



# Cambridge O Level

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**MATHEMATICS (SYLLABUS D)**

**4024/12**

Paper 1

**May/June 2022**

**2 hours**

You must answer on the question paper.

You will need: Geometrical instruments

## INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary working clearly.

## INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

## ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER

1 Work out.

(a)  $\frac{2}{3} + \frac{1}{6}$

..... [1]

(b)  $0.4 \times 0.2$

..... [1]

2 Asha asks a group of students about their favourite fruit.  
The table and pictogram show some of the results.

Fruit	Apple	Banana	Orange	Melon
Frequency	8		5	

Apple	
Banana	○ ○ ○
Orange	
Melon	○ ◐

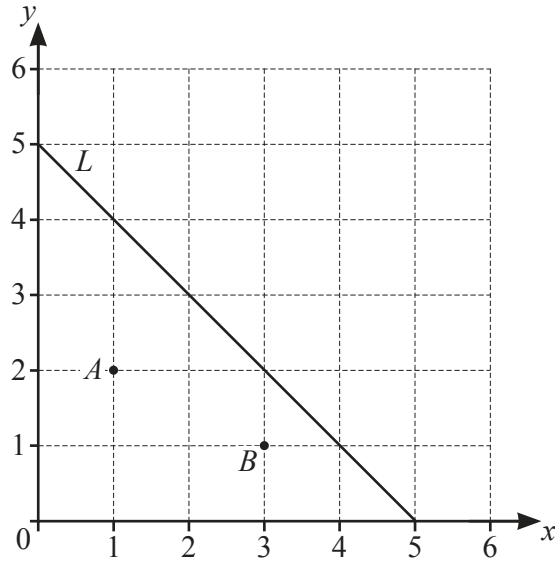
Key: ○ represents 4 people

(a) Complete the table and pictogram. [3]

(b) Write down the mode.

..... [1]

3



$A$  and  $B$  are vertices of a quadrilateral.  
Line  $L$  is the line of symmetry of the quadrilateral.

Find the coordinates of the other two vertices of the quadrilateral.

(..... , ..... ) and (..... , ..... ) [2]

- 4 (a) The temperature inside Luke’s house is  $18^{\circ}\text{C}$ .  
The temperature outside his house is  $-3^{\circ}\text{C}$ .

Find the difference between these temperatures.

.....  $^{\circ}\text{C}$  [1]

- (b) Luke’s thermometer measures the temperature correct to the nearest degree.  
At midnight, the thermometer measures the temperature outside as  $-6^{\circ}\text{C}$ .

Find the upper bound of the temperature outside at midnight.

.....  $^{\circ}\text{C}$  [1]

- 5 The scale drawing shows the positions of two villages, *A* and *B*.  
The scale is 1 cm to 2 km.



**Scale: 1 cm to 2 km**

- (a) Find the actual distance between village *A* and village *B*.

..... km [2]

- (b) Measure the bearing of *B* from *A*.

..... [1]

- 6 Kabir invests \$250 in a savings account.  
The account pays simple interest at a rate of 1.5% per year.

Calculate the total amount of interest he will receive at the end of 4 years.

\$ ..... [2]

7

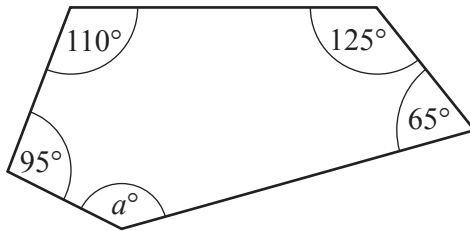
NOT TO  
SCALE

The area of the rectangle is  $9 \text{ cm}^2$ .  
The area of the triangle is  $85 \text{ mm}^2$ .

Calculate the shaded area.  
Give your answer in  $\text{cm}^2$ .

.....  $\text{cm}^2$  [2]

8

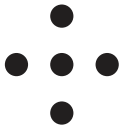
NOT TO  
SCALE

The diagram shows a pentagon.

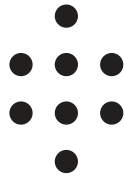
Find the value of  $a$ .

$a =$  ..... [3]

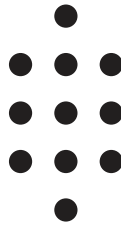
- 9 Shani makes a sequence of patterns using counters.



Pattern 1



Pattern 2



Pattern 3

- (a) Complete the table.

Pattern number	1	2	3	4	5
Number of counters	5	8	11		

[1]

- (b) Find an expression, in terms of  $n$ , for the number of counters in Pattern  $n$ .

..... [2]

- (c) Shani has 100 counters.  
She uses some of the counters to make Pattern 20.  
She uses all the remaining counters to make Pattern  $k$ .

Find the value of  $k$ .

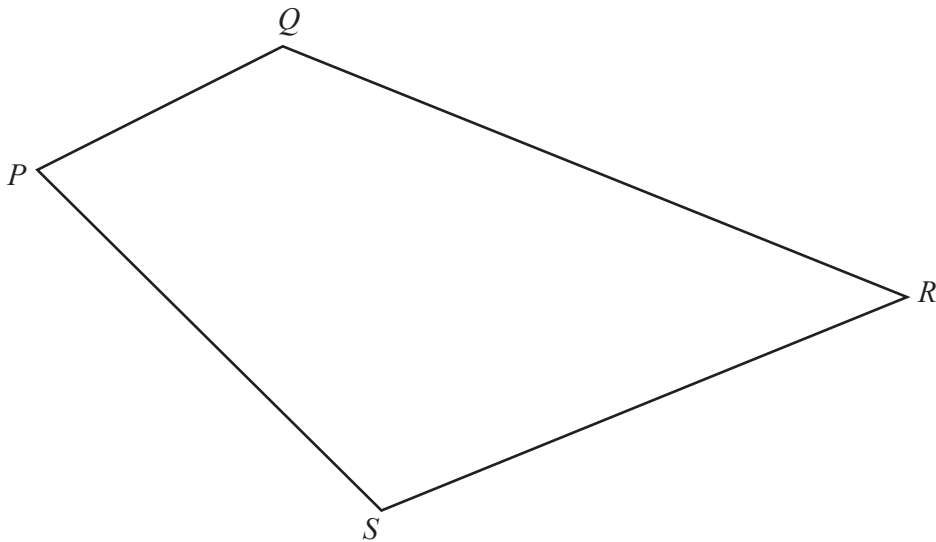
$k =$  ..... [3]

- 10 A bag contains red balls, blue balls and green balls.  
 The ratio red : blue = 3 : 8 .  
 The ratio green : blue = 2 : 5 .

Work out the fraction of the balls that are blue.

..... [3]

11



- (a) Use a **straight edge and compasses only** to construct the bisector of angle  $PSR$ . [2]
- (b) Point  $X$  lies inside quadrilateral  $PQRS$  and is closer to  $PS$  than to  $RS$ .  
 Shade the region in which  $X$  must lie. [1]

12 (a) Write 0.002 035 61 correct to 3 significant figures.

..... [1]

(b) By writing each number correct to 1 significant figure, estimate the value of

$$\frac{\sqrt{3.93} \times 63.7}{0.425}$$

..... [2]

13 (a) Evaluate  $(\sqrt{9} \times \sqrt[3]{64})^2$ .

..... [2]

(b) Write down an irrational value of  $n$  that satisfies this inequality.

$$4.5 \leq n \leq 5.5$$

..... [1]



- 14 (a) Write these numbers in order of size, starting with the smallest.

2000      0.002       $2 \times 10^{-4}$        $2 \times 10^{-2}$

....., ....., ....., ..... [1]  
*smallest*

- (b) This is a calculation using numbers in standard form.

$$a \times 10^{-7} \div 5 \times 10^b = 4 \times 10^{-16}$$

Find the value of  $a$  and the value of  $b$ .

$a =$  .....

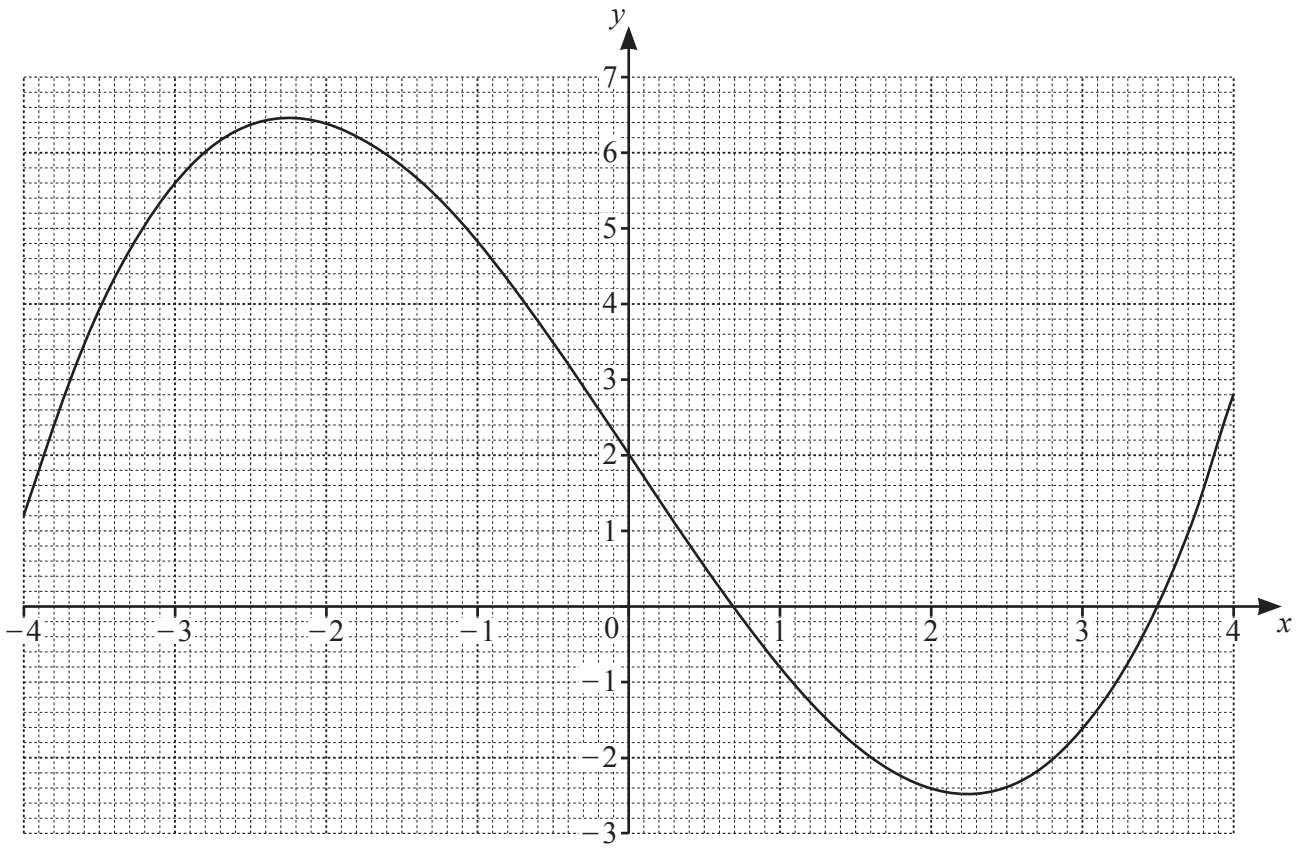
$b =$  ..... [2]

- 15  $y$  is directly proportional to  $(x-1)^2$ .  
 When  $x = 5$ ,  $y = 32$ .

Find the value of  $y$  when  $x = -2$ .

$y =$  ..... [2]

16 The graph of  $y = \frac{x^3}{5} - 3x + 2$  is drawn on the grid.



(a) By drawing a tangent, estimate the gradient of the curve at  $x = -1$ .

..... [2]

(b) By drawing a suitable straight line on the graph, find the solutions of the equation  $\frac{x^3}{5} - 3x = 0$ .

..... [3]

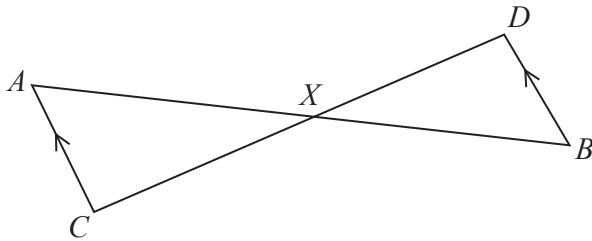
17 (a) Ryan says:

Each diagonal of quadrilateral  $Q$  divides it into two congruent isosceles triangles.

Draw a ring around each of the quadrilaterals in the list for which Ryan's statement is always true.

Square    Rectangle    Rhombus    Parallelogram    Trapezium    Kite    [1]

(b)



NOT TO SCALE

$AXB$  and  $CXD$  are straight lines.  
 $X$  is the midpoint of  $AB$ .  
 $AC$  is parallel to  $DB$ .

Show that triangle  $AXC$  is congruent to triangle  $BXD$ .  
 Give a reason for each statement you make.

.....

.....

.....

.....

[3]

18  $f(x) = 3x - 7$

Find  $f^{-1}(x)$ .

$f^{-1}(x) = \dots\dots\dots$  [2]

- 19 (a)  $\mathcal{U} = \{a, b, c, d, e, f, g, h, i, j\}$   
 $P = \{a, e, i\}$   
 $Q = \{f, g, h, i, j\}$   
 $R = \{c, d, e, f, g\}$

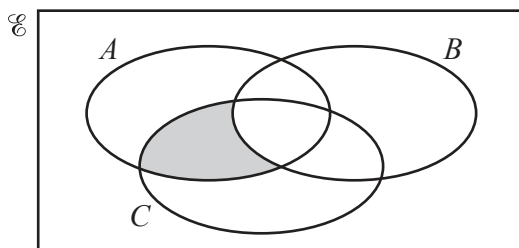
(i) Find  $P \cup Q$ .

$\dots\dots\dots$  [1]

(ii) Find  $n(P' \cap (Q \cup R))$ .

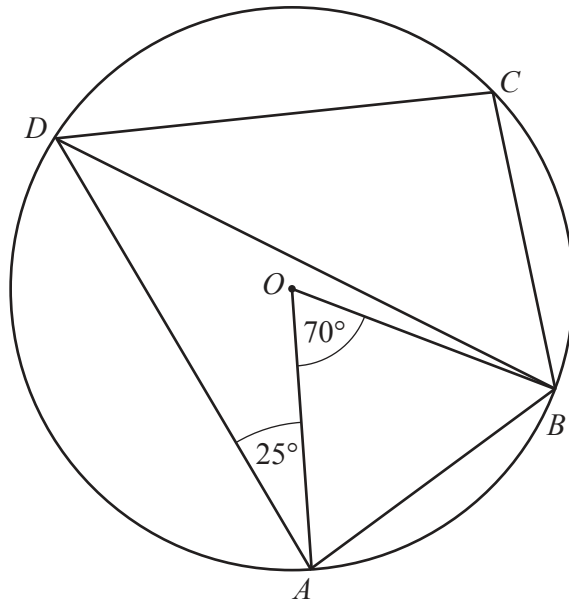
$\dots\dots\dots$  [1]

(b)



Use set notation to describe the shaded subset in the Venn diagram.

$\dots\dots\dots$  [1]



NOT TO SCALE

$A$ ,  $B$ ,  $C$  and  $D$  are points on the circle, centre  $O$ .

(a) Find  $\hat{A}DB$ .

$\hat{A}DB = \dots\dots\dots [1]$

(b) Find  $\hat{B}CD$ .

$\hat{B}CD = \dots\dots\dots [2]$

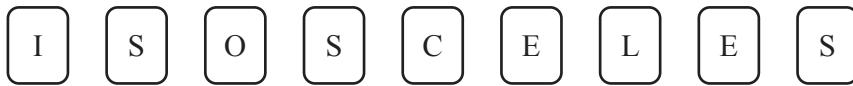
21 (a) Factorise  $4x^2 + 5x - 6$ .

..... [2]

(b) Simplify  $\left(\frac{16}{x^6}\right)^{-\frac{1}{2}}$ .

..... [2]

22 A bag contains these 9 letter tiles.



(a) Nur takes one tile from the bag at random.  
She notes the letter and then puts the tile back in the bag.

Find the probability that she does **not** take a letter E.

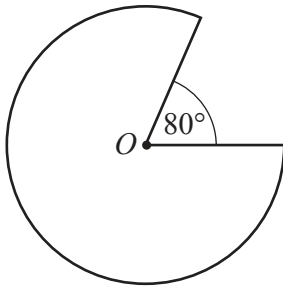
..... [1]

(b) Nur now takes two of the 9 letter tiles at random without replacement.

Find the probability that both tiles show the same letter.

..... [3]

23



NOT TO  
SCALE

The diagram shows the major sector of a circle with centre  $O$  and radius 3 cm.

Calculate the area of this sector.

Give your answer in the form  $k\pi$ , where  $k$  is an integer.

.....  $\text{cm}^2$  [2]

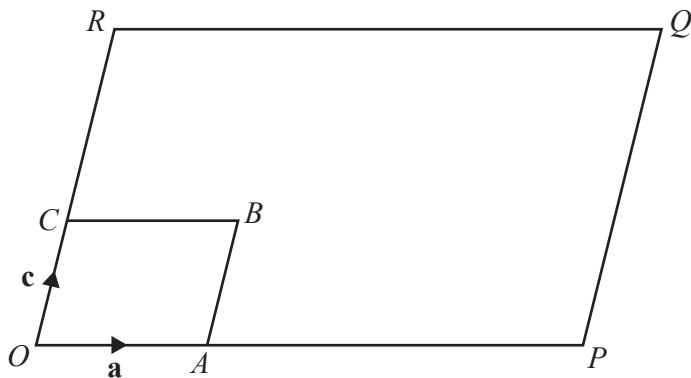
24 (a) Solve  $\frac{2-5x}{3x+10} = 3$ .

$x =$  ..... [3]

(b) Express as a single fraction in its simplest form  $\frac{3}{x-2} - \frac{5}{2x+1}$ .

..... [3]

**Question 25 is printed on the next page.**



NOT TO SCALE

$OABC$  and  $OPQR$  are parallelograms.  
 $A$  is a point on  $OP$  and  $C$  is a point on  $OR$ .  
 $\vec{OA} = \mathbf{a}$  and  $\vec{OC} = \mathbf{c}$ .  
 $OA : OP = 1 : 4$  and  $OC : CR = 2 : 3$ .

(a) Find  $\vec{OR}$  in terms of  $\mathbf{c}$ .

$\vec{OR} = \dots\dots\dots [1]$

(b) Find  $\vec{CQ}$ , as simply as possible, in terms of  $\mathbf{a}$  and  $\mathbf{c}$ .

$\vec{CQ} = \dots\dots\dots [2]$

(c) Find the ratio area  $OABC$  : area  $OPQR$ .

$\dots\dots\dots : \dots\dots\dots [1]$

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