

Cambridge O Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

599157273

ADDITIONAL MATHEMATICS

4037/13

Paper 1 October/November 2021

2 hours

You must answer on the question paper.

No additional materials are needed.

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.
- 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 80.
- The number of marks for each question or part question is shown in brackets [].

This document has 16 pages. Any blank pages are indicated.

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

where *n* is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\left\{2a + (n-1)d\right\}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \ (r \neq 1)$$

$$S_{\infty} = \frac{a}{1-r} \ (|r| < 1)$$

2. TRIGONOMETRY

Identities

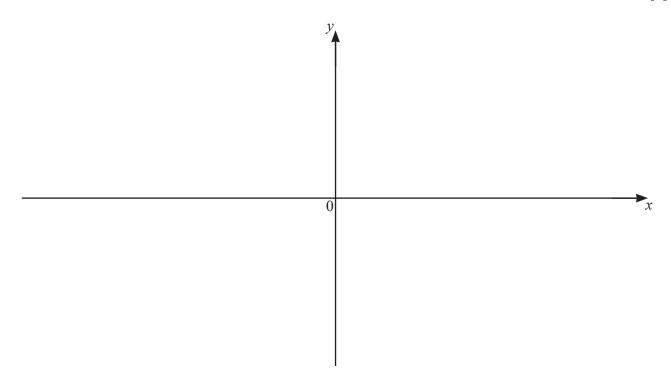
$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\csc^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$\Delta = \frac{1}{2}bc \sin A$$

On the axes below, sketch the graph of $y = -\frac{1}{4}(2x+1)(x-3)(x+4)$ stating the intercepts with the coordinate axes. [3]

3



A particle moves in a straight line such that its velocity, $v \,\text{ms}^{-1}$, at time t seconds after passing through a fixed point O, is given by $v = e^{3t} - 25$. Find the speed of the particle when t = 1. [2]

3 Solve the equation $\cot^2(2x - \frac{\pi}{3}) = \frac{1}{3}$, where x is in radians and $0 \le x < \pi$. [5]

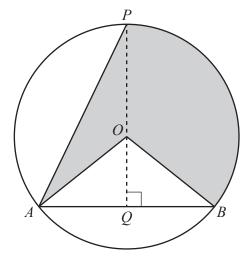
(a)	Find the first three terms, in ascending powers of x^2 , in the expansion of coefficients as rational numbers.	$\left(\frac{1}{2}\right)$	$-\frac{2}{3}x^2$	8	Write your
	(a)	(a) Find the first three terms, in ascending powers of x^2 , in the expansion of coefficients as rational numbers.	(a) Find the first three terms, in ascending powers of x^2 , in the expansion of $(\frac{1}{2})^2$ coefficients as rational numbers.	(a) Find the first three terms, in ascending powers of x^2 , in the expansion of $\left(\frac{1}{2} - \frac{2}{3}x^2\right)^3$ coefficients as rational numbers.	(a) Find the first three terms, in ascending powers of x^2 , in the expansion of $\left(\frac{1}{2} - \frac{2}{3}x^2\right)^8$. coefficients as rational numbers.

(b) Find the coefficient of
$$x^2$$
 in the expansion of $\left(\frac{1}{2} - \frac{2}{3}x^2\right)^8 \left(2x + \frac{1}{x}\right)^2$. [3]

	A geometric progression is such that its sum to 4 terms is 17 times its sum to 2 terms. It is given that the common ratio of this geometric progression is positive and not equal to 1.								
(a)	Find the common ratio of this geometric progression.	[3]							
(b)	Given that the 6th term of the geometric progression is 64, find the first term.	[2]							
(c)	Explain why this geometric progression does not have a sum to infinity.	[1]							
	(a)	A geometric progression is such that its sum to 4 terms is 17 times its sum to 2 terms. It is given that common ratio of this geometric progression is positive and not equal to 1. (a) Find the common ratio of this geometric progression. (b) Given that the 6th term of the geometric progression is 64, find the first term. (c) Explain why this geometric progression does not have a sum to infinity.							

6 (a) A 5-digit number is made using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. No digit may be used more than once in any 5-digit number. Find how many such 5-digit numbers are odd and greater than 70 000. [3]

(b) The number of combinations of n objects taken 3 at a time is 2 times the number of combinations of n objects taken 2 at a time. Find the value of n. [4]



The diagram shows a circle, centre O, radius 10 cm. The points A, B and P lie on the circumference of the circle. The chord AB is of length 14 cm. The point Q lies on AB and the line POQ is perpendicular to AB.

(a) Show that angle *POA* is 2.366 radians, correct to 3 decimal places.

(b) Find the area of the shaded region.

[3]

[2]

(c) Find the perimeter of the shaded region.

[5]

V = V = V = V = V = V = V = V = V = V =	$x^2 + 6x - 2$ intersect at the points A and B	2v = x	and	$v = x^2 + x - 1$	The curves	8
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(a) Show that the mid-point of the line AB is (2, 9).

[5]

The line l is the perpendicular bisector of AB.

(b) Show that the point C(12, 7) lies on the line l.

[3]

(c) The point *D* also lies on *l*, such that the distance of *D* from *AB* is two times the distance of *C* from *AB*. Find the coordinates of the two possible positions of *D*. [4]

hen e^{2y} is plotted against x^2 , a straight line graph passing through the points (4, 7.96) and (2, 3.7 ained.	6) is
	[5]
Find y when $x = 1$.	[2]
Using your equation from part (a), find the positive values of x for which the straight line expression of x for which the straight line expression x for x	xists. [3]
	Find y when $x=1$. Using your equation from part (a) , find the positive values of x for which the straight line expands the positive values of x for which the straight line expansion $x=1$.

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10 A curve with equation y = f(x) is such that $\frac{d^2y}{dx^2} = (2x+3)^{-\frac{1}{2}} + 5$ for x > 0. The curve has gradient 10 at the point $\left(3, \frac{19}{2}\right)$.

(a) Show that, when
$$x = 11$$
, $\frac{dy}{dx} = 52$. [5]

(b) Find
$$f(x)$$
. [4]

11 A curve has equation $y = \frac{\left(x^2 - 5\right)^{\frac{1}{3}}}{x + 1}$ for x > -1.

(a) Show that
$$\frac{dy}{dx} = \frac{Ax^2 + Bx + C}{3(x+1)^2(x^2-5)^{\frac{2}{3}}} \text{ where } A, B \text{ and } C \text{ are integers.}$$
 [6]

(b)	Find the <i>x</i> -coordinate of the stationary point on the curve.	[2]

(c) Explain how you could determine the nature of this stationary point. [You are not required to find the nature of this stationary point.]

[2]

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