Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **May/June 2016**

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.

© UCLES 2016

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

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

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

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

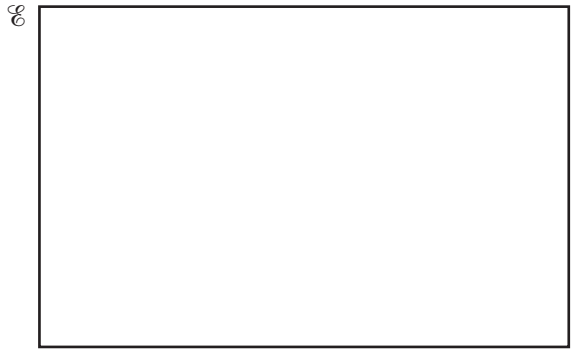
© UCLES 2016

1 Find the values of x for which $(x-4)(x+2) > 7$. [3]

View solution

2 **(a)** Illustrate the statements $A \subset B$ and $B \subset C$ using the Venn diagram below. [1]

View solution



View solution

(b) It is given that
the elements of set $\mathscr{E}$ are the letters of the alphabet,
the elements of set P are the letters in the word *maths*,
the elements of set Q are the letters in the word *exam*.

(i) Write the following using set notation.

The letter h is in the word *maths*. [1]

View solution

(ii) Write the following using set notation.

The number of letters occurring in both of the words *maths* and *exam* is two. [1]

(iii) List the elements of the set $P \cap Q'$. [1]

View solution

3 Do not use a calculator in this question.

(i) Find the value of $-\log_p p^2$. [1]

View solution

(ii) Find $\lg\left(\frac{1}{10^n}\right)$. [1]

View solution

(iii) Show that $\frac{\lg 20 - \lg 4}{\log_5 10} = (\lg y)^2$, where y is a constant to be found. [2]

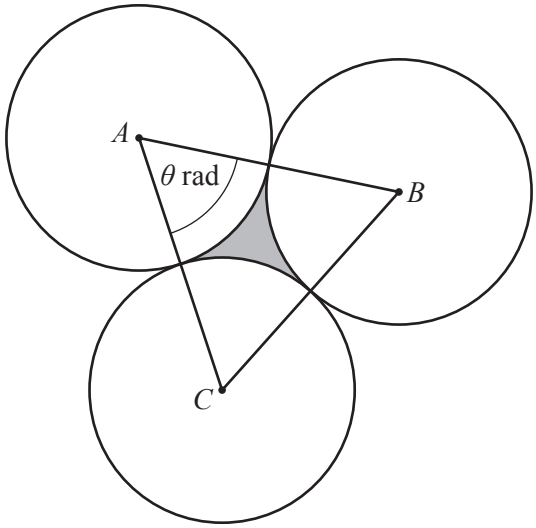
View solution

(iv) Solve $\log_r 2x + \log_r 3x = \log_r 600$. [2]

View solution

© UCLES 2016

4



The diagram shows 3 circles with centres A, B and C, each of radius 5 cm. Each circle touches the other two circles. Angle BAC is θ radians.

(i) Write down the value of θ. [1]

View solution

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

View solution

© UCLES 2016

5 Do not use a calculator in this question.

(a) Express $\dfrac{\sqrt{8}}{\sqrt{7}-\sqrt{5}}$ in the form $\sqrt{a}+\sqrt{b}$, where a and b are integers. [3]

View solution

(b) Given that $28+p\sqrt{3}=(q+2\sqrt{3})^2$, where p and q are integers, find the values of p and of q. [3]

View solution

© UCLES 2016

6 **(i)** Express $4x^2 + 8x - 5$ in the form $p(x + q)^2 + r$, where p, q and r are constants to be found. [3]

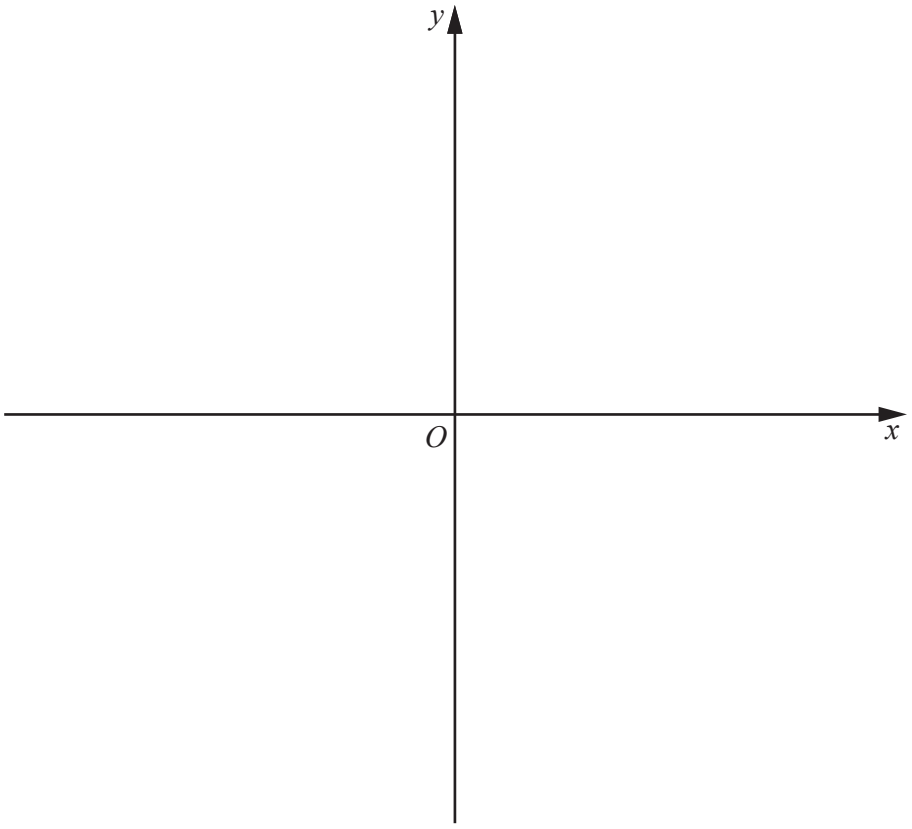
View solution

(ii) State the coordinates of the vertex of $y = |4x^2 + 8x - 5|$. [2]

View solution

(iii) On the axes below, sketch the graph of $y = |4x^2 + 8x - 5|$, showing the coordinates of the points where the curve meets the axes. [3]

View solution



7 O, P, Q and R are four points such that $\overrightarrow{OP} = \mathbf{p}$, $\overrightarrow{OQ} = \mathbf{q}$ and $\overrightarrow{OR} = 3\mathbf{q} - 2\mathbf{p}$.

(i) Find, in terms of **p** and **q**,

(a) $\overrightarrow{PQ}$, [1]

View solution

(b) $\overrightarrow{QR}$. [1]

View solution

(ii) Justifying your answer, what can be said about the positions of the points P, Q and R? [2]

View solution

(iii) Given that $\overrightarrow{OP} = \mathbf{i} + 3\mathbf{j}$ and that $\overrightarrow{OQ} = 2\mathbf{i} + \mathbf{j}$, find the unit vector in the direction $\overrightarrow{OR}$. [3]

View solution

© UCLES 2016

8 **(a)** **(i)** Use the Binomial Theorem to expand $(a+b)^4$, giving each term in its simplest form. [2]

View solution

(ii) Hence find the term independent of x in the expansion of $\left(2x+\frac{1}{5x}\right)^4$. [2]

View solution

(b) The coefficient of x^3 in the expansion of $\left(1+\frac{x}{2}\right)^n$ equals $\frac{5n}{12}$. Find the value of the positive integer n. [3]

View solution

© UCLES 2016

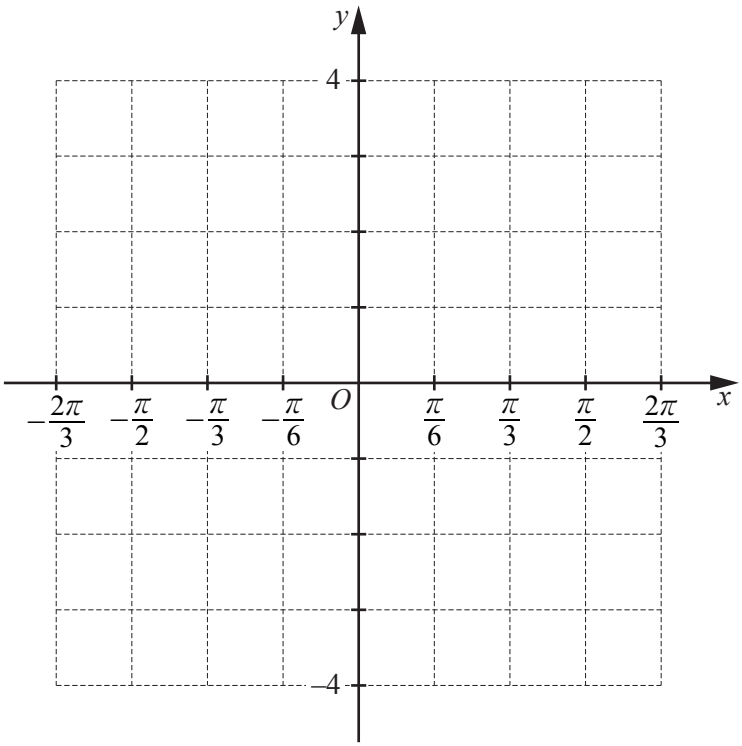
9 **(a)** Given that $y = a\tan bx + c$ has period $\frac{\pi}{4}$ radians and passes through the points $(0, -2)$ and $\left(\frac{\pi}{16}, 0\right)$, find the value of each of the constants a, b and c. [3]

View solution

a = ... b = ... c = ...

(b) **(i)** On the axes below, draw the graph of $y = 2\cos 3x + 1$ for $-\frac{2\pi}{3} \leqslant x \leqslant \frac{2\pi}{3}$ radians. [3]

View solution



(ii) Using your graph, or otherwise, find the exact solutions of $(2\cos 3x + 1)^2 = 1$ for $-\frac{2\pi}{3} \leqslant x \leqslant \frac{2\pi}{3}$ radians. [2]

View solution

© UCLES 2016

10 (a) (i) Find how many 5-digit even numbers can be made using each of the digits 1, 2, 3, 4, 5 once only. [2]

View solution

(ii) Find how many different 3-digit numbers can be made using the digits 1, 2, 3, 4, 5 if each digit can be used once only. [2]

View solution

(b) A man and two women are to sit in a row of five empty chairs. Calculate the number of ways they can be seated if

(i) the two women must sit next to each other, [2]

View solution

(ii) all three people must sit next to each other. [2]

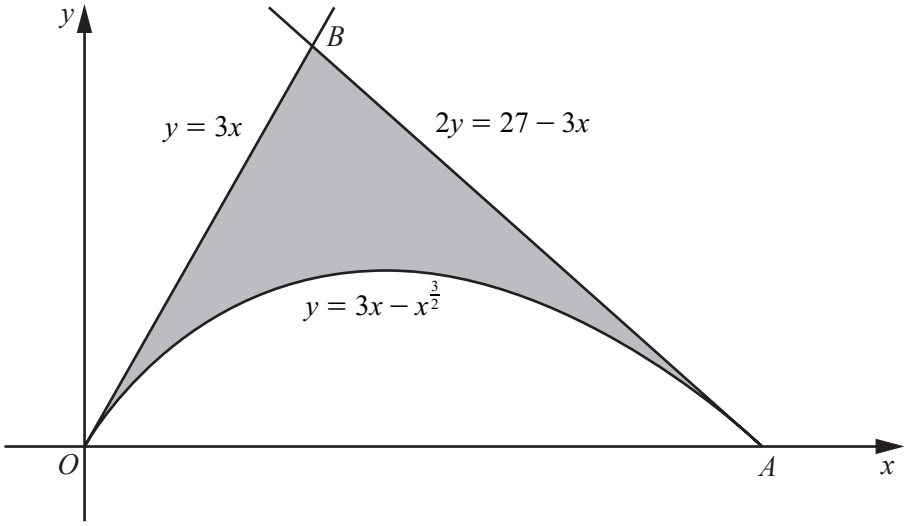
View solution

© UCLES 2016

11 **(i)** Find $\int(3x - x^{\frac{3}{2}})\,dx$. [2]

View solution

The diagram shows part of the curve $y = 3x - x^{\frac{3}{2}}$ and the lines $y = 3x$ and $2y = 27 - 3x$. The curve and the line $y = 3x$ meet the x-axis at O and the curve and the line $2y = 27 - 3x$ meet the x-axis at A.



(ii) Find the coordinates of A. [1]

View solution

(iii) Verify that the coordinates of B are $(3, 9)$. [1]

View solution

© UCLES 2016

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

View solution

© UCLES 2016

12 A curve has equation $y = \frac{2x-5}{x-1} - 12x$.

(i) Find $\frac{dy}{dx}$. [3]

View solution

(ii) Find $\frac{d^2y}{dx^2}$. [2]

View solution

© UCLES 2016

(iii) Find the coordinates of the stationary points of the curve and determine their nature. [5]

View solution

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 International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

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