Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2004

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

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 in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express $\frac{7}{100}$ as a decimal.

(b) Express 0.08 as a percentage.

Answer (*a*) ..... [1]

(*b*) ..... % [1]

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2 **(a)** Express $\frac{72}{108}$ as a fraction in its lowest terms.

(b) Evaluate $\frac{1}{3} + \frac{4}{7}$.

Answer (*a*) ..... [1]

(*b*) ..... [1]

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3 **(a)** Evaluate $63 \div 0.9$.

Answer (*a*) ..... [1]

(b) Add brackets to the expression in the answer space to make it correct.

Answer (*b*) 1 + 72 ÷ 4 × 2 = 10 [1]

---

4 **(a)** Simplify $(3x^3)^2$.

(b) Given that $(16)^{-\frac{1}{2}} \times k = 1$, evaluate k.

Answer (*a*) ..... [1]

(*b*) k = ... [1]

---

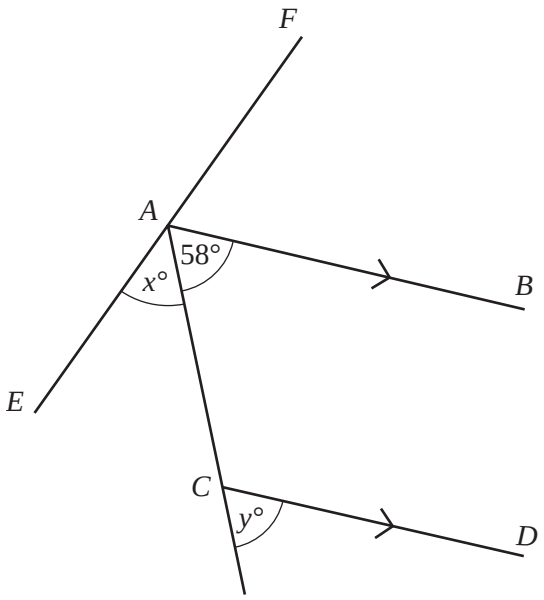
5 In the diagram, EAF is a straight line and AB is parallel to CD.

AB bisects $F\hat{A}C$ and $C\hat{A}B = 58°$.

Find the value of

(a) x,

(b) y.



Answer (*a*) x = ... [1]

(*b*) y = ... [1]

---

6 Given that $\mathbf{A} = \begin{pmatrix} 3 & -1 \\ 4 & 2 \end{pmatrix}$,

find

(a) the determinant of **A**,

(b) $\mathbf{A}^{-1}$.

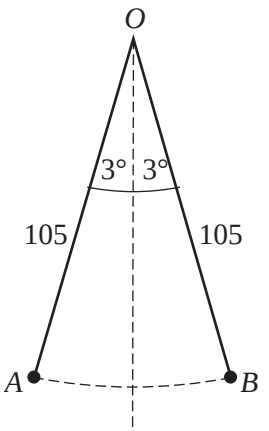
Answer (*a*) ..... [1]

(*b*) ..... [1]

7 A pendulum of length 105 cm is suspended from O.

Its end swings 3° on either side of the vertical from A to B.

Taking $\pi = \frac{22}{7}$, calculate the length of the arc AB.



Answer ..... cm [2]

---

8 Express as a single fraction in its simplest form $\frac{2}{x-3} - \frac{1}{x+2}$.

Answer ..... [2]

---

9 Some children were asked how many television programmes they had watched on the previous day. The table shows the results.

Number of programmes watched	0	1	2	3
Number of children	7	3	1	y

(a) If the median is 2, find the value of y.

(b) If the median is 1, find the greatest possible value of y.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

10 **(a)** Express 217.3×10^2 in standard form.

Answer (*a*) ..... [1]

(b) Arrange the following numbers in order starting with the smallest.

$$217.3 \times 10^2 \ , \quad 22.6 \times 10^3 \ , \quad 0.031 \times 10^5 \ , \quad 2.5 \times 10^4 \ .$$

Answer (*b*) ..... , ... , ... , ... [2]

---

11 A function f is defined by $\mathrm{f} : x \mapsto \dfrac{x + 5}{3}$.

(a) Given that $\mathrm{f} : 1 \mapsto k$, find the value of k.

(b) Given also that $\mathrm{f}^{-1} : x \mapsto cx + d$, find the value of c and the value of d.

Answer (*a*) k = ... [1]

(*b*) c = ... d = ... [2]

---

12 It is given that $x = -3.5$, $y = 1.5$ and $z = 4.5$.

(a) Find the value of $x - z$.

(b) Given also that $(y + z) : t = 4 : 15$, find the value of t.

Answer (*a*) $x - z$ = ... [1]

(*b*) t = ... [2]

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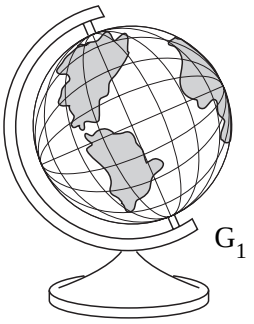
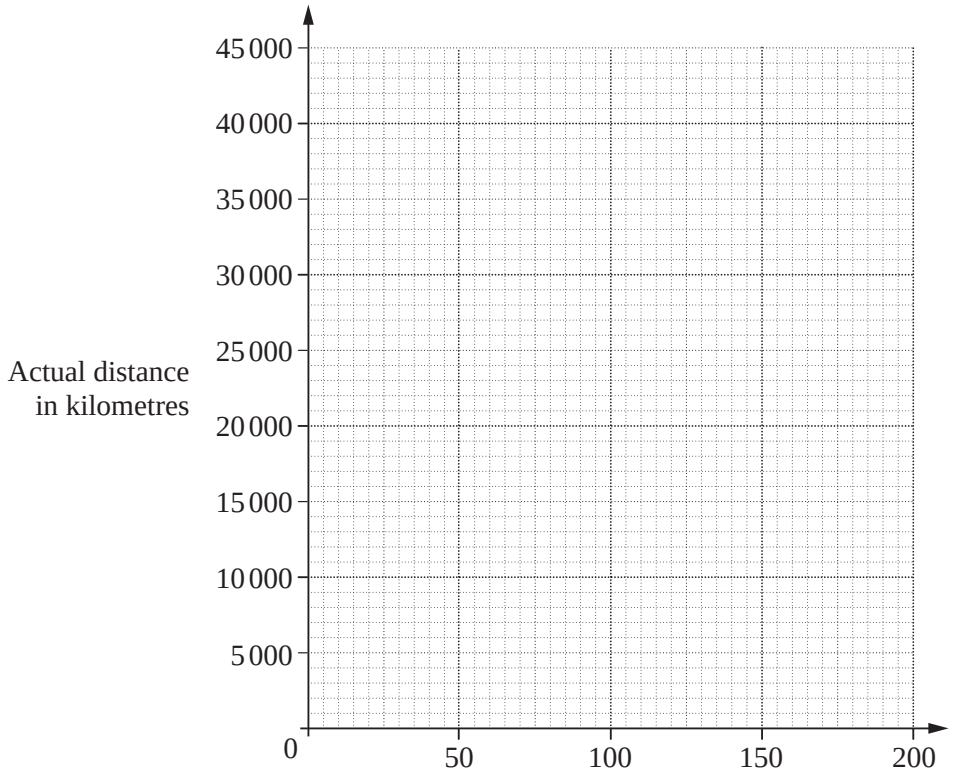
13 String is used to measure distances on two globes, G_1 and G_2.



(a) The length of string required to go around the equator on globe G_1 is 157.5 cm.
The actual length of the equator is 40 000 km.
On the axes below, draw a graph which will enable you to convert lengths of string on the globe G_1 to actual distances.

Answer (*a*)



[1]

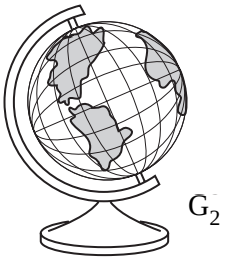
(b) The flight path between two places, *A* and *B*, on globe G_1 requires 35 cm of string.

(i) Use your graph to estimate the actual distance between *A* and *B*.

Answer (*b*) (i) ..... km [1]

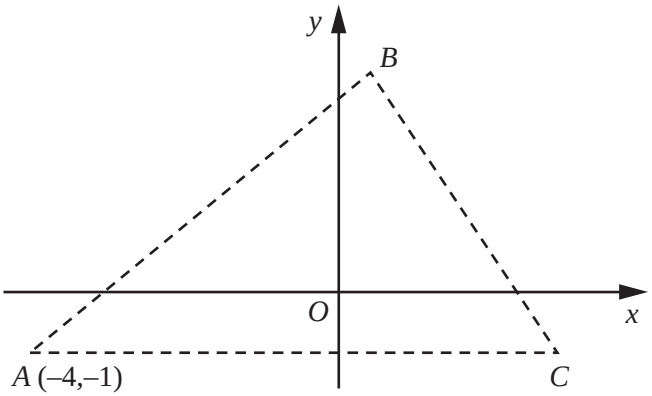
(ii) On the other globe G_2, the same flight path between *A* and *B* requires 17.5 cm of string.

Write down the value of $\dfrac{\text{volume of globe } G_2}{\text{volume of globe } G_1}$.



Answer (*b*)(ii) ..... [1]

14



In the diagram, A is the point $(-4, -1)$ and AC is parallel to the x-axis.

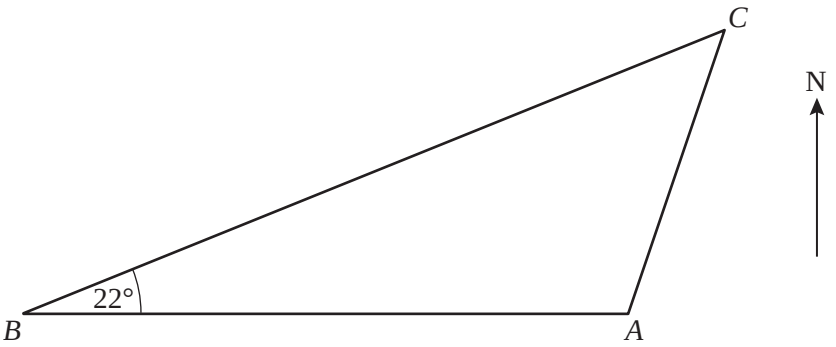
(a) The equation of BC is $y + 2x = 4$.
Find the x-coordinate of C.

(b) The equation of AB is $y = x + 3$.
Write down the inequalities which describe the region **inside** the triangle ABC.

Answer (*a*) ..... [1]

(*b*) ..... [2]

15



A, B and C are three ships.
B is due West of A.

(a) Given that $A\hat{B}C = 22°$, write down the bearing of C from B.

(b) By using your protractor, find the bearing of A from C.

Answer (*a*) ..... [1]

(*b*) ..... [2]

---

16 **(a)** Maryam's height is 1.52 m correct to the nearest centimetre.
State the lower bound of her height.

(b) The length of each of Maryam's paces is 0.55 m.
She walks at a constant speed of 2 paces per second.
Calculate the distance, in kilometres, that she walks in one hour.

Answer (*a*) ..... [1]

(*b*) ..... km [2]

---

17 Solve the equation $\frac{4}{x+3} = \frac{x-1}{3}$.

Answer ..... [3]

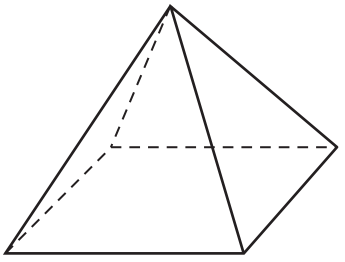
---

18 The base of a pyramid is a square with diagonals of length 6 cm.

The sloping faces are isosceles triangles with equal sides of length 7 cm.

The height of the pyramid is $\sqrt{l}$ cm.

Calculate l.



Answer l = ... [3]

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19 (a)

Calculate the percentage reduction in the price of the camera.

Answer (*a*) ..... % [2]

(b) Matthew invested $500 at 6% simple interest per year.
Calculate how much interest had been earned after 8 months.

Answer (*b*) $ ..... [2]

20 The diagram in the answer space is a map showing a section of coastline and a beacon on land. Fishing boats can only operate when they are

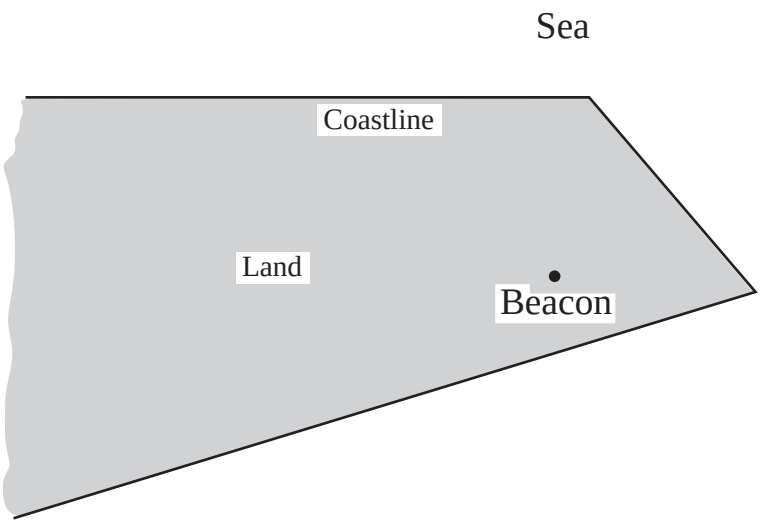
I not more than 6.5 km from the beacon,

II at least 2 km from the coastline.

The scale of the map is 1 cm to 1 km.

Construct the boundaries of the region where fishing can take place.
Label this region *F*.

Answer



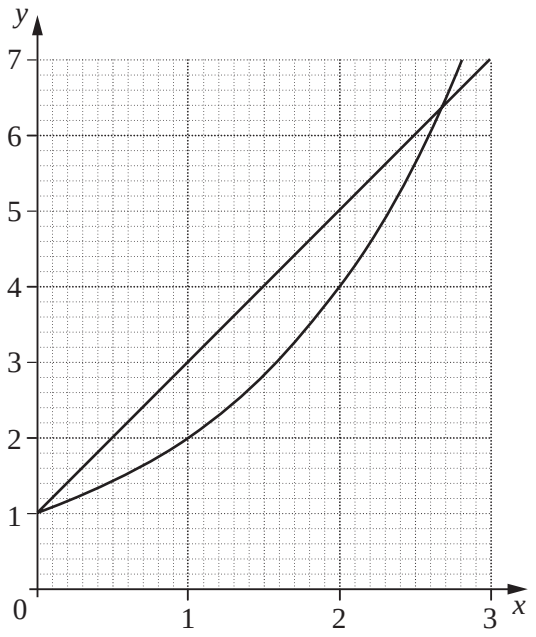
[4]

21 **(a)** The diagram shows the graphs of

$y = 2^x$ and
$y = 2x + 1$.

(i) State the gradient of the line $y = 2x + 1$.

(ii) Find the value of x such that $x > 0$ and $2x + 1 = 2^x$.



Answer (*a*)(i) ..... [1]

(ii) $x =$ ..... [1]

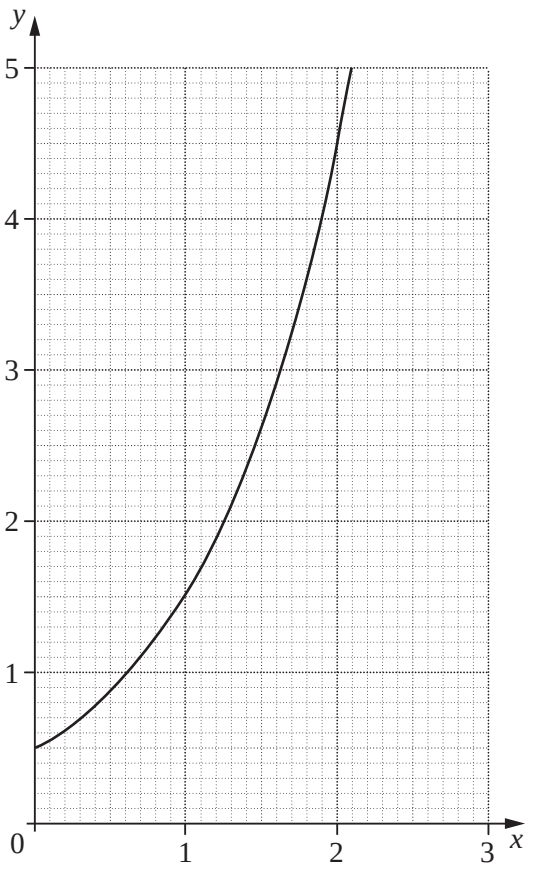
(b) The diagram shows the graph of

$y = ka^x$.

State the value of

(i) k ,

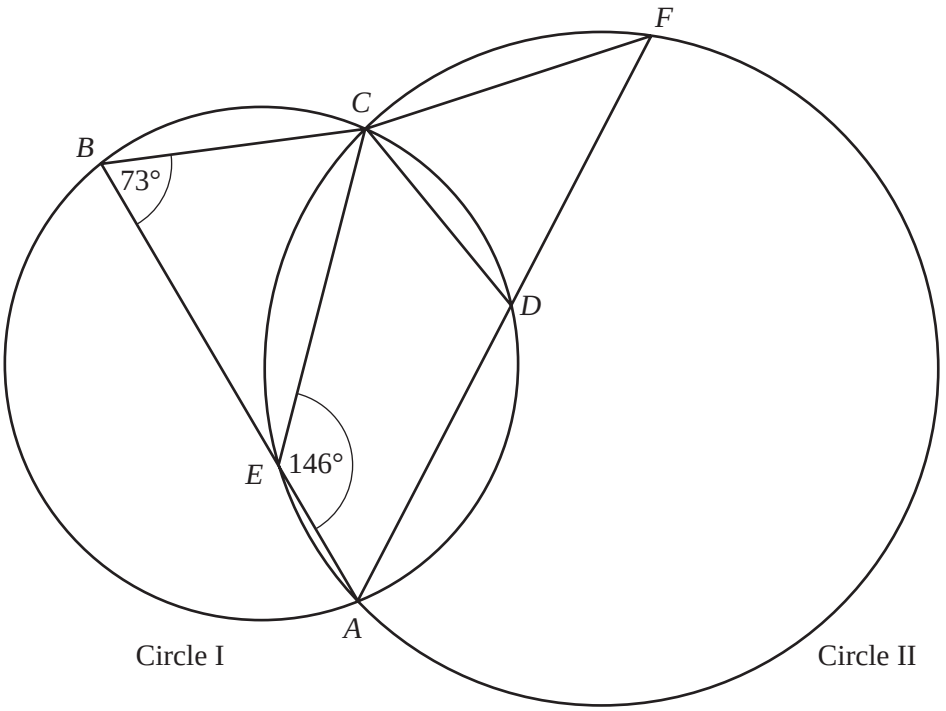
(ii) a.



Answer (*b*)(i) $k =$ ..... [1]

(ii) $a =$ ..... [1]

22



In the diagram, the points *A*, *B*, *C* and *D* lie on circle I.
The points *A*, *E*, *C* and *F* lie on circle II.
AEB and *ADF* are straight lines.
$E\hat{B}C = 73°$ and $A\hat{E}C = 146°$.

(a) Calculate

(i) $A\hat{D}C$,

(ii) $C\hat{F}A$.

(b) Explain why the centre of circle I lies on circle II.

Answer (*a*)(i) ..... [1]

(ii) ..... [1]

(*b*) .....

..... [2]

23 **(a)** Factorise completely $5a^2 - 20$.

Answer (*a*) ..... [2]

(b) A formula connecting x and y is $y = \frac{k}{x^3}$, where k is a constant.

Given that $y = -1$ when $x = 2$, calculate the value of

(i) k,

(ii) x when $y = 64$.

Answer (*b*)(i) $k =$ ..... [1]

(ii) $x =$ ..... [1]

24 A man who is 1.8 m tall stands on horizontal ground 50 m from a vertical tree.
The angle of elevation of the top of the tree from his eyes is 30°.
Use as much of the information below as is necessary to calculate an estimate of the height of the tree.
Give the answer to a reasonable degree of accuracy.

[sin 30° = 0.5 , cos 30° = 0.866 , tan 30° = 0.577]

Answer ..... m [4]

25 **(a)** **(i)** Express 7056 as the product of its prime factors.

(ii) Hence evaluate $\sqrt{7056}$.

Answer (*a*)(i) ..... [2]

(ii) ..... [1]

(b) $\sqrt{5\frac{1}{16}}$ can be expressed as the rational number $\frac{p}{q}$ where p and q are integers.

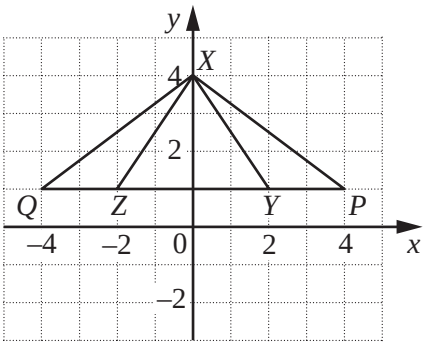
Find the value of p and the value of q.

Answer (*b*) p = ... , q = ... [1]

(c) Write down an example of an irrational number.

Answer (*c*) ..... [1]

26 **(a)** Describe fully the single transformation that maps ΔXYZ onto ΔXPQ.



Answer (*a*) .....

..... [2]

(b) The diagram in the answer space shows ΔABC and the point B' (9 , 2).

(i) A translation maps B onto B'.
Write down the column vector that represents this translation.

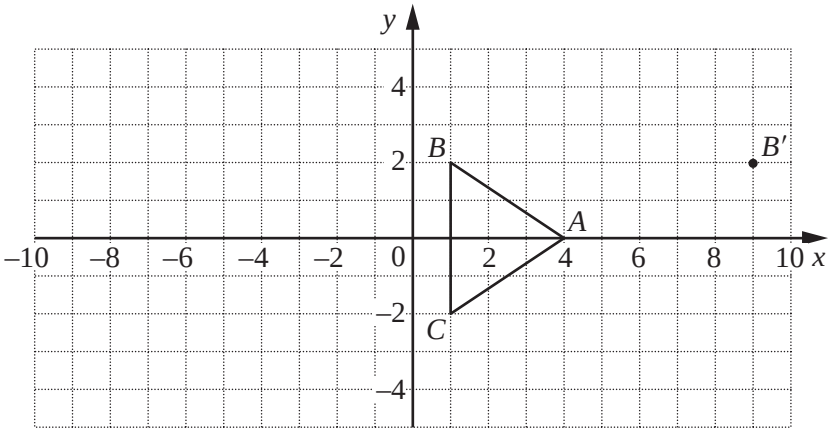
Answer (*b*)(i) ..... [1]

(ii) A shear in which the x-axis is invariant maps ΔABC onto $\Delta A'B'C'$.

(a) Draw $\Delta A'B'C'$ on the diagram in the answer space.

(b) State the shear factor.

Answer (*b*)(ii)*(a)*



[2]

Answer (*b*)(ii)*(b)* ..... [1]