Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3911186838

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **May/June 2019**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

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 **16** printed pages.

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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

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

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

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

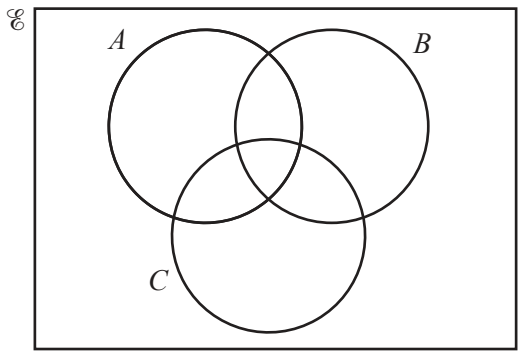
Formulae for ΔABC

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

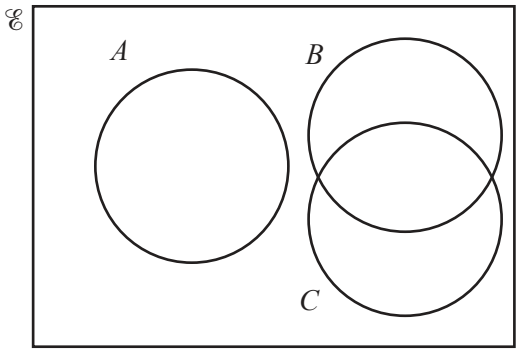
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

1 **(a)** On the Venn diagrams below, shade the region indicated.



$A' \cap B' \cap C'$



$A \cup (B \cap C)$

[2]

(b) $\mathscr{E} = \{x : 0° \leqslant x \leqslant 360°\}$

$P = \{x : \cos 2x = 0.5\}$

$Q = \{x : \sin x = 0.5\}$

Find $P \cap Q$. [3]

2 Do not use a calculator in this question.

Find the coordinates of the points of intersection of the curve $y = (2x+3)^2(x-1)$ and the line $y = 3(2x+3)$. [5]

3 The number, B, of a certain type of bacteria at time t days can be described by $B = 200e^{2t} + 800e^{-2t}$.

(i) Find the value of B when $t = 0$. [1]

(ii) At the instant when $\frac{dB}{dt} = 1200$, show that $e^{4t} - 3e^{2t} - 4 = 0$. [3]

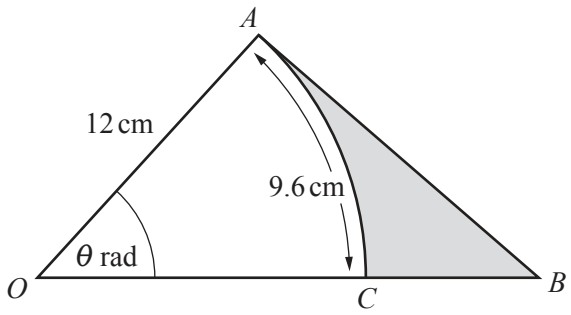
(iii) Using the substitution $u = e^{2t}$, or otherwise, solve $e^{4t} - 3e^{2t} - 4 = 0$. [2]

[Turn over

4 **(a)** Given that $\dfrac{\left(pr^2\right)^{\frac{3}{2}}\sqrt{qr}}{q^2\left(pr^2\right)^{-1}}$ can be written in the form $p^a q^b r^c$, find the value of each of the constants a, b and c. [3]

(b) Solve
$$3x^{\frac{1}{2}} - y^{-\frac{1}{2}} = 4,$$
$$4x^{\frac{1}{2}} + 3y^{-\frac{1}{2}} = 14.$$
[3]

5



The diagram shows the right-angled triangle OAB. The point C lies on the line OB. Angle $OAB = \frac{\pi}{2}$ radians and angle $AOB = \theta$ radians. AC is an arc of the circle, centre O, radius 12 cm and AC has length 9.6 cm.

(i) Find the value of θ. [2]

(ii) Find the area of the shaded region. [4]

[Turn over

6 **(a)** Eight books are to be arranged on a shelf. There are 4 mathematics books, 3 geography books and 1 French book.

(i) Find the number of different arrangements of the books if there are no restrictions. [1]

(ii) Find the number of different arrangements if the mathematics books have to be kept together. [3]

(iii) Find the number of different arrangements if the mathematics books have to be kept together and the geography books have to be kept together. [3]

(b) A team of 6 players is to be chosen from 8 men and 4 women. Find the number of different ways this can be done if

(i) there are no restrictions, [1]

(ii) there is at least one woman in the team. [2]

7 A pilot wishes to fly his plane from a point A to a point B on a bearing of 055°. There is a wind blowing at $120\,\text{km}\,\text{h}^{-1}$ from the west. The plane can fly at $650\,\text{km}\,\text{h}^{-1}$ in still air.

(i) Find the direction in which the pilot must fly his plane in order to reach B. [4]

(ii) Given that the distance between A and B is 1250 km, find the time it will take the pilot to fly from A to B. [4]

8 When e^y is plotted against $\frac{1}{x}$, a straight line graph passing through the points $(2, 20)$ and $(4, 8)$ is obtained.

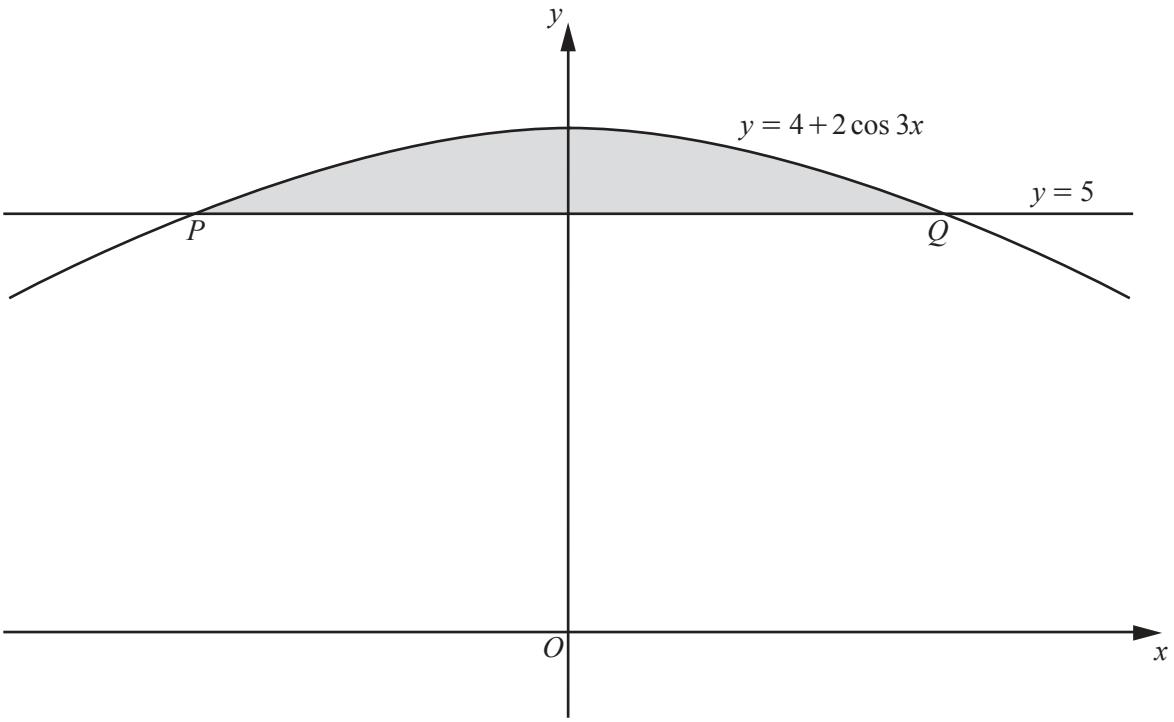
(i) Find y in terms of x. [5]

(ii) Hence find the positive values of x for which y is defined. [1]

(iii) Find the exact value of y when $x = 3$. [1]

(iv) Find the exact value of x when $y = 2$. [2]

9

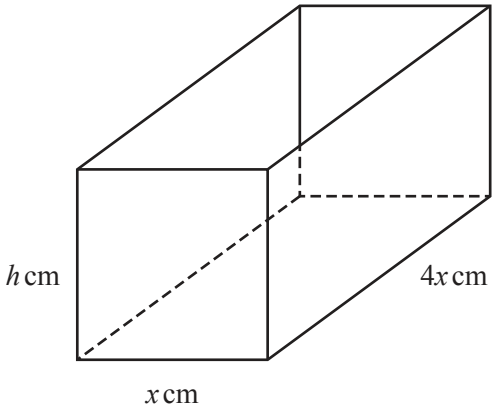


The diagram shows the curve $y = 4 + 2\cos 3x$ intersecting the line $y = 5$ at the points P and Q.

(i) Find, in terms of π, the x-coordinate of P and of Q. [3]

(ii) Find the exact area of the shaded region. You must show all your working. [6]

10



The diagram shows an open container in the shape of a cuboid of width x cm, length $4x$ cm and height h cm. The volume of the container is $800\,\text{cm}^3$.

(i) Show that the external surface area, $S\,\text{cm}^2$, of the open container is such that $S = 4x^2 + \frac{2000}{x}$. [4]

(ii) Given that x can vary, find the stationary value of S and determine its nature. [5]

Question 11 is printed on the next page.

11 The normal to the curve $y = (x-2)(3x+1)^{\frac{2}{3}}$ at the point where $x = \frac{7}{3}$, meets the y-axis at the point P. Find the exact coordinates of the point P. [7]