Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0484787472

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **May/June 2021**

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 **16** pages. Any blank pages are indicated.

JC21 06_9709_21/RP

BLANK PAGE

1 Solve the inequality $|3x - 7| < |4x + 5|$. [4]

2 By first expanding $\sin(\theta + 30°)$, solve the equation $\sin(\theta + 30°)\operatorname{cosec}\theta = 2$ for $0° < \theta < 360°$. [6]

3 **(a)** Show that $(\sec x + \cos x)^2$ can be expressed as $\sec^2 x + a + b\cos 2x$, where a and b are constants to be determined. [2]

(b) Hence find the exact value of $\int_0^{\frac{1}{4}\pi} (\sec x + \cos x)^2 \, dx$. [4]

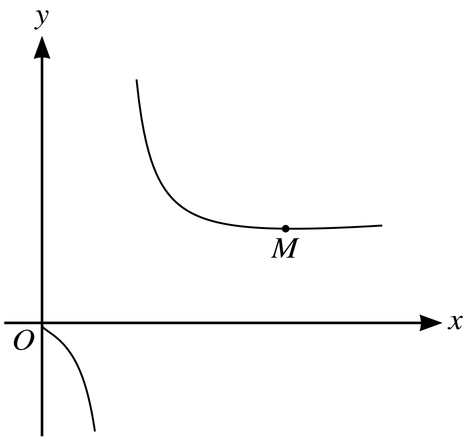
4 A curve has parametric equations

$$x = \ln(2t + 6) - \ln t, \qquad y = t \ln t.$$

(a) Find the value of t at the point P on the curve for which $x = \ln 4$. [3]

(b) Find the exact gradient of the curve at P. [5]

5



The diagram shows the curve with equation $y = \dfrac{3x+2}{\ln x}$. The curve has a minimum point M.

(a) Find an expression for $\dfrac{dy}{dx}$ and show that the x-coordinate of M satisfies the equation $x = \dfrac{3x+2}{3\ln x}$. [3]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(b) Use the equation in part **(a)** to show by calculation that the x-coordinate of M lies between 3 and 4. [2]

....

....

....

....

....

....

....

....

....

(c) Use an iterative formula, based on the equation in part **(a)**, to find the x-coordinate of M correct to 5 significant figures. Give the result of each iteration to 7 significant figures. [3]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

6 **(a)** Use the trapezium rule with three intervals to find an approximation to $\int_1^4 \frac{6}{1+\sqrt{x}}\,dx$. Give your answer correct to 5 significant figures. [3]

....

....

....

....

....

....

....

....

....

....

....

(b) Find the exact value of $\int_1^4 2e^{\frac{1}{2}x-2}\,dx$. [3]

....

....

....

....

....

....

....

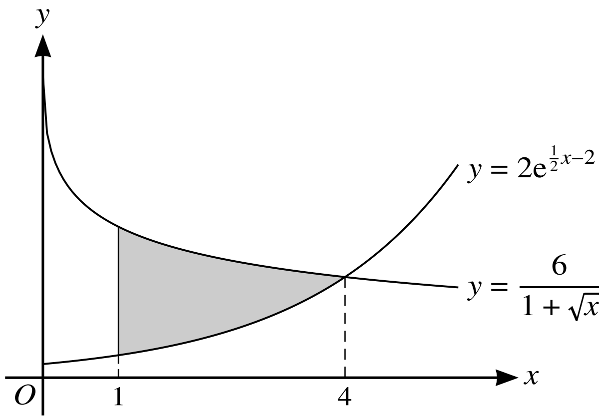
....

....

....

....

(c)



The diagram shows the curves $y = \frac{6}{1+\sqrt{x}}$ and $y = 2e^{\frac{1}{2}x-2}$ which meet at a point with x-coordinate 4. The shaded region is bounded by the two curves and the line $x = 1$.

Use your answers to parts **(a)** and **(b)** to find an approximation to the area of the shaded region. Give your answer correct to 3 significant figures. [2]

....

....

....

....

....

....

....

....

(d) State, with a reason, whether your answer to part **(c)** is an over-estimate or under-estimate of the exact area of the shaded region. [1]

....

....

....

....

....

....

7 The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = ax^3 - 11x^2 - 19x - a,$$

where a is a constant. It is given that $(x - 3)$ is a factor of $\mathrm{p}(x)$.

(a) Find the value of a. [2]

....

....

....

....

....

....

....

(b) When a has this value, factorise $\mathrm{p}(x)$ completely. [3]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(c) Hence find the exact values of y that satisfy the equation $p(e^y + e^{-y}) = 0$. [4]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

BLANK PAGE

BLANK PAGE