Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER				

MATHEMATICS (US) **0444/31**

Paper 3 (Core) **May/June 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 104.

Write your calculator model in the box below.

This document consists of **19** printed pages and **1** blank page.

CAMBRIDGE International Examinations

Formula List

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle, radius r.	$A = \pi r^2$
Circumference, C, of circle, radius r.	$C = 2\pi r$
Lateral surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$

1 Eduardo goes to the Theater.
He leaves his house at twenty-five minutes to six in the evening.

(a) Write down this time using the 24-hour clock.

..... [1]

(b) He travels to the Theater by bus.
Part of the timetable is shown below.

Belmont Road	1740	1815	1850
Railway Station	1747	1820	1857
Leisure Center	1759	1834	1907
Theater	1805	1840	1912
Bus Station	1816	1848	1922

It takes Eduardo 16 minutes to walk to the Railway Station from his house.

(i) Find the time he arrives at the Railway Station.

..... [1]

(ii) He gets on the next bus to the Theater.

Find the time he arrives at the Theater.

..... [1]

(iii) The 1850 bus from Belmont Road takes the least time to travel to the Bus Station.

Work out how many minutes quicker this journey is than the journey on the 1740 bus.

..... min [2]

(iv) The distance from Belmont Road to the Bus Station is 8.5 km.

Calculate the average speed for the bus leaving Belmont Road at 1740.
Give your answer in kilometers per hour, correct to 1 decimal place.

..... km/h [4]

[Turn over

2 Camilla joins a soccer club.
The total cost of joining is made up of membership, kit and travel.

(a) The ratio membership : kit : travel = 3 : 5 : 6.
The cost of membership is $78.

(i) Show that the total cost of joining is $364.

[1]

(ii) Calculate the cost of the kit and the cost of the travel.

Kit = $ .....

Travel = $ ..... [3]

(b) Camilla's father pays $\frac{10}{13}$ of the $364.
Camilla pays the rest.

Calculate how much she pays.

$ ..... [2]

(c) Camilla's brother joins the soccer club.
He receives a 12% discount on the $364 because he is younger than Camilla.

Calculate the total cost of joining for him.

$ ..... [2]

(d) During the year, Camilla's team played 24 matches.
The table gives some information about the results of these matches.

Played	Won	Drawn	Lost
24	W	6	L

(i) Write down an equation, in terms of W and L, for the number of matches played.

..... [1]

(ii) Points are given when a team wins or draws a match.

The points are

Match won	3 points
Match drawn	1 point
Match lost	0 points.

The team has a total of 54 points.

Write down an equation, in terms of W, for the total points given.

..... [1]

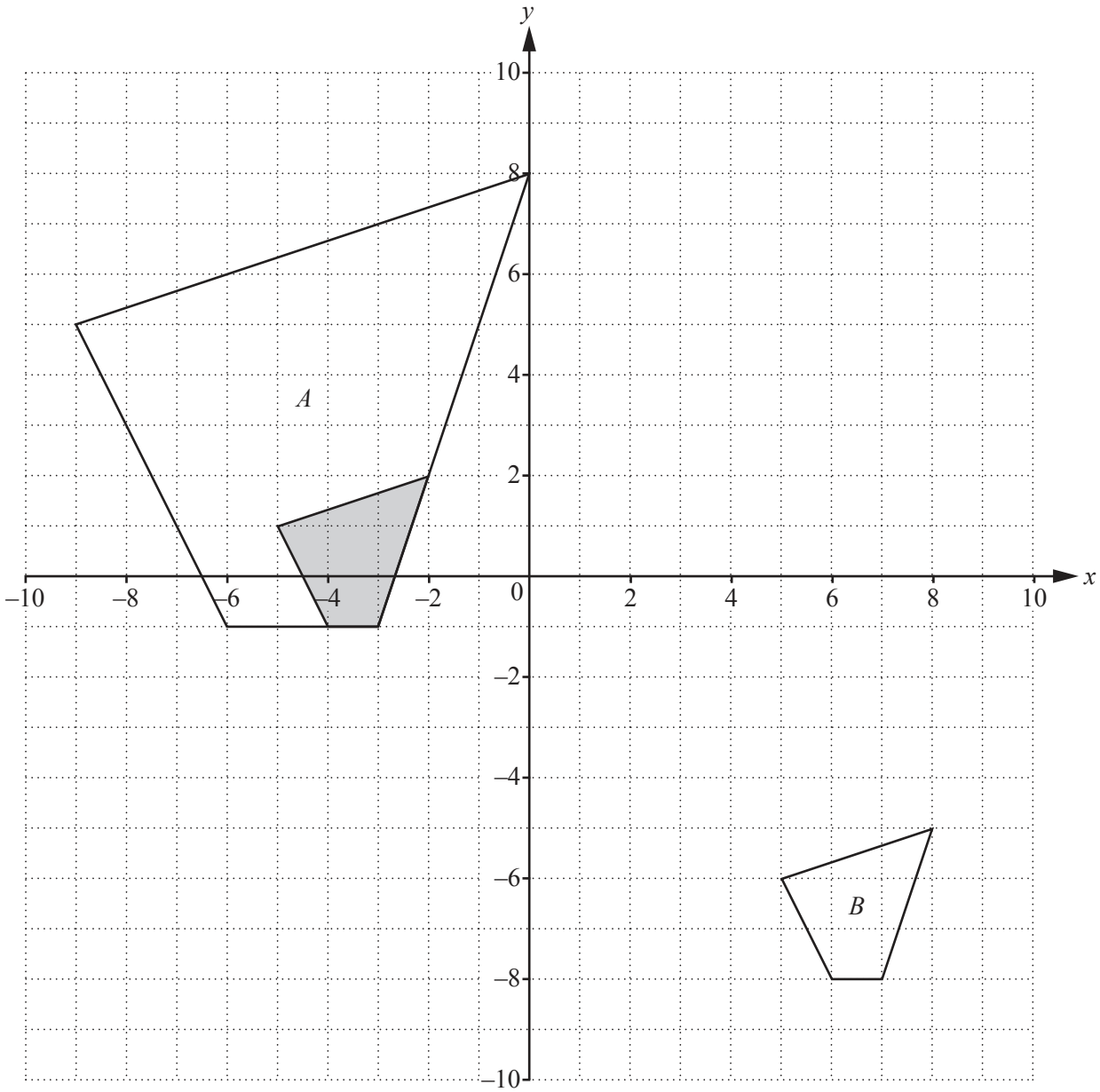
(iii) Work out the value of W and the value of L.

$W =$ .....

$L =$ ..... [3]

[Turn over

3



(a) Write down the mathematical name of the shaded polygon.

..... [1]

(b) Describe fully the **single** transformation that maps the shaded polygon onto polygon *A*.

.....

..... [3]

(c) Describe fully the **single** transformation that maps the shaded polygon onto polygon *B*.

.....

..... [2]

(d) On the grid, draw the reflection of the shaded polygon in the line $x = 2$. [2]

(e) On the grid, draw the rotation of the shaded polygon through 90° counterclockwise about the origin. [2]

4 Francis asks 16 families how many children they have.
The list shows the results.

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

(a) (i) Write down the mode.

..... [1]

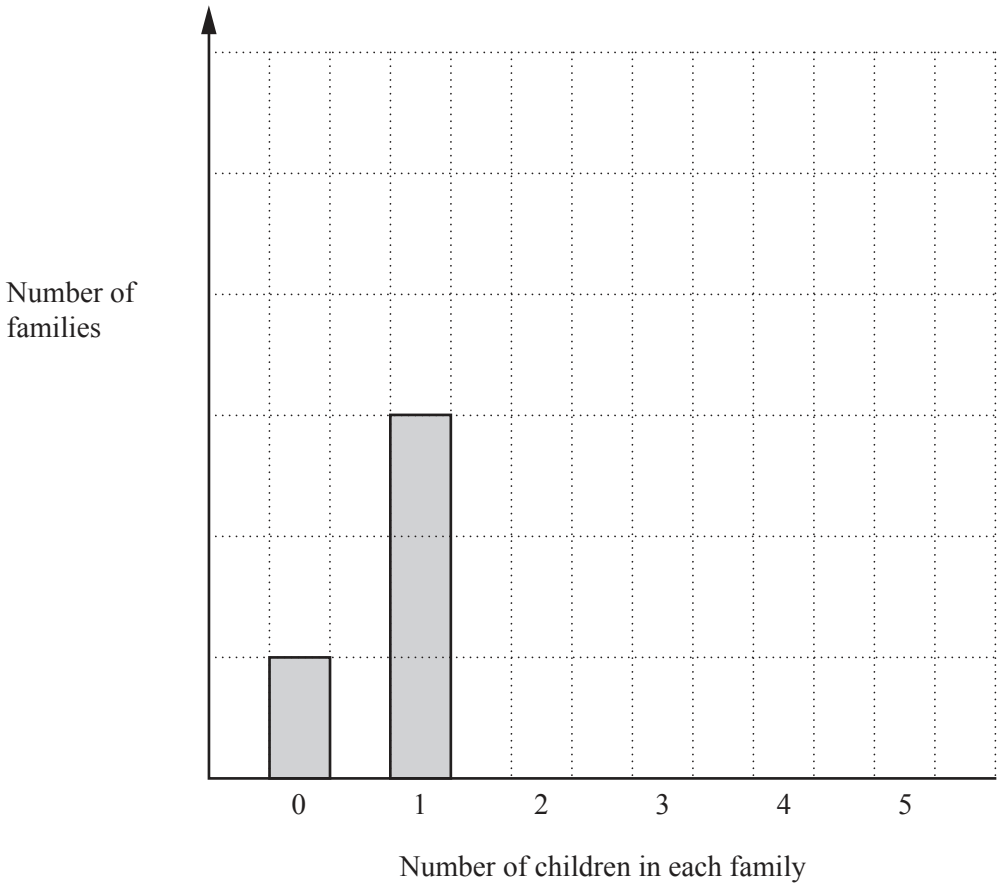
(ii) Find the median.

..... [1]

(iii) Calculate the mean.

..... [3]

(iv) Complete the bar chart, including the vertical scale.



[3]

(b) Francis also recorded the age group and gender of the children aged 12 or less.
The information is shown in the table.

	Age 4 and younger	Age 5 to 8	Age 9 to 12	Total
Male			3	
Female	8			23
Total		18	12	45

Complete the table. [2]

(c) Francis displays the results for the totals of each age group on a pie chart.
The sector angle for the group 'Age 4 and younger' is 120°.

Calculate the sector angle for

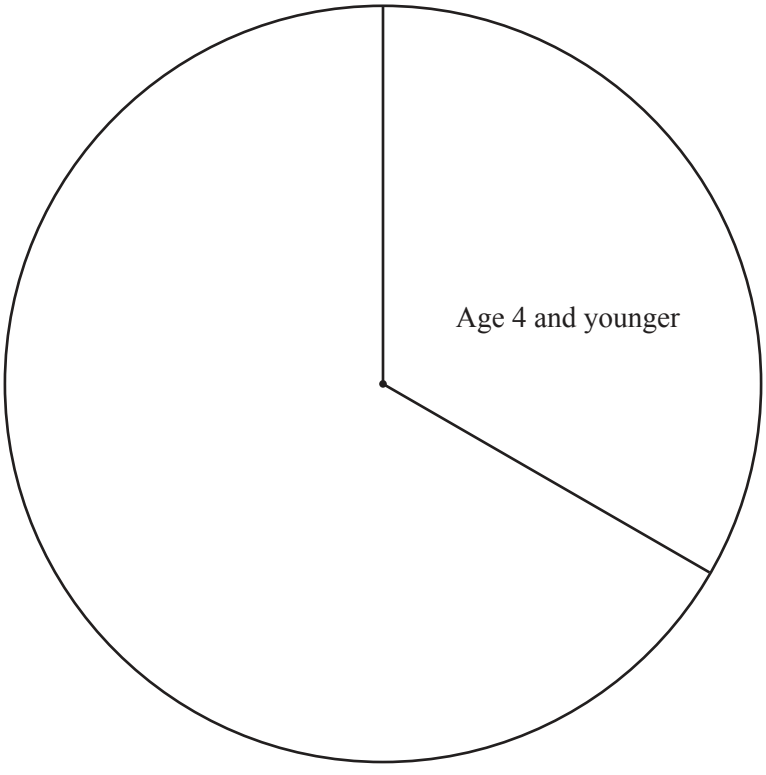
(i) age 5 to 8,

..... [2]

(ii) age 9 to 12.

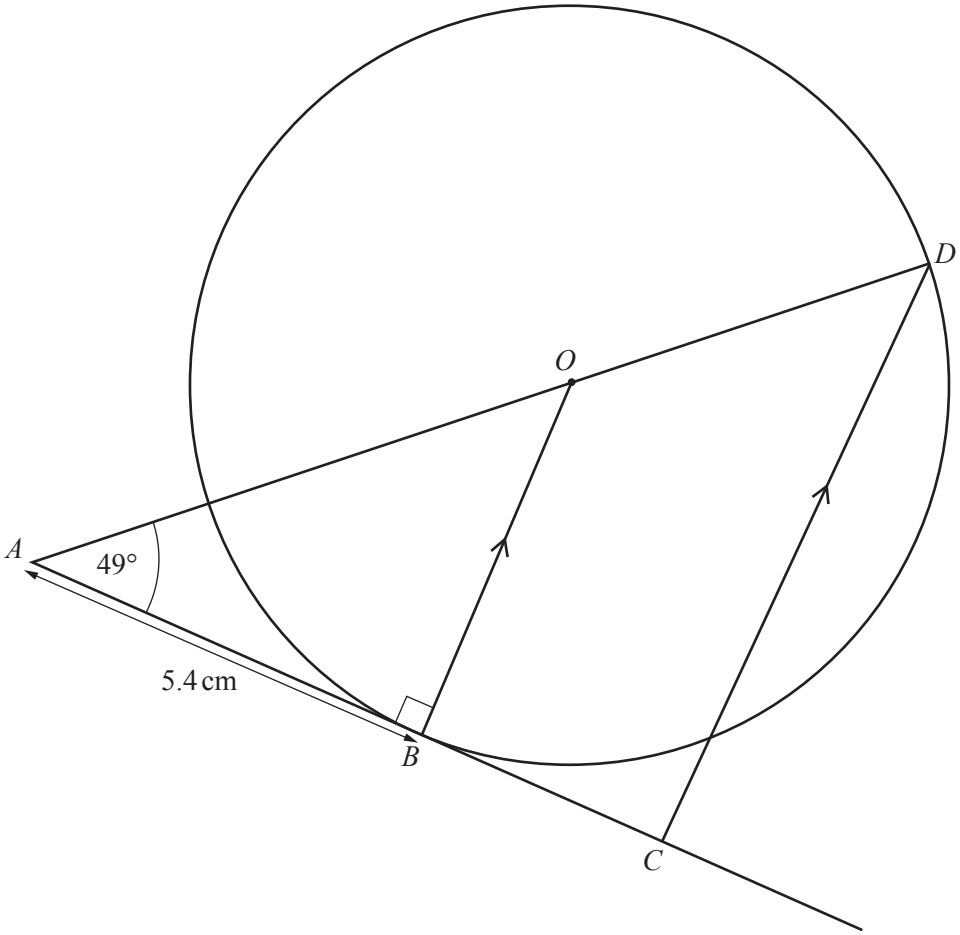
..... [1]

(d) Complete the pie chart.



[1]

5 (a)



The diagram shows a circle, center O, with points B and D on the circumference.
The line AC touches the circle at B.
OB is parallel to DC and angle $OAB = 49°$.

(i) Write down the mathematical name of the line OB.

..... [1]

(ii) Write down the reason why angle ABO is 90°.

.....

..... [1]

(iii) Find angle AOB.

Angle $AOB =$ ..... [1]

(iv) Write down the reason why angle ADC = angle AOB.

..... [1]

(v) Complete the statement using a mathematical word.

Triangle AOB is ..... to triangle ADC. [1]

(vi) $AB = 5.4\,\text{cm}$

Calculate

(a) OB,

$OB =$ ..... cm [2]

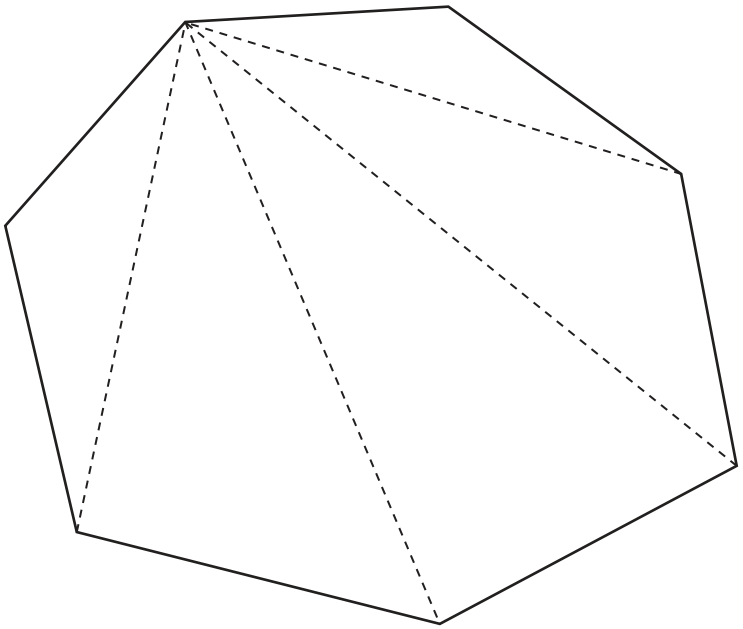
(b) OA,

$OA =$ ..... cm [2]

(c) the area of the circle.

.....cm^2 [2]

(b) Here is a polygon with 7 sides.



Show that the sum of the interior angles of this polygon is 900°.

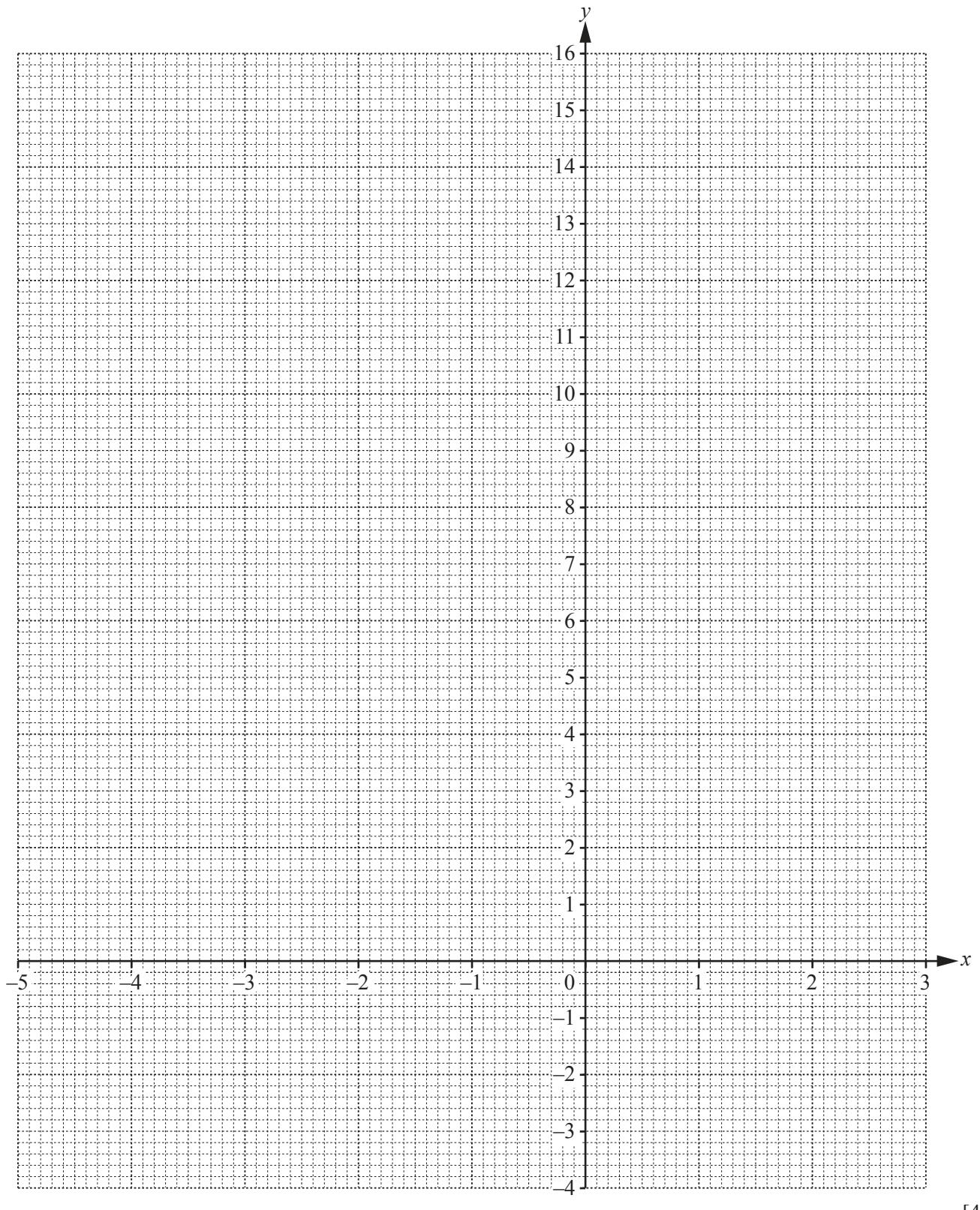
[1]

6 **(a)** Complete the table of values for $y = x^2 + 2x - 1$.

x	−5	−4	−3	−2	−1	0	1	2	3
y	14		2	−1		−1	2		

[3]

(b) On the grid, draw the graph of $y = x^2 + 2x - 1$ for $-5 \leqslant x \leqslant 3$.



[4]

(c) **(i)** On the grid, draw the line of symmetry. [1]

(ii) Write down the equation of the line of symmetry.

..... [1]

(d) **(i)** On the grid, plot the points $(-5, 7)$ and $(0, -3)$ and join them with a straight line, L. [2]

(ii) Write down the x co-ordinate of each point where the line L crosses the graph of $y = x^2 + 2x - 1$.

$x =$ ..... and $x =$ ..... [2]

(iii) Work out the slope of the line L.

..... [2]

7 Francesca owns a business.
One year she has a total of $6000 to spend on rent, furniture and office equipment.

(a) (i) The rent is $400 per month.

Work out how much Francesca spends on rent in this year.

$ ..... [1]

(ii) Desks cost $58.50 each and chairs cost $15 each.
Francesca buys 2 desks and 5 chairs.

Work out how much Francesca spends on furniture.

$ ..... [2]

(iii) Francesca also spends $800 on office equipment.

Work out how much remains of the $6000.

$ ..... [2]

(iv) She spends this remaining amount on boxes of paper.
Paper costs $4.95 per box.

Work out how many boxes she buys.

..... boxes [2]

(b) Francesca needs to buy computer equipment.
She borrows $2000 from a bank for 3 years at a rate of 5% per year compound interest.

Calculate the total amount she pays back at the end of the 3 years.

$ ..... [3]

8 Here is a sequence of diagrams made using identical rectangles.
A dot is shown at the junction of three lines.
A cross is shown at the junction of two lines.

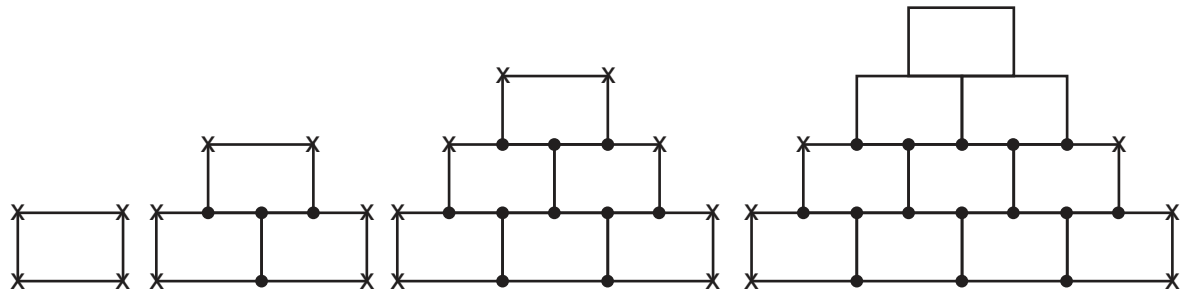


Diagram 1 Diagram 2 Diagram 3 Diagram 4

(a) Write down the order of rotational symmetry of Diagram 1.

..... [1]

(b) Complete Diagram 4 using dots and crosses. [1]

(c) Complete the table for Diagram 4 and Diagram 5.

Diagram	1	2	3	4	5
Number of dots	0	4	10		
Number of crosses	4	6	8		

[3]

(d) (i) Describe, in words, the rule for continuing the sequence for the number of dots.

..... [1]

(ii) The expression for the number of dots in Diagram n is $n^2 + n - 2$.

Find the number of dots in Diagram 12.

..... [2]

(e) **(i)** Write down an expression for the number of crosses in Diagram n.

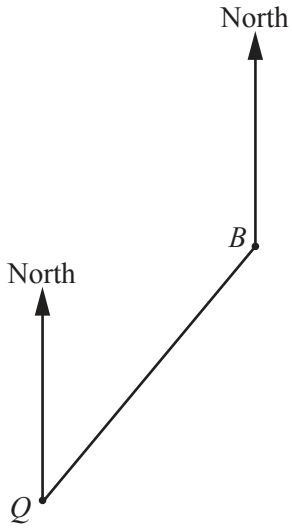
..... [2]

(ii) Diagram n has 100 crosses.

Find the value of n.

$n =$ ..... [2]

9 The scale drawing shows the positions of Bogota (B) and Quito (Q).
The scale is 1 centimeter represents 150 kilometers.



Scale: 1 cm to 150 km

(a) **(i)** Measure the length of the line BQ.

..... cm [1]

(ii) Work out the actual distance from Bogota to Quito.

..... km [1]

(iii) Measure the bearing of Quito from Bogota.

..... [1]

(b) A plane leaves Quito and flies straight to Manaus.
Manaus is 2100 km on a bearing of 100° from Quito.

On the scale drawing, mark the position of Manaus (M). [3]

(c) The plane flies the 2100 km from Quito to Manaus at an average speed of 550 km/h.

Calculate the time taken for this flight

(i) in hours, correct to 3 significant figures,

..... h [2]

(ii) in hours and minutes, correct to the nearest minute.

..... h ..... min [1]

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