $y$  such that  $|2^{1-y} - 5| = |2^{-y} + 6|$ . Give your answer correct to 3 significant figures. [2]

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5 The sequence of values given by the iterative formula  $x_{n+1} = \frac{6 + 8x_n}{8 + x_n^2}$  with initial value  $x_1 = 2$  converges to  $\alpha$ .

(a) Use the iterative formula to find the value of  $\alpha$  correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

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(b) State an equation satisfied by  $\alpha$  and hence determine the exact value of  $\alpha$ . [2]

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6 It is given that  $3 \sin 2\theta = \cos \theta$  where  $\theta$  is an angle such that  $0^\circ < \theta < 90^\circ$ .

(a) Find the exact value of  $\sin \theta$ . [2]

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(b) Find the exact value of  $\sec \theta$ . [2]

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(c) Find the exact value of  $\cos 2\theta$ . [2]

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7 A curve is defined by the parametric equations

$$x = 3t - 2 \sin t, \quad y = 5t + 4 \cos t,$$

where  $0 \leq t \leq 2\pi$ . At each of the points  $P$  and  $Q$  on the curve, the gradient of the curve is  $\frac{5}{2}$ .

(a) Show that the values of  $t$  at  $P$  and  $Q$  satisfy the equation  $10 \cos t - 8 \sin t = 5$ . [3]

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(b) Express  $10 \cos t - 8 \sin t$  in the form  $R \cos(t + \alpha)$ , where  $R > 0$  and  $0 < \alpha < \frac{1}{2}\pi$ . Give the exact value of  $R$  and the value of  $\alpha$  correct to 3 significant figures. [3]

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(c) Hence find the values of  $t$  at the points  $P$  and  $Q$ . [4]

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