O

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7964346832

ADDITIONAL MATHEMATICS **4037/22**

Paper 2 **May/June 2013**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

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 **15** printed pages and **1** blank page.

DC (JF/SW) 72417

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

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

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

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

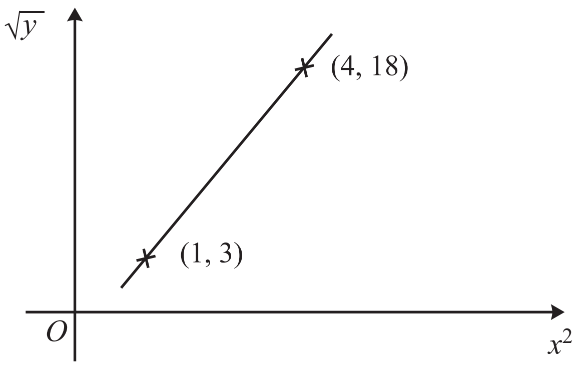
Formulae for ΔABC

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

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

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

1



Variables x and y are such that when $\sqrt{y}$ is plotted against x^2 a straight line graph passing through the points (1, 3) and (4, 18) is obtained. Express y in terms of x. [4]

For Examiner's Use

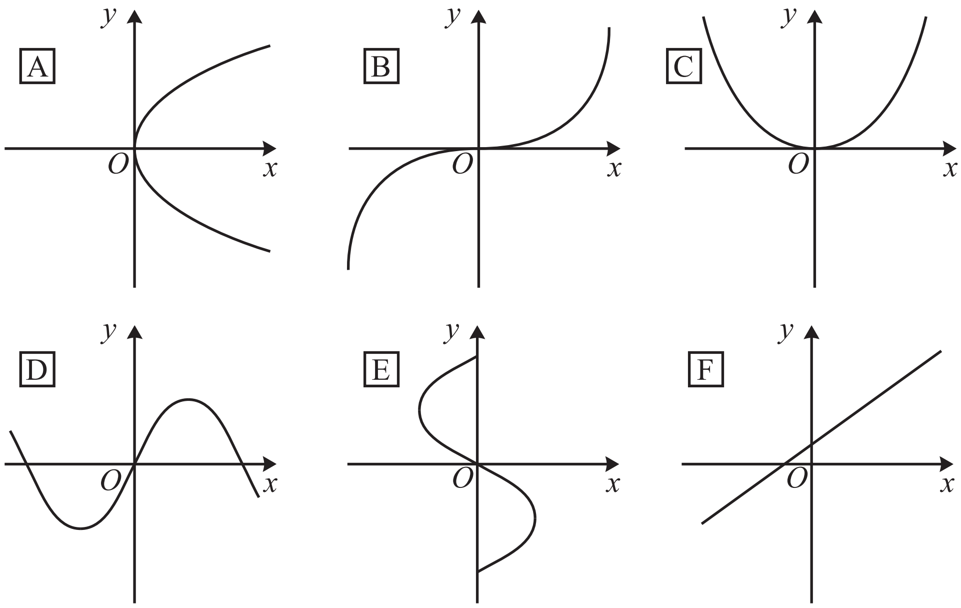
For Examiner's Use

2 **(a)** Solve the equation $3^{p+1} = 0.7$, giving your answer to 2 decimal places. [3]

(b) Express $\dfrac{y \times (4x^3)^2}{\sqrt{8y^3}}$ in the form $2^a \times x^b \times y^c$, where a, b and c are constants. [3]

For Examiner's Use

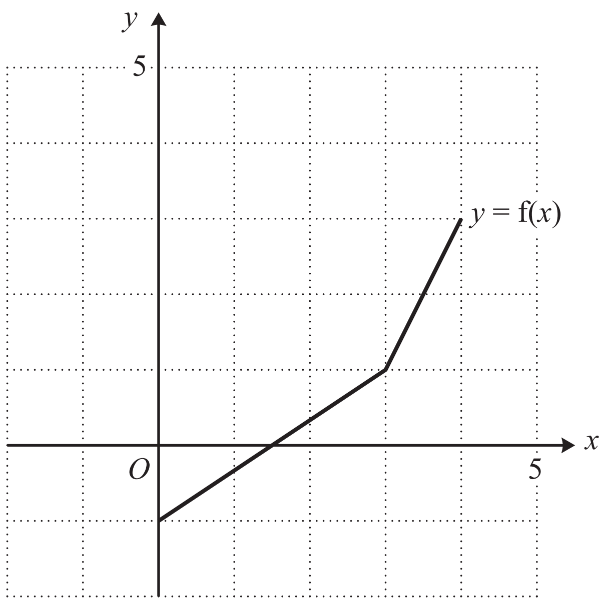
3 **(a)**



(i) Write down the letter of each graph which does **not** represent a function. [2]

(ii) Write down the letter of each graph which represents a function that does **not** have an inverse. [2]

(b)



The diagram shows the graph of a function $y = \mathrm{f}(x)$. On the same axes sketch the graph of $y = \mathrm{f}^{-1}(x)$. [2]

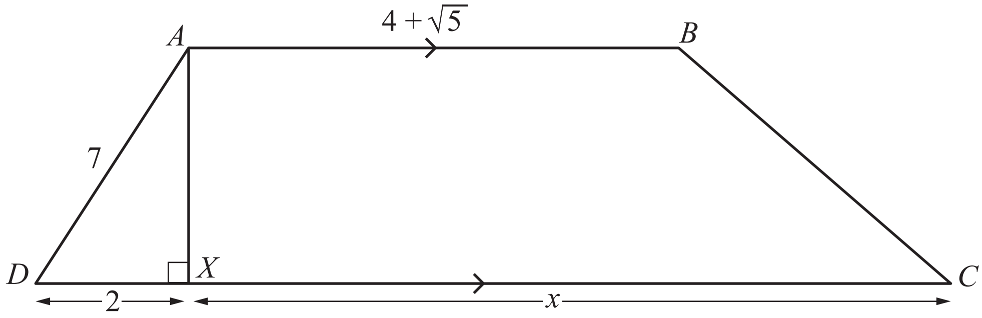
4 The position vectors of the points A and B, relative to an origin O, are $4\mathbf{i} - 21\mathbf{j}$ and $22\mathbf{i} - 30\mathbf{j}$ respectively. The point C lies on AB such that $\overrightarrow{AB} = 3\overrightarrow{AC}$.

(i) Find the position vector of C relative to O. [4]

(ii) Find the unit vector in the direction $\overrightarrow{OC}$. [2]

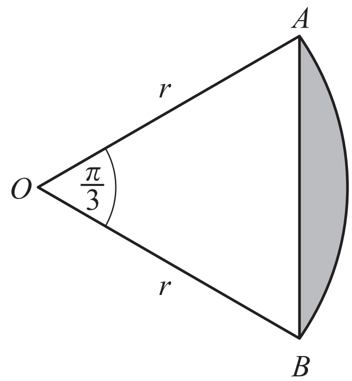
5 Calculators must not be used in this question.

For Examiner's Use



The diagram shows a trapezium $ABCD$ in which $AD = 7\,\text{cm}$ and $AB = (4+\sqrt{5})\,\text{cm}$. AX is perpendicular to DC with $DX = 2\,\text{cm}$ and $XC = x\,\text{cm}$. Given that the area of trapezium $ABCD$ is $15(\sqrt{5}+2)\,\text{cm}^2$, obtain an expression for x in the form $a + b\sqrt{5}$, where a and b are integers. [6]

6



The shaded region in the diagram is a segment of a circle with centre O and radius r cm.

Angle $AOB = \frac{\pi}{3}$ radians.

(i) Show that the perimeter of the segment is $r\left(\frac{3+\pi}{3}\right)$ cm. [2]

(ii) Given that the perimeter of the segment is 26 cm, find the value of r and the area of the segment. [5]

For Examiner's Use

7 Differentiate, with respect to x,

For Examiner's Use

(i) $(3 - 5x)^{12}$, [2]

(ii) $x^2 \sin x$, [2]

(iii) $\dfrac{\tan x}{1 + e^{2x}}$. [4]

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

For Examiner's Use

The points $A(-6, 2)$, $B(2, 6)$ and C are the vertices of a triangle.

(i) Find the equation of the line AB in the form $y = mx + c$. [2]

(ii) Given that angle $ABC = 90°$, find the equation of BC. [2]

(iii) Given that the length of AC is 10 units, find the coordinates of each of the two possible positions of point C. [4]

For Examiner's Use

For Examiner's Use

9 **(a)** The graph of $y = k(3^x) + c$ passes through the points (0, 14) and (−2, 6). Find the value of k and of c. [3]

(b) The variables x and y are connected by the equation $y = e^x + 25 - 24e^{-x}$.

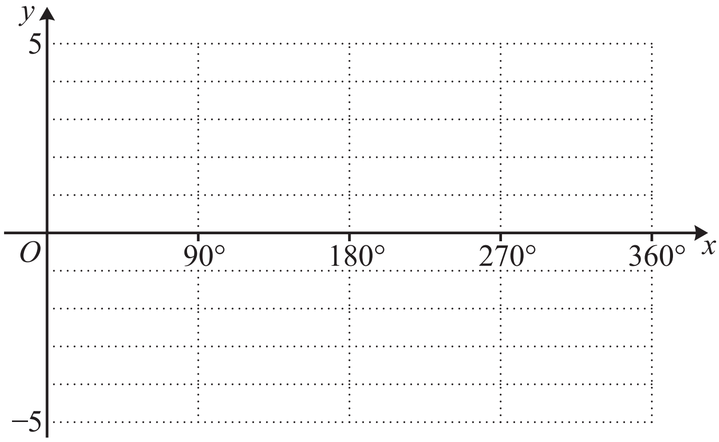
(i) Find the value of y when $x = 4$. [1]

(ii) Find the value of e^x when $y = 20$ and hence find the corresponding value of x. [4]

For Examiner's Use

10 (a) The function f is defined, for $0° \leqslant x \leqslant 360°$, by $f(x) = 1 + 3\cos 2x$.

(i) Sketch the graph of $y = f(x)$ on the axes below. [4]



(ii) State the amplitude of f. [1]

(iii) State the period of f. [1]

(b) Given that $\cos x = p$, where $270° < x < 360°$, find $\operatorname{cosec} x$ in terms of p. [3]

For Examiner's Use

11 A curve has equation $y = 3x + \dfrac{1}{(x-4)^3}$.

(i) Find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$. [4]

(ii) Show that the coordinates of the stationary points of the curve are (5, 16) and (3, 8). [2]

(iii) Determine the nature of each of these stationary points. [2]

For Examiner's Use

(iv) Find $\int\left(3x + \frac{1}{(x-4)^3}\right)\,dx$. [2]

(v) Hence find the area of the region enclosed by the curve, the line $x = 5$, the x-axis and the line $x = 6$. [2]

BLANK PAGE