Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8671641646

MATHEMATICS **9709/11**

Paper 1 Pure Mathematics 1 **May/June 2024**

1 hour 50 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

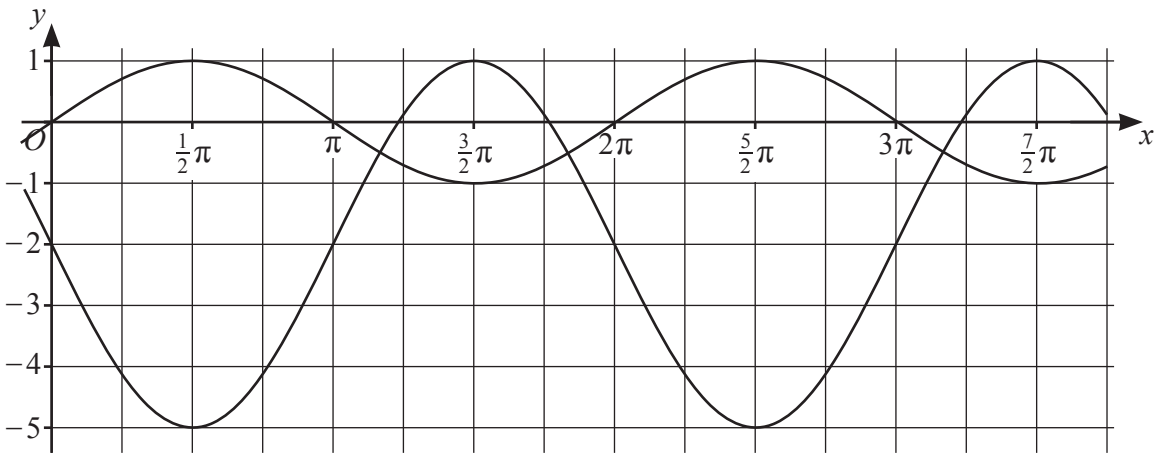
- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

1 **(a)** Express $3y^2 - 12y - 15$ in the form $3(y+a)^2 + b$, where a and b are constants. [2]

(b) Hence find the exact solutions of the equation $3x^4 - 12x^2 - 15 = 0$. [3]

2



The diagram shows two curves. One curve has equation $y = \sin x$ and the other curve has equation $y = \mathrm{f}(x)$.

(a) In order to transform the curve $y = \sin x$ to the curve $y = \mathrm{f}(x)$, the curve $y = \sin x$ is first reflected in the x-axis.

Describe fully a sequence of two further transformations which are required. [4]

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(b) Find $\mathrm{f}(x)$ in terms of $\sin x$. [2]

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3 The coefficient of x^3 in the expansion of $(3+ax)^6$ is 160.

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

(b) Hence find the coefficient of x^3 in the expansion of $(3+ax)^6(1-2x)$. [3]

4 The equation of a curve is $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = (2x-1)\sqrt{3x-2} - 2$. The following points lie on the curve. Non-exact values have been given correct to 5 decimal places.

$A(2, 4)$, $B(2.0001, k)$, $C(2.001, 4.00625)$, $D(2.01, 4.06261)$, $E(2.1, 4.63566)$, $F(3, 11.22876)$

(a) Find the value of k. Give your answer correct to 5 decimal places. [1]

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The table shows the gradients of the chords AB, AC, AD and AF.

Chord	AB	AC	AD	AE	AF
Gradient of chord	6.2501	6.2511	6.2608		7.2288

(b) Find the gradient of the chord AE. Give your answer correct to 4 decimal places. [1]

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(c) Deduce the value of $\mathrm{f}'(2)$ using the values in the table. [1]

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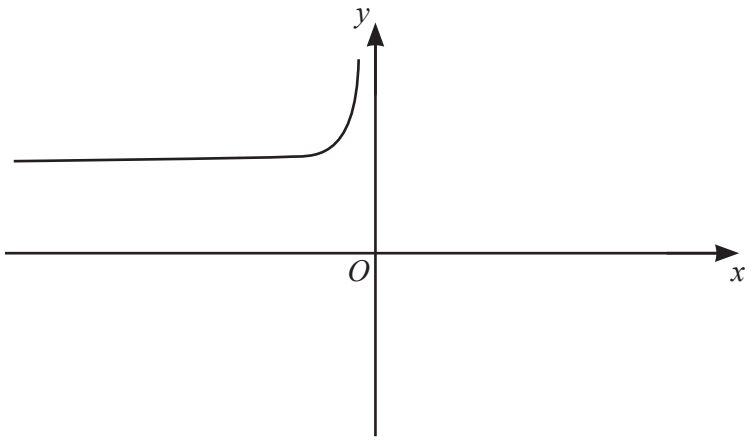
5 **(a)** Prove the identity $\frac{\sin^2 x - \cos x - 1}{1 + \cos x} \equiv -\cos x$. [3]

(b) Hence solve the equation $\frac{\sin^2 x - \cos x - 1}{2 + 2\cos x} = \frac{1}{4}$ for $0° \leqslant x \leqslant 360°$. [3]

6



The function f is defined by $f(x) = \frac{2}{x^2} + 4$ for $x < 0$. The diagram shows the graph of $y = f(x)$.

(a) On this diagram, sketch the graph of $y = f^{-1}(x)$. Show any relevant mirror line. [2]

(b) Find an expression for $f^{-1}(x)$. [3]

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(c) Solve the equation $f(x) = 4.5$. [1]

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(d) Explain why the equation $f^{-1}(x) = f(x)$ has no solution. [1]

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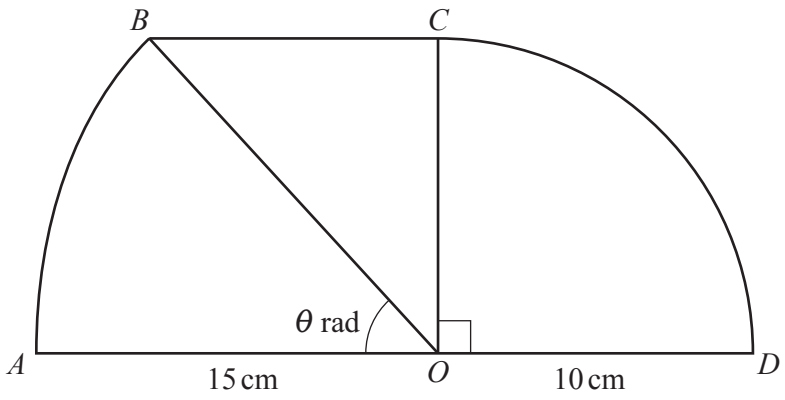

In the diagram, AOD and BC are two parallel straight lines. Arc AB is part of a circle with centre O and radius 15 cm. Angle $BOA = \theta$ radians. Arc CD is part of a circle with centre O and radius 10 cm. Angle $COD = \frac{1}{2}\pi$ radians.

(a) Show that $\theta = 0.7297$, correct to 4 decimal places. [1]

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(b) Find the perimeter and the area of the shape $ABCD$. Give your answers correct to 3 significant figures. [7]

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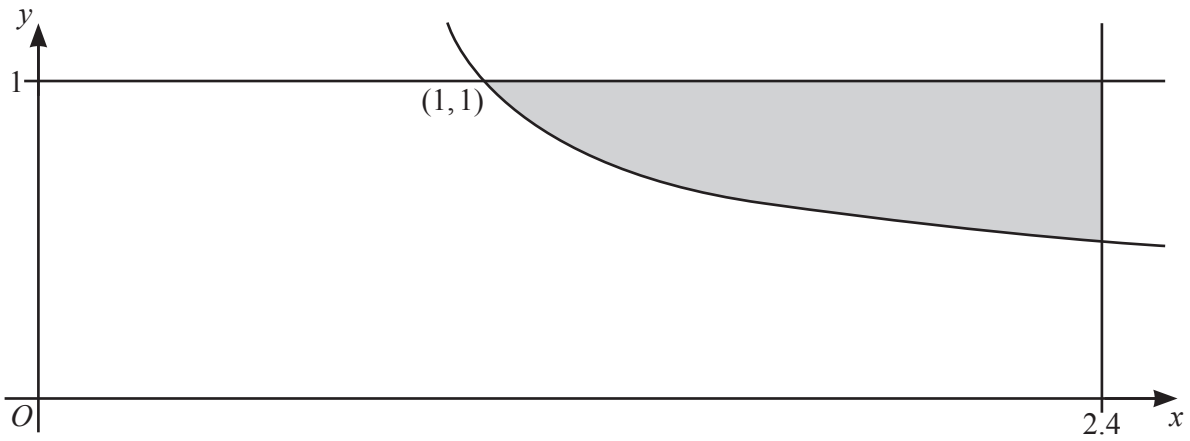
8 **(a)** The first three terms of an arithmetic progression are 25, $4p - 1$ and $13 - p$, where p is a constant.

Find the value of the tenth term of the progression. [4]

(b) The first three terms of a geometric progression are $25, 4q-1$ and $13-q$, where q is a positive constant.

Find the sum to infinity of the progression. [4]

9



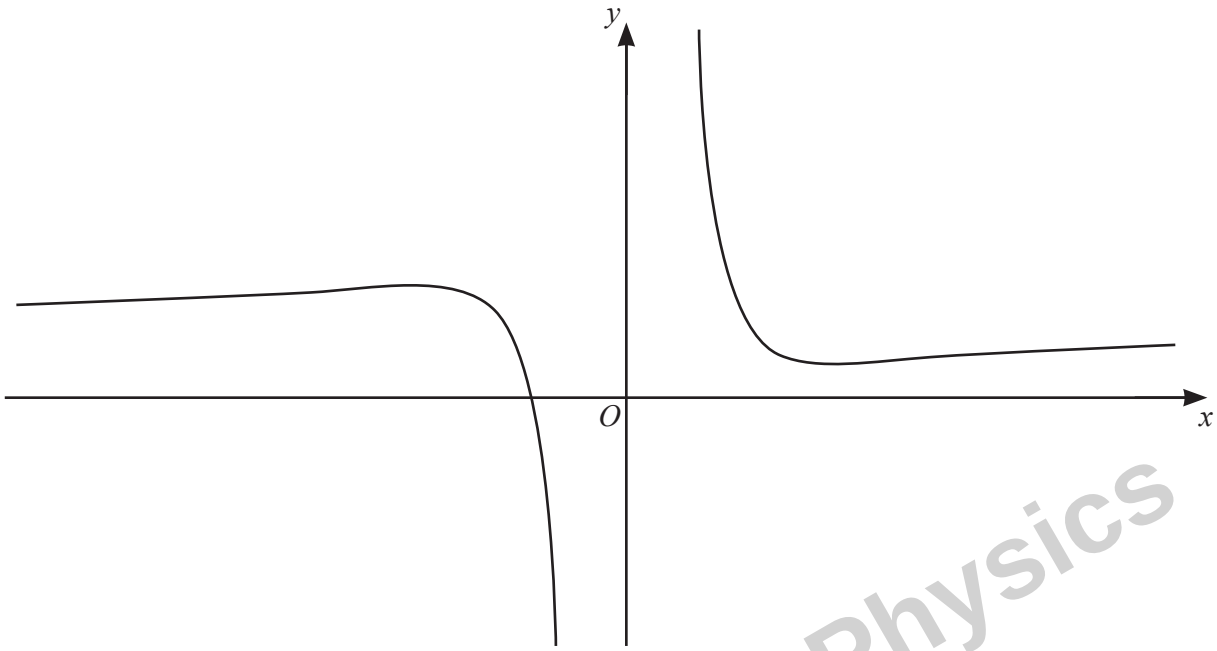
The diagram shows part of the curve with equation $y = \dfrac{1}{(5x-4)^{\frac{1}{3}}}$ and the lines $x = 2.4$ and $y = 1$. The curve intersects the line $y = 1$ at the point $(1, 1)$.

Find the exact volume of the solid generated when the shaded region is rotated through 360° about the x-axis. [6]

10 The equation of a circle is $(x-3)^2+y^2=18$. The line with equation $y=mx+c$ passes through the point $(0,-9)$ and is a tangent to the circle.

Find the two possible values of m and, for each value of m, find the coordinates of the point at which the tangent touches the circle. [8]

11



A function is defined by $f(x) = \frac{4}{x^3} - \frac{3}{x} + 2$ for $x \neq 0$. The graph of $y = f(x)$ is shown in the diagram.

(a) Find the set of values of x for which $f(x)$ is decreasing. [5]

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(b) A triangle is bounded by the y-axis, the normal to the curve at the point where $x = 1$ and the tangent to the curve at the point where $x = -1$.

Find the area of the triangle. Give your answer correct to 3 significant figures. [8]

Additional page

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

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