






NAME   
SCHOOL   
TEACHER 


Pre-Leaving Certificate Examination, 2017

# Mathematics

Paper 2

Ordinary Level

Time: 2 hours, 30 minutes

300 marks

School stamp
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Running total	
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For examiner	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Grade
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## Instructions

There are **two** sections in this examination paper.

Section A	Concepts and Skills	150 marks	6 questions
Section B	Contexts and Applications	150 marks	3 questions

Answer **all nine** questions.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. There is space for extra work at the back of the booklet. You may also ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You will lose marks if you do not show all necessary work.

You may lose marks if you do not include appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

Write the make and model of your calculator(s) here:

Answer **all six** questions from this section.

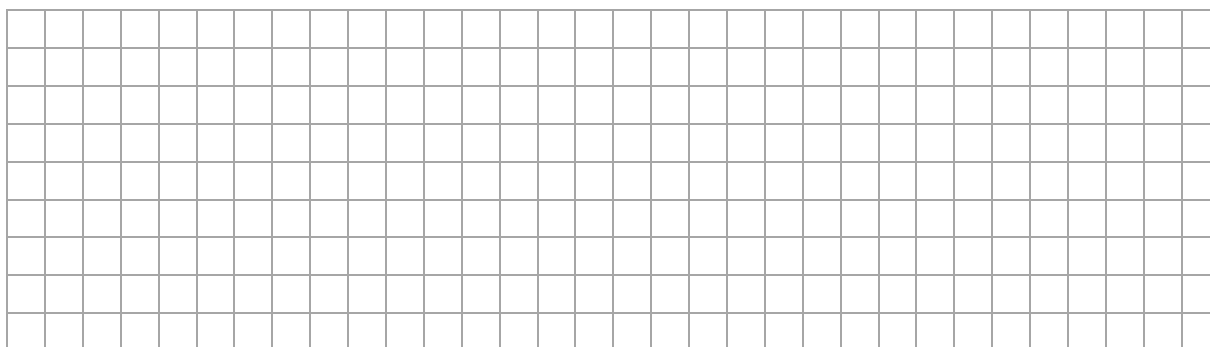
**Question 1****(25 marks)**

- (a) Construct a triangle  $ABC$  in which  $|AB| = 7$  cm,  $|BC| = 4$  cm and  $|\angle ABC| = 90^\circ$ .  
Show all your construction lines clearly.

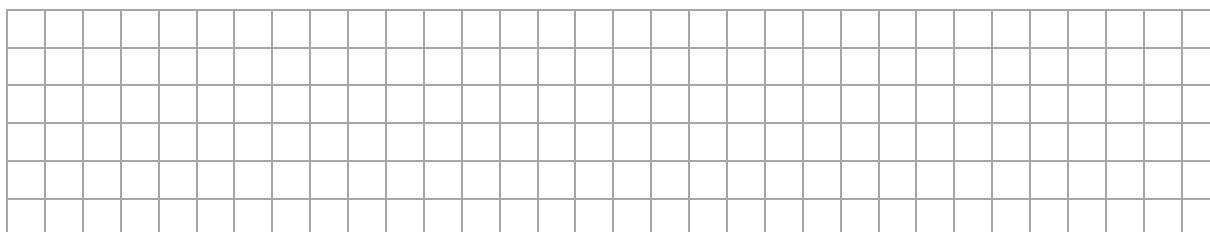
- (b) (i) Measure the length of  $[AC]$  constructed in part (a).

 $|AC| =$ 


Use the Theorem of Pythagoras to calculate  $|AC|$ , correct to two decimal places.  
Explain any difference you found in your two answers.



- (ii) Use a trigonometric ratio to find  $|\angle CAB|$ . Give your answer correct to the nearest degree.



- (c) On the same diagram above, construct a circle with  $[AC]$  as a diameter.

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**Question 2****(25 marks)**

The circle  $c_1$  has equation  $(x - 1)^2 + (y - 1)^2 = 25$ .

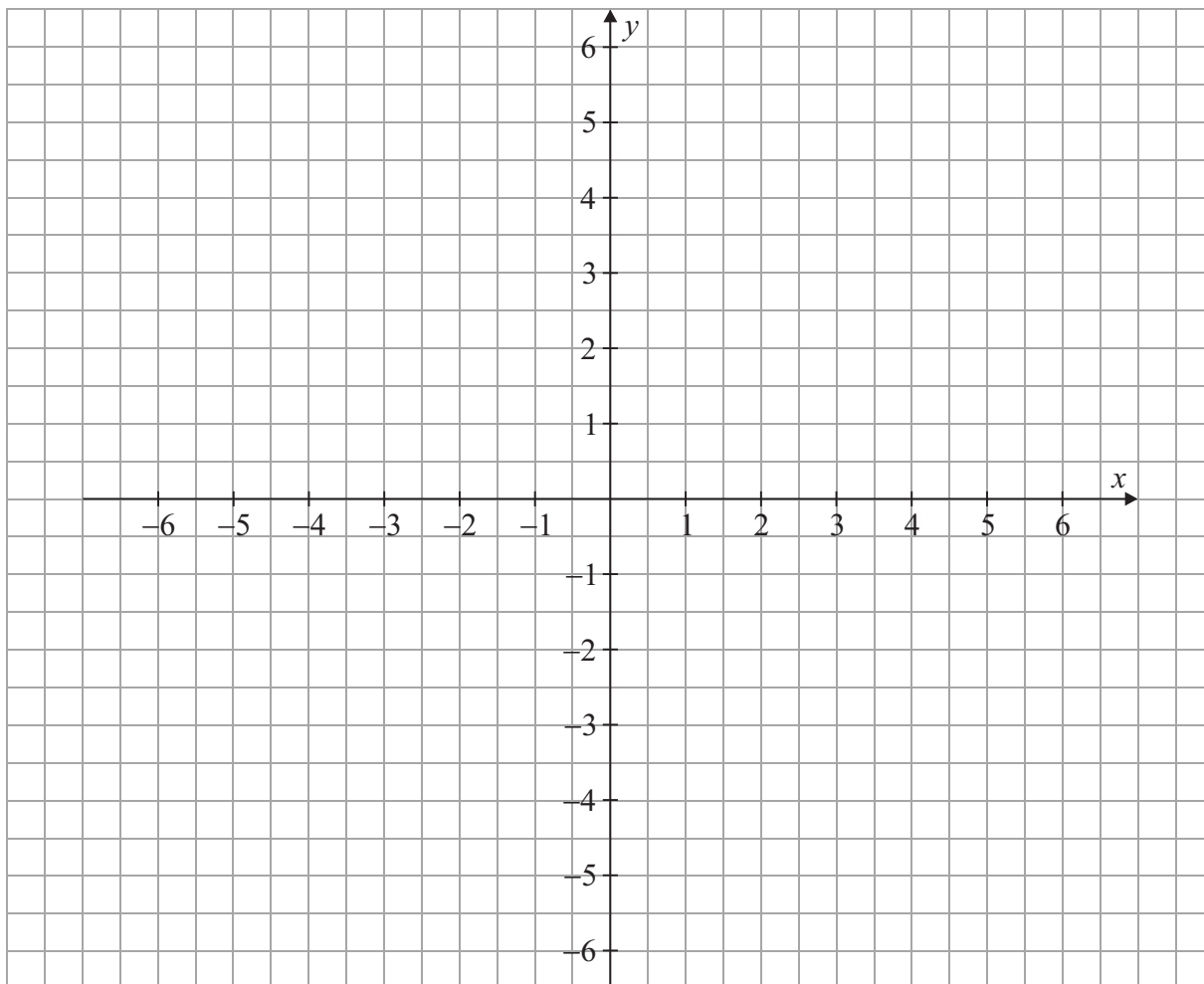
- (a) (i) Write down the co-ordinates of the centre of  $c_1$ .

(     ,     )
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Write down the length of the radius of  $c_1$ .

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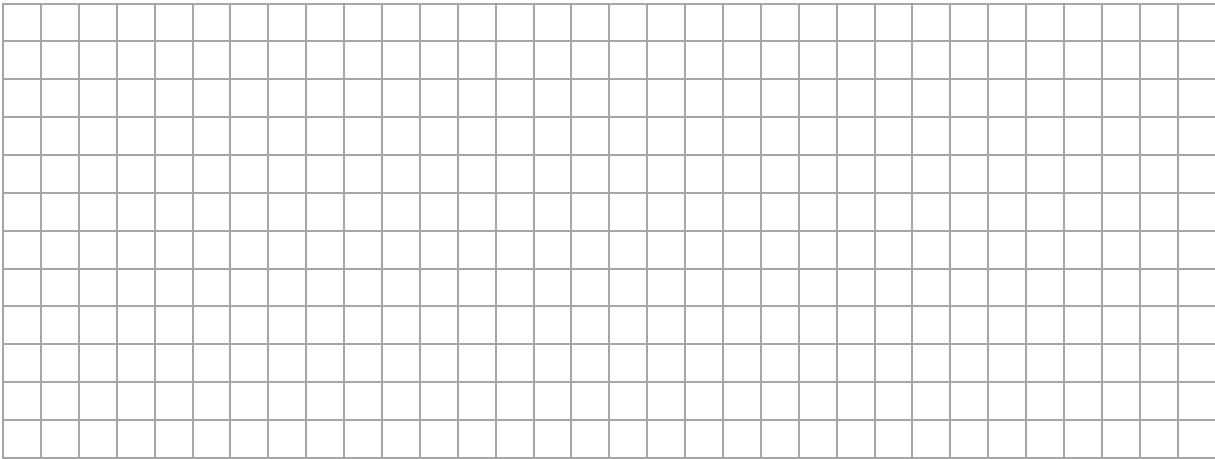
- (ii) Draw the circle  $c_1$  on the grid below. Each unit on the co-ordinate grid is 1 cm.



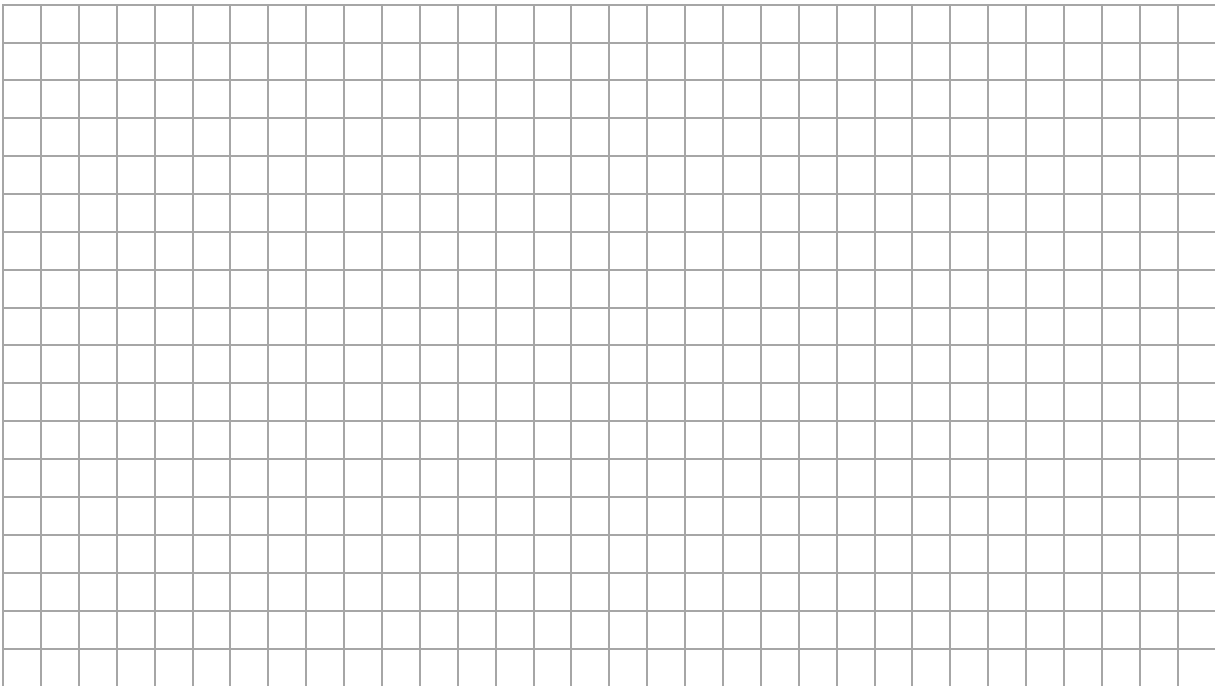
- (b) Does the point  $(5, 3)$  lie inside, outside or on  $c_1$ ? Justify your answer using algebra.



(c) (i) Find the equation of another circle  $c_2$  with centre  $(0, 0)$  that passes through the point  $(2, 2)$ .



(ii) Find, using algebra, the points of intersection of  $c_2$  and the line  $y = -2x + 2$ .



### Question 3

**(25 marks)**

The line  $l$  contains the point  $A(0, 2)$  and has a slope 3.

- (a)** Find the equation of  $l$ . Give your answer in the form  $ax + by + c = 0$ , where  $a, b, c \in \mathbb{Z}$ .

[illegible]

- (b) (i)** Determine whether the line  $k: x + 3y - 26 = 0$  is perpendicular to  $l$ .

[illegible]

- (ii)** Find the co-ordinates of  $B$ , the point of intersection of the lines  $l$  and  $k$ .

[illegible]

- (c)  $k$  intersects the  $x$ -axis at the point  $C$ .

- (i)** Find the co-ordinates of  $C$ .

[illegible]

- (ii)** Hence, or otherwise, find the area of the triangle  $ABC$ .

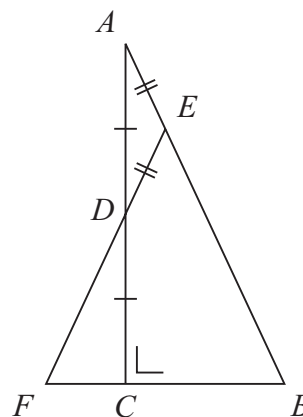
[illegible]

### Question 4

**(25 marks)**

The diagram shows two triangles,  $ACB$  and  $FCD$ . Both triangles have right angles at  $C$ .

The point  $D$  is the midpoint of  $[AC]$ .  
 $[FD]$  is extended such that it intersects  $[AB]$   
at the point  $E$ .  
 $|AE| = |ED|$ .



- (a)** Prove that triangles  $ACB$  and  $FCD$  are similar. Justify your answer by setting out a series of steps with geometrical statements supporting each step.

[illegible]

- (b)** Hence, show that the triangle  $EFB$  is isosceles.

[illegible]

- (c) Given that  $|AE| = 2$  cm, and using your answers from parts (a) and (b), find  $|BE|$ .  
(Hint: Let  $|BE| = x$  and  $|DF| = y$ .)

The image shows a full-page grid of graph paper. The grid consists of 20 columns and 20 rows of squares. In the bottom right corner, there is a small table with three columns and one row. The table has a header row with the words "previous", "page", and "running".

previous	page	running

### Question 5

**(25 marks)**

A game consists of rolling two fair, six-sided dice, one red and one black. The dice are thrown at the same time and the scores are then added. The red die has the numbers 1, 2, 2, 3, 4 and 5 on its sides. The black die has the numbers 1, 2, 3, 3, 4 and 6 on its sides.



- (a)** Complete the table below to show all possible outcomes of the game.

		Red Die					
		1	2	2	3	4	5
Black Die	1						
	2						
	3						
	3						
	4						
	6						

- (b)** It costs €2.50 to play the game. A score of 6, 7 or 8 wins €3. A score of 9, 10 or 11 wins €10. Calculate the expected value for the game and determine whether it is a fair game or not.

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.



### Question 6

**(25 marks)**

A restaurant offers a special two-course set menu for lunch as shown below.

**Two-Course Set Menu**  
**€18 per person**  
 Tomato Soup  
 Chicken Wings  
 Garlic Bread  
 \*\*\*\*\*  
 Beef Burger  
 Roast Chicken  
 Vegetarian Lasagne  
 Salmon

- (a) Assuming that only one selection from each course can be chosen, how many different combinations are possible?

[illegible]

- (b) (i)** If all combinations are equally likely, what is the probability that a customer selects chicken for both courses?

[illegible]

- (ii)** What is the probability that a customer selects a vegetarian option (no meat or fish) for both courses?

[illegible]

- (iii) Amy goes to the restaurant for lunch on three consecutive days. What is the probability that she selects a vegetarian option for both courses on two of these days?

[illegible]

- (c) The restaurant wishes to add one more option to the set menu. To which course should this option be added in order to maximise the number of different combinations possible? Justify your answer.

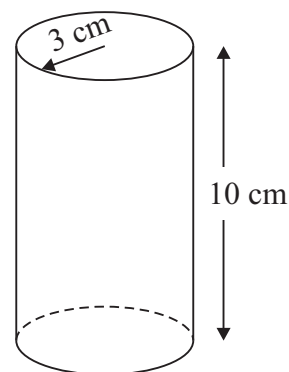
[illegible]

Answer **all three** questions from this section.

### Question 7

**(45 marks)**

The diagram shows the cylinder  $P$ , which has a radius of 3 cm and a height of 10 cm.



- (a) (i)** Find the curved surface area of cylinder  $P$ .  
Give your answer in terms of  $\pi$ .

- (ii) Make an accurate scaled drawing below of the net of cylinder  $P$ , using the scale 1:2. Record the dimensions of the net on your drawing. Give your answers correct to two decimal places.

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin gray lines. There are 20 columns and 20 rows of squares, creating a total area of 400 small squares. The grid covers the entire page, leaving no margins or other markings.

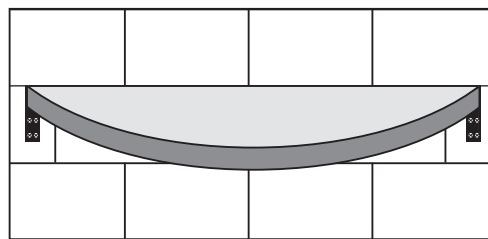


### Question 8

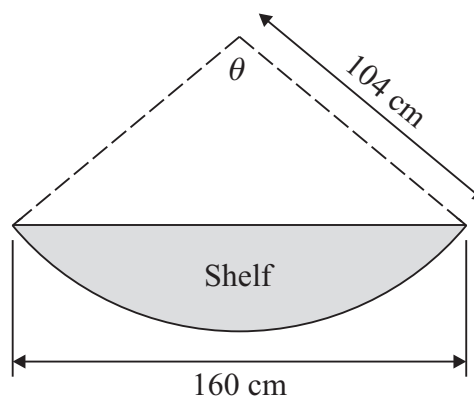
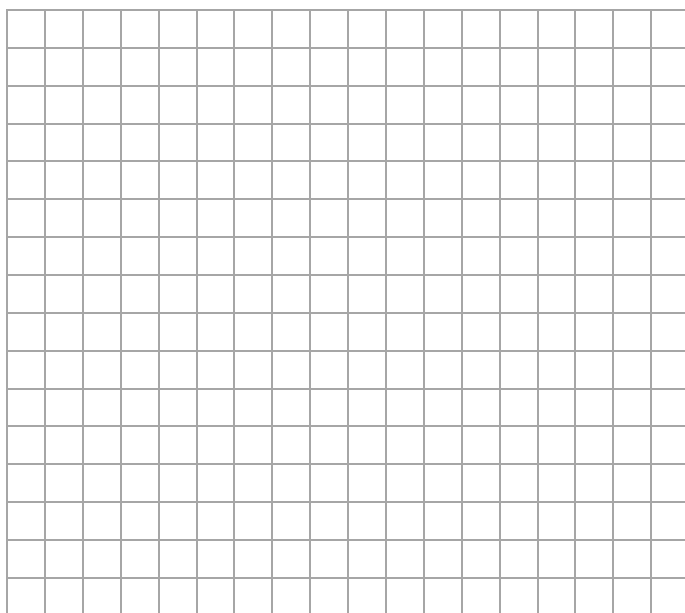
(35 marks)

The horizontal surface of a wall shelf is in the shape of part of a sector of a circle, as shown. The radius of the circle is 104 cm.

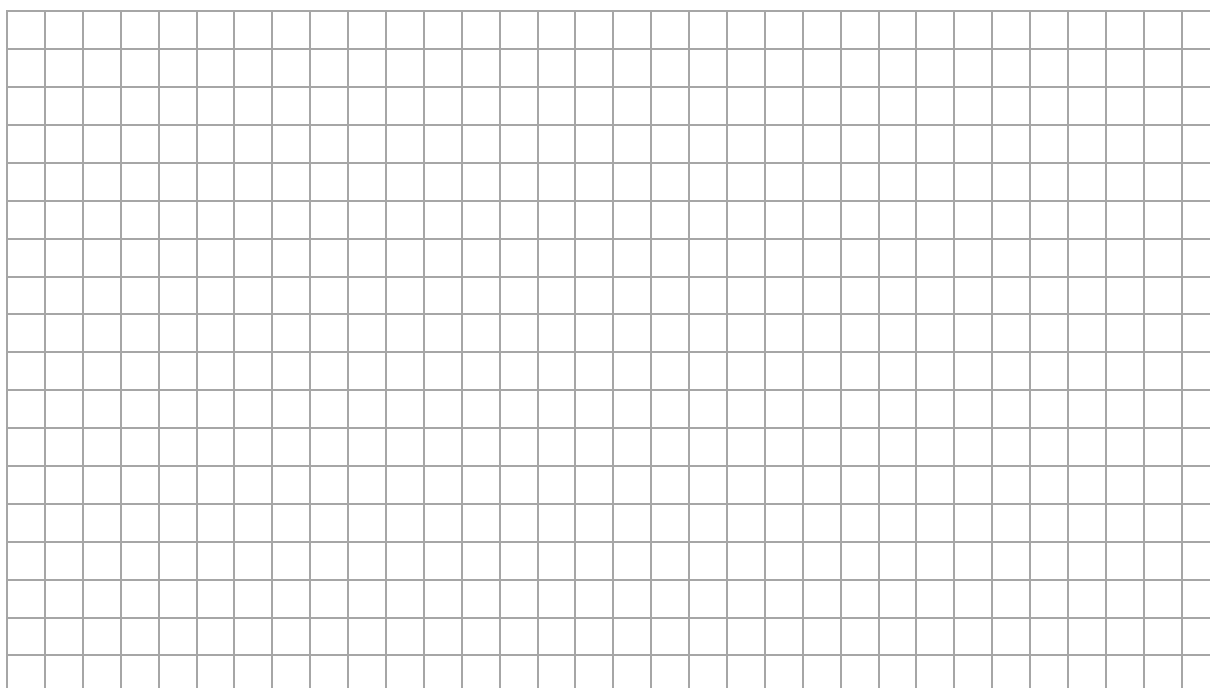
The back edge of the shelf, which attaches to the wall, is a chord of the circle. The length of this back edge is 160 cm.



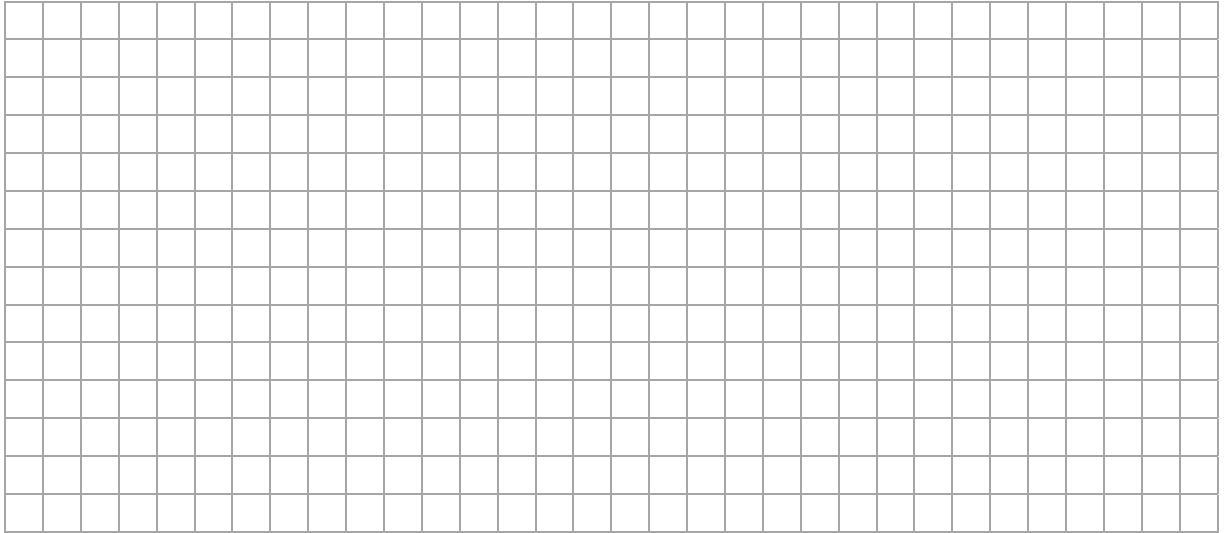
- (a) Find the measure of  $\theta$ , the angle subtended at the centre of the circle by the arc of the sector. Give your answer, in degrees, correct to one decimal place.



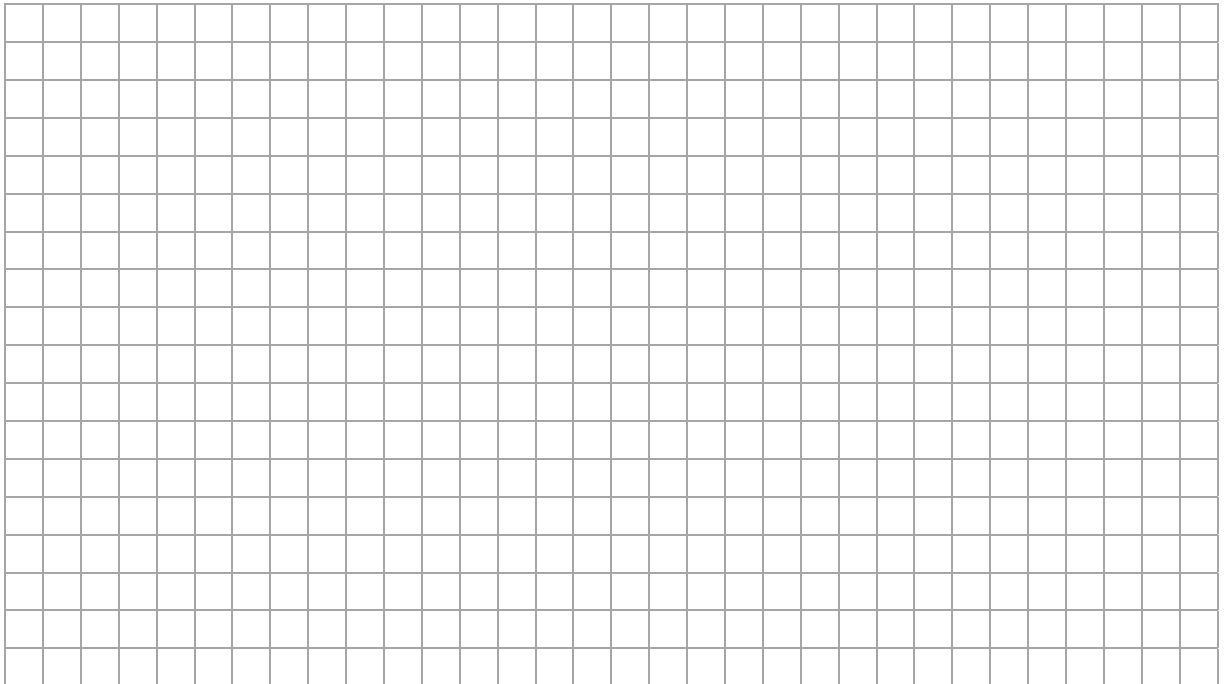
- (b) Find the area of the horizontal surface of the wall shelf, as shown by the shaded region in the diagram above. Give your answer correct to two significant figures.



- (c) A metal trim, of width 6.5 cm, is applied to the front edge of the shelf along the arc of the sector. Find the area of metal trim required. Give your answer correct to the nearest whole number.



- (d) Find the distance from the front edge of the shelf to the wall. Give your answer correct to one decimal place.



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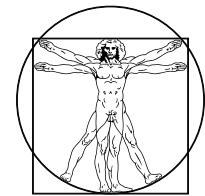
### Question 9

**(70 marks)**

The heights and arm spans, in cm, of a random sample of students in a school were recorded. The data collected is shown below.

Height	Arm Span
140	143
140	149
153	155
156	163
160	150
160	160
161	159
162	160
162	162
165	157
165	165
165	167

Height	Arm Span
169	171
170	162
173	168
177	166
177	177
178	178
181	174
183	170
187	181
188	178
189	173
191	192



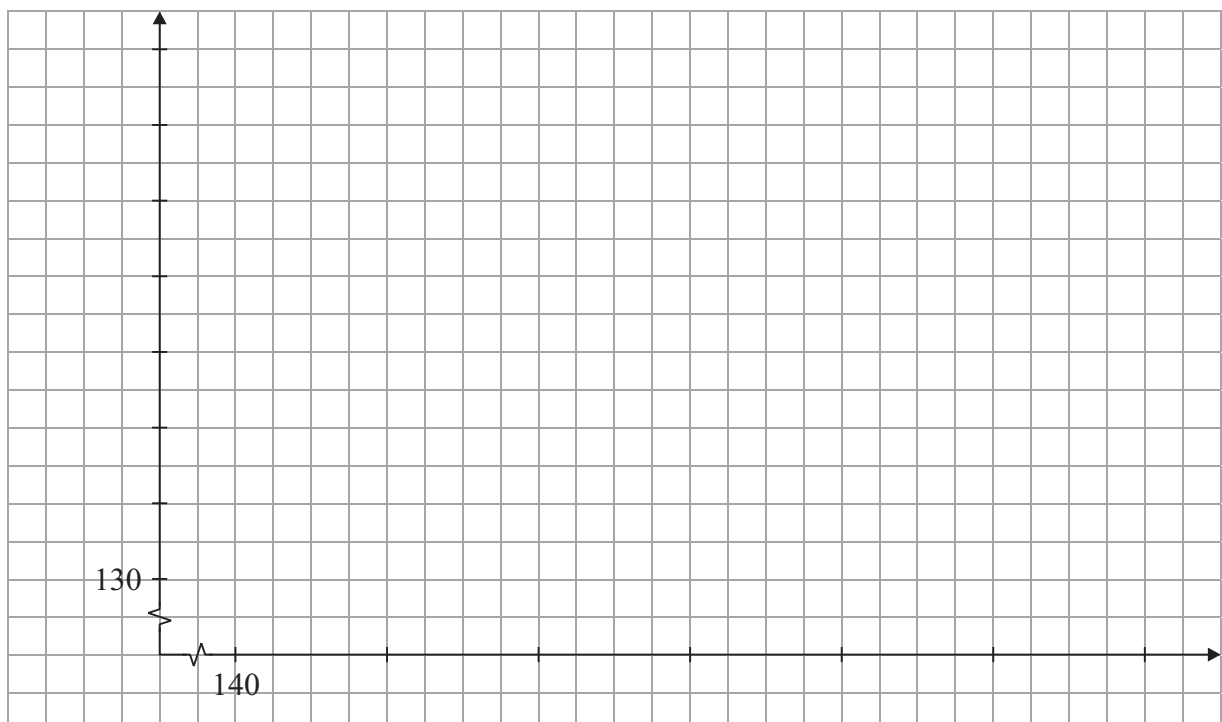
- (a) (i)** What type of data was collected? Explain your answer.

[illegible]

- (ii) Explain the term *random sample*.

[illegible]

- (iii)** Complete the axes of the scatter graph below and plot the data collected.



(iv) Describe the correlation, if any, in the context of the data.

[illegible]

(b) The mean height of a larger group of 15-year-old girls in school is 163 cm with a standard deviation of 13 cm. Assuming the girls' heights are normally distributed, use the Empirical Rule to find the percentage of girls who are less than 176 cm in height.

A full-page sheet of white graph paper featuring a uniform grid of thin, light gray horizontal and vertical lines. The grid consists of small squares covering the entire area of the page.

(c) The data of a sample group from this student population was used to create the information shown in the table below.

Height (cm)	145-150	150-155	155-160	160-165	165-170	170-175	175-180	180-185
Number of girls	72	120	178	240	167	90	82	51

(i) Use mid-interval values of the information in the table to estimate the mean height of the girls in this sample.

A large grid of graph paper, consisting of 20 columns and 20 rows of squares. In the bottom right corner, there is a small table with 3 columns and 1 row. The table has the following text:

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- (ii) Find the margin of error, at 95% confidence, for this sample. Write your answer as a percentage, correct to one decimal place.

[illegible]

- (iii) Estimate the percentage of girls in the sample who are less than 176 cm in height.

A full-page view of a blank sheet of graph paper. The grid consists of small squares formed by thin gray lines. There are 20 columns and 15 rows of squares. The entire page is covered by this grid, with no margins or other markings.

- (iv) Create a 95% confidence interval for the percentage of girls in the sample who are less than 176 cm in height.

[illegible]



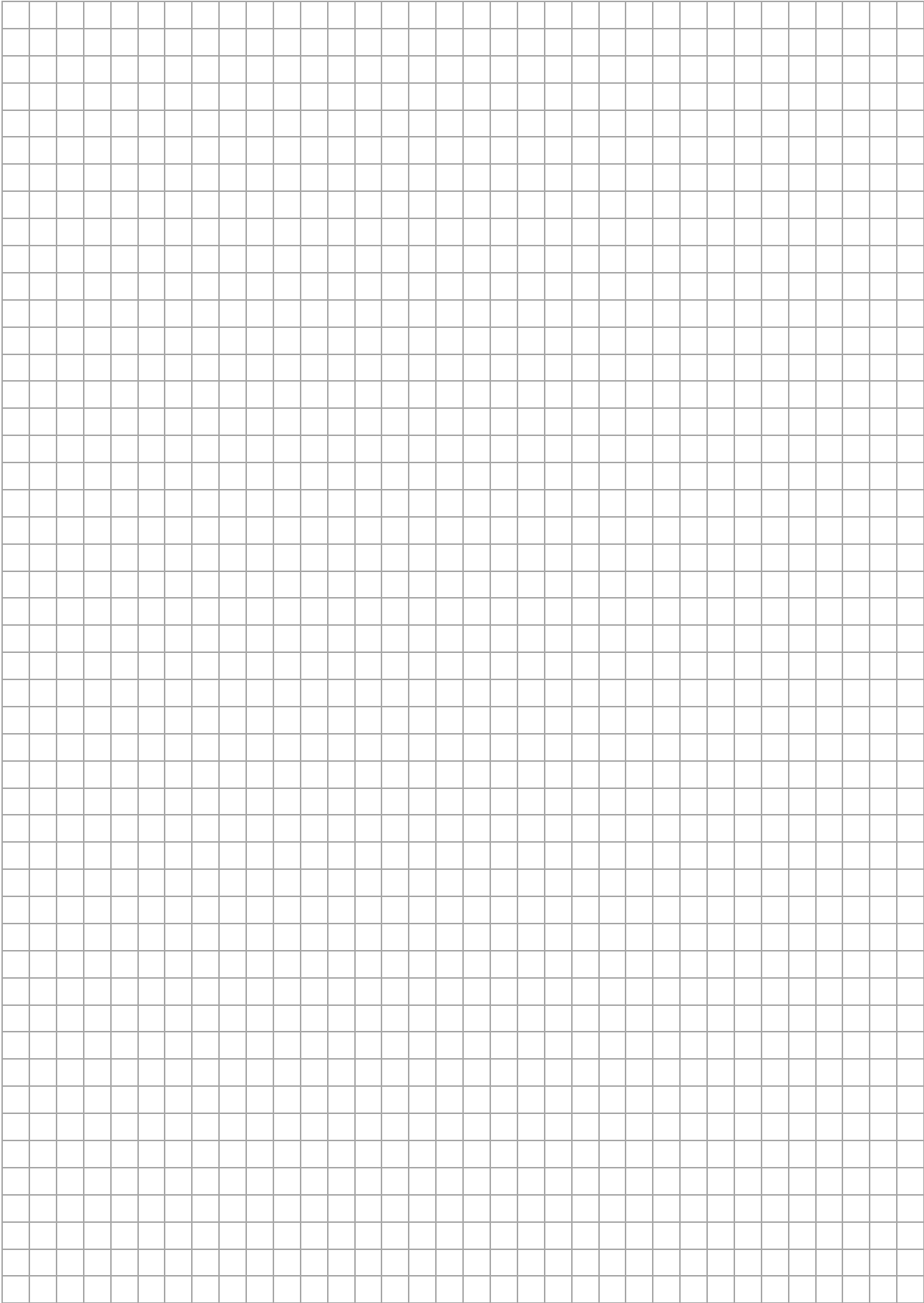
- (d) A student claims that the proportion of girls in the sample group who are less than 176 cm in height is the same as in the student population of 15-year-old girls.

Use a hypothesis test at the 5% level of significance to decide whether there is sufficient evidence to accept this student's claim. State clearly the null hypothesis and the alternative hypothesis. Interpret your conclusion in the context of the question.

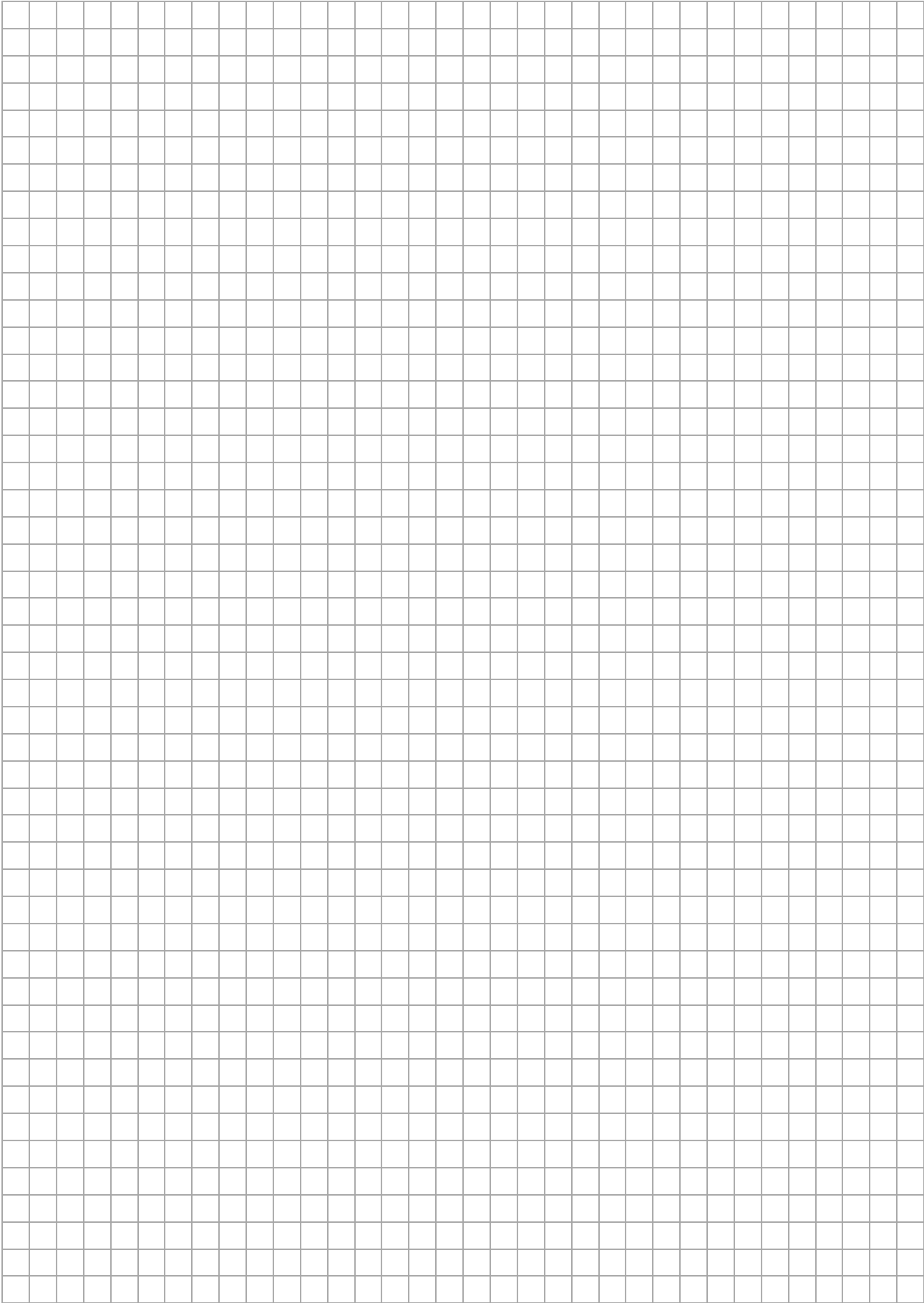
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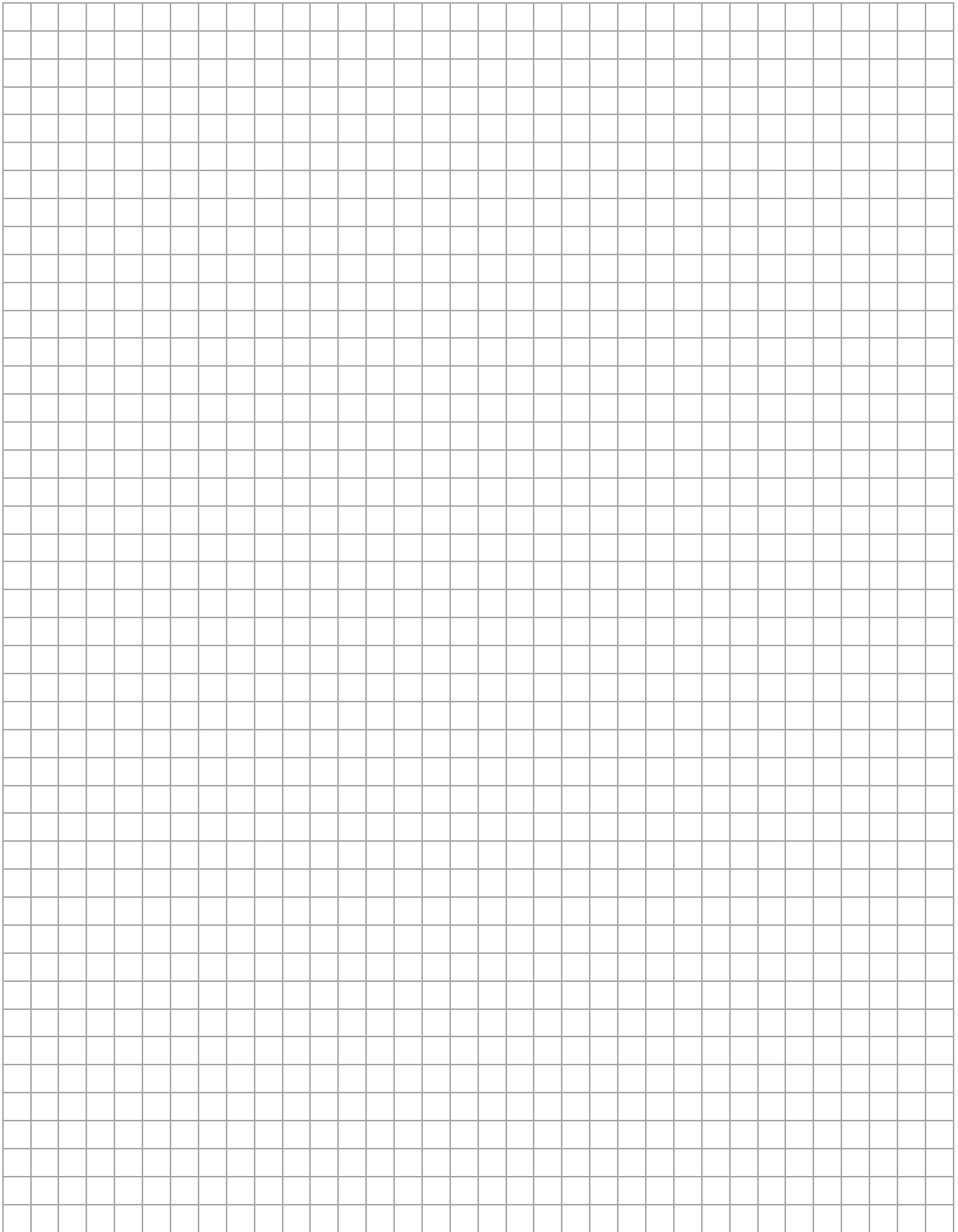
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Pre-Leaving Certificate, 2017 – Ordinary Level

**Mathematics – Paper 2**

Time: 2 hours, 30 minutes

