Cambridge Assessment International Education

# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*1704896938*

**ADDITIONAL MATHEMATICS** **0606/22**

Paper 2 **February/March 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.
- 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.

DC (RW/CGW) 303976/2

***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 ΔABC*

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

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

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

1 A line, $L$, has equation $4x+5y=9$. Points $A$ and $B$ have coordinates $(-6, 7)$ and $(1, 9)$ respectively. Find the equation of the line parallel to $L$ which passes through the mid-point of $AB$. [3]

2 Solve the equation $\log_5(8x+7)-\log_5 2x=2$. [3]

**3** A group of students, 4 girls and 3 boys, stand in line.

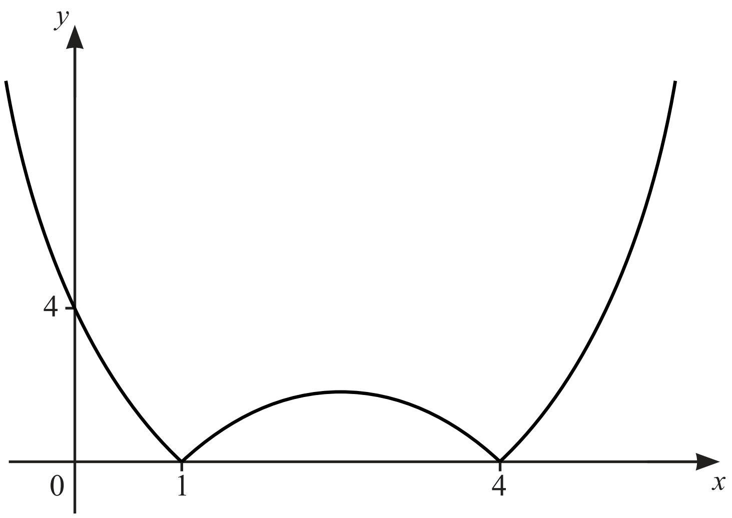
**(a)** Find the number of different ways the students can stand in line if there are no restrictions. [1]

**(b)** Find the number of different ways the students can stand in line if the 3 boys are next to each other. [2]

**(c)** Cam and Dea are 2 of the girls. Find the number of ways the students can stand in line if Cam and Dea are **not** next to each other. [2]

**4** Find the $x$-coordinates of the points of intersection of the curves $\frac{x^2}{4} + \frac{y^2}{9} = 1$ and $y = \frac{3}{2x}$.
Give your answers correct to 3 decimal places. [5]

**5 (a)**




The diagram shows the graph of $y = |f(x)|$, where $f(x)$ is a quadratic function. Write down the two possible expressions for $f(x)$. [2]

**(b)** The three roots of $p(x) = 0$, where $p(x) = 5x^3 + ax^2 + bx - 2$ are $x = \frac{1}{5}$, $x = n$ and $x = n + 1$, where $a$ and $b$ are positive integers and $n$ is a negative integer. Find $p(x)$, simplifying your coefficients. [5]

**6** **(a)** **(i)** Use the binomial theorem to expand $(1+3x)^7$ in ascending powers of $x$, as far as the term in $x^3$. Simplify each term. [2]

**(ii)** Show that your expansion from **part (i)** gives the value of $1.03^7$ as 1.23 to 2 decimal places. [2]

**(b)** Find the term independent of $x$ in the expansion of $\left(\frac{x^4}{2}+\frac{2}{x}\right)^{15}$. [2]

7 In this question, all angles are in radians.

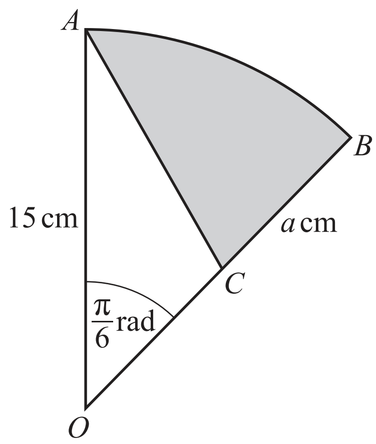
**(a)** Solve the equation $\sec^2\theta = \tan\theta + 3$ for $-\pi < \theta < \pi$. [5]

**(b)** Show that, for $0 < \phi < \frac{\pi}{2}$, $\frac{\tan\phi}{\sqrt{1-\cos^2\phi}} = \sec\phi$. [3]

**(c)** Given that $\operatorname{cosec} x = -\frac{17}{8}$ and that $\frac{3\pi}{2} < x < 2\pi$, find the exact value of $\cot x$. [2]

**8**




The diagram shows the sector $AOB$ of a circle, centre $O$ and radius 15 cm. Angle $AOB$ is $\frac{\pi}{6}$ radians. Point $C$ lies on $OB$ such that $CB$ is $a$ cm. $AC$ is a straight line.

**(a)** Find the exact value of $a$ such that the area of triangle $AOC$ is equal to the area of the shaded region $ACB$. [4]

**(b)** For the value of $a$ found in **part (a)**, find the perimeter of the shaded region. Give your answer correct to 1 decimal place. [3]

**9** **(a)** A vehicle travels along a straight, horizontal road. At time $t = 0$ seconds, the vehicle, travelling at a velocity of $w\,\text{ms}^{-1}$, passes point $O$. The vehicle travels at this constant velocity for 12 seconds. It then slows down, with constant deceleration, for 10 seconds until it reaches a velocity of $(w-14)\,\text{ms}^{-1}$. It continues to travel at this velocity for 28 seconds until it reaches point $A$, 458 m from $O$.

Find the value of $w$. [4]

**(b)** A particle moves in a straight line. The velocity, $v\,\mathrm{ms}^{-1}$, of the particle at time $t$ seconds, where $t \geqslant 0$, is given by $v = (t-4)(t-5)$.

**(i)** Find the value of $t$ for which the acceleration of the particle is $0\,\mathrm{ms}^{-2}$. [2]

**(ii)** Find the set of values of $t$ for which the velocity of the particle is negative. [2]

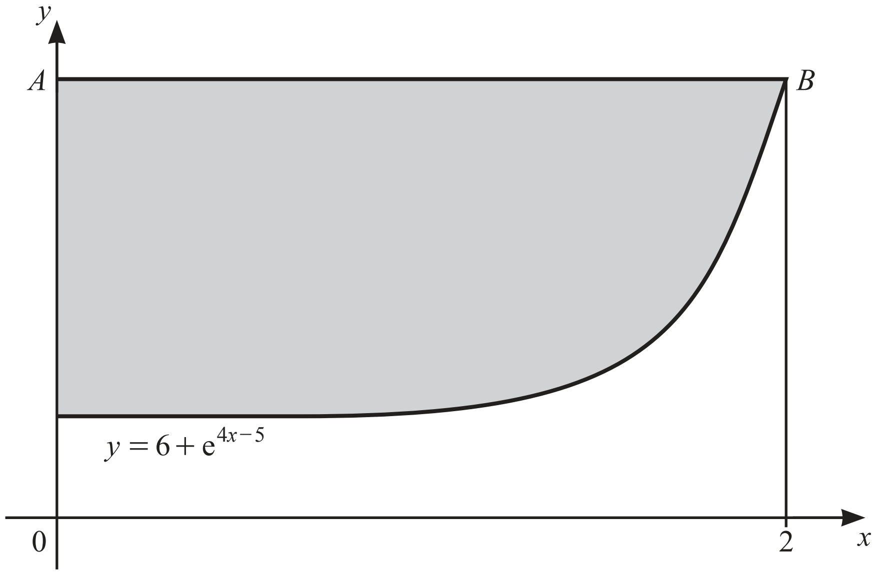
**(iii)** Find the distance travelled by the particle in the first 5 seconds of its motion. [4]

**10** Relative to an origin $O$, the position vector of point $P$ is $3\mathbf{i}-2\mathbf{j}$ and the position vector of point $Q$ is $8\mathbf{i}+13\mathbf{j}$.

**(a)** The point $R$ is such that $\overrightarrow{PQ} = 5\overrightarrow{PR}$. Find the unit vector in the direction $\overrightarrow{OR}$. [5]

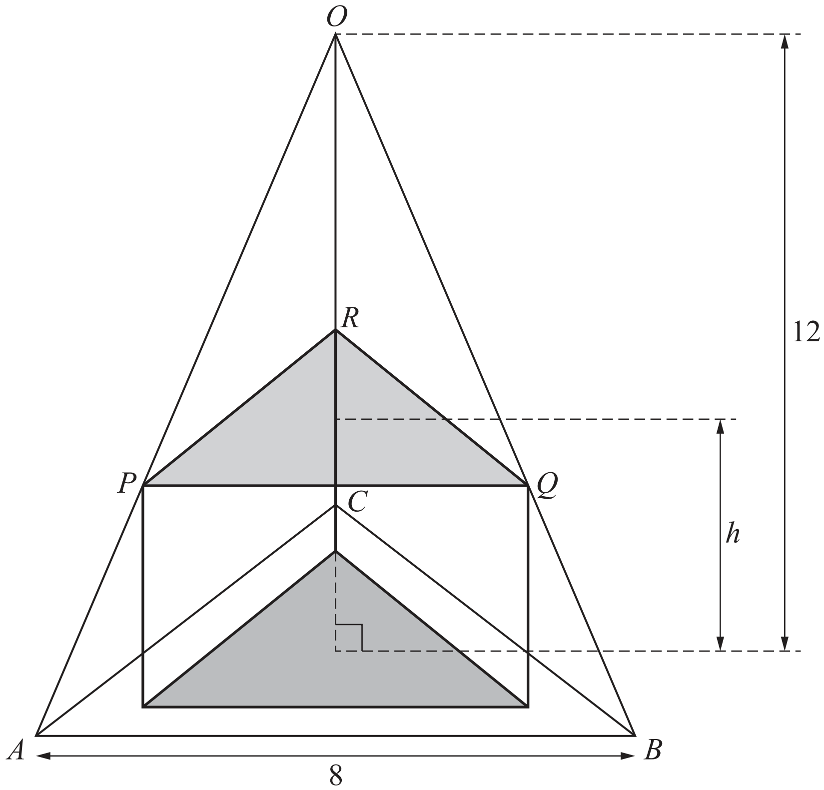
**(b)** The position vector of $S$ relative to $O$ is $\lambda\mathbf{j}$. Given that $RS$ is parallel to $PQ$, find the value of $\lambda$. [3]

**11**




The diagram shows part of the graphs of $y = 6 + e^{4x-5}$ and $x = 2$. The line $x = 2$ meets the curve at the point $B(2, b)$ and the line $AB$ is parallel to the $x$-axis. Find the area of the shaded region. [7]

**12** In this question all lengths are in centimetres.




The diagram shows a right triangular prism of height $h$ inside a right pyramid.
The pyramid has a height of 12 and a base that is an equilateral triangle, $ABC$, of side 8.
The base of the prism sits on the base of the pyramid.
Points $P$, $Q$ and $R$ lie on the edges $OA$, $OB$ and $OC$, respectively, of the pyramid $OABC$.
Pyramids $OABC$ and $OPQR$ are similar.

**(a)** Show that the volume, $V$, of the triangular prism is given by $V = \frac{\sqrt{3}}{9}(ah^3 + bh^2 + ch)$ where $a$, $b$ and $c$ are integers to be found. [4]

**(b)** It is given that, as $h$ varies, $V$ has a maximum value. Find the value of $h$ that gives this maximum value of $V$. [3]

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