Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0484784722

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.

[Turn over

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

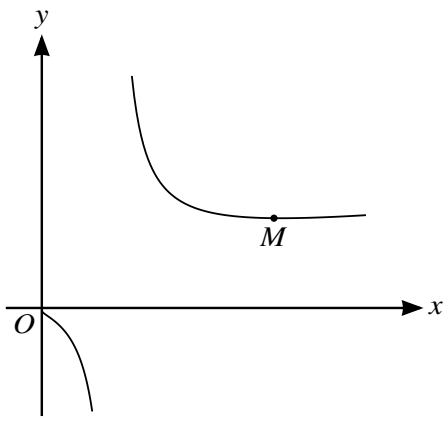
4 A curve has parametric equations

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

(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 $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ 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 $\int_1^4 \frac{6}{1+\sqrt{x}}\,\mathrm{d}x$. Give your answer correct to 5 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

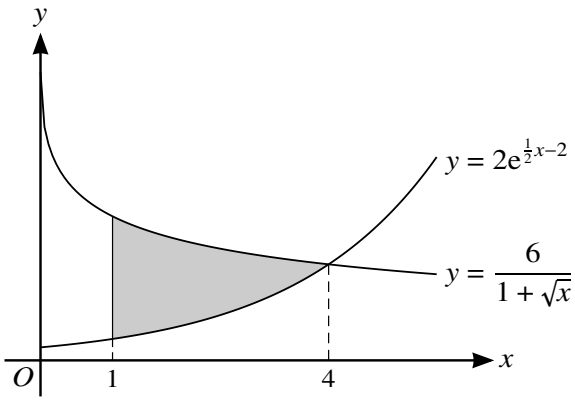
.....

.....

.....

.....

(c)



The diagram shows the curves $y = \dfrac{6}{1+\sqrt{x}}$ 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 $p(x)$ is defined by

$$p(x) = ax^3 - 11x^2 - 19x - a,$$

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

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

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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