

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

1 6 6 8 6 0 3 2 4 3

ADDITIONAL MATHEMATICS

0606/21

Paper 2 May/June 2011

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 a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, 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.

For Examiner's Use		
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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

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n,$$

where *n* is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

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

$$\csc^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

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

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

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

Without using a calculator, express $\frac{(5+2\sqrt{3})^2}{2+\sqrt{3}}$ in the form $p+q\sqrt{3}$, where p and q are integers. [4]

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2 (i) Find the coefficient of x^3 in the expansion of $\left(1 - \frac{x}{2}\right)^{12}$. [2]

(ii) Find the coefficient of x^3 in the expansion of $(1 + 4x) \left(1 - \frac{x}{2}\right)^{12}$. [3]

Relative to an origin O, the position vectors of the points A and B are $\mathbf{i} - 4\mathbf{j}$ and $7\mathbf{i} + 20\mathbf{j}$ respectively. The point C lies on AB and is such that $\overrightarrow{AC} = \frac{2}{3} \overrightarrow{AB}$. Find the position vector of C and the magnitude of this vector.

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4	Find the set of values of k for which the line $y = 2x - 5$ cuts the curve $y = x^2 + kx + 11$	in two	<i>F</i>
	distinct points.	[6]	Exan

5	The expression $x^3 + 8x^2 + px - 25$	leaves	a remainder	of R	when	divided by	x-1	and a
	remainder of $-R$ when divided by x	+ 2.						

(i) Find the value of p.

[4]

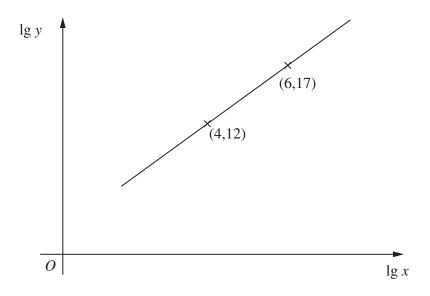
(ii) Hence find the remainder when the expression is divided by x + 3.

[2]

5	(a)	A sl	helf contains 8 different travel books, of which 5 are about Europe and 3 are about Africa.	For
		(i)	Find the number of different ways the books can be arranged if there are no restrictions. [2]	Examiner Use
		(ii)	Find the number of different ways the books can be arranged if the 5 books about Europe are kept together. [2]	
	(b)	3 D	VDs and 2 videotapes are to be selected from a collection of 7 DVDs and 5 videotapes.	
		Cal	culate the number of different selections that could be made. [3]	

7 The variables x and y are related so that when $\lg y$ is plotted against $\lg x$ a straight line graph passing through the points (4, 12) and (6, 17) is obtained.

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(i) Express y in terms of x, giving your answer in the form $y = ax^b$.

[6]

(ii) Find the value of x when y = 300.

[2]

8	The temperature, T° Celsius, of an object, t minutes	after it is removed from a heat source, is
	given by	

$$T = 55e^{-0.1t} + 15.$$

(i) Find the temperature of the object at the instant it is removed from the heat source. [1]

(ii) Find the temperature of the object when t = 8. [1]

(iii) Find the value of t when T = 25. [3]

(iv) Find the rate of change of T when t = 16. [3]

	10	
9	A coastguard station receives a distress call from a ship which is travelling at $15\mathrm{km}\mathrm{h}^{-1}$ on bearing of 150° . A lifeboat leaves the coastguard station at 1500 hours; at this time the ship is a distance of $30\mathrm{km}$ on a bearing of 270° . The lifeboat travels in a straight line at constant speed a reaches the ship at 1540 hours.	ıt a
	(i) Find the speed of the lifeboat.	[5]

[3]

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(ii) Find the bearing on which the lifeboat travelled.

10 (i) Solve the equation $3\sin x + 4\cos x = 0$ for $0^{\circ} < x < 360^{\circ}$.

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[3]

(ii) Solve the equation $6\cos y + 6\sec y = 13$ for $0^{\circ} < y < 360^{\circ}$.

[5]

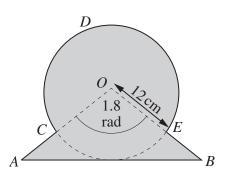
(iii) Solve the equation $\sin(2z-3) = 0.7$ for $0 < z < \pi$ radians.

[3]

11 Answer only **one** of the following two alternatives.

EITHER

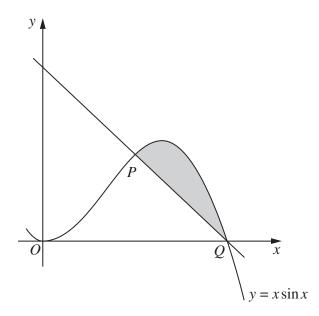
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The diagram shows an isosceles triangle AOB and a sector OCDEO of a circle with centre O. The line AB is a tangent to the circle. Angle AOB = 1.8 radians and the radius of the circle is 12 cm.

- (i) Show that the distance AC = 7.3 cm to 1 decimal place. [2]
- (ii) Find the perimeter of the shaded region. [6]
- (iii) Find the area of the shaded region. [4]

OR



The diagram shows part of the curve $y = x \sin x$ and the normal to the curve at the point $P\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$. The curve passes through the point $Q(\pi, 0)$.

- (i) Show that the normal to the curve at P passes through the point Q. [4]
- (ii) Given that $\frac{d}{dx}(x\cos x) = \cos x x\sin x$, find $\int x\sin x dx$. [3]
- (iii) Find the area of the shaded region. [5]

Start your answer to Question 11 nere.		For
	EITHER	Examiner's Use
Indicate which question you are answering.	OR	

Continue your answer here if necessary.

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