



Cambridge O Level

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



ADDITIONAL MATHEMATICS

4037/22

Paper 2

October/November 2020

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

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

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*

$$\begin{aligned} \sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A \end{aligned}$$

Formulae for $\triangle ABC$

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

1 Solve the inequality $(x-8)(x-10) > 35$.

[4]

2 Find the value of x such that $\frac{4^{x+1}}{2^{x-1}} = 32^{\frac{x}{3}} \times 8^{\frac{1}{3}}$.

[4]

- 3 (a) Find the equation of the perpendicular bisector of the line joining the points (12, 1) and (4, 3), giving your answer in the form $y = mx + c$. [5]

- (b) The perpendicular bisector cuts the axes at points A and B . Find the length of AB . [3]

4 Solve the simultaneous equations.

$$\log_3(x+y) = 2$$

$$2\log_3(x+1) = \log_3(y+2)$$

[6]

5 DO NOT USE A CALCULATOR IN THIS QUESTION.

(a) Find the equation of the tangent to the curve $y = x^3 - 6x^2 + 3x + 10$ at the point where $x = 1$. [4]

(b) Find the coordinates of the point where this tangent meets the curve again. [5]

6 Find the exact value of $\int_2^4 \frac{(x+1)^2}{x^2} dx$.

[6]

7 A geometric progression has a first term of 3 and a second term of 2.4. For this progression, find

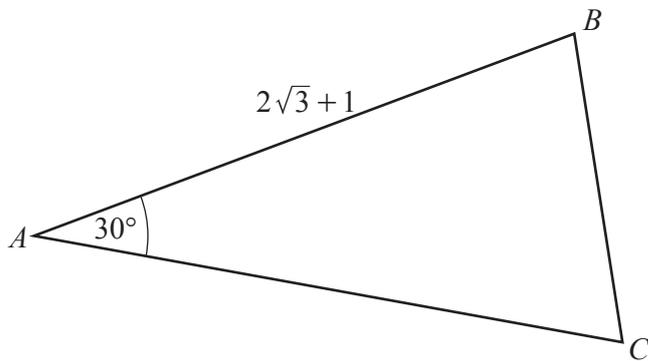
(a) the sum of the first 8 terms, [3]

(b) the sum to infinity, [1]

(c) the least number of terms for which the sum is greater than 95% of the sum to infinity. [4]

8 DO NOT USE A CALCULATOR IN THIS QUESTION.

In this question lengths are in centimetres.



You may use the following trigonometric ratios.

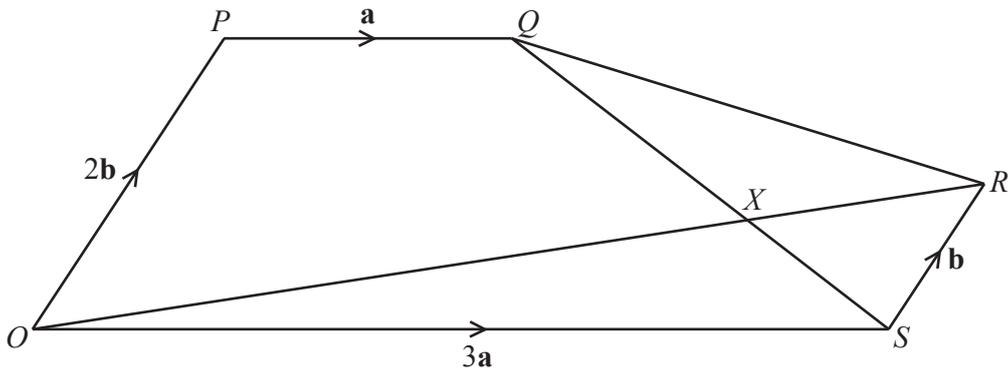
$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

- (a) Given that the area of the triangle ABC is 5.5 cm^2 , find the exact length of AC . Write your answer in the form $a + b\sqrt{3}$, where a and b are integers. [4]

- (b) Show that $BC^2 = c + d\sqrt{3}$, where c and d are integers to be found. [4]



In the diagram $\vec{OP} = 2\mathbf{b}$, $\vec{OS} = 3\mathbf{a}$, $\vec{SR} = \mathbf{b}$ and $\vec{PQ} = \mathbf{a}$. The lines OR and QS intersect at X .

(a) Find \vec{OQ} in terms of \mathbf{a} and \mathbf{b} . [1]

(b) Find \vec{QS} in terms of \mathbf{a} and \mathbf{b} . [1]

(c) Given that $\vec{QX} = \mu\vec{QS}$, find \vec{OX} in terms of \mathbf{a} , \mathbf{b} and μ . [1]

(d) Given that $\vec{OX} = \lambda\vec{OR}$, find \vec{OX} in terms of \mathbf{a} , \mathbf{b} and λ . [1]

(e) Find the value of λ and of μ .

[3]

(f) Find the value of $\frac{OX}{XS}$.

[1]

(g) Find the value of $\frac{OR}{OX}$.

[1]

10 The number, b , of bacteria in a sample is given by $b = P + Qe^{2t}$, where P and Q are constants and t is time in weeks. Initially there are 500 bacteria which increase to 600 after 1 week.

(a) Find the value of P and of Q .

[4]

(b) Find the number of bacteria present after 2 weeks.

[1]

(c) Find the first week in which the number of bacteria is greater than 1 000 000.

[3]

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

[4]

(b) Solve the equation $5 \tan x - 3 \cot x = 2 \sec x$ for $0^\circ \leq x \leq 360^\circ$.

[6]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.