



Cambridge O Level

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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ADDITIONAL MATHEMATICS

4037/02

Paper 2

For examination from 2020

SPECIMEN PAPER

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*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

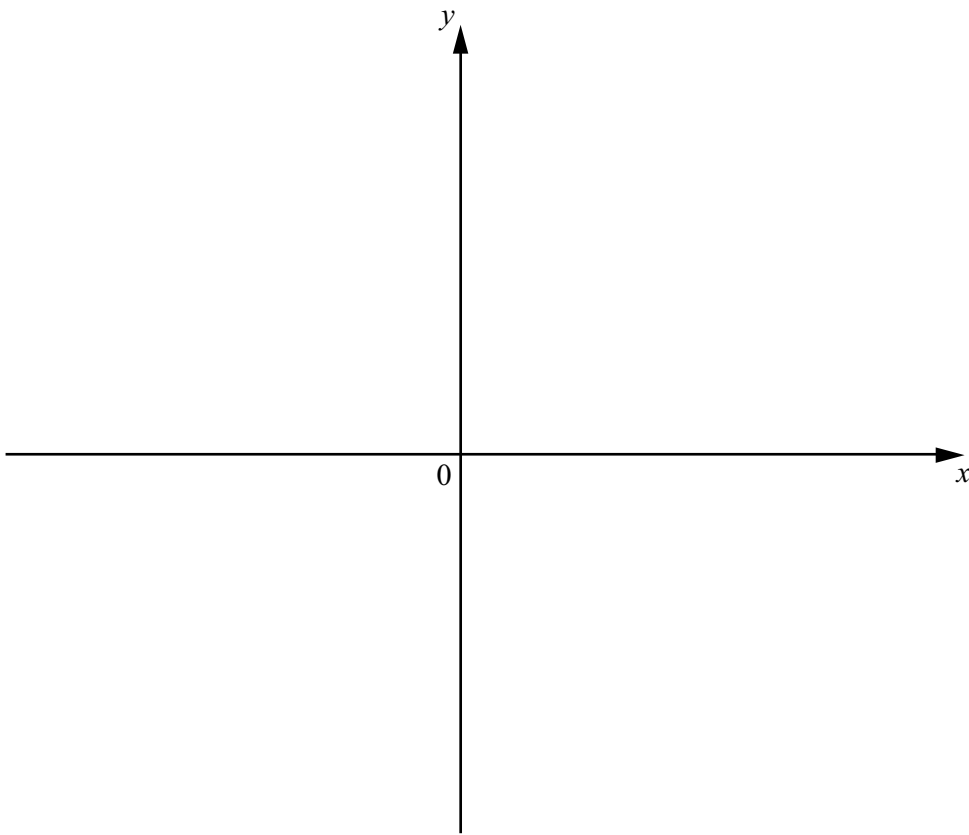
1 Solve

$$xy = 3,$$

$$x^4y^5 = 486.$$

[3]

- 2 (a) On the axes below, sketch the graph of $y = \frac{1}{5}(x - 2)(x - 4)(x + 5)$, showing the coordinates of the points where the graph meets the coordinate axes.



[2]

- (b) Explain why your sketch in part (a) can be used to solve $(x - 2)(x - 4)(x + 5) \leq 0$.

[1]

- (c) Hence solve $(x - 2)(x - 4)(x + 5) \leq 0$.

[1]

3 Functions g and h are such that

$$\begin{aligned}g(x) &= 2 + 4 \ln x && \text{for } x > 0, \\h(x) &= x^2 + 4 && \text{for } x > 0.\end{aligned}$$

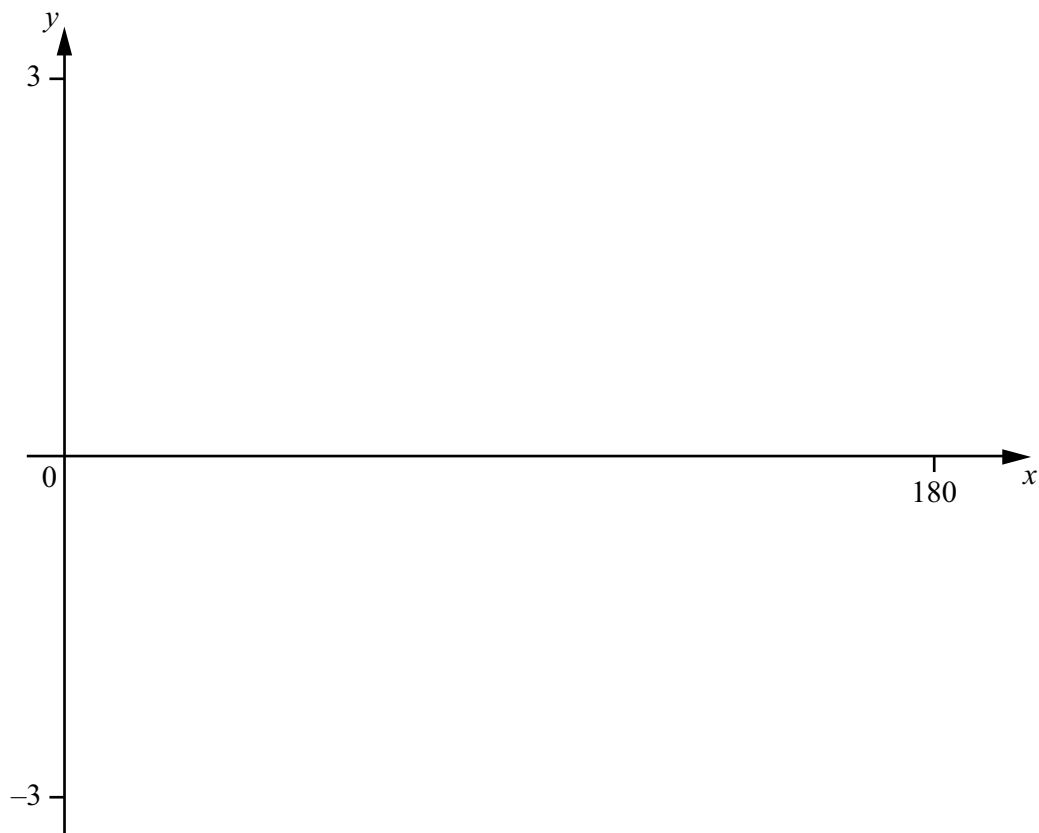
(a) Find g^{-1} , stating its domain and its range. [4]

(b) Solve $gh(x) = 10$. [3]

(c) Solve $g'(x) = h'(x)$.

[3]

- 4 On the axes below, sketch the graph of $y = 2 \sin \frac{3}{2}x - 1$ for $0^\circ \leq x \leq 180^\circ$, showing the coordinates of the points where the graph meets the coordinate axes. [4]



5 (a) A 6-character password is to be chosen from the following 9 characters.

letters A B E F

numbers 5 8 9

symbols * \$

Each character may be used only once in any password.

Find the number of different 6-character passwords that may be chosen if

(i) there are no restrictions, [1]

(ii) the password consists of 2 letters, 2 numbers and 2 symbols in that order, [2]

(iii) the password must start and finish with a symbol. [2]

- (b) An examination consists of a section A, containing 10 short questions, and a section B containing 5 long questions. Candidates are required to answer 6 questions from section A and 3 questions from section B.

Find the number of different selections of questions that can be made if

- (i) there are no further restrictions, [2]

- (ii) candidates must answer the first 2 questions in section A and the first question in section B. [2]

6 A particle P travels in a straight line such that, t s after passing through a fixed point O , its velocity $v \text{ m s}^{-1}$ is given by $v = \left(\frac{t^2}{e^8} - 4 \right)^3$.

(a) Find the speed of P at O . [1]

(b) Find the value of t for which P is instantaneously at rest. [2]

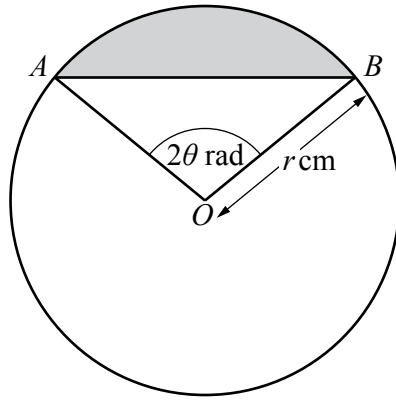
(c) Find the acceleration of P when $t = 1$. [4]

7 Variables x and y are such that when $\lg y$ is plotted against x^2 , a straight line graph passing through the points $(1, 0.73)$ and $(4, 0.10)$ is obtained.

(a) Given that $y = Ab^{x^2}$, find the value of each of the constants A and b . [4]

(b) Find the value of y when $x = 1.5$. [2]

(c) Find the positive value of x when $y = 2$. [2]

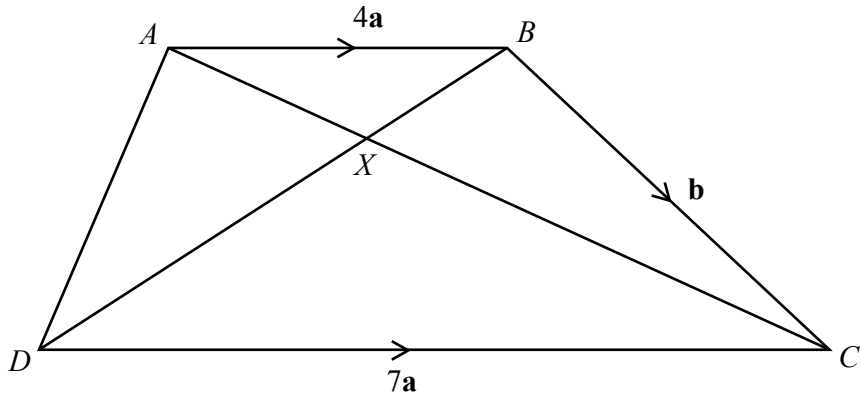


The diagram shows a circle, centre O , radius r cm. The points A and B lie on the circle such that angle $AOB = 2\theta$ radians.

- (a) Given that the perimeter of the shaded region is 20 cm, show that $r = \frac{10}{\theta + \sin \theta}$. [3]

(b) Given that r and θ can vary, find the value of $\frac{dr}{d\theta}$ when $\theta = \frac{\pi}{6}$. [4]

9



In the diagram $\vec{AB} = 4\mathbf{a}$, $\vec{BC} = \mathbf{b}$ and $\vec{DC} = 7\mathbf{a}$. The lines AC and DB intersect at the point X .

Find, in terms of \mathbf{a} and \mathbf{b} ,

(a) \vec{DB} , [1]

(b) \vec{DA} . [1]

Given that $\vec{AX} = \lambda \vec{AC}$ find, in terms of \mathbf{a} , \mathbf{b} and λ ,

(c) \vec{AX} , [1]

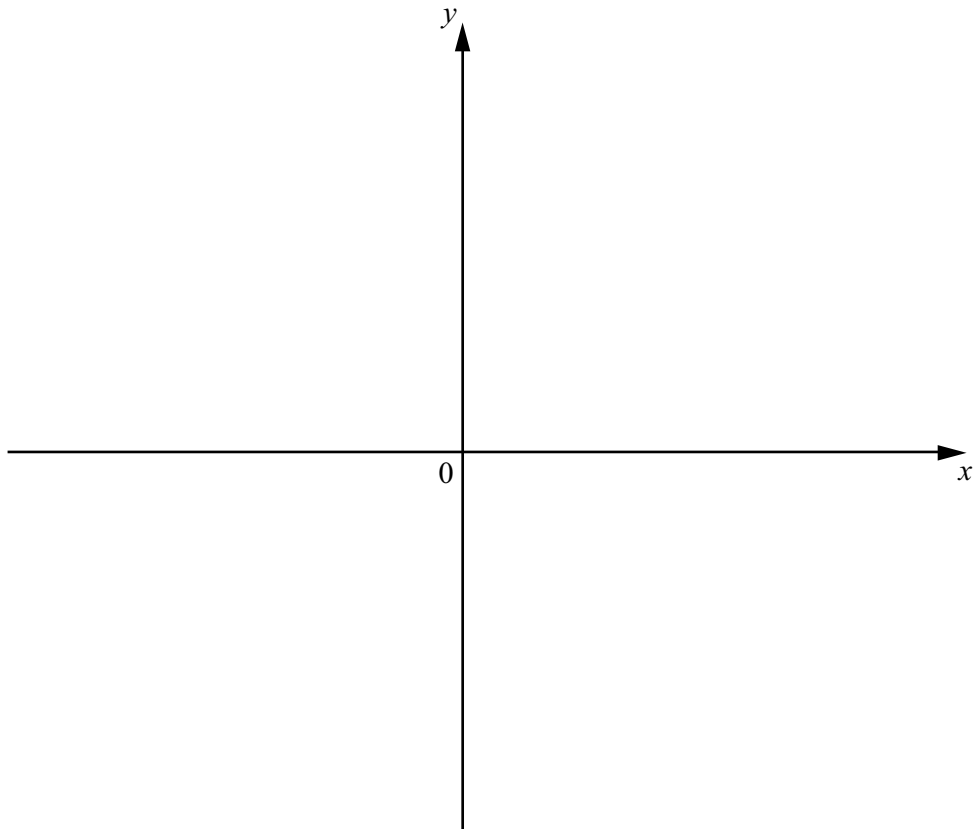
(d) \vec{DX} . [2]

Given that $\overrightarrow{DX} = \mu \overrightarrow{DB}$,

(e) find the value of λ and of μ .

[4]

- 10 (a) (i) Sketch the graph of $y = e^x - 5$ on the axes below, showing the exact coordinates of any points where the graph cuts the coordinate axes.



[3]

- (ii) Find the range of values of k for which the equation $e^x - 5 = k$ has no solutions.

[1]

- (b) Simplify $\log_a \sqrt{2} + \log_a 8 + \log_a \left(\frac{1}{2}\right)$, giving your answer in the form $p \log_a 2$, where p is a constant. [2]

- (c) Solve the equation $\log_3 x - \log_9 4x = 1$. [4]

Question 11 is printed on the next page.

11 (a) (i) Show that $\frac{\operatorname{cosec} \theta}{\operatorname{cosec} \theta - \sin \theta} = \sec^2 \theta$. [3]

(ii) Hence solve $\frac{2 \operatorname{cosec} \phi}{\operatorname{cosec} \phi - \sin \phi} = 8$ for $0^\circ < \phi < 360^\circ$. [3]

(b) Solve $\sqrt{3} \tan\left(x + \frac{\pi}{4}\right) = 1$ for $0 < x < 2\pi$, giving your answers in terms of π . [3]

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