Cambridge Assessment International Education

# Cambridge IGCSE®

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|---|---|---|---|
| CANDIDATE NAME | | | |
| CENTRE NUMBER | | CANDIDATE NUMBER | |

*0123456789*

**ADDITIONAL MATHEMATICS** **0606/02**

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*

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

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*

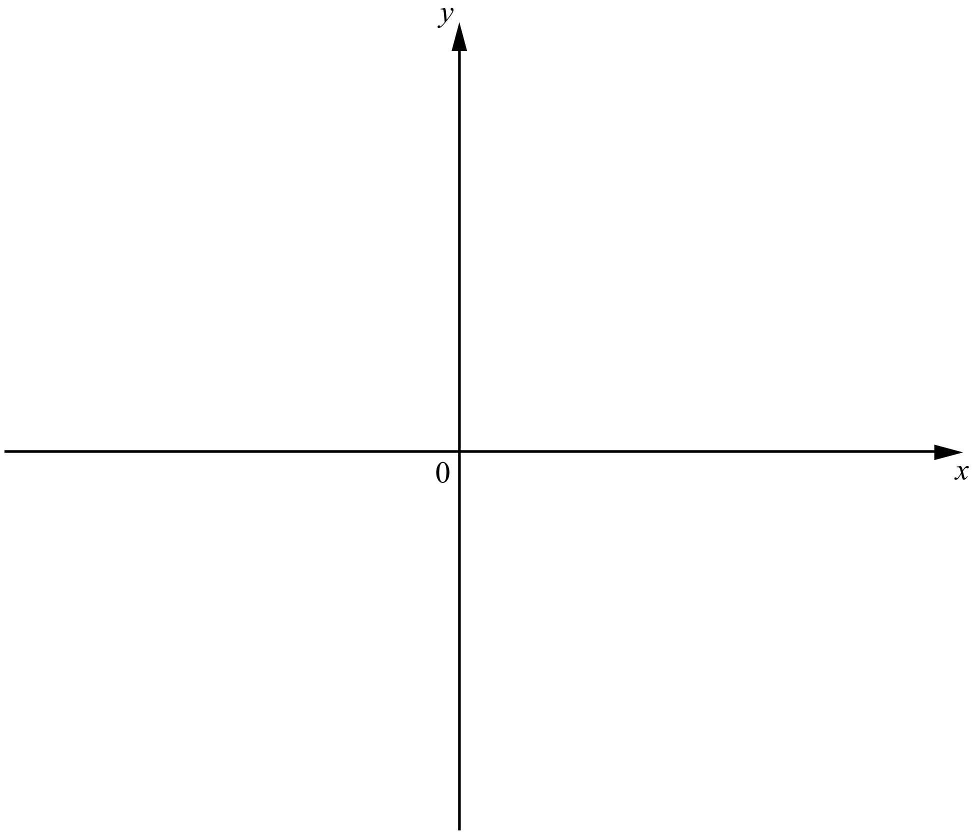
$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

*Formulae for $\Delta ABC$*

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

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 $(x-2)(x-4)(x+5) \leqslant 0$. [1]

**(c)** Hence solve $(x-2)(x-4)(x+5) \leqslant 0$. [1]

**3** Functions g and h are such that

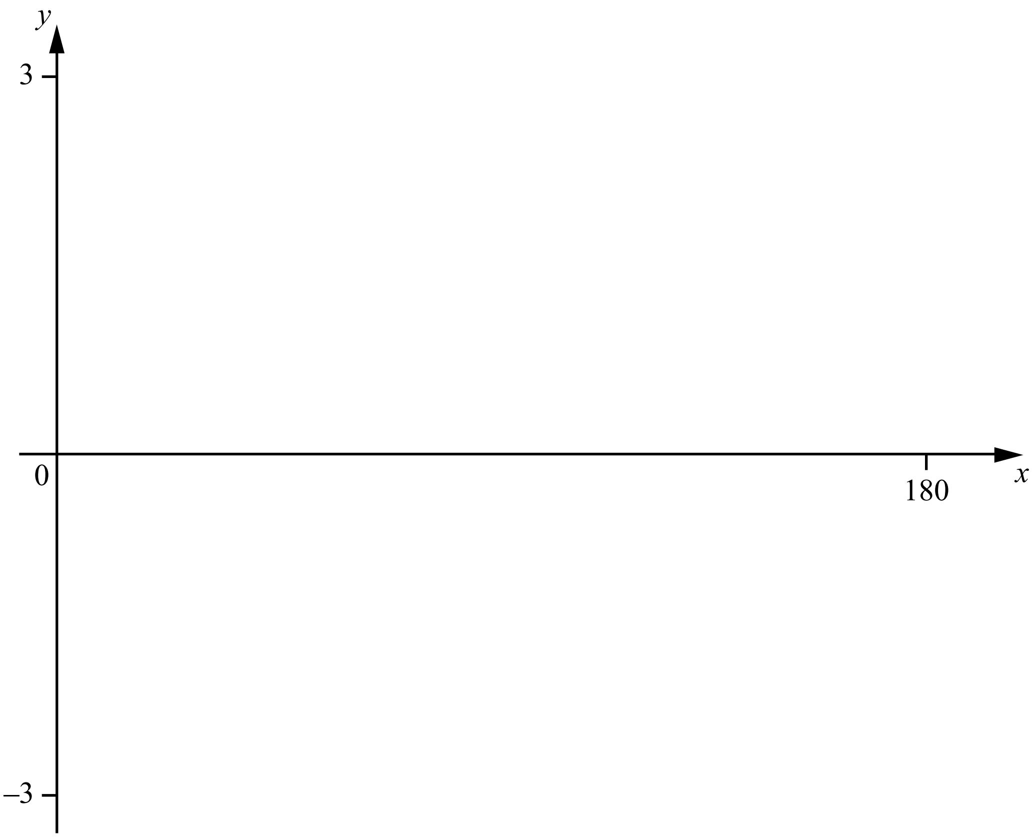
$$\mathrm{g}(x) = 2 + 4\ln x \quad \text{for } x > 0,$$
$$\mathrm{h}(x) = x^2 + 4 \quad \text{for } x > 0.$$

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

**(b)** Solve $\mathrm{gh}(x) = 10$. [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 $0° \leqslant x \leqslant 180°$, 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 $v\,\mathrm{m\,s^{-1}}$ is given by $v = \left(e^{\frac{t^2}{8}} - 4\right)^3$.

**(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]

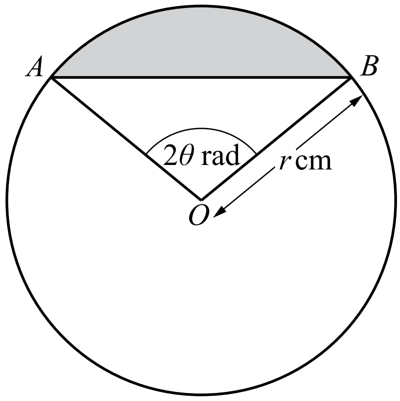
**7** Variables $x$ and $y$ are such that when $\lg y$ is plotted against $x^2$, a straight line graph passing through the points $(1, 0.73)$ and $(4, 0.10)$ is obtained.

**(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]

**8**

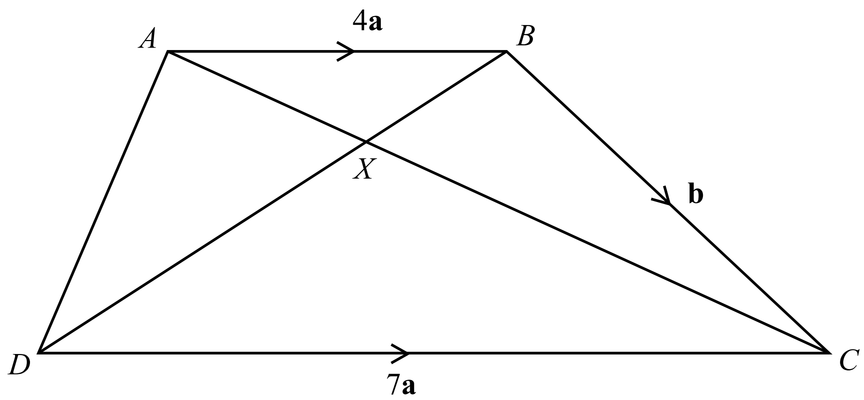



The diagram shows a circle, centre $O$, radius $r$ cm. The points $A$ and $B$ lie on the circle such that angle $AOB = 2\theta$ radians.

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

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

**9**




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

Find, in terms of **a** and **b**,

**(a)** $\overrightarrow{DB}$, [1]

**(b)** $\overrightarrow{DA}$. [1]

Given that $\overrightarrow{AX} = \lambda\overrightarrow{AC}$ find, in terms of **a**, **b** and $\lambda$,

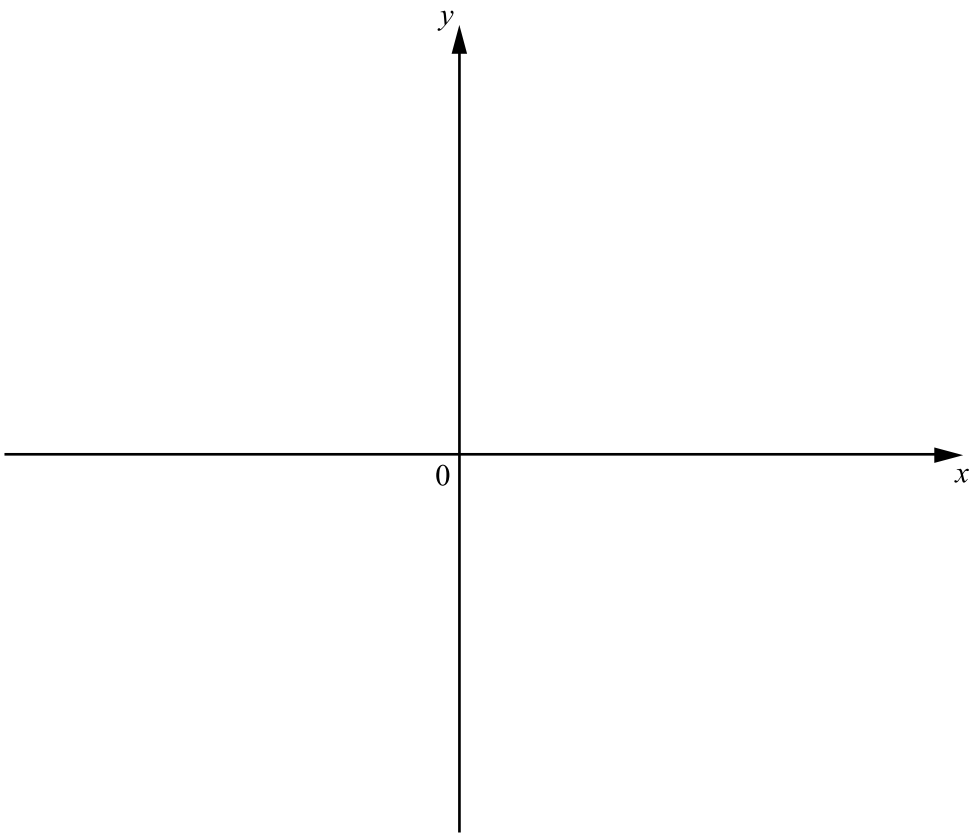
**(c)** $\overrightarrow{AX}$, [1]

**(d)** $\overrightarrow{DX}$. [2]

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

**(e)** find the value of $\lambda$ and of $\mu$. [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 $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - \sin\theta} = \sec^2\theta$. [3]

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

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