UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1269823337

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2012**

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.

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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This document consists of **17** printed pages and **3** blank pages.

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UNIVERSITY *of* CAMBRIDGE
International Examinations

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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

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

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

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

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 Solve the inequality $4x - 9 > 4x(5 - x)$.

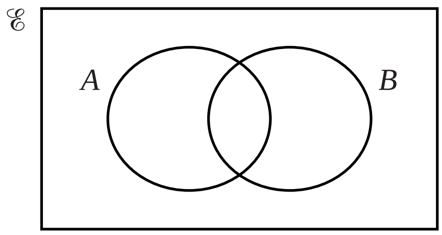
2 **(a)** It is given that $\mathscr{E}$ is the set of integers, P is the set of prime numbers between 10 and 50, F is the set of multiples of 5, and T is the set of multiples of 10. Write the following statements using set notation.

(i) There are 11 prime numbers between 10 and 50. [1]

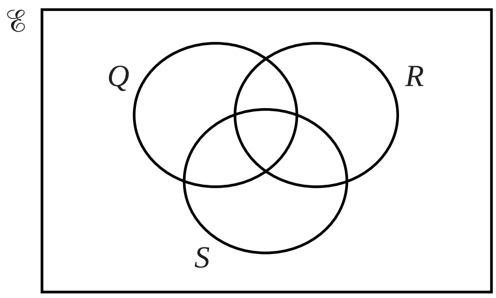
(ii) 18 is not a multiple of 5. [1]

(iii) All multiples of 10 are multiples of 5. [1]

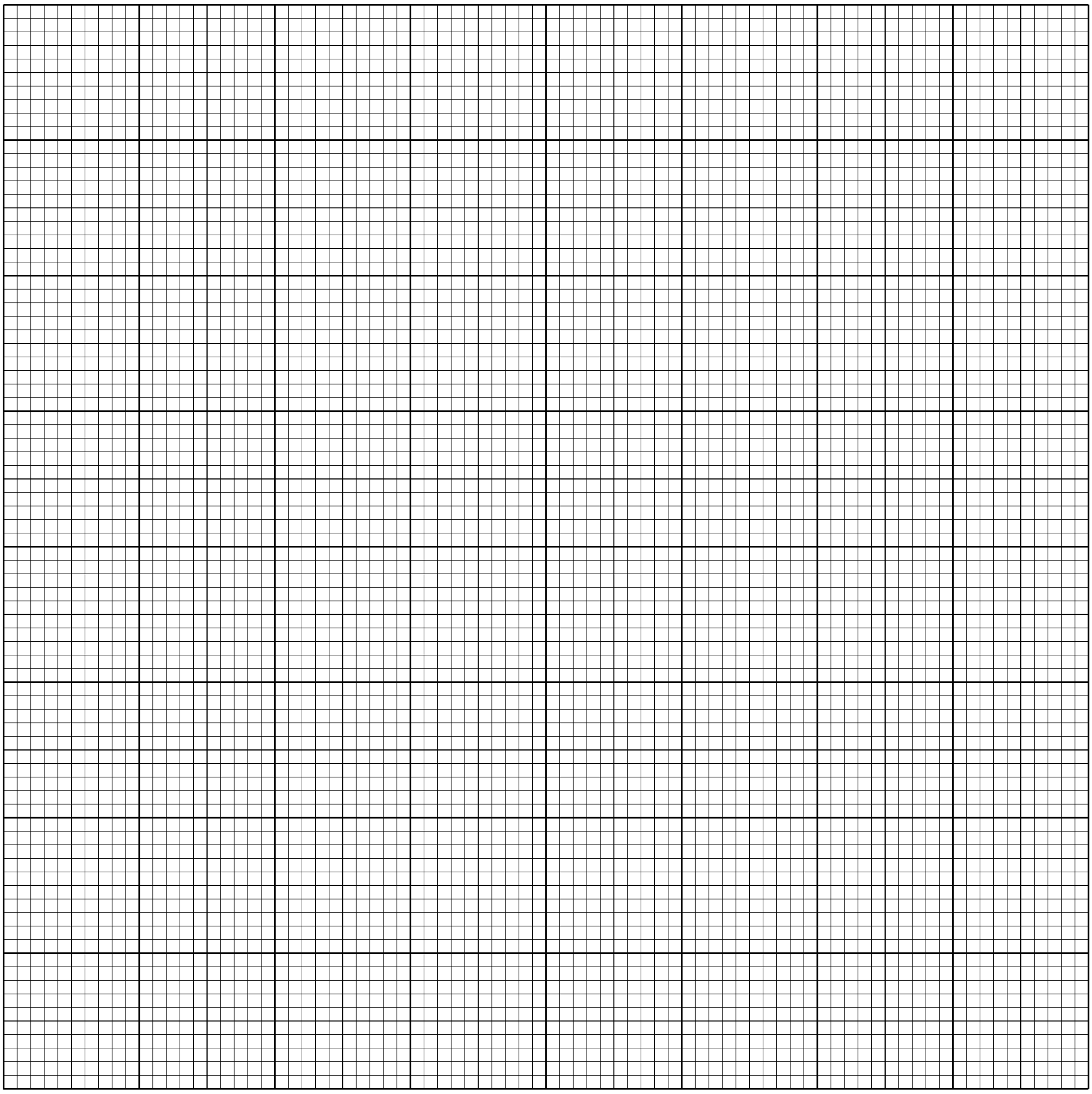
(b) **(i)** In the Venn diagram below shade the region that represents $(A' \cap B) \cup (A \cap B')$. [1]



(ii) In the Venn diagram below shade the region that represents $Q \cap (R \cup S')$. [1]



3 **(i)** On the grid below draw, for $0° \leqslant x \leqslant 360°$, the graphs of $y = 3\sin 2x$ and $y = 2 +$



(ii) State the number of values of x for which $3\sin 2x = 2 + \cos x$ in the interval $0° \leqslant x \leqslant 360°$. [1]

4 It is given that $f(x) = 4 + 8x - x^2$.

(i) Find the value of a and of b for which $f(x) = a - (x + b)^2$ and hence write down the coordinates of the stationary point of the curve $y = f(x)$. [3]

(ii) On the axes below, sketch the graph of $y = f(x)$, showing the coordinates of the point where your graph intersects the y-axis. [2]

5 It is given that $\mathbf{A} = \begin{pmatrix} 4 & -2 \\ 8 & -3 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 2 & 0 & 4 \\ 5 & -1 & 4 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 5 \\ -2 \\ 3 \end{pmatrix}$.

(i) Calculate **ABC**. [4]

(ii) Calculate $\mathbf{A}^{-1}\mathbf{B}$. [4]

6 The normal to the curve $y = x^3 + 6x^2 - 34x + 44$ at the point $P\ (2, 8)$ cuts the x-axis at A a [illegible] y-axis at B. Show that the mid-point of the line AB lies on the line $4y = x + 9$.

7 In this question $\begin{pmatrix}1\\0\end{pmatrix}$ is a unit vector due east and $\begin{pmatrix}0\\1\end{pmatrix}$ is a unit vector due north. At 12 00 a coastguard, at point O, observes a ship with position vector $\begin{pmatrix}16\\12\end{pmatrix}$ km relative to O. The ship is moving at a steady speed of $10\,\text{km h}^{-1}$ on a bearing of 330°.

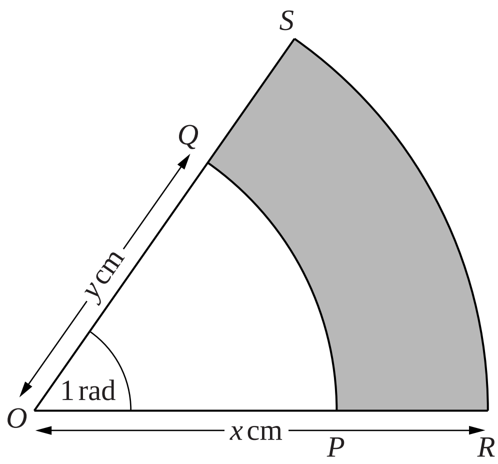
(i) Find the value of p such that $\begin{pmatrix}-5\\p\end{pmatrix}$ km h^{-1} represents the velocity of the ship. [2]

(ii) Write down, in terms of t, the position vector of the ship, relative to O, t hours after 12 00. [2]

(iii) Find the time when the ship is due north of O. [2]

(iv) Find the distance of the ship from O at this time. [2]

8



In the diagram PQ and RS are arcs of concentric circles with centre O and angle $POQ = 1$ radian. The radius of the larger circle is x cm and the radius of the smaller circle is y cm.

(i) Given that the perimeter of the shaded region is 20 cm, express y in terms of x. [2]

(ii) Given that the area of the shaded region is 16 cm^2, express y^2 in terms of x^2. [2]

(iii) Find the value of x and of y.

9 **(a)** An art gallery displays 10 paintings in a row. Of these paintings, 5 are by Picasso, 4 are by Monet and 1 by Turner.

(i) Find the number of different ways the paintings can be displayed if there are no restrictions. [1]

(ii) Find the number of different ways the paintings can be displayed if the paintings by each of the artists are kept together. [3]

(b) A committee of 4 senior students and 2 junior students is to be selected from a group of 6 senior students and 5 junior students.

(i) Calculate the number of different committees which can be selected. [3]

One of the 6 senior students is a cousin of one of the 5 junior students.

(ii) Calculate the number of different committees which can be selected if at most one of these cousins is included. [3]

10 **(i)** The remainder when the expression $x^3 + 9x^2 + bx + c$ is divided by $x - 2$ is tw[illegible] remainder when the expression is divided by $x - 1$. Show that $c = 24$.

(ii) Given that $x + 8$ is a factor of $x^3 + 9x^2 + bx + 24$, show that the equation $x^3 + 9x^2 + bx + 24 = 0$ has only one real root. [4]

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QUESTION 11 IS PRINTED ON THE NEXT PAGE.

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

EITHER

A particle travels in a straight line so that, t s after passing through a fixed point O, its displacement, s m, from O is given by $s = t^2 - 10t + 10\ln(1 + t)$, where $t > 0$.

(i) Find the distance travelled in the twelfth second. [2]

(ii) Find the value of t when the particle is at instantaneous rest. [5]

(iii) Find the acceleration of the particle when $t = 9$. [3]

OR

A particle travels in a straight line so that, t s after passing through a fixed point O, its velocity, $v\,\text{cms}^{-1}$, is given by $v = 4e^{2t} - 24t$.

(i) Find the velocity of the particle as it passes through O. [1]

(ii) Find the distance travelled by the particle in the third second. [4]

(iii) Find an expression for the acceleration of the particle and hence find the stationary value of the velocity. [5]

Start your answer to Question 11 here.

Indicate which question you are answering.

EITHER	
OR	

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Continue your answer here.

Continue your answer here if necessary.

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