Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4569060243

ADDITIONAL MATHEMATICS **0606/22**

Paper 2 **February/March 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **14** printed pages and **2** blank pages.

DC (KN/CGW) 144842/2

CAMBRIDGE International Examinations

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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

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

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

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

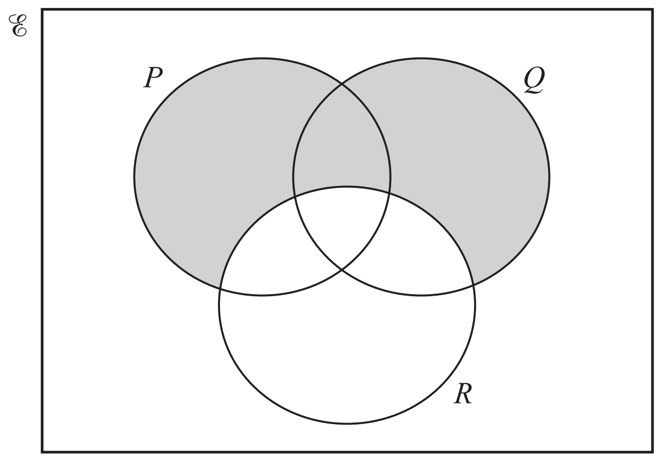
Formulae for ΔABC

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

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

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

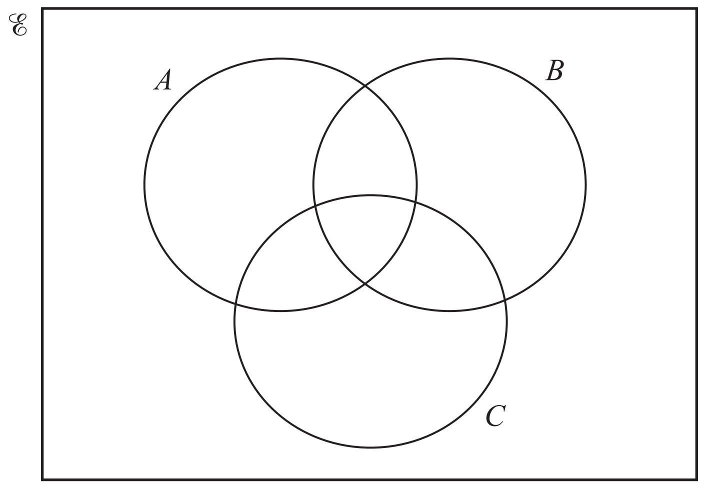
1 **(a)**



Using set notation, write down the set represented by the shaded region. [1]

(b) $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$A = \{ x: x \text{ is a prime number}\}$
$B = \{ x: x \text{ is an even number}\}$
$C = \{1, 2, 3, 4, 8\}$

(i) Complete the Venn diagram to show the elements of each set. [3]



(ii) Write down the value of $n((A \cup B \cup C)')$. [1]

2 Determine the set of values of k for which the equation $(3-2k)x^2+(2k-3)x+1=0$ has no real roots. [5]

3 A group of five people consists of two women, Alice and Betty, and three men, Carl, David and Ed.

(i) Three of these five people are chosen at random to be a chairperson, a treasurer and a secretary. Find the number of ways in which this can be done if the chairperson and treasurer are both men. [2]

These five people sit in a row of five chairs. Find the number of different possible seating arrangements if

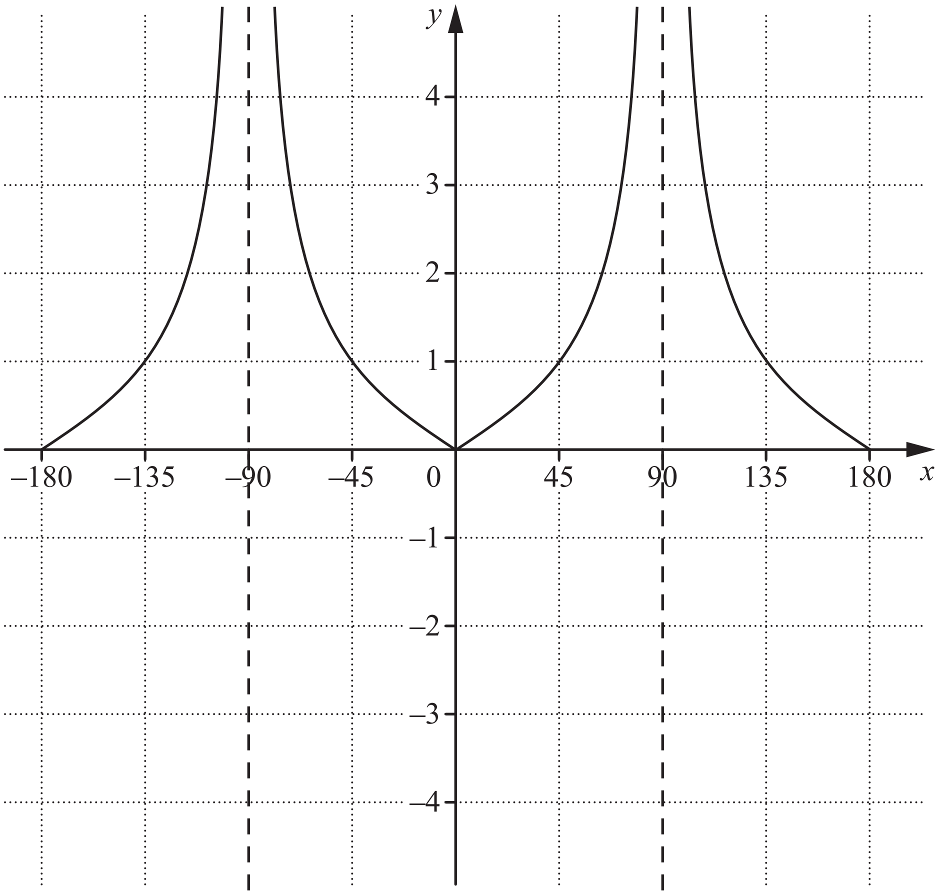
(ii) David must sit in the middle, [1]

(iii) Alice and Carl must sit together. [2]

4 **(a)** **(i)** State the amplitude of $15\sin 2x - 5$. [1]

(ii) State the period of $15\sin 2x - 5$. [1]

(b)

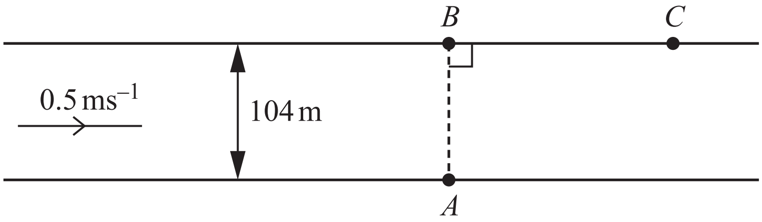


The diagram shows the graph of $y = |f(x)|$ for $-180^\circ \leqslant x^\circ \leqslant 180^\circ$, where $f(x)$ is a trigonometric function.

(i) Write down two possible expressions for the trigonometric function $f(x)$. [2]

(ii) State the number of solutions of the equation $|f(x)| = 1$ for $-180^\circ \leqslant x^\circ \leqslant 180^\circ$. [1]

5



A river is 104 metres wide and the current flows at $0.5\,\text{ms}^{-1}$ parallel to its banks. A woman can swim at $1.6\,\text{ms}^{-1}$ in still water. She swims from point A and aims for point B which is directly opposite, but she is carried downstream to point C. Calculate the time it takes the woman to swim across the river and the distance downstream, BC, that she travels. [4]

6 **(i)** Differentiate $1 + \tan\left(\frac{x}{3}\right)$ with respect to x. [2]

(ii) Hence find $\int \sec^2\left(\frac{x}{3}\right)\mathrm{d}x$. [2]

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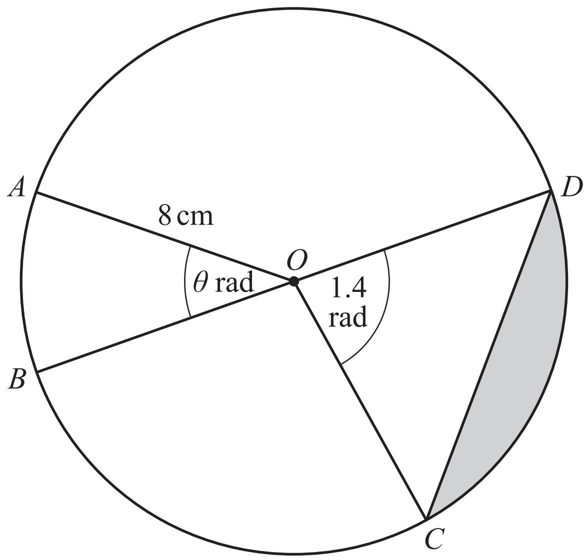


The diagram shows a circle with centre O and radius 8 cm. The points A, B, C and D lie on the circumference of the circle. Angle $AOB = \theta$ radians and angle $COD = 1.4$ radians. The area of sector AOB is $20\,\text{cm}^2$.

(i) Find angle θ. [2]

(ii) Find the length of the arc AB. [2]

(iii) Find the area of the shaded segment. [3]

8 **(a)** Solve the following equations.

(i) $5e^{3x+4} = 14$ [2]

(ii) $\lg(2y - 7) + \lg y = 2\lg 3$ [4]

(b) Write $\dfrac{\log_2 p - \log_2 q}{(\log_2 r)(\log_r 2)}$ as a single logarithm to base 2. [2]

9 **Solutions to this question by accurate drawing will not be accepted.**

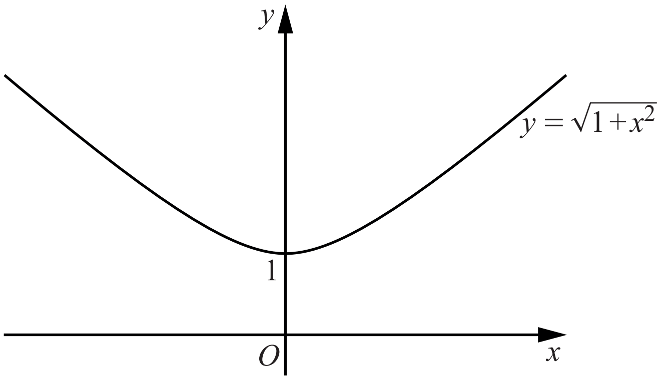
P is the point (8, 2) and Q is the point (11, 6).

(i) Find the equation of the line L which passes through P and is perpendicular to the line PQ. [3]

The point R lies on L such that the area of triangle PQR is 12.5 units^2.

(ii) Showing all your working, find the coordinates of each of the two possible positions of point R. [6]

10 **(a)** The function f is defined by $f(x) = \sqrt{1 + x^2}$, for all real values of x. The graph of $y = f(x)$ is given below.



(i) Explain, with reference to the graph, why f does not have an inverse. [1]

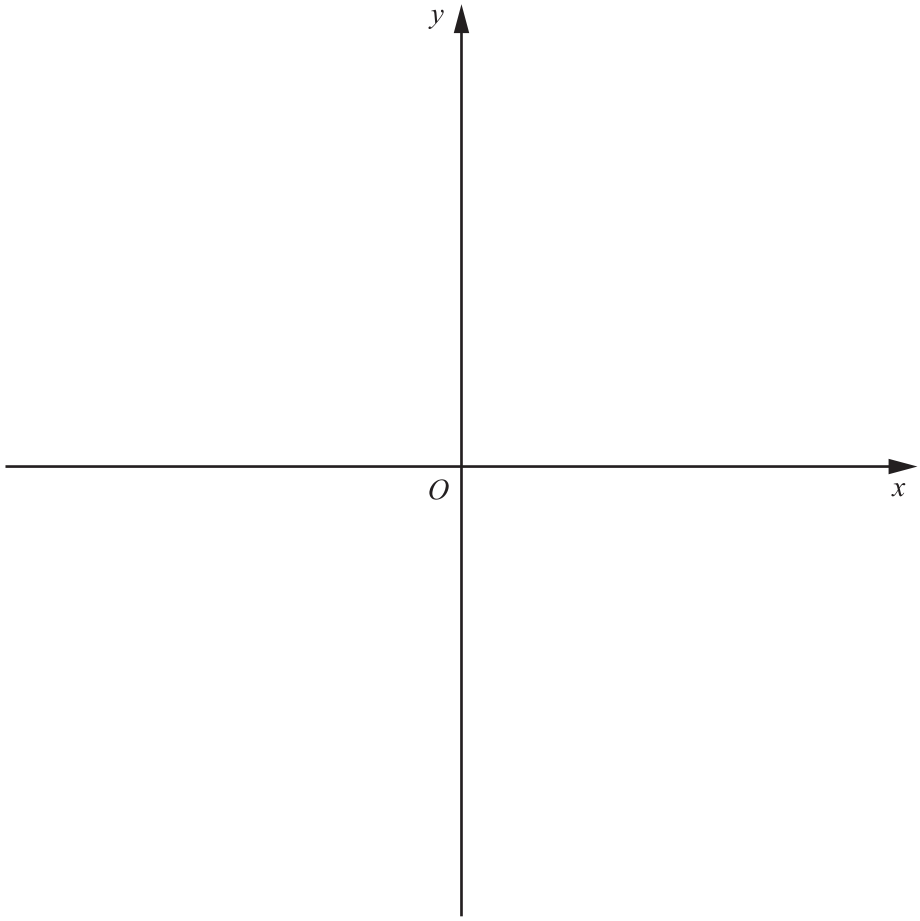
(ii) Find $f^2(x)$. [2]

(b) The function g is defined, for $x > k$, by $g(x) = \sqrt{1 + x^2}$ and g has an inverse.

(i) Write down a possible value for k. [1]

(ii) Find $g^{-1}(x)$. [2]

(c) The function h is defined, for all real values of x, by $\mathrm{h}(x) = 4\mathrm{e}^{x} + 2$. Sketch the graph of $y = \mathrm{h}(x)$. Hence, on the same axes, sketch the graph of $y = \mathrm{h}^{-1}(x)$. Give the coordinates of any points where your graphs meet the coordinate axes. [4]



11 **(a)** **(i)** Show that $\dfrac{(1-\sin A)(1+\sin A)}{\sin A\cos A} = \cot A$. [2]

(ii) Hence solve $\dfrac{(1-\sin 3x)(1+\sin 3x)}{\sin 3x\cos 3x} = \dfrac{1}{2}$ for $0° \leqslant x \leqslant 180°$. [4]

(b) Solve $10\tan^2 y - \sec y - 1 = 0$ for $0 \leqslant y \leqslant 2\pi$ radians. [5]

12 The volume, V, and surface area, S, of a sphere of radius r are given by $V = \frac{4}{3}\pi r^3$ and $S = 4\pi r^2$ respectively.

The volume of a sphere increases at a rate of $200\,\text{cm}^3$ per second. At the instant when the radius of the sphere is $10\,\text{cm}$, find

(i) the rate of increase of the radius of the sphere, [4]

(ii) the rate of increase of the surface area of the sphere. [3]

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