

Cambridge O Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		
ADDITIONAL MATHEMATICS 403				4037/23	
Paper 2			Oc	October/November 2022	
				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.

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

• 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 [].

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

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

Geometric series

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

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

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

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 $\triangle ABC$

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

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1 Solve the following inequality.

$$(2x+3)(x-4) > (3x+4)(x-1)$$
[5]

2 The tangent to the curve $y = ax^2 - 5x + 2$ at the point where x = 2 has equation y = 7x + b. Find the values of the constants *a* and *b*. [5]

3 Solve the equation $\lg(2x-1) + \lg(x+2) = 2 - \lg 4$.

[5]

4 The line y = kx + 6 intersects the curve $y = x^3 - 4x^2 + 3kx + 2$ at the point where x = 2. (a) Find the value of k.

(b) Show that, for this value of *k*, the line cuts the curve only once.

[4]

[2]

5 (a) Show that
$$\frac{\cos x}{1-\sin x} + \frac{1-\sin x}{\cos x} = 2 \sec x$$
.

(b) Hence solve the equation
$$\frac{\cos\frac{\theta}{2}}{1-\sin\frac{\theta}{2}} + \frac{1-\sin\frac{\theta}{2}}{\cos\frac{\theta}{2}} = 8\cos^2\frac{\theta}{2} \text{ for } -360^\circ < \theta < 360^\circ.$$
[4]

[4]

6 The first four terms in ascending powers of x in the expansion $(3 + ax)^4$ can be written as $81 + bx + cx^2 + \frac{3}{2}x^3$. Find the values of the constants a, b and c. [6]

7 Given that ${}^{n}C_{4} = 13 \times {}^{n}C_{2}$, find the value of ${}^{n}C_{8}$.

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[5]

8 (a) Particle A starts from the point with position vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and travels with speed 26 ms⁻¹ in the direction of the vector $\begin{pmatrix} 12 \\ 5 \end{pmatrix}$. Find the position vector of A after t seconds. [3]

(b) At the same time, particle *B* starts from the point with position vector $\begin{pmatrix} 67\\-18 \end{pmatrix}$. It travels with speed 20 ms^{-1} at an angle of α above the positive *x*-axis, where $\tan \alpha = \frac{3}{4}$. Find the position vector of *B* after *t* seconds. [4]

9 The equation of a curve is $y = kxe^{-2x}$, where k is a constant.

(a) Find
$$\frac{dy}{dx}$$
. [2]

(b) Find the coordinates of the stationary point on the curve $y = 10xe^{-2x}$. [3]

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(c) Use your answer to part (a) to find $\int 4xe^{-2x}dx$.

(d) Find the exact value of $\int_0^1 4x e^{-2x} dx$.

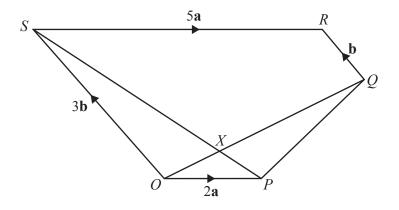
[2]

[3]

10 (a) The third term of an arithmetic progression is 10 and the sum of the first 8 terms is 116. Find the first term and common difference. [5]

(b) Find the sum of nineteen terms of the progression, starting with the twelfth term. [4]

11



In the vector diagram, $\overrightarrow{OP} = 2\mathbf{a}$, $\overrightarrow{SR} = 5\mathbf{a}$, $\overrightarrow{OS} = 3\mathbf{b}$ and $\overrightarrow{QR} = \mathbf{b}$. (a) Given that $\overrightarrow{PX} = \lambda \overrightarrow{PS}$, write \overrightarrow{OX} in terms of \mathbf{a} , \mathbf{b} and λ .

[3]

(**b**) Given that $\overrightarrow{OX} = \mu \overrightarrow{OQ}$, write \overrightarrow{OX} in terms of **a**, **b** and μ .

[2]

(c) Find the values of λ and μ .

(d) Write down the value of $\frac{OX}{OQ}$.

[1]

[4]

(e) Find the value of
$$\frac{PX}{XS}$$
.

[1]

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