Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2015**

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.

© UCLES 2015

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 2015

1 It is given that $f(x) = 4x^3 - 4x^2 - 15x + 18$.

(i) Show that $x + 2$ is a factor of $f(x)$. [1]

View solution

(ii) Hence factorise $f(x)$ completely and solve the equation $f(x) = 0$. [4]

View solution

© UCLES 2015

2 **(i)** Find, in the simplest form, the first 3 terms of the expansion of $(2-3x)^6$, in ascending powers of x. [3]

View solution

(ii) Find the coefficient of x^2 in the expansion of $(1+2x)(2-3x)^6$. [2]

View solution

3 Relative to an origin O, points A, B and C have position vectors $\begin{pmatrix}5\\4\end{pmatrix}$, $\begin{pmatrix}-10\\12\end{pmatrix}$ and $\begin{pmatrix}6\\-18\end{pmatrix}$ respectively. All distances are measured in kilometres. A man drives at a constant speed directly from A to B in 20 minutes.

(i) Calculate the speed in kmh^{-1} at which the man drives from A to B. [3]

View solution

He now drives directly from B to C at the same speed.

(ii) Find how long it takes him to drive from B to C. [3]

View solution

© UCLES 2015

4 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 3 & 5 \\ 7 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & -2 & 4 \\ -2 & 3 & 0 \end{pmatrix}$, calculate **2BA**. [3]

View solution

(b) The matrices **C** and **D** are given by $\mathbf{C} = \begin{pmatrix} 1 & 2 \\ -1 & 6 \end{pmatrix}$ and $\mathbf{D} = \begin{pmatrix} 3 & -2 \\ 1 & 4 \end{pmatrix}$.

View solution

(i) Find $\mathbf{C}^{-1}$. [2]

(ii) Hence find the matrix **X** such that **CX + D = I**, where **I** is the identity matrix. [3]

View solution

© UCLES 2015

5 **(a)** Solve the following equations to find p and q.

View solution

$$8^{q-1} \times 2^{2p+1} = 4^7$$

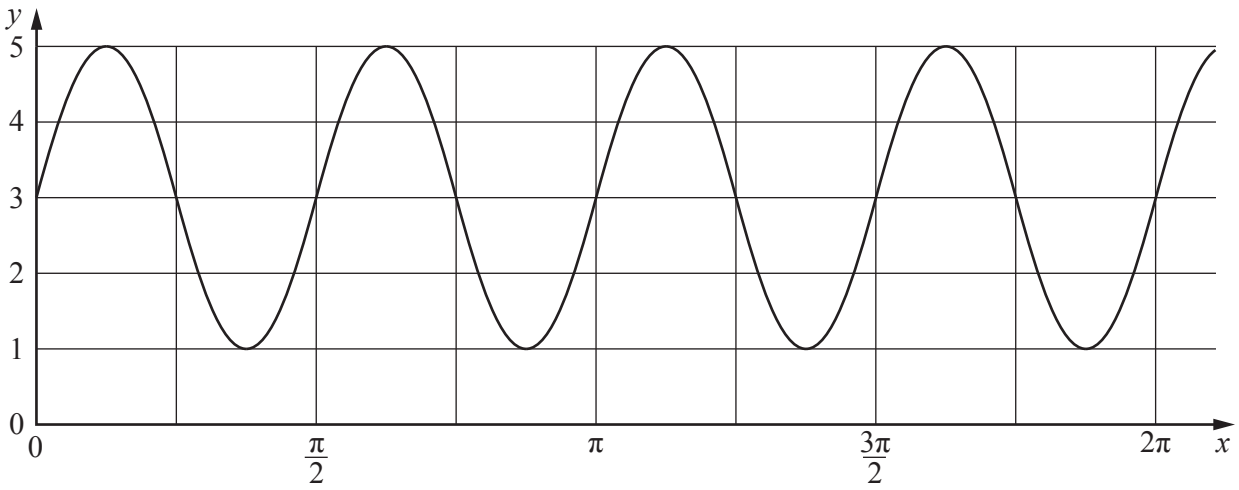
$$9^{p-4} \times 3^q = 81$$

[4]

(b) Solve the equation $\lg(3x-2) + \lg(x+1) = 2 - \lg 2$. [5]

View solution

6



The figure shows part of the graph of $y = a + b\sin cx$.

(i) Find the value of each of the integers a, b and c. [3]

View solution

Using your values of a, b and c find

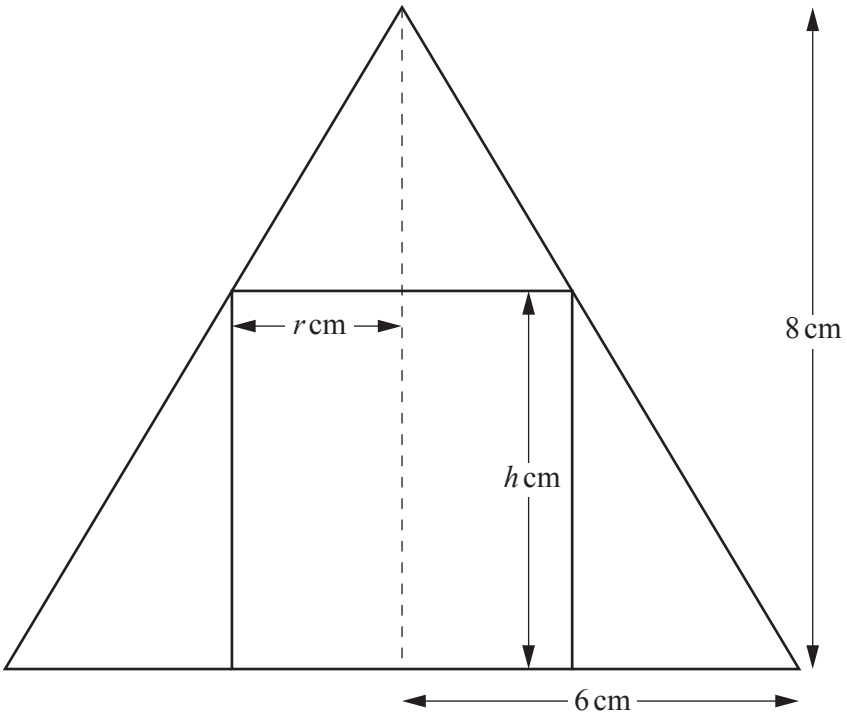
(ii) $\frac{\mathrm{d}y}{\mathrm{d}x}$, [2]

View solution

(iii) the equation of the normal to the curve at $\left(\frac{\pi}{2}, 3\right)$. [3]

View solution

7



A cone, of height 8 cm and base radius 6 cm, is placed over a cylinder of radius r cm and height h cm and is in contact with the cylinder along the cylinder's upper rim. The arrangement is symmetrical and the diagram shows a vertical cross-section through the vertex of the cone.

(i) Use similar triangles to express h in terms of r. [2]

View solution

(ii) Hence show that the volume, V cm^3, of the cylinder is given by $V = 8\pi r^2 - \frac{4}{3}\pi r^3$. [1]

View solution

(iii) Given that r can vary, find the value of r which gives a stationary value of V. Find this stationary value of V in terms of π and determine its nature. [6]

View solution

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

Two points A and B have coordinates $(-3, 2)$ and $(9, 8)$ respectively.

(i) Find the coordinates of C, the point where the line AB cuts the y-axis. [3]

View solution

(ii) Find the coordinates of D, the mid-point of AB. [1]

View solution

© UCLES 2015

(iii) Find the equation of the perpendicular bisector of AB. [2]

View solution

The perpendicular bisector of AB cuts the y-axis at the point E.

(iv) Find the coordinates of E. [1]

View solution

(v) Show that the area of triangle ABE is four times the area of triangle ECD. [3]

View solution

© UCLES 2015

9 Solve the following equations.

(i) $4\sin 2x + 5\cos 2x = 0 \quad \text{for } 0° \leqslant x \leqslant 180°$ [3]

View solution

(ii) $\cot^2 y + 3\,\text{cosec}\, y = 3 \quad \text{for } 0° \leqslant y \leqslant 360°$ [5]

View solution

(iii) $\cos\left(z+\frac{\pi}{4}\right)=-\frac{1}{2}$ for $0 \leqslant z \leqslant 2\pi$ radians, giving each answer as a multiple of π [4]

View solution

Question 10 is printed on the next page.

10 A particle is moving in a straight line such that its velocity, v ms^{-1}, t seconds after passing a fixed point O is $v = e^{2t} - 6e^{-2t} - 1$.

(i) Find an expression for the displacement, s m, from O of the particle after t seconds. [3]

View solution

(ii) Using the substitution $u = e^{2t}$, or otherwise, find the time when the particle is at rest. [3]

View solution

(iii) Find the acceleration at this time. [2]

View solution

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.