



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0606/22

February/March 2022

2 hours

You must answer on the question paper.

No additional materials are needed.

- 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.

- 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.

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 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]

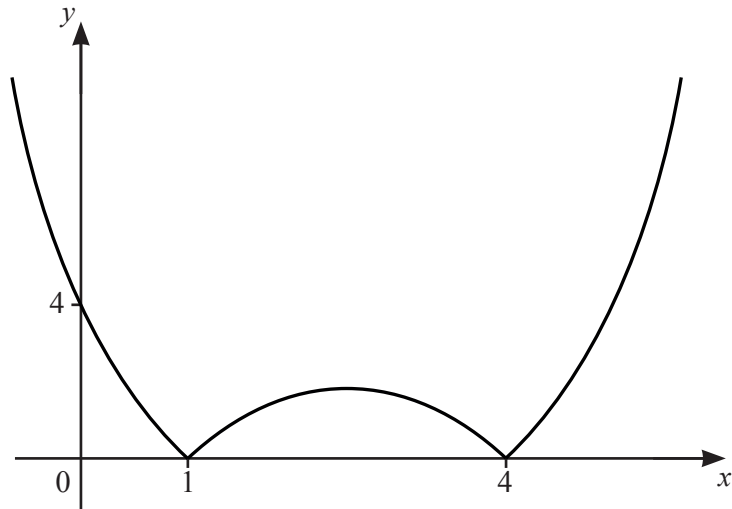
(b) Find the number of different ways the students can stand in line if the 3 boys are next to each other. [2]

(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]

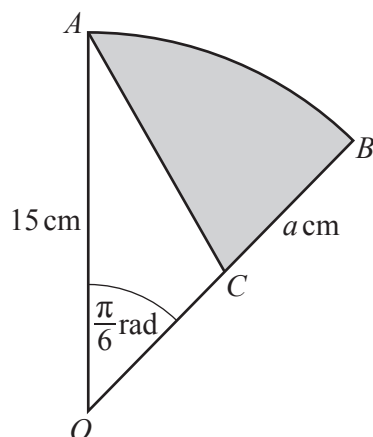
- (b) Find the term independent of x in the expansion of $\left(\frac{x^4}{2} + \frac{2}{x}\right)^{15}$. [2]

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]



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 $a\text{ cm}$. 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, $v \text{ ms}^{-1}$, of the particle at time t seconds, where $t \geq 0$, is given by $v = (t-4)(t-5)$.

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

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

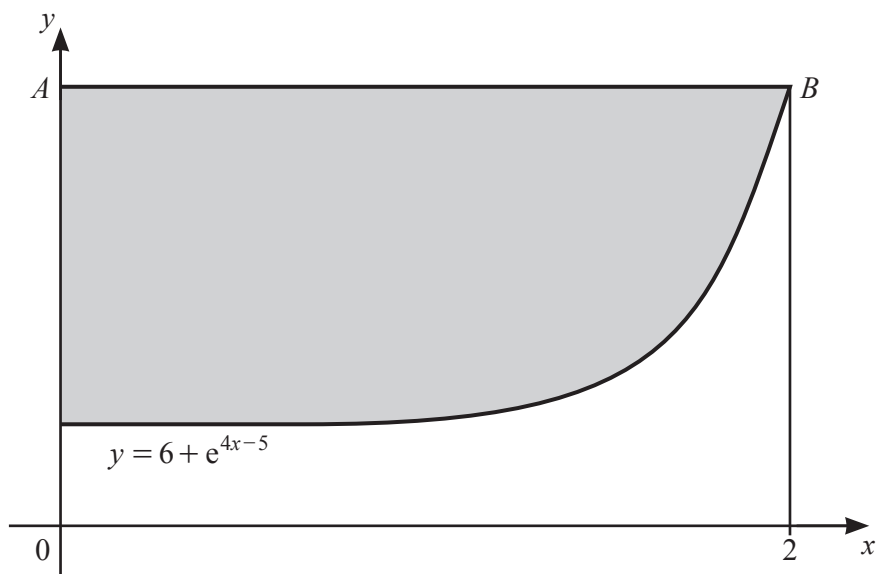
(iii) Find the distance travelled by the particle in the first 5 seconds of its motion. [4]

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]

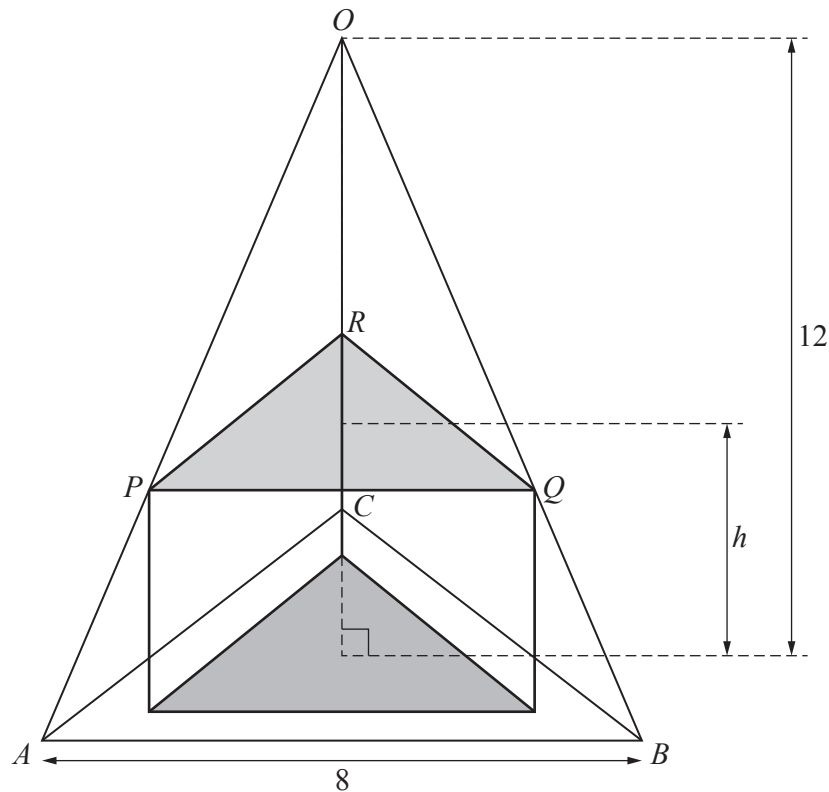
(b) The position vector of S relative to O is $\lambda\mathbf{j}$. Given that RS is parallel to PQ , find the value of λ . [3]

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]

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.