Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

6938333361

ADDITIONAL MATHEMATICS **0606/13**

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 **16** printed pages.

DC (KN/TP) 165276/2

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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

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

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

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

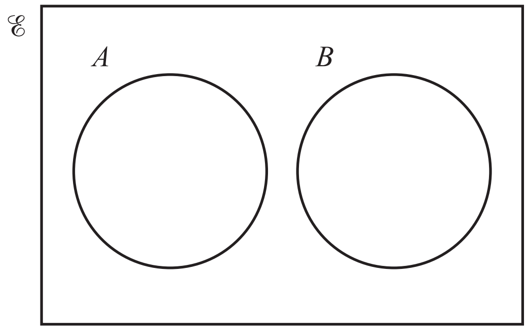
Formulae for ΔABC

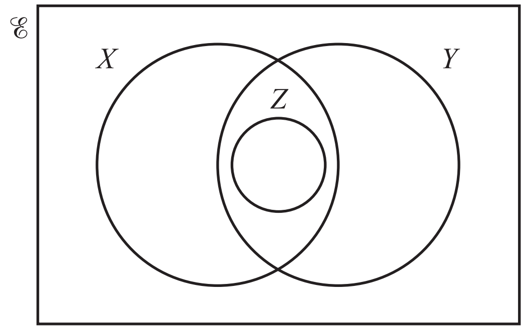
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1 Describe, using set notation, the relationship between the sets shown in each of the Venn diagrams below.





....

[3]

2 Given that $\dfrac{\sqrt{p}(qr)^{-2}}{p^2 q^{\frac{1}{3}} r} = \dfrac{1}{p^a q^b r^c}$, find the value of each of the constants a, b and c. [3]

3 Show that the line $y = mx + 4$ will touch or intersect the curve $y = x^2 + 3x + m$ for all values of m. [4]

4 It is given that $y = \dfrac{\ln(2x^3+5)}{x-1}$ for $x > 1$.

(i) Find the value of $\dfrac{dy}{dx}$ when $x = 2$. You must show all your working. [4]

(ii) Find the approximate change in y as x increases from 2 to $2+p$, where p is small. [1]

5 **(i)** On the axes below, sketch the graph of $y = \left|3x^2 - 14x - 5\right|$, showing the coordinates of the points where the graph meets the coordinate axes.

[4]

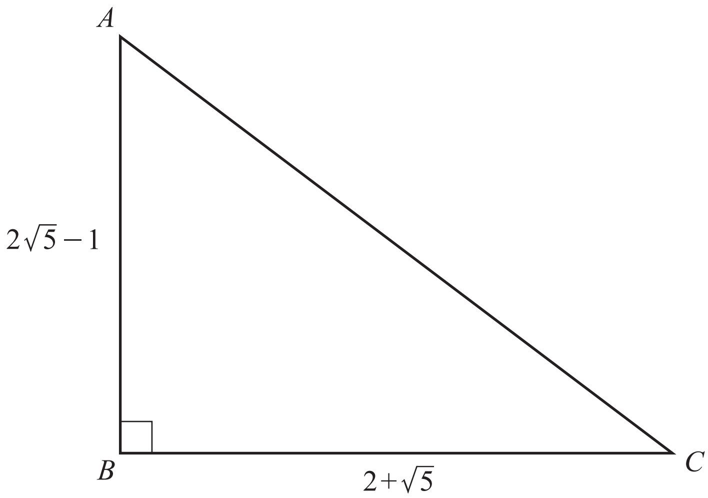
(ii) Find the exact value of k such that $\left|3x^2 - 14x - 5\right| = k$ has 3 solutions only. [3]

6 **(a)** **(i)** Show that $\sec\theta - \dfrac{\tan\theta}{\operatorname{cosec}\theta} = \cos\theta$. [3]

(ii) Solve $\sec 2\theta - \dfrac{\tan 2\theta}{\operatorname{cosec} 2\theta} = \dfrac{\sqrt{3}}{2}$ for $0^\circ \leqslant \theta \leqslant 180^\circ$. [3]

(b) Solve $2\sin^2\left(\phi + \dfrac{\pi}{3}\right) = 1$ for $0 < \phi < 2\pi$ radians. [4]

7 **Do not use a calculator in this question.**
In this question, all lengths are in centimetres.



The diagram shows the triangle ABC such that $AB = 2\sqrt{5}-1$, $BC = 2+\sqrt{5}$ and angle $ABC = 90^\circ$.

(i) Find the exact length of AC. [3]

(ii) Find $\tan ACB$, giving your answer in the form $p + q\sqrt{r}$, where p, q and r are integers. [3]

(iii) Hence find $\sec^2 ACB$, giving your answer in the form $s + t\sqrt{u}$ where s, t and u are integers. [2]

8

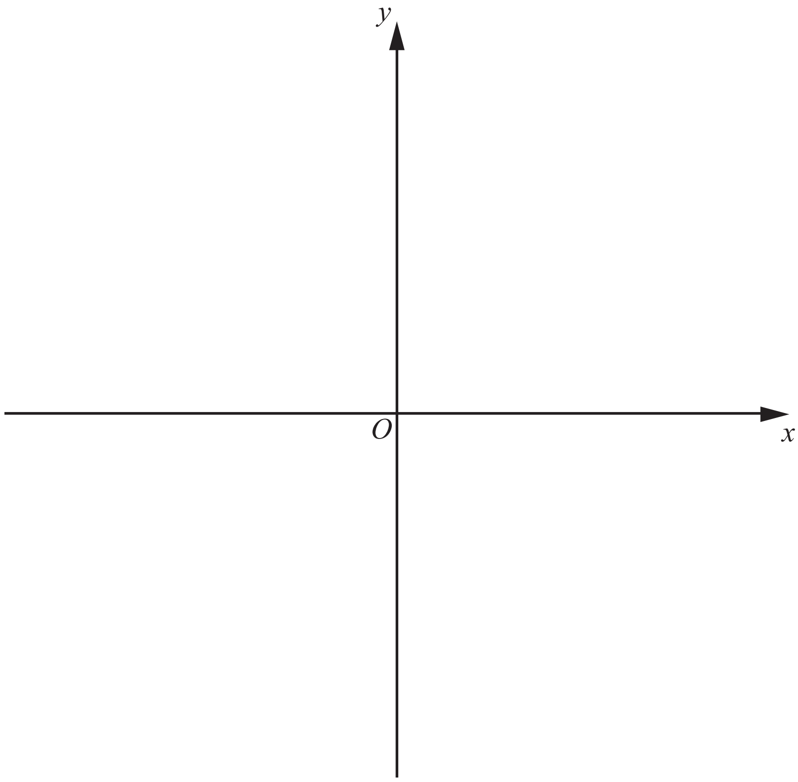
$$f : x \mapsto e^{3x} \quad \text{for} \quad x \in \mathbb{R}$$
$$g : x \mapsto 2x^2 + 1 \quad \text{for} \quad x \geqslant 0$$

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

(ii) Show that $f^{-1}g(\sqrt{62}) = \ln 5$. [3]

(iii) Solve $f'(x) = 6g''(x)$, giving your answer in the form $\ln a$, where a is an integer. [3]

(iv) On the axes below, sketch the graph of $y = \mathrm{g}$ and the graph of $y = \mathrm{g}^{-1}$, showing the points where the graphs meet the coordinate axes.



[3]

9 **(a)** Jack has won 7 trophies for sport and wants to arrange them on a shelf. He has 2 trophies for cricket, 4 trophies for football and 1 trophy for swimming. Find the number of different arrangements if

(i) there are no restrictions, [1]

(ii) the football trophies are to be kept together, [3]

(iii) the football trophies are to be kept together and the cricket trophies are to be kept together. [3]

(b) A team of 8 players is to be chosen from 6 girls and 8 boys. Find the number of different ways the team may be chosen if

(i) there are no restrictions, [1]

(ii) all the girls are in the team, [1]

(iii) at least 1 girl is in the team. [2]

10 A curve is such that $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = (2x+3)^{-\frac{1}{2}}$. The curve has a gradient of 5 at the point where $x = 3$ and passes through the point $\left(\frac{1}{2}, -\frac{1}{3}\right)$.

(i) Find the equation of the curve. [7]

(ii) Find the equation of the normal to the curve at the point where $x = 3$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

Question 11 is printed on the next page.

11 A pilot wishes to fly his plane from a point A to a point B. The bearing of B from A is 050°. A wind is blowing from the north at a speed of $120\,\text{km}\,\text{h}^{-1}$. The plane can fly at $600\,\text{km}\,\text{h}^{-1}$ in still air.

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

(ii) Given that the distance from A to B is 2500 km, find the time taken to fly from A to B. [4]