Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2049112309

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2019**

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 **15** printed pages and **1** blank page.

DC (CE/CB) 165273/2

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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

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

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

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

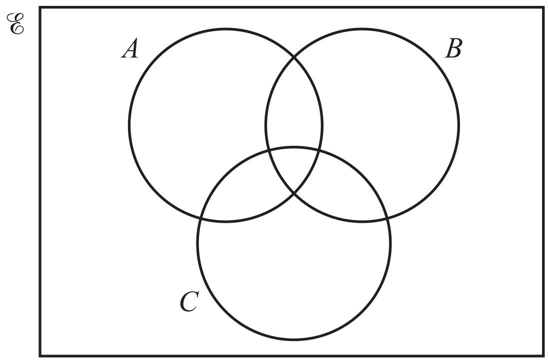
Formulae for ΔABC

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

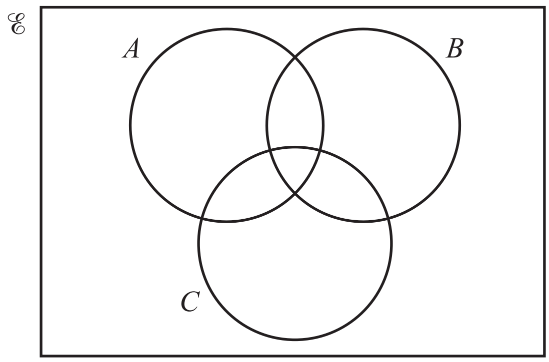
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

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



$(A \cap B) \cup C$



$(A' \cup B) \cap C$

[2]

(b) On the Venn diagram below, draw sets P, Q and R such that

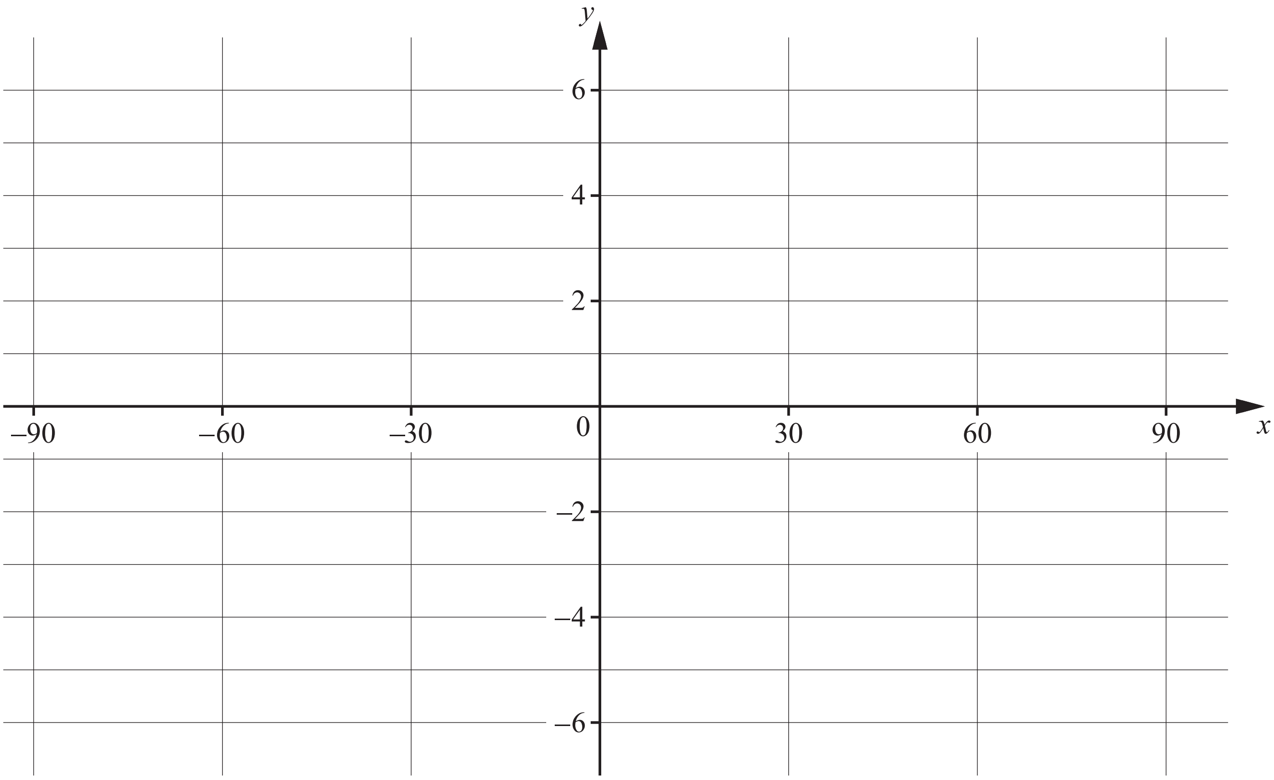
$$P \subset R, \quad Q \subset R \quad \text{and} \quad P \cap Q = \varnothing.$$

[2]

2 **(i)** Write down the amplitude of $4\sin 3x - 1$. [1]

(ii) Write down the period of $4\sin 3x - 1$. [1]

(iii) On the axes below, sketch the graph of $y = 4\sin 3x - 1$ for $-90° \leqslant x° \leqslant 90°$.



[3]

3 The polynomial $p(x) = (2x - 1)(x + k) - 12$, where k is a constant.

(i) Write down the value of $p(-k)$. [1]

When $p(x)$ is divided by $x + 3$ the remainder is 23.

(ii) Find the value of k. [2]

(iii) Using your value of k, show that the equation $p(x) = -25$ has no real solutions. [3]

4 **(i)** The first 3 terms, in ascending powers of x, in the expansion of $(2+bx)^8$ can be written as $a + 256x + cx^2$. Find the value of each of the constants a, b and c. [4]

(ii) Using the values found in **part (i)**, find the term independent of x in the expansion of $(2+bx)^8\left(2x-\frac{3}{x}\right)^2$. [3]

5 A particle P is moving with a velocity of $20\,\text{ms}^{-1}$ in the same direction as $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

(i) Find the velocity vector of P. [2]

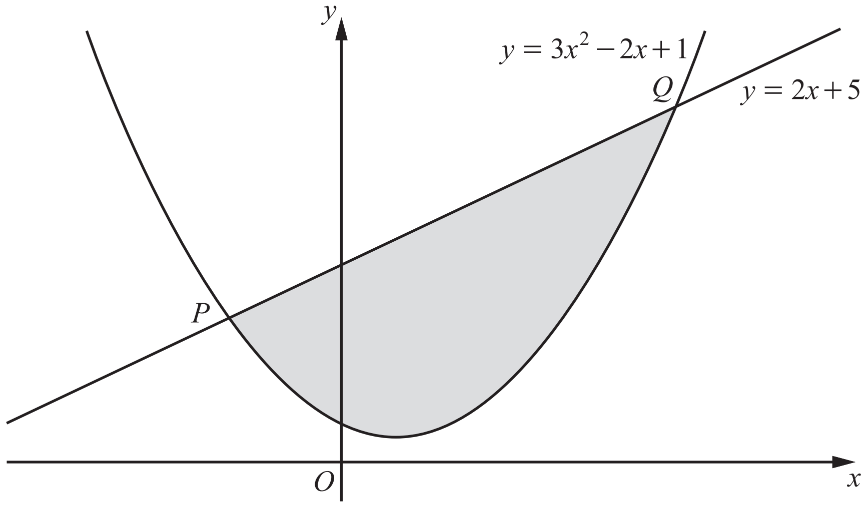
At time $t = 0$ s, P has position vector $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ relative to a fixed point O.

(ii) Write down the position vector of P after t s. [2]

A particle Q has position vector $\begin{pmatrix} 17 \\ 18 \end{pmatrix}$ relative to O at time $t = 0$ s and has a velocity vector $\begin{pmatrix} 8 \\ 12 \end{pmatrix}$ ms^{-1}.

(iii) Given that P and Q collide, find the value of t when they collide and the position vector of the point of collision. [3]

6



The diagram shows the curve $y = 3x^2 - 2x + 1$ and the straight line $y = 2x + 5$ intersecting at the points P and Q. Showing all your working, find the area of the shaded region. [8]

7 **(a)** Solve $\log_3 x + \log_9 x = 12$. [3]

(b) Solve $\log_4(3y^2 - 10) = 2\log_4(y-1) + \frac{1}{2}$. [5]

8 It is given that $f(x) = 5e^x - 1$ for $x \in \mathbb{R}$.

(i) Write down the range of f. [1]

(ii) Find f^{-1} and state its domain. [3]

It is given also that $g(x) = x^2 + 4$ for $x \in \mathbb{R}$.

(iii) Find the value of fg(1). [2]

(iv) Find the exact solutions of $g^2(x) = 40$. [3]

9 In this question all lengths are in centimetres.

A closed cylinder has base radius r, height h and volume V. It is given that the total surface area of the cylinder is 600π and that V, r and h can vary.

(i) Show that $V = 300\pi r - \pi r^3$. [3]

(ii) Find the stationary value of V and determine its nature. [5]

10 When lg y is plotted against x^2 a straight line graph is obtained which passes through the points (2, 4) and (6, 16).

(i) Show that $y = 10^{A+Bx^2}$, where A and B are constants. [4]

(ii) Find y when $x = \frac{1}{\sqrt{3}}$. [2]

(iii) Find the positive value of x when $y = 2$. [3]

11 It is given that $y = (x^2 + 1)(2x - 3)^{\frac{1}{2}}$.

(i) Show that $\dfrac{dy}{dx} = \dfrac{Px^2 + Qx + 1}{(2x - 3)^{\frac{1}{2}}}$, where P and Q are integers. [5]

(ii) Hence find the equation of the normal to the curve $y = (x^2 + 1)(2x - 3)^{\frac{1}{2}}$ at the point where $x = 2$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

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