UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5272705046

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **May/June 2013**

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.

This document consists of **16** printed pages.

DC (NH/SW) 57089/6

UNIVERSITY *of* 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

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

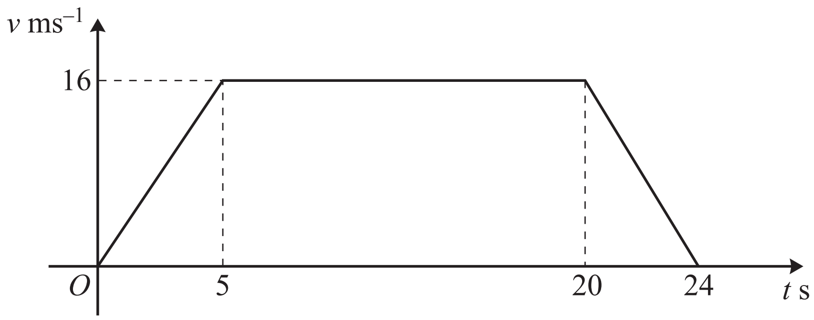
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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

1 Prove that $\left(\dfrac{1+\sin\theta}{\cos\theta}\right)^2 + \left(\dfrac{1-\sin\theta}{\cos\theta}\right)^2 = 2 + 4\tan^2\theta$. [4]

For Examiner's Use

2



The velocity-time graph represents the motion of a particle moving in a straight line.

(i) Find the acceleration during the first 5 seconds. [1]

(ii) Find the length of time for which the particle is travelling with constant velocity. [1]

(iii) Find the total distance travelled by the particle. [3]

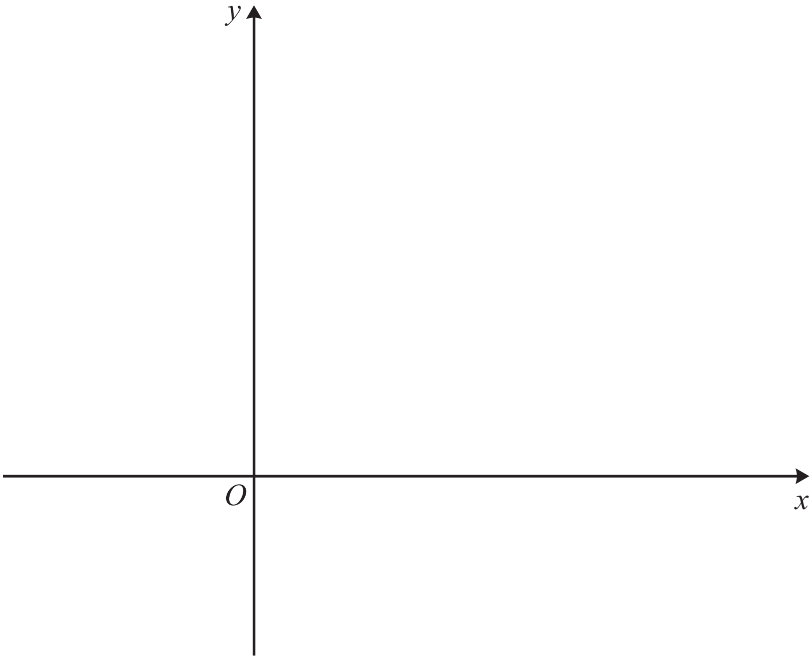
For Examiner's Use

3 Variables x and y are related by the equation $y = 10 - 4\sin^2 x$, where $0 \leqslant x \leqslant \frac{\pi}{2}$. Given that x is increasing at a rate of 0.2 radians per second, find the corresponding rate of change of y when $y = 8$. [6]

For Examiner's Use

For Examiner's Use

4 **(i)** Sketch the graph of $y = |4x - 2|$ on the axes below, showing the coordinates of the points where the graph meets the axes. [3]



(ii) Solve the equation $|4x - 2| = x$. [3]

5

A piece of wire of length 96 cm is formed into the rectangular shape *PQRSTU* shown in the diagram. It is given that $PQ = TU = SR = x$ cm. It may be assumed that *PQ* and *TU* coincide and that *TS* and *QR* have the same length.

(i) Show that the area, A cm^2, enclosed by the wire is given by $A = \dfrac{96x - 3x^2}{2}$. [2]

(ii) Given that x can vary, find the stationary value of A and determine the nature of this stationary value. [4]

For Examiner's Use

6 Find the equation of the normal to the curve $y = \dfrac{x^2 + 8}{x - 2}$ at the point on the curve where $x = 4$. [6]

For Examiner's Use

7 **(i)** Find the first four terms in the expansion of $(2 + x)^6$ in ascending powers of x. [3]

For Examiner's Use

(ii) Hence find the coefficient of x^3 in the expansion of $(1 + 3x)(1 - x)(2 + x)^6$. [4]

For Examiner's Use

8 The line $y = 2x - 8$ cuts the curve $2x^2 + y^2 - 5xy + 32 = 0$ at the points A and B. Find the length of the line AB. [7]

For Examiner's Use

9 It is given that $x \in \mathbb{R}$ and that
$$\mathscr{E} = \{x : -5 < x < 12\},$$
$$S = \{x : 5x + 24 > x^2\},$$
$$T = \{x : 2x + 7 > 15\}.$$

Find the values of x such that

(i) $x \in S$, [3]

(ii) $x \in S \cup T$, [2]

(iii) $x \in (S \cap T)'$. [3]

10 A plane, whose speed in still air is 240 km h^{-1}, flies directly from *A* to *B*, where *B* is 500 km from *A* on a bearing of 032°. There is a constant wind of 50 km h^{-1} blowing from the west.

For Examiner's Use

(i) Find the bearing on which the plane is steered. [4]

(ii) Find, to the nearest minute, the time taken for the flight. [4]

For Examiner's Use

11 A one-one function f is defined by $f(x) = (x - 1)^2 - 5$ for $x \geqslant k$.

For Examiner's Use

(i) State the least value that k can take. [1]

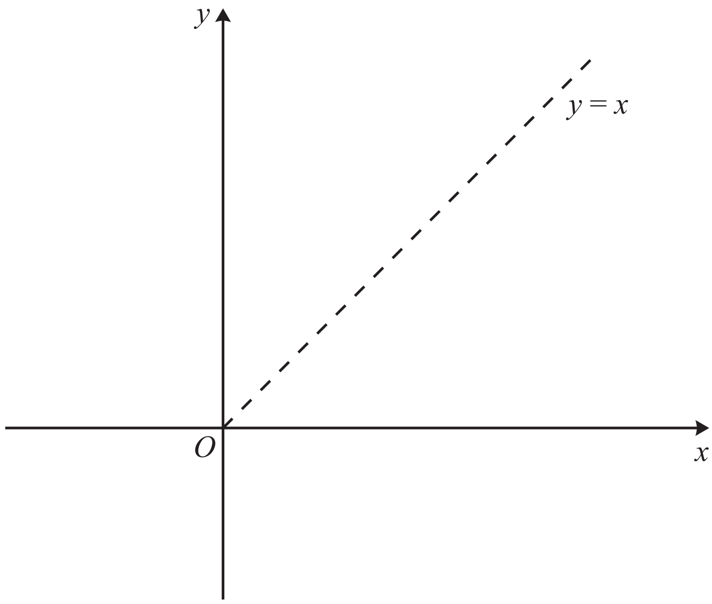
For this least value of k

(ii) write down the range of f, [1]

(iii) find $f^{-1}(x)$, [2]

(iv) sketch and label, on the axes below, the graph of $y = \mathrm{f}(x)$ and of $y = \mathrm{f}^{-1}(x)$, [2]

For Examiner's Use



(v) find the value of x for which $\mathrm{f}(x) = \mathrm{f}^{-1}(x)$. [2]

Question 12 is printed on the next page.

12 The function $f(x) = x^3 + x^2 + ax + b$ is divisible by $x - 3$ and leaves a remainder of 20 when divided by $x + 1$.

For Examiner's Use

(i) Show that $b = 6$ and find the value of a. [4]

(ii) Using your value of a and taking b as 6, find the non-integer roots of the equation $f(x) = 0$ in the form $p \pm \sqrt{q}$, where p and q are integers. [5]