



Coimisiún na Scrúduithe Stáit  
State Examinations Commission

Leaving Certificate Examination 2015

# Mathematics

Paper 2

Ordinary Level

Monday 8 June      Morning 9:30 – 12:00

300 marks

Examination number
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Centre 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 all necessary work is not clearly shown.**

**You may lose marks if the appropriate units of measurement are not included, where relevant.**

**You may lose marks if your answers are not given 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 bank issues a unique six-digit password to each of its online customers. The password may contain any of the numbers 0 to 9 in any position and numbers may be repeated. For example, the following is a valid password.

0	7	1	7	3	7
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- (a) How many different passwords are possible?

- (b) (i) How many different passwords do **not** contain **any** zero?

- (ii) One password is selected at random from all the possible passwords. What is the probability that this password contains at least one zero?

- (c) John is issued with one such password from the bank. Each time John wants to access his account online, the bank's website requires him to input three of his password digits into the boxes provided. For example, he may be asked for the 2<sup>nd</sup>, 4<sup>th</sup> and 5<sup>th</sup> digits, as shown below.

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In how many different ways can the bank select the three required boxes?

## Question 2

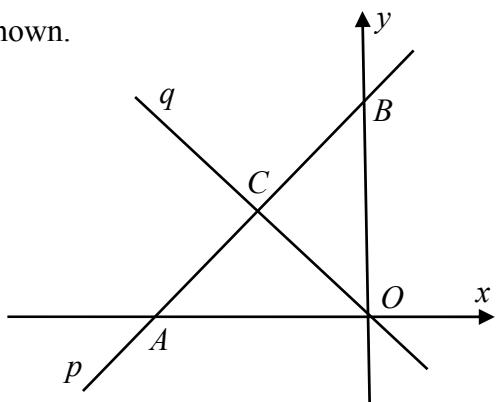
(25 marks)

The line  $p$  makes equal intercepts on the axes at  $A$  and at  $B$ , as shown.

- (a) (i) Write down the slope of  $p$ .

Slope of  $p$  =

- (ii) The point  $(1, 5)$  is on  $p$ . Find the equation of  $p$ . Write your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$ , and  $c \in \mathbb{Z}$ .

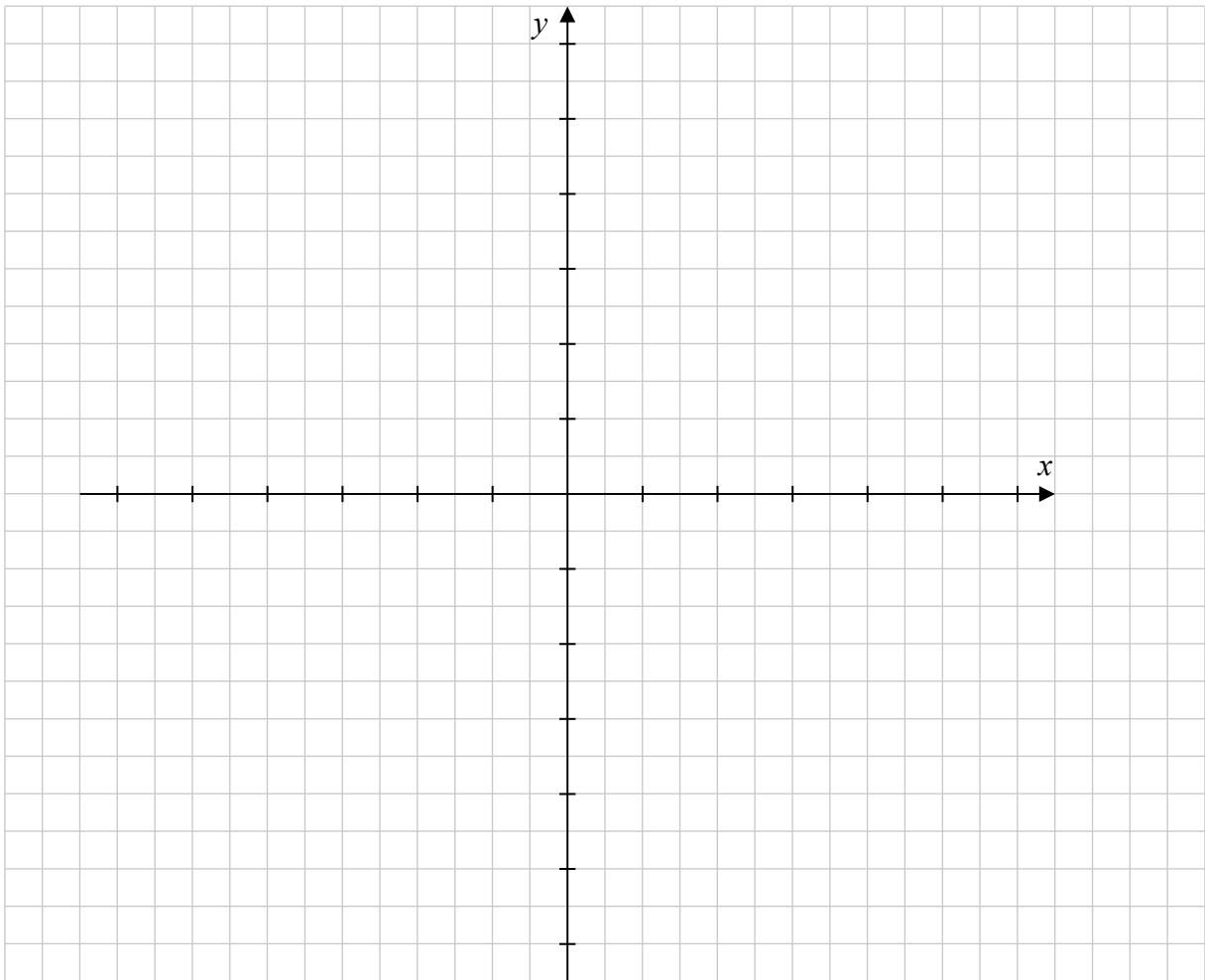


- (b) The line  $q$  is perpendicular to  $p$  and contains the point  $O(0, 0)$ . Find the equation of  $q$ .

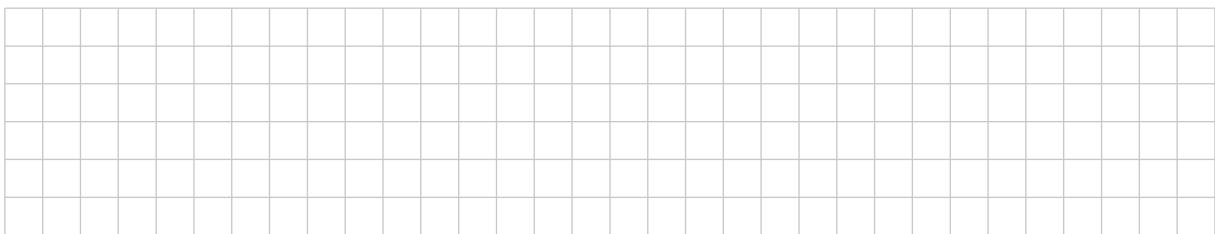
- (c) The lines  $p$  and  $q$  intersect at the point  $C$ . Explain why the triangles  $OCA$  and  $BOC$  are congruent.

**Question 3****(25 marks)**

- (a) Draw the circle  $c: x^2 + y^2 = 25$ . Show your scale on both axes.



- (b) Verify, using algebra, that  $A(-4, 3)$  is on  $c$ .



- (c) Find the equation of the circle with centre  $(-4, 3)$  that passes through the point  $(3, 4)$ .



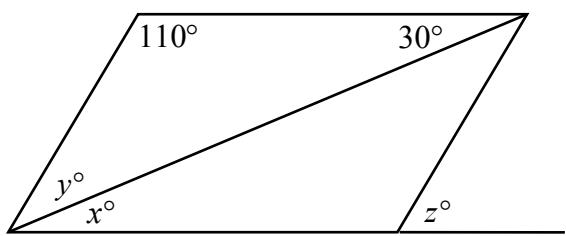
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## Question 4

(25 marks)

- (a)** The diagram shows a parallelogram, with one side produced.  
Use the data on the diagram to find the value of  $x$ , of  $y$ , and of  $z$ .

Give a reason for your answer in each case.



$x =$

Reason:

$$y = \underline{\hspace{2cm}}$$

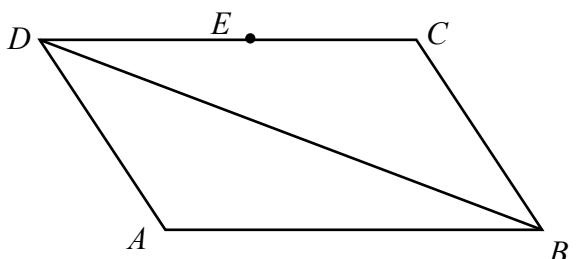
Reason:

**z =**

Reason:

- (b)** The area of the parallelogram  $ABCD$  is  $480 \text{ m}^2$ .  
**(i)** Find the area of the triangle  $ABD$ .

$$|\triangle ABD| = \underline{\hspace{2cm}}$$

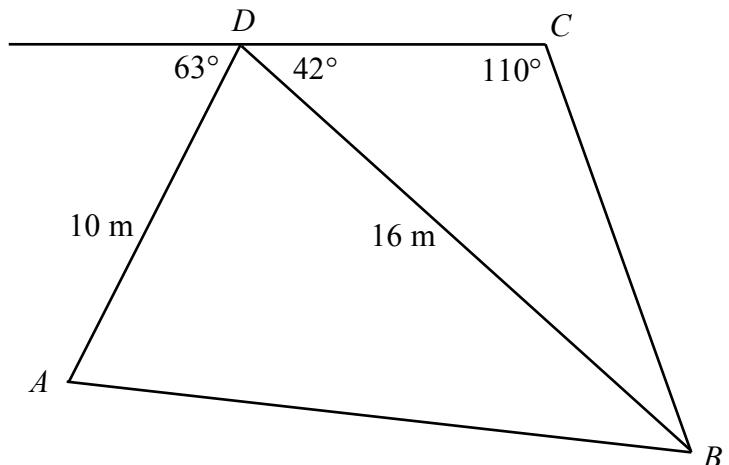
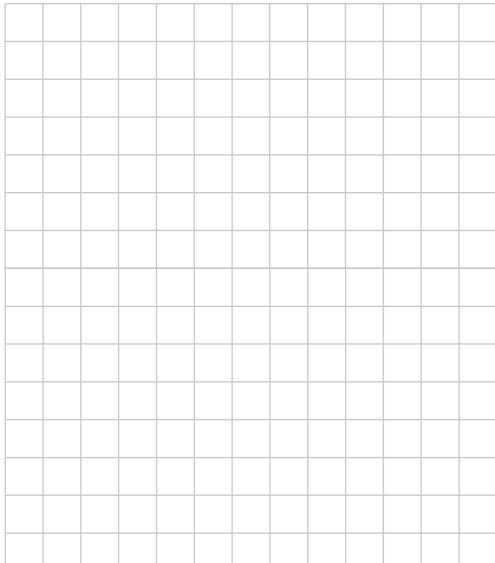


- (ii)  $E$  is the midpoint of  $[CD]$ . Find the area of the triangle  $BCE$ .

**Question 5****(25 marks)**

The diagram shows the triangles  $BCD$  and  $ABD$ , with some measurements given.

- (a) (i) Find  $|BC|$ , correct to two decimal places.



- (ii) Find the area of the triangle  $BCD$ , correct to two decimal places.



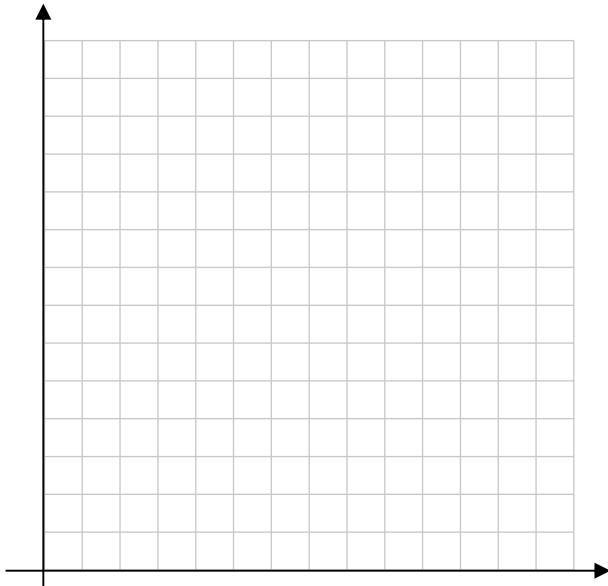
- (b) Find  $|AB|$ , correct to two decimal places.



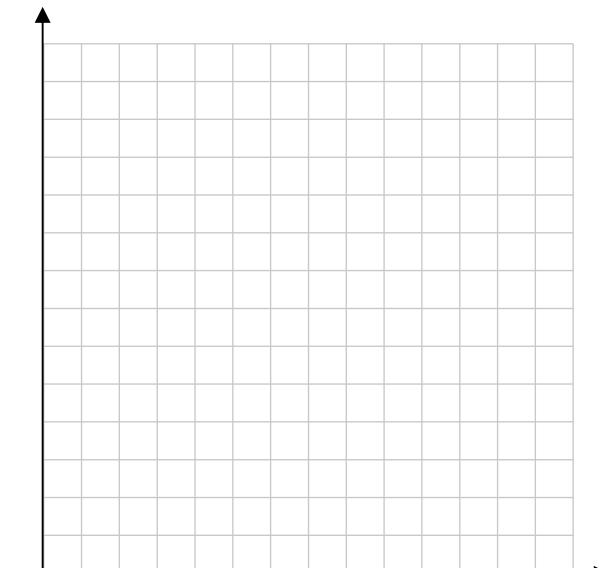
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**Question 6****(25 marks)**

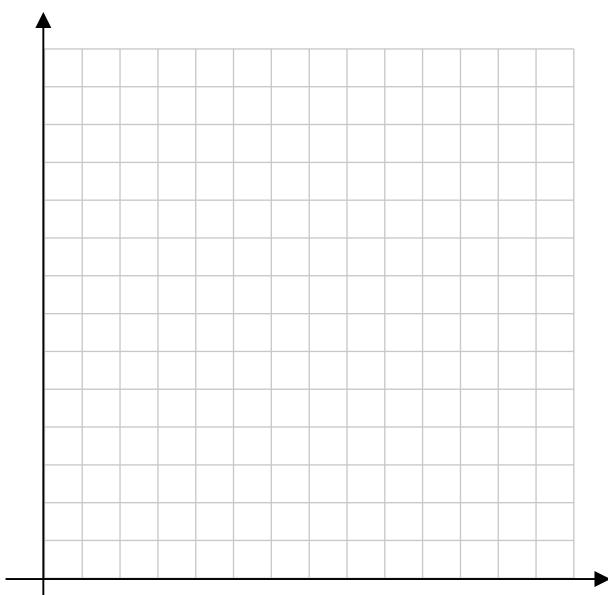
- (a) Mark ten or more points on each of the scatter graphs below to show an example of the type of correlation named under each graph.



(i) Strong positive correlation



(ii) Strong negative correlation



(iii) No correlation

- (b) A few days before the Scottish Independence Referendum in September 2014 a *YouGov* poll estimated the support for the ‘No’ campaign to be 54%.

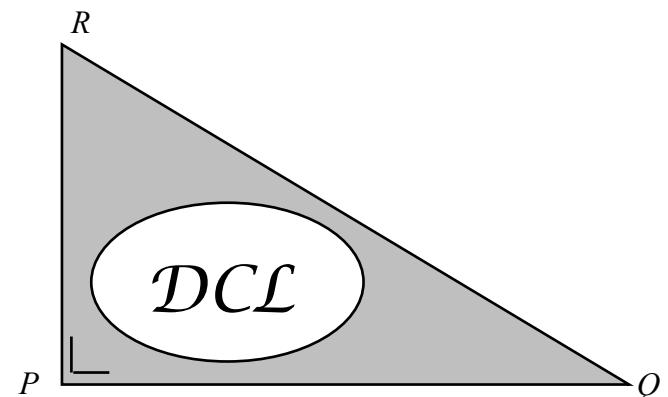
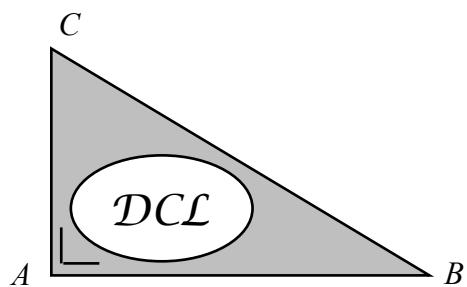
(i) If *YouGov* sampled 1000 people, find the margin of error.  
Write your answer as a percentage, correct to one decimal place.

- (ii) Create a 95% confidence interval for the level of support for the ‘No’ campaign in the population.

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

**Question 7****(35 marks)**

The diagram below shows the right-angled triangle  $ABC$ , which is used in the logo for a company called *Deane Construction Limited (DCL)*. The triangle  $PQR$  is the image of  $ABC$  under an enlargement.



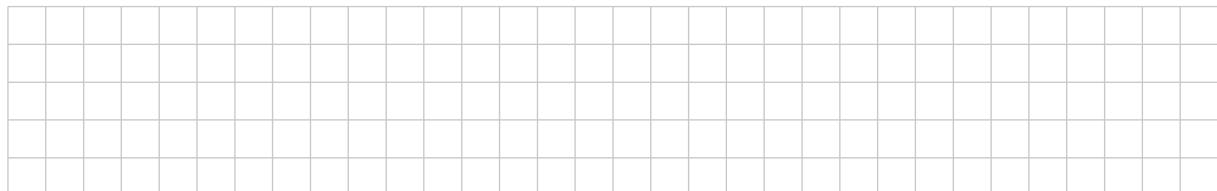
(a) (i) Construct the centre of enlargement and label it  $O$ .

(ii) Measure, in centimetres,  $|OB|$  and  $|OQ|$ .

$$|OB| = \underline{\hspace{2cm}}$$

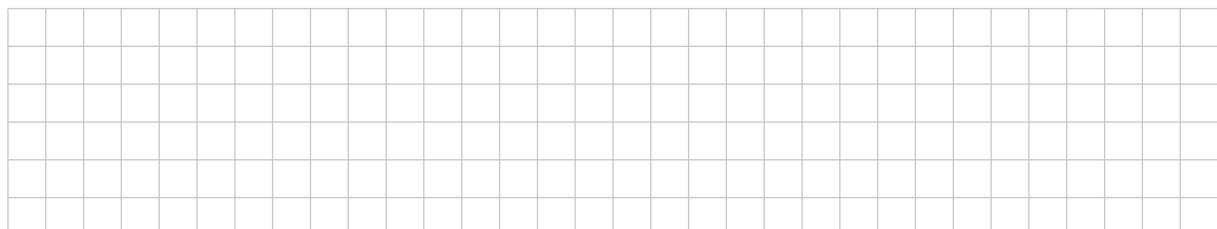
$$|OQ| = \underline{\hspace{2cm}}$$

(iii) Use your measurements to find the scale factor of the enlargement, correct to one decimal place.



(b) The area of the triangle  $ABC$  is  $7.5 \text{ cm}^2$ .

Use the scale factor to find the area of the image triangle  $PQR$  under the enlargement.



(c) (i) Given that  $|AB| = 5 \text{ cm}$ , use the scale factor to find  $|PQ|$ .



(ii) Given that  $|QR| = 8.7 \text{ cm}$ , use the scale factor to find  $|BC|$ .



(iii) Hence, show that  $|\angle ABC| = |\angle PQR|$ .



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## Question 8

(45 marks)

- (a)** A company has a spherical storage tank. The diameter of the tank is 12 m.

(i) Write down the radius of the tank.

Radius = \_\_\_\_\_

- (ii) Find the volume of the tank, correct to the nearest  $\text{m}^3$ .



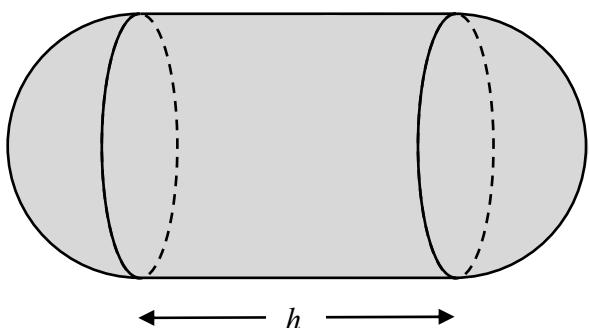
- (b) The company paints the outside curved surface of the spherical tank.

(i) Find the curved surface area of the tank, correct to one decimal place.

- (ii) The curved surface is painted with a special paint. One litre of paint will cover  $3.5 \text{ m}^2$ . Find how many litres of paint are used, correct to the nearest litre.

- (iii) The paint is sold in 25 litre tins. Each tin costs €180. Find the total cost of the paint.

- (c) At another site the company has a differently-shaped tank with the same volume. This tank has hemispherical ends and a cylindrical mid-section of length  $h$  m, as shown. The radius of each hemispherical end is 4·5 m.



- (i) Find the volume of one hemispherical end, correct to the nearest  $\text{m}^3$ .

- (ii) Find the length,  $h$ , of the cylindrical section, correct to one decimal place.

## Question 9

(70 marks)

The heights of a random sample of 1000 students were collected and recorded.

- (a)** Tick one box from the table below to indicate how you would categorise the type of data collected. Explain your choice.

Categorical Nominal	
Categorical Ordinal	
Numerical Discrete	
Numerical Continuous	

Explanation:

- (b)** The sample of 1000 students was made up of 500 boys and 500 girls. The data from the 500 girls was used to create the information shown in Table 1.

**Table 1 (Girls)**

<b>Height (cm)</b>	145-150	150-155	155-160	160-165	165-170	170-175	175-180	180-185
<b>Number of girls</b>	15	48	80	112	125	81	29	10

- (i) Use the information in Table 1 to estimate the mean height of the girls, using mid-interval values.

- (ii) What is the largest possible value for the range of the heights of the girls in this sample?

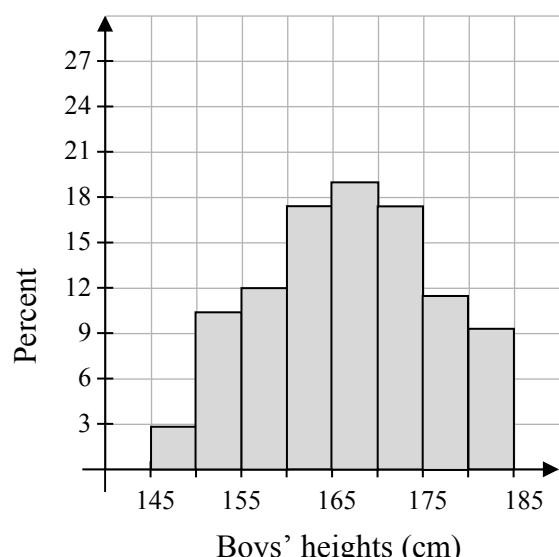
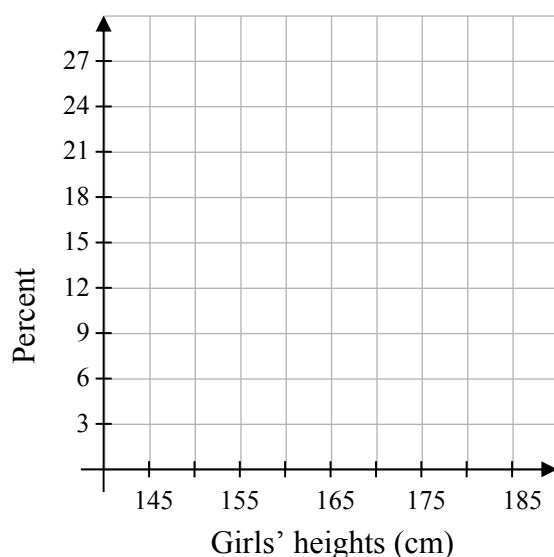
- (iii) The median height of the girls in the sample is 164.5 cm. Explain what this means in the context of the heights of the 500 girls.

- (c) (i) Use the data in Table 1 to complete Table 2 by finding the percentage of girls in each of the height categories.

Table 2 (Girls, %)								
Height (cm)	145-150	150-155	155-160	160-165	165-170	170-175	175-180	180-185
Percentage of girls				22·4	25			



- (ii) Use the data in Table 2 to draw a histogram showing the percentage of girls in each height category.



- (iii) A histogram showing the percentage of boys in each height category is given above. John examines both histograms and comments that “There are roughly twice as many boys as girls in the 175 to 180 cm category”. Do the histograms support his claim? Explain your answer.

Answer:

Reason:



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- (iv) Mary examines both histograms and comments that "I see that there are more tall girls than tall boys". Do the two histograms support her claim? Explain your answer.

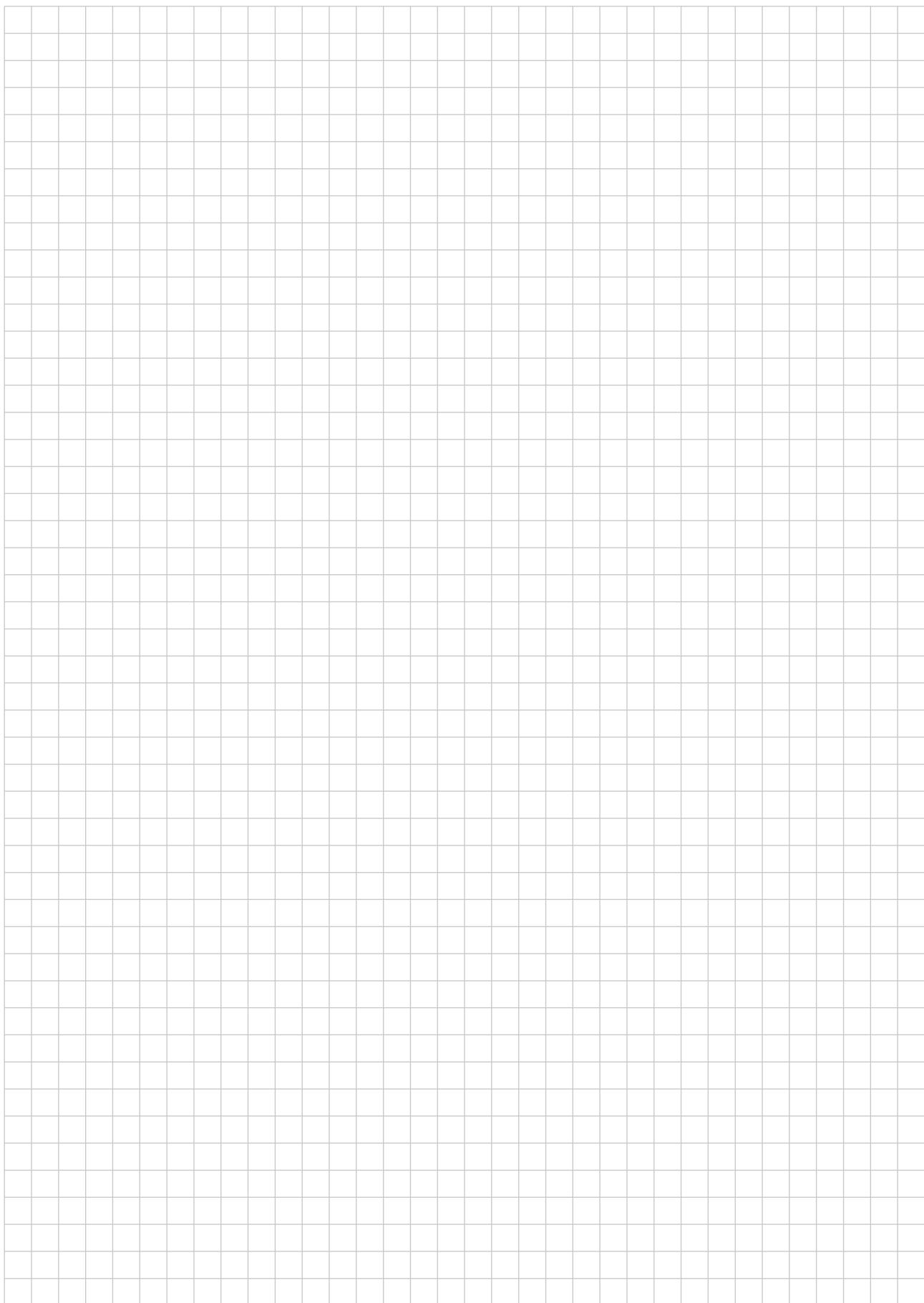
**Answer:**

Reason:

- (d) (i) The mean height of the boys in the sample is 166.7 cm and the standard deviation of their height is 8.9 cm. Assuming that boys' heights are normally distributed, use the Empirical Rule to find an interval that will contain the heights of approximately 95% of all boys.

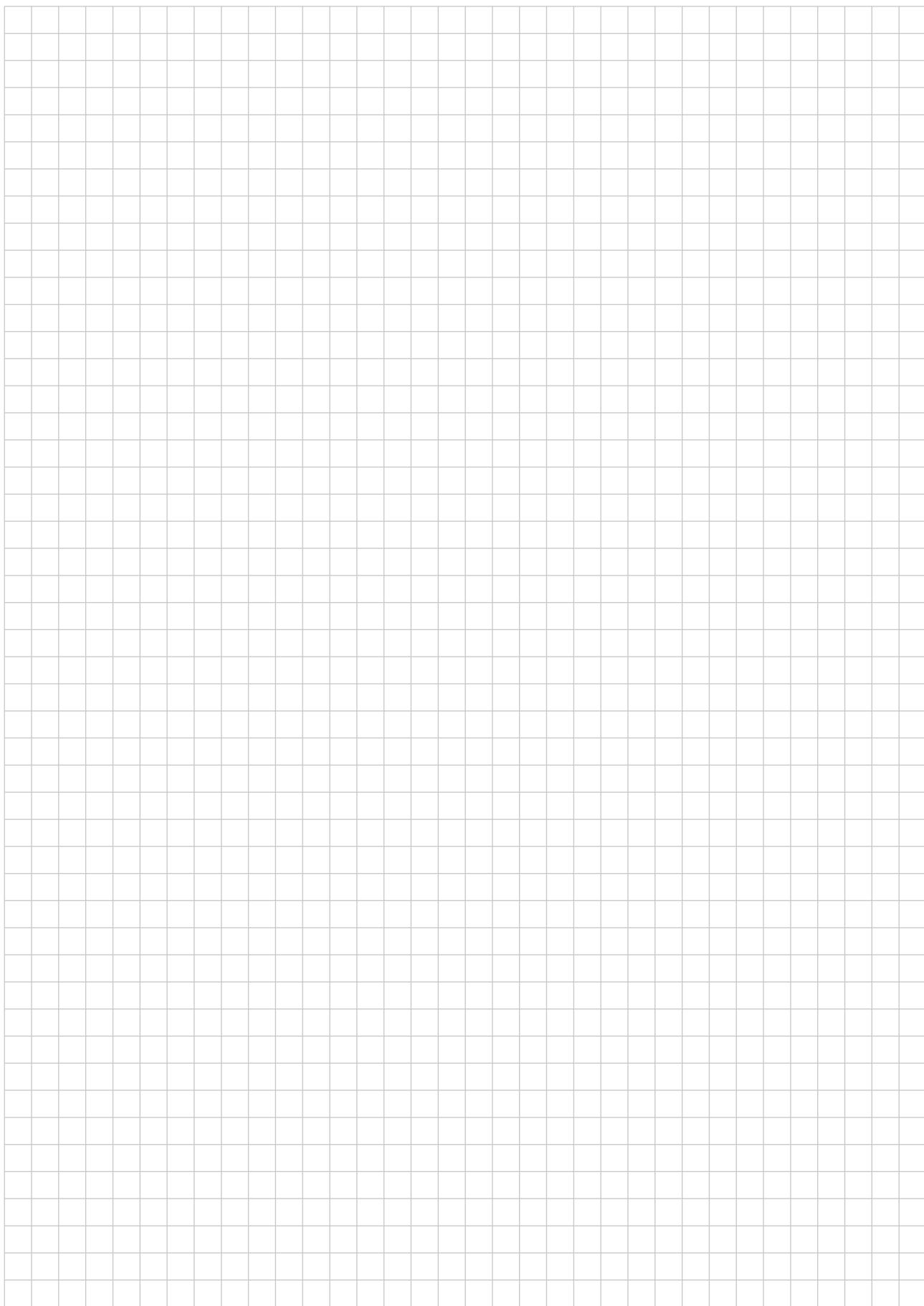
- (ii) The standard deviation of the heights of the girls in the sample is 7.7 cm while the standard deviation of the heights of the boys is 8.9 cm. Interpret this difference in the context of the data.

You may use this page for extra work.

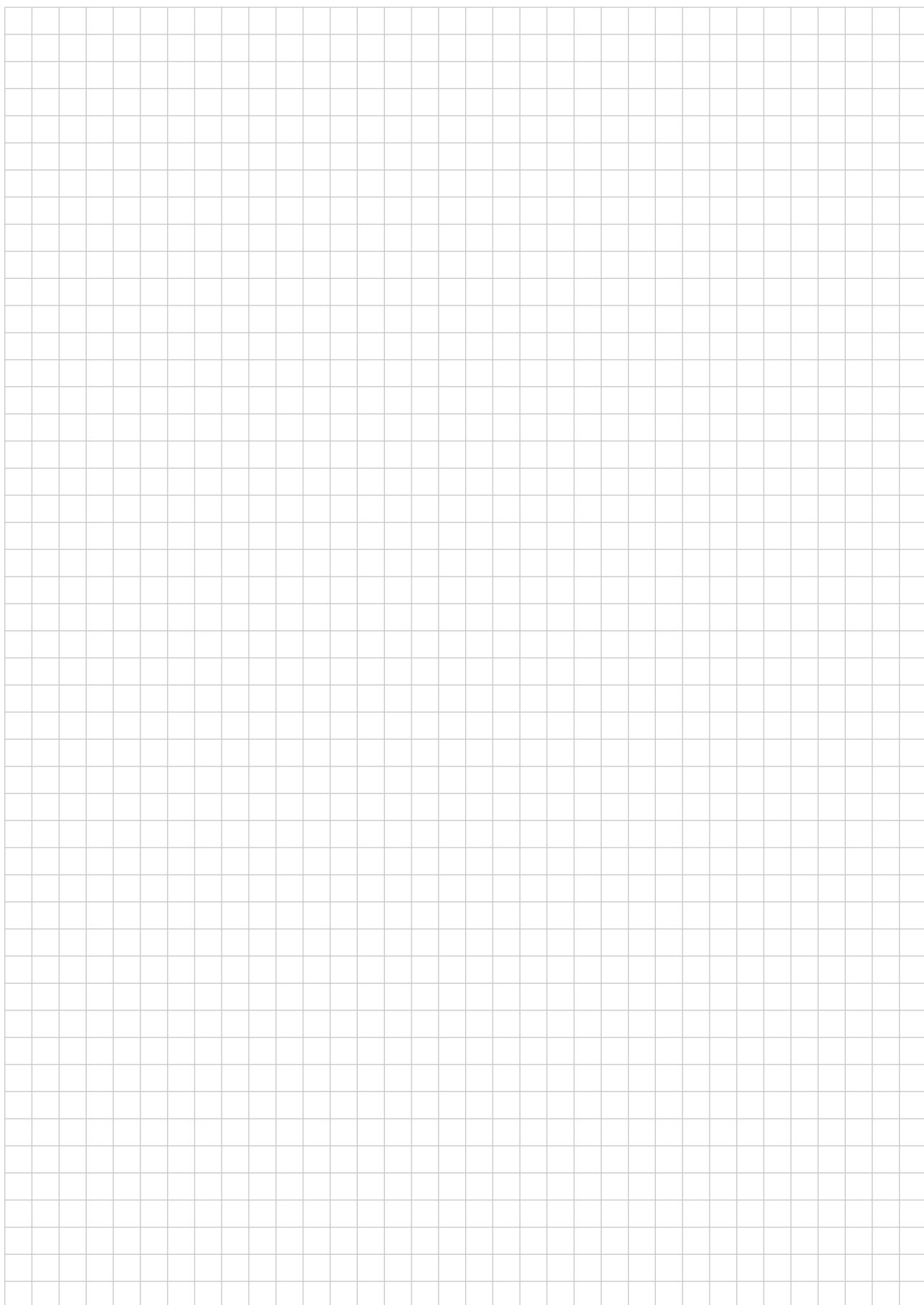


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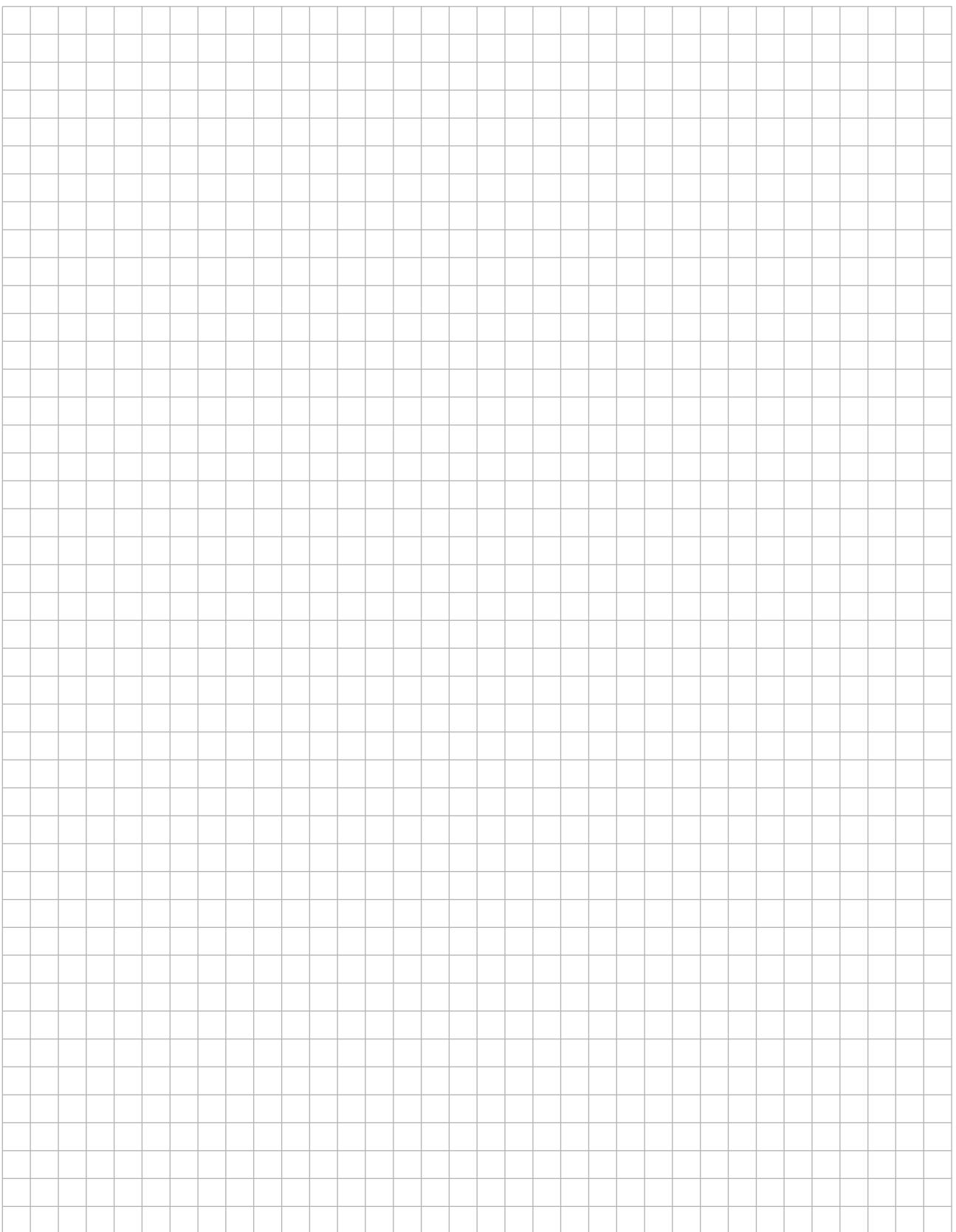
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Leaving Certificate 2015 – Ordinary Level

## **Mathematics – Paper 2**

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