



Cambridge International AS & A Level

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MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1

October/November 2022

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.

2 The function f is defined by $f(x) = -2x^2 - 8x - 13$ for $x < -3$.

(a) Express $f(x)$ in the form $-2(x + a)^2 + b$, where a and b are integers. [2]

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(b) Find the range of f . [1]

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

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- 3 (a) Find the first three terms in ascending powers of x of the expansion of $(1 + 2x)^5$. [2]

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- (b) Find the first three terms in ascending powers of x of the expansion of $(1 - 3x)^4$. [2]

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- (c) Hence find the coefficient of x^2 in the expansion of $(1 + 2x)^5(1 - 3x)^4$. [2]

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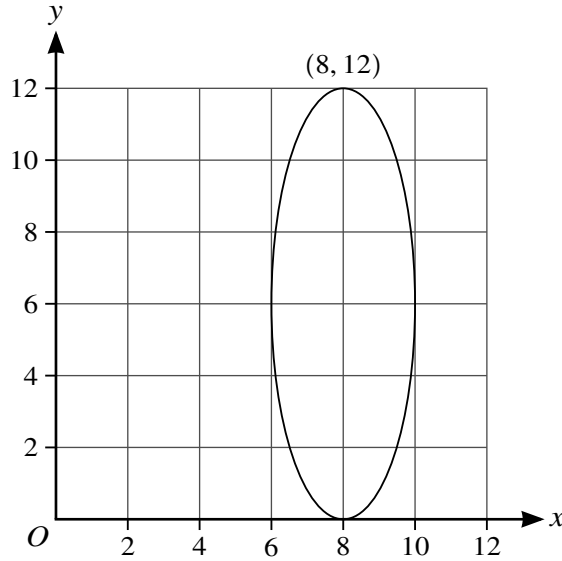
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The diagram shows a curve which has a maximum point at (8, 12) and a minimum point at (8, 0). The curve is the result of applying a combination of two transformations to a circle. The first transformation applied is a translation of $\begin{pmatrix} 7 \\ -3 \end{pmatrix}$. The second transformation applied is a stretch in the y-direction.

- (a) State the scale factor of the stretch. [1]

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- (b) State the radius of the original circle. [1]

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- (c) State the coordinates of the centre of the circle after the translation has been completed but before the stretch is applied. [2]

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- (d) State the coordinates of the centre of the original circle. [2]

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7 The curve $y = f(x)$ is such that $f'(x) = \frac{-3}{(x+2)^4}$.

(a) The tangent at a point on the curve where $x = a$ has gradient $-\frac{16}{27}$.

Find the possible values of a .

[4]

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(b) Find the volume of revolution when the shaded region is rotated through 360° about the x -axis. Give your answer in the form $\frac{\pi}{a}(b\sqrt{c} - d)$, where a, b, c and d are integers. [4]

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(c) Find an exact expression for the perimeter of the shaded region. [2]

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11 The coordinates of points A , B and C are $A(5, -2)$, $B(10, 3)$ and $C(2p, p)$, where p is a constant.

(a) Given that AC and BC are equal in length, find the value of the fraction p . [3]

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(b) It is now given instead that AC is perpendicular to BC and that p is an integer.

(i) Find the value of p . [4]

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