Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

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

Paper 1

May/June 2003

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.

For Examiner's Use

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.

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

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[Turn over

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

1 **(a)** Express 0.03 as a fraction.

(b) Express \$150 as a percentage of \$500.

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

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

---

2 **(a)** Evaluate $\frac{7}{8} - \frac{7}{10}$, giving your answer as a fraction in its lowest terms.

(b) Evaluate $2\frac{1}{3} \times 3\frac{1}{2}$, giving your answer as a mixed number.

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

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

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3 Evaluate

(a) $24 \div 6 + 2 \times 9$,

(b) 0.4×0.02 .

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

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

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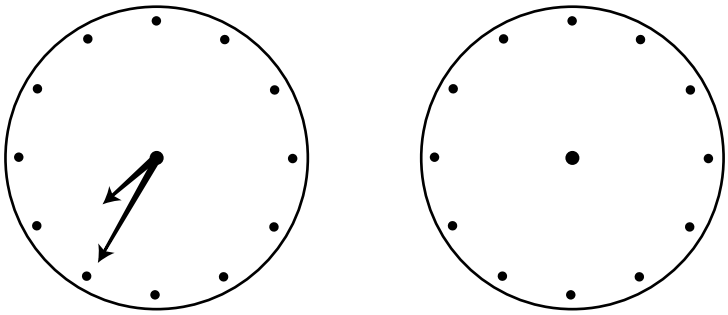
4 Local time in Singapore is 11 hours ahead of Trinidad.

(a) Look at the two clocks in the answer space.
One shows the local time in Singapore.
Show the local time in Trinidad on the other clock.

Answer (*a*)



Singapore Trinidad [1]

(b) It is 9.15 a.m. in Trinidad.
Using the 24 hour clock, write down the local time in Singapore.

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

---

5 **(a)** Factorise $x^2 - 7x + 12$.

(b) Solve $(x + 1)(3x - 2) = 0$.

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

(*b*) x = ... or ..... [1]

---

6 **(a)** Express 99 as the product of its prime factors.

(b) Find the smallest possible integer value of n for which $99n$ is a multiple of 24.

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

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

---

7 **(a)** It is given that $5^{-2} \times 5^{k} = 1$.
Write down the value of k.

(b) It is given that $\sqrt[3]{7} = 7^{m}$.
Write down the value of m.

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

(*b*) $m =$ ..... [1]

---

8 **(a)** Add together 37 kilograms and 40 grams.
Give your answer in kilograms.

(b) The length of a piece of string is 0.026 metres, correct to the nearest millimetre.
Write down, in millimetres, the lower bound of this length.

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

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

---

9 $p = 3.2 \times 10^{11}$ and $q = 8 \times 10^{-4}$.
Expressing your answers in standard form, evaluate

(a) q^2,

(b) $p \div q$.

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

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

---

10 $\mathbf{a} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} u \\ 10 \end{pmatrix}$.

(a) Express $2\mathbf{a} + \mathbf{b}$ as a column vector.

(b) Given that the vector **c** is parallel to the vector **a**, calculate the value of u.

Answer (*a*) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(*b*) $u =$..... [1]

---

11 Solve the simultaneous equations

$$4x - y = 9,$$
$$2x - 3y = -23.$$

Answer $x =$ .....

$y =$..... [3]

---

12 Five items bought at a shop are shown on the receipt.

The part showing the cost of the apples is missing.

Apples	
Roll	1.35
Mineral water	1.20
Cheese	1.64
Tomatoes	1.20
Total	$ 5.90

(a) How much did the apples cost?

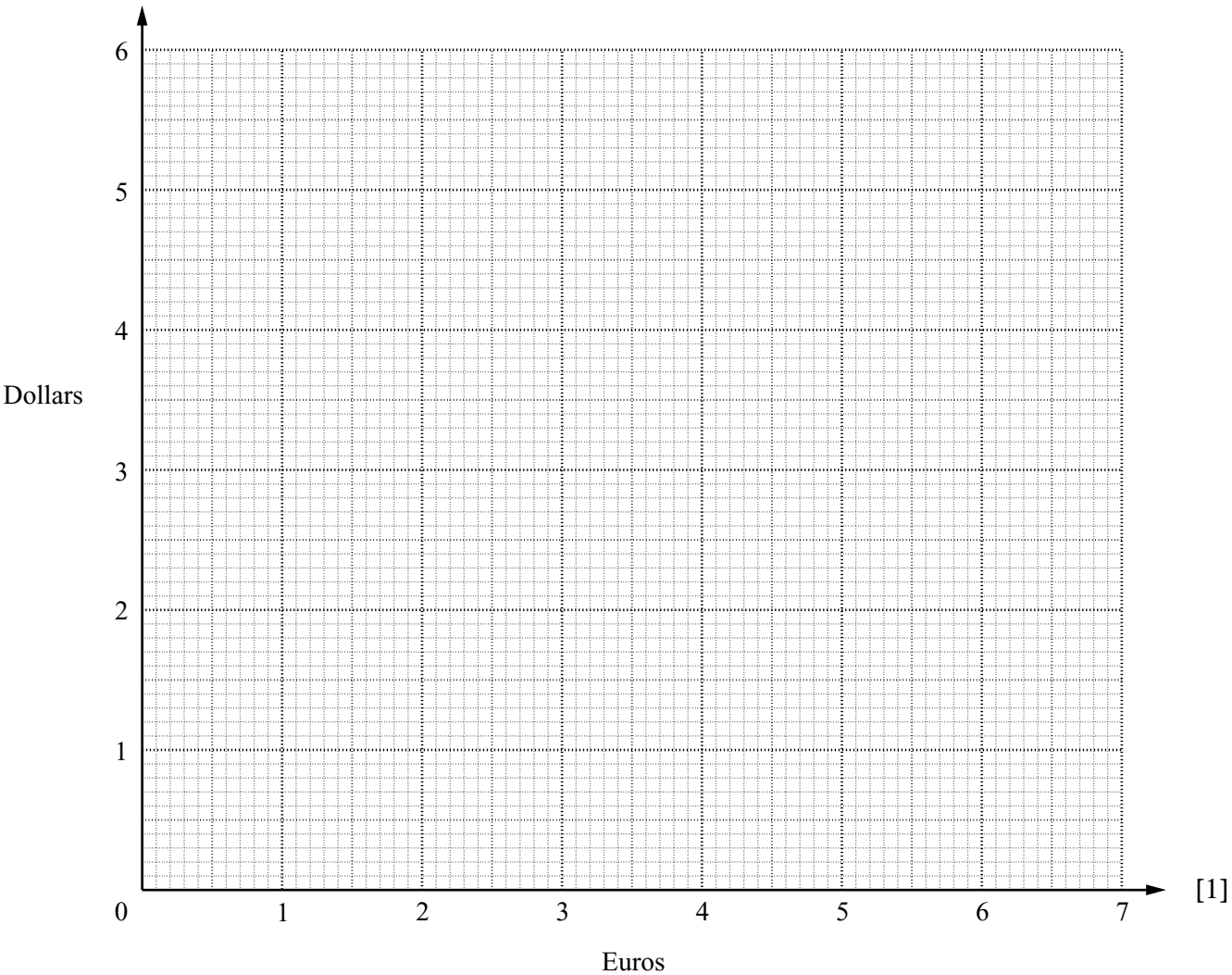
Answer (*a*) $..... [1]

(b) The total cost of $5.90 when converted to euros is 6.80 euros.

(i) Using these totals, draw a graph on the axes in the answer space which will enable you to convert dollars ($) to euros.

(ii) Use your graph to estimate the cost of the mineral water in euros.

Answer (*b*)(i)



[1]

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

13 **(a)** Solve the equation $\frac{5}{x+1} = 4$.

(b) Solve the inequality $7 - y < 9$.

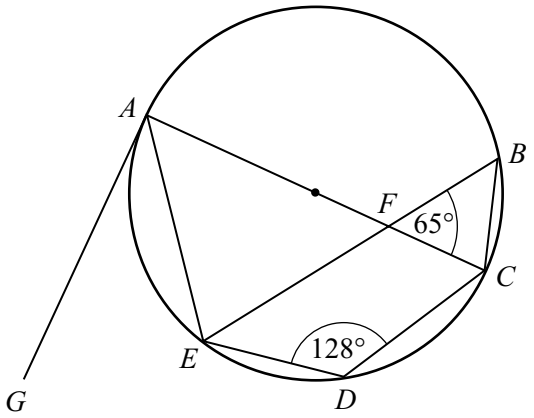
(c) Write down the least integer value of z for which $z > -4$.

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

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

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

14



The points A, B, C, D and E lie on the circle with diameter AC.
EB and AC meet at F.
GA is a tangent to the circle at A.
$C\hat{D}E = 128°$ and $B\hat{F}C = 65°$.
Calculate

(a) $G\hat{A}E$,

(b) $A\hat{E}B$.

Answer (*a*) $G\hat{A}E =$ ..... [2]

(*b*) $A\hat{E}B =$ ..... [1]

---

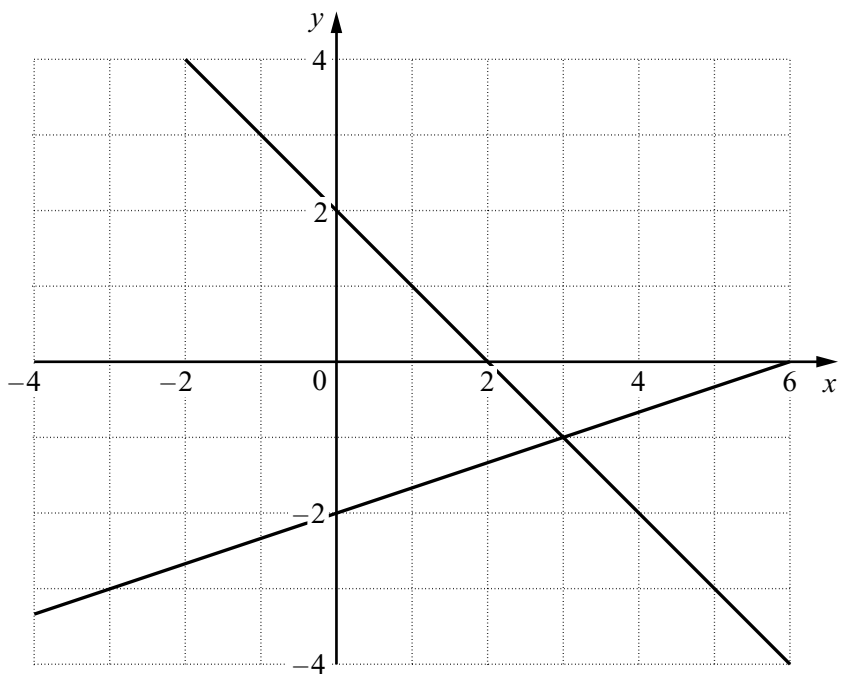
15 The lines $x + y = 2$ and $x - 3y = 6$ are shown on the diagram in the answer space.

(a) Find the gradient of the line $x - 3y = 6$.

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

(b) On the diagram in the answer space, shade the region defined by the inequalities $x + y \leqslant 2$, $x - 3y \leqslant 6$ and $x + 1 \geqslant 0$.

Answer (*b*)



[2]

16 **(a)** State the order of rotational symmetry of a regular decagon.

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

(b) Write down those letters of the word AMBULANCE which have a vertical axis of symmetry.

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

(c) *A* and *B* are two points in space which are 10 cm apart.
Describe fully the locus of points in three dimensions that are 3 cm from the line which starts at *A* and ends at *B*.

Answer (*c*).....

.....[2]

---

17 A function is defined by $f(x) = 3x + 4$.

(a) Given that $f(k) = k$, find k.

(b) Find the inverse of f.

Answer (*a*) $k =$ ..... [2]

(*b*) $f^{-1}(x) =$ ..... [2]

---

18 **(a)** In a group of language students,
24 studied Spanish, 23 studied French and 15 studied German,
12 studied Spanish and French,
10 studied German and French,
6 studied Spanish and German,
4 studied all three languages.
By drawing a Venn diagram, or otherwise, calculate the number of students who studied

(i) both Spanish and French, but not German,

(ii) only one language.

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

(ii) ..... [1]

(b) The set A consists of the points whose coordinates (x, y) are given by $A = \{(x, y) : y = 2x + 1\}$.
The points in set B are given by $B = \{(0, 0), (0, 1), (1, 2), (2, 5), (3, 6)\}$.

Find

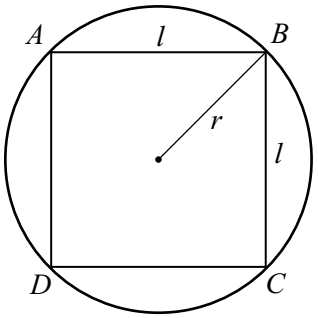
(i) $n(B)$,

(ii) $A \cap B$.

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

(ii) {.....} [1]

19 The vertices of the square *ABCD* lie on a circle of radius *r* cm.



(a) Show that the length, *l* cm, of a side of the square is $r\sqrt{2}$ cm.

(b) By comparing the perimeter of the square and the circumference of the circle, or otherwise, show that $\sqrt{2} < \frac{\pi}{2}$.

(c) What special kind of numbers are $\sqrt{2}$ and π?

Answer (*a*) .....

.....

..... [1]

(*b*).....

.....

..... [2]

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

---

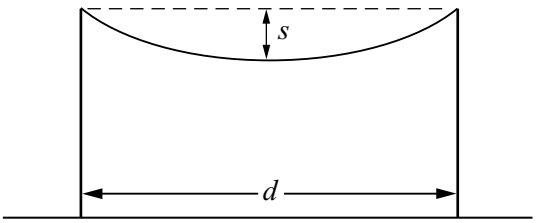
20 **(a)** Expand and simplify $(x - 1)(x^2 + x + 1)$.

(b) Factorise $ax - bx - 3ay + 3by$.

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

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

21



Two vertical posts of the same height stand on horizontal ground.
The distance between the posts is d centimetres.
When a wire of length w centimetres is suspended between the posts, the sag in the middle is s centimetres.

The sag is given by the formula $s = \sqrt{\dfrac{3d(w-d)}{8}}$.

(a) Find s when $d = 800$ and $w = 803$.

(b) Express w in terms of d and s.

Answer (*a*) $s =$ ..... [1]

(*b*) $w =$ ..... [3]

22 It is given that $\sin 30° = 0.5$ and $\cos 30° = 0.866$.

(a) Write down the value of

(i) $\cos 150°$,

(ii) $\cos 60°$.

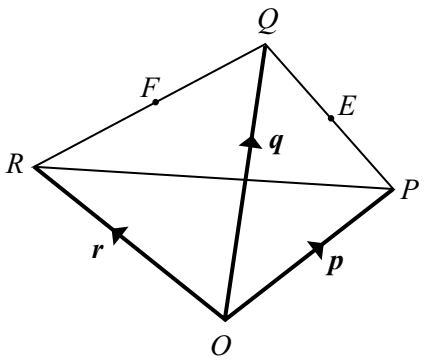
(b) A triangle has sides of length 6 cm and 5 cm.
The angle between these two sides is 150°.
Calculate the area of the triangle.

Answer (*a*)(i) $\cos 150°$ = ... [1]

(ii) $\cos 60°$ = ... [1]

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

23



In the diagram,

$\overrightarrow{OP} = \mathbf{p}$, $\overrightarrow{OQ} = \mathbf{q}$ and $\overrightarrow{OR} = \mathbf{r}$.

The midpoints of PQ and QR are E and F, respectively.

(a) Express, as simply as possible, in terms of **p** and/or **q**,

(i) $\overrightarrow{PE}$,

(ii) $\overrightarrow{OE}$.

(b) Hence write down $\overrightarrow{OF}$.

(c) Find $\overrightarrow{EF}$.

(d) Write down two facts about EF and PR.

Answer (*a*)(i) $\overrightarrow{PE}$ = ... [1]

(ii) $\overrightarrow{OE}$ = ... [1]

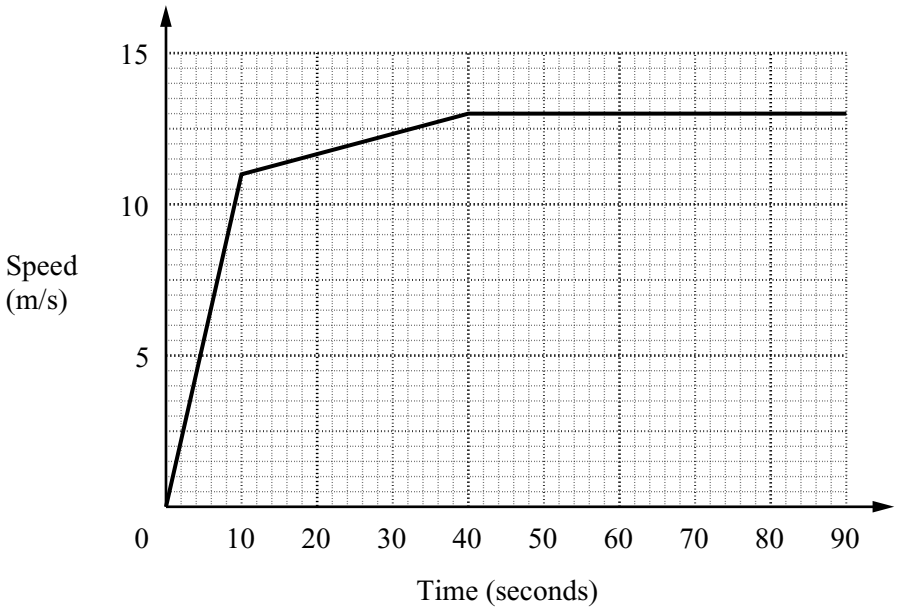
(*b*) $\overrightarrow{OF}$ = ... [1]

(*c*) $\overrightarrow{EF}$ = ... [1]

(*d*) .....

..... [1]

24



The speed–time graph shows the performance of a cyclist during the first 90 seconds of a race.

(a) Calculate the acceleration of the cyclist during the first 10 seconds.

(b) Calculate the distance, in metres, travelled by the cyclist in the first 90 seconds.

(c) Calculate the time taken for the cyclist to travel 1 kilometre.

Answer (*a*)..... m/s^2 [1]

(*b*)..... m [3]

(*c*)..... s [2]

25 The numbers of goals scored in 20 football matches were

5	0	5	4	1	0	5	5	1	3
4	5	0	0	5	5	3	2	5	4

(a) **(i)** Complete the table in the answer space.

(ii) Using the axes in the answer space, represent the information as a bar chart.

(b) State the median.

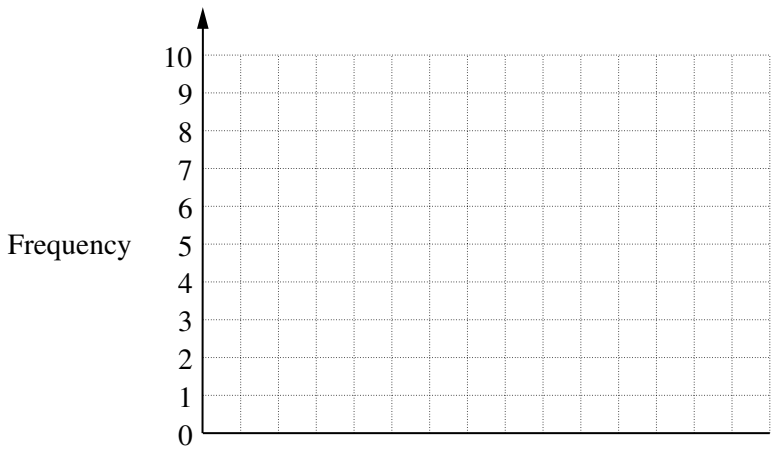
(c) Calculate the mean number of goals.

Answer (*a*)(i)

Number of goals		Frequency
0		
1		
2		
3		
4		
5		

[1]

Answer (*a*)(ii)



[2]

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

(*c*)..... [2]