



Coimisiún na Scrúduithe Stáit  
State Examinations Commission

Junior Certificate Examination 2016

# Mathematics

Paper 2  
Higher Level

Monday 13 June – Morning 9:30 to 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	Question	Mark
1		11	
2		12	
3			
4			
5			
6			
7			
8			
9			
10		Total	

Grade
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## Instructions

There are 12 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. You may 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 the 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:











- (f) Display the data **graphically** in a way that allows you to compare the data for the two years. Label your graph(s) clearly. Show any calculations that you make.

You may use the data from **Table 1** or **Table 2**. The tables are reprinted on the next page.

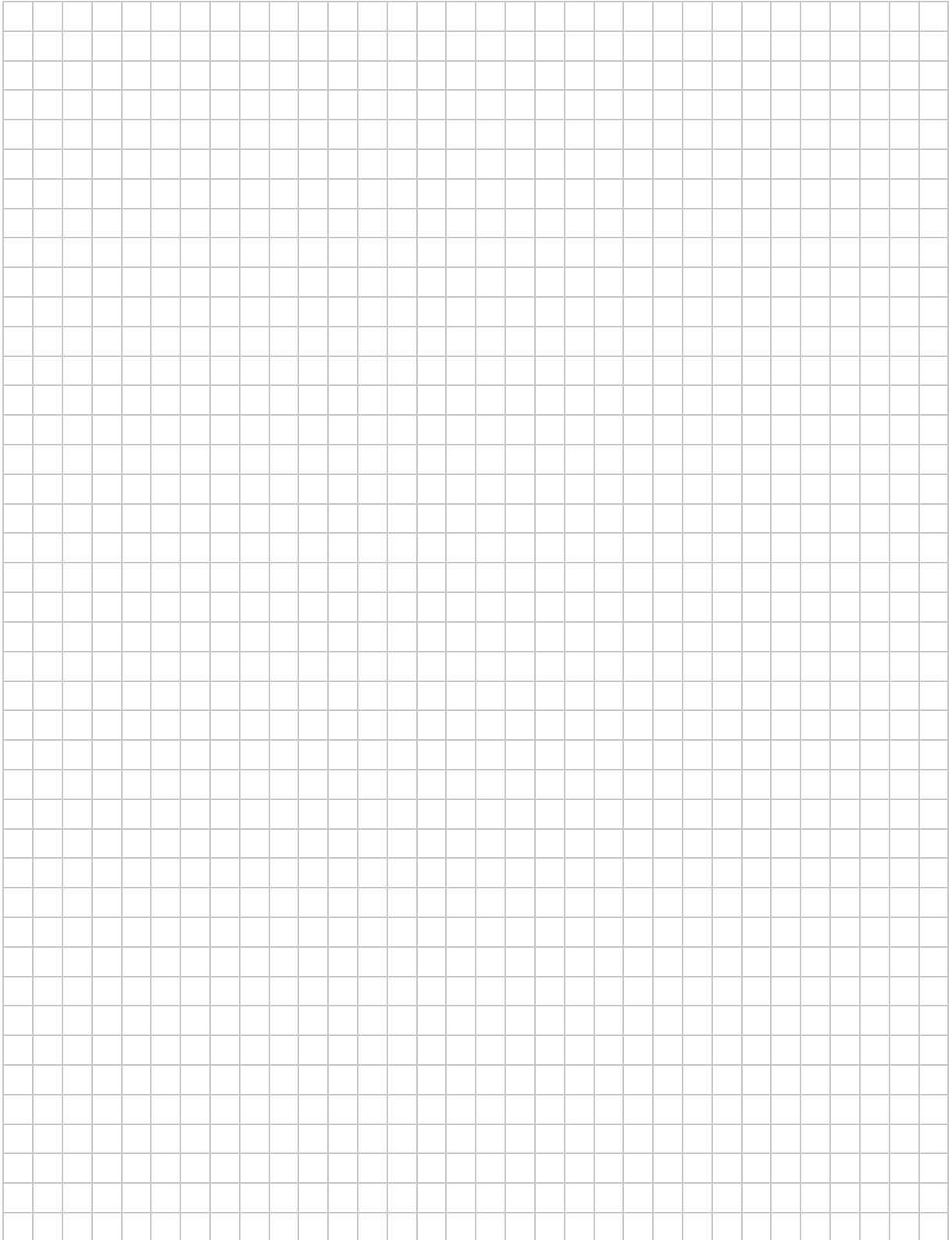




Table 2						
% of female members of parliament		0 – 9	10 – 19	20 – 29	30 – 39	40 – 49
Number of countries	2005					
	2015					

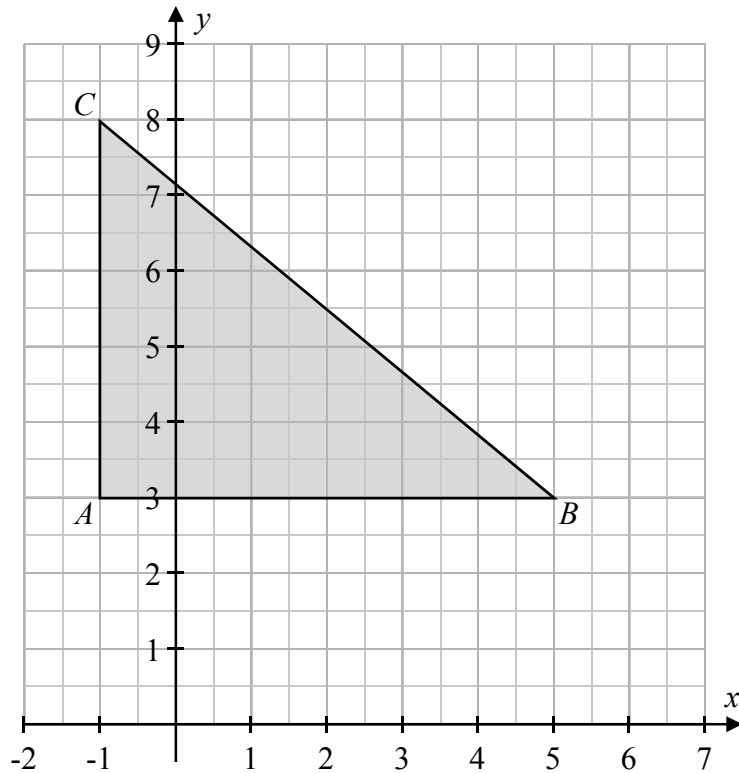
Table 1	
% of female members of parliament	
2005	2015
9	10
9	13
11	13
12	14
12	16
12	18
13	19
13	20
16	20
17	23
17	23
19	24
20	24
20	26
21	26
21	28
22	29
22	31
22	31
23	31
33	36
34	37
35	37
36	37
37	39
37	41
38	42
45	44

Space for extra work:

**Question 4**

(Suggested maximum time: 20 minutes)

The triangle  $ABC$  is shown on the co-ordinate grid below.



- (a) Write down the co-ordinates of the points  $A$ ,  $B$ , and  $C$ .

$A =$  
         
  $B =$  
         
  $C =$

- (b) Find the equation of each of the lines  $AB$ ,  $AC$ , and  $BC$ .

$AB:$	$AC:$
$BC:$	

- (c) Use trigonometry to find the measure of the angle  $ABC$ .  
Give your answer in degrees, correct to two decimal places.

- (d) (i) Find  $|BC|$ . Give your answer in surd form.

- (ii) Hence, or otherwise, find the area of the circle that goes through the points  $A$ ,  $B$ , and  $C$ .  
Give your answer in terms of  $\pi$ .

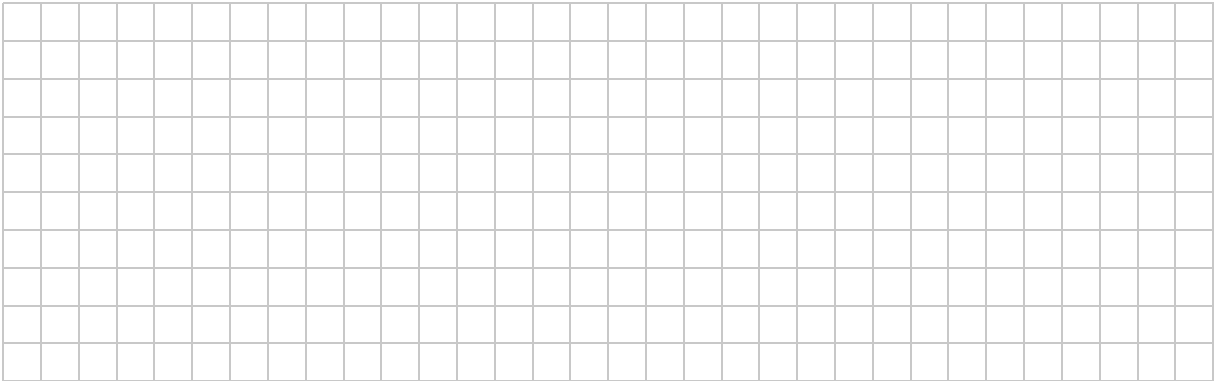
- (e) Find the equation of the line through the point  $A$  that is perpendicular to the line  $BC$ .

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**Question 5**

**(Suggested maximum time: 10 minutes)**

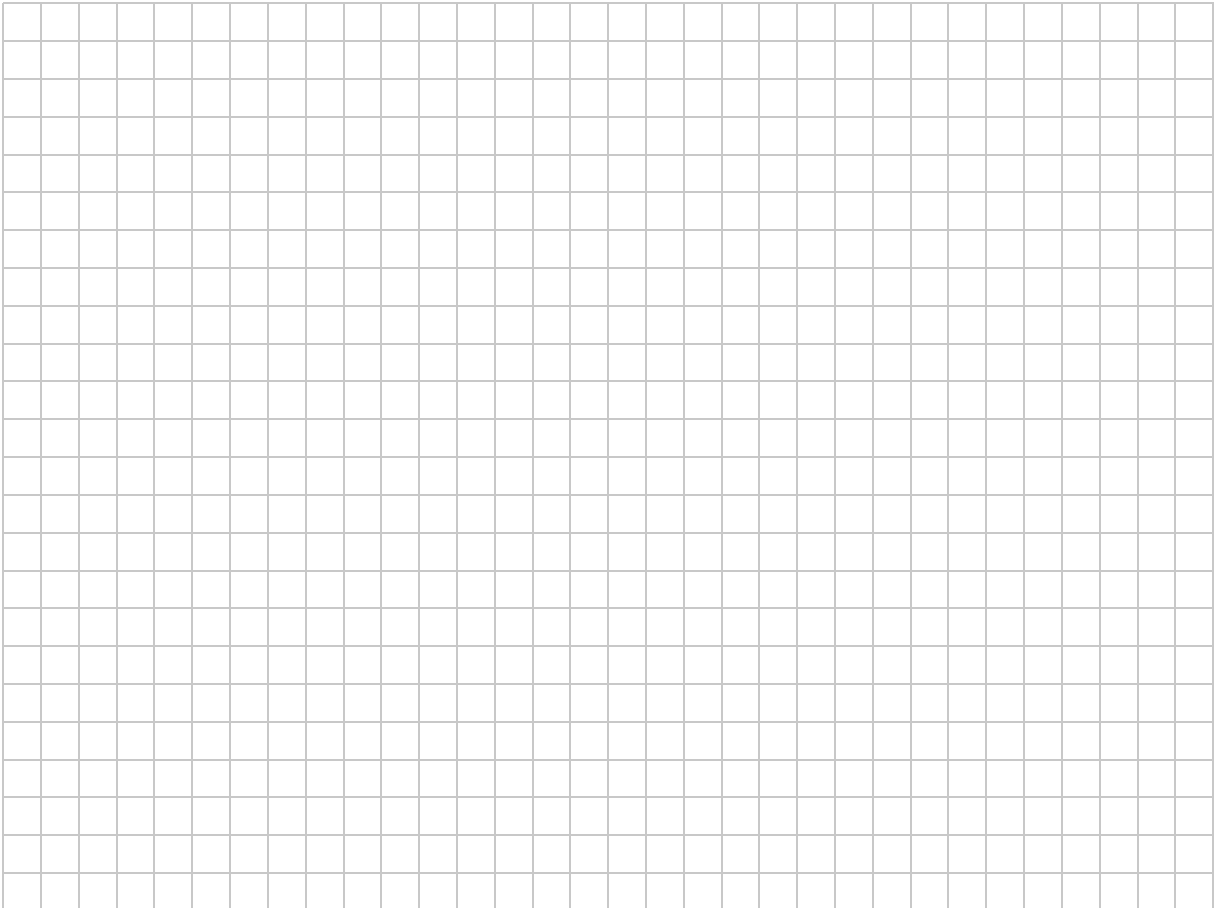
**(a)** Is the point  $(3, -5)$  on the line  $5x + 3y + 6 = 0$ ? Justify your answer.



**(b)** Find the point of intersection of the following two lines.

$$3x + 2y = 7$$

$$y = -2x + 5$$



**Question 6**

**(Suggested maximum time: 5 minutes)**

Prove that the angles in any triangle add to  $180^\circ$ .

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*Diagram:*

<i>Given:</i>
<i>To Prove:</i>
<i>Construction:</i>
<i>Proof:</i>

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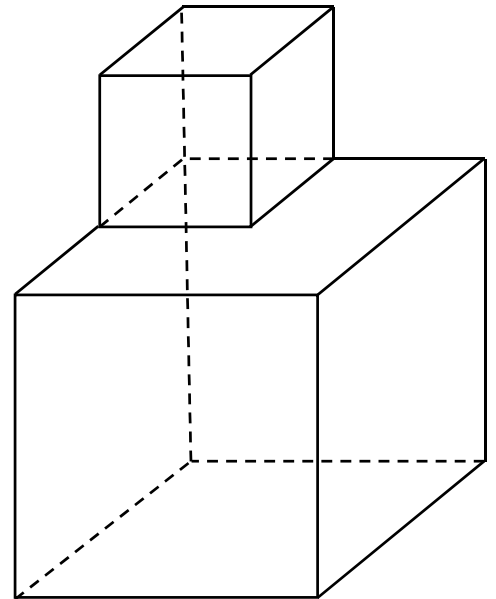
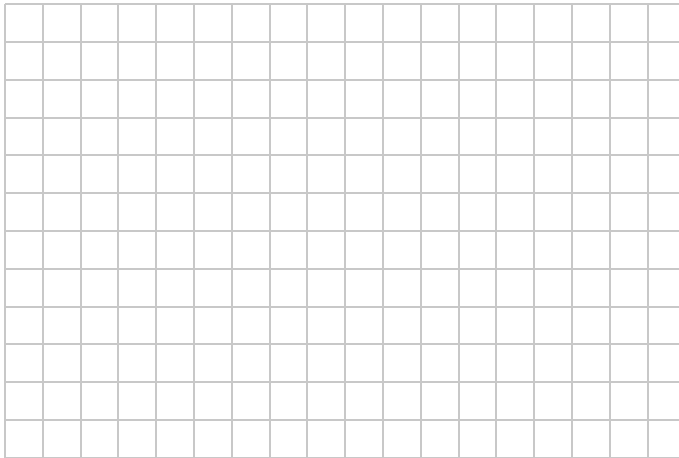


**Question 9**

**(Suggested maximum time: 10 minutes)**

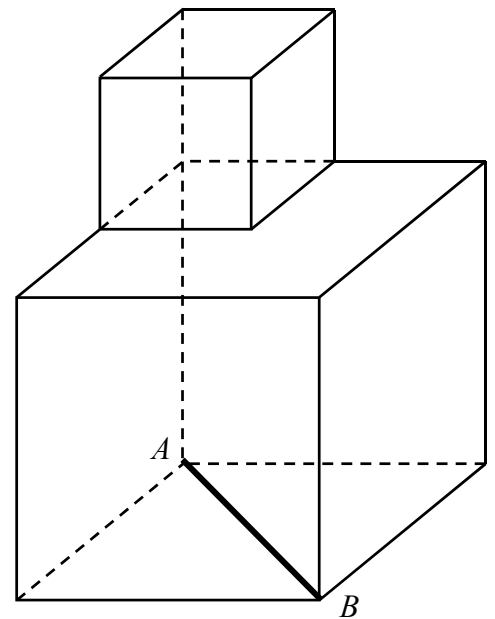
A shape is made by placing a small cube on top of a larger one, as shown. The cubes have edges of length 1 unit and 2 units.

- (a) Find the total surface area of this shape.



- (b) The line segment  $[AB]$  is a diagonal of the base of the shape, as shown.

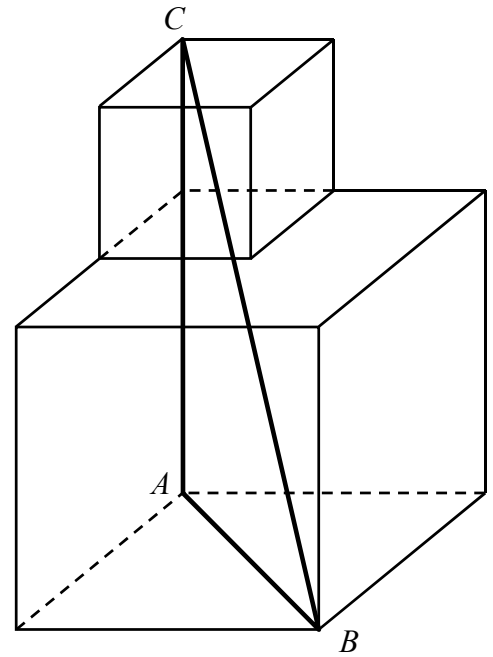
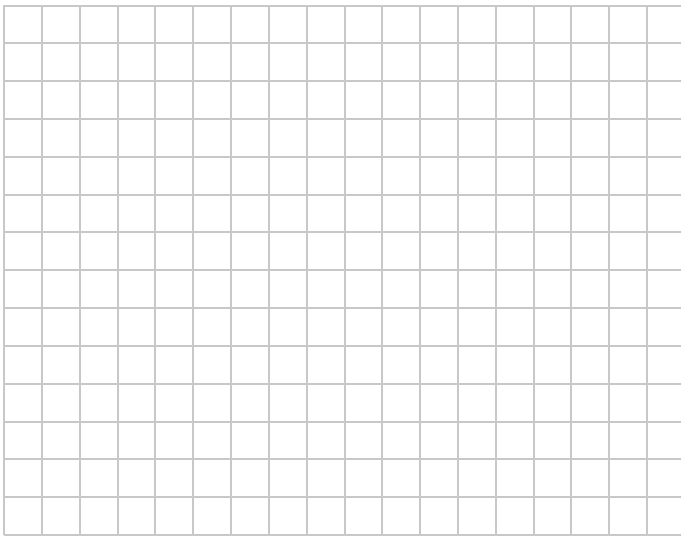
- (i) Find  $|AB|$ . Give your answer in surd form.



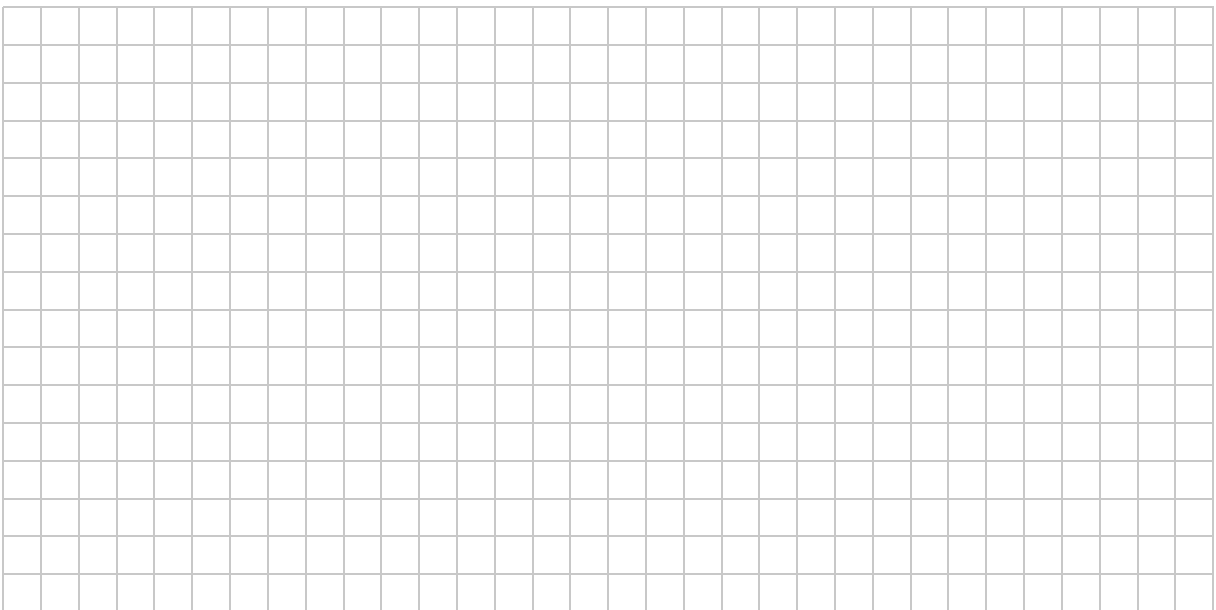


The right-angled triangle  $ABC$  is constructed inside this shape, as shown.

(ii) Find  $|BC|$ . Give your answer in surd form.



(iii) Find the length of the part of the line  $BC$  that is inside the larger cube.



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**Question 10**

**(Suggested maximum time: 10 minutes)**

In this question, all lengths are in cm and all areas are in  $\text{cm}^2$ .

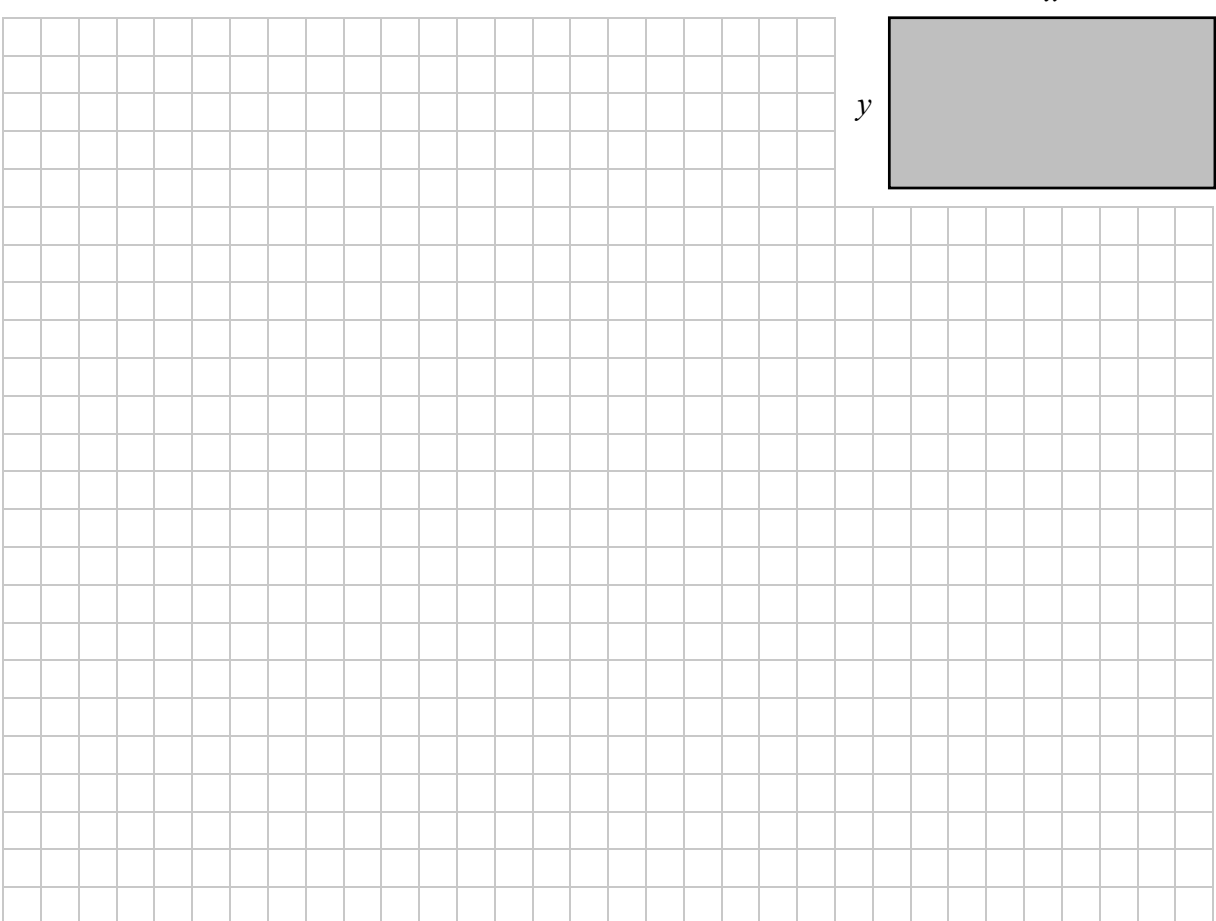
- (a) The diagram shows a rectangle with sides of length 7 and  $y$ .  
The value of the area of the rectangle is equal to the length of its perimeter.

Use this information to find the value of  $y$ .



- (b) The diagram shows a rectangle with sides of length  $x$  and  $y$ , where  $x > 2$ .  
The value of the area of the rectangle is equal to the length of its perimeter.

Use this information to write  $y$  in terms of  $x$ .



**Question 11**

**(Suggested maximum time: 5 minutes)**

Fiona finds the volumes of five different cylinders.  
Each of them has a height of  $K$  centimetres.

- (a) Complete the table below to show the volume of each of the five cylinders.  
Give each answer in terms of  $\pi$  and  $K$ .

Radius of cylinder (cm)	Height of cylinder (cm)	Volume of cylinder (cm <sup>3</sup> )
1	$K$	
2	$K$	
3	$K$	$9\pi K$
4	$K$	
5	$K$	

- (b) Is the sequence of volumes in the table linear, quadratic, exponential, or none of these?  
Justify your answer fully.

Answer: \_\_\_\_\_

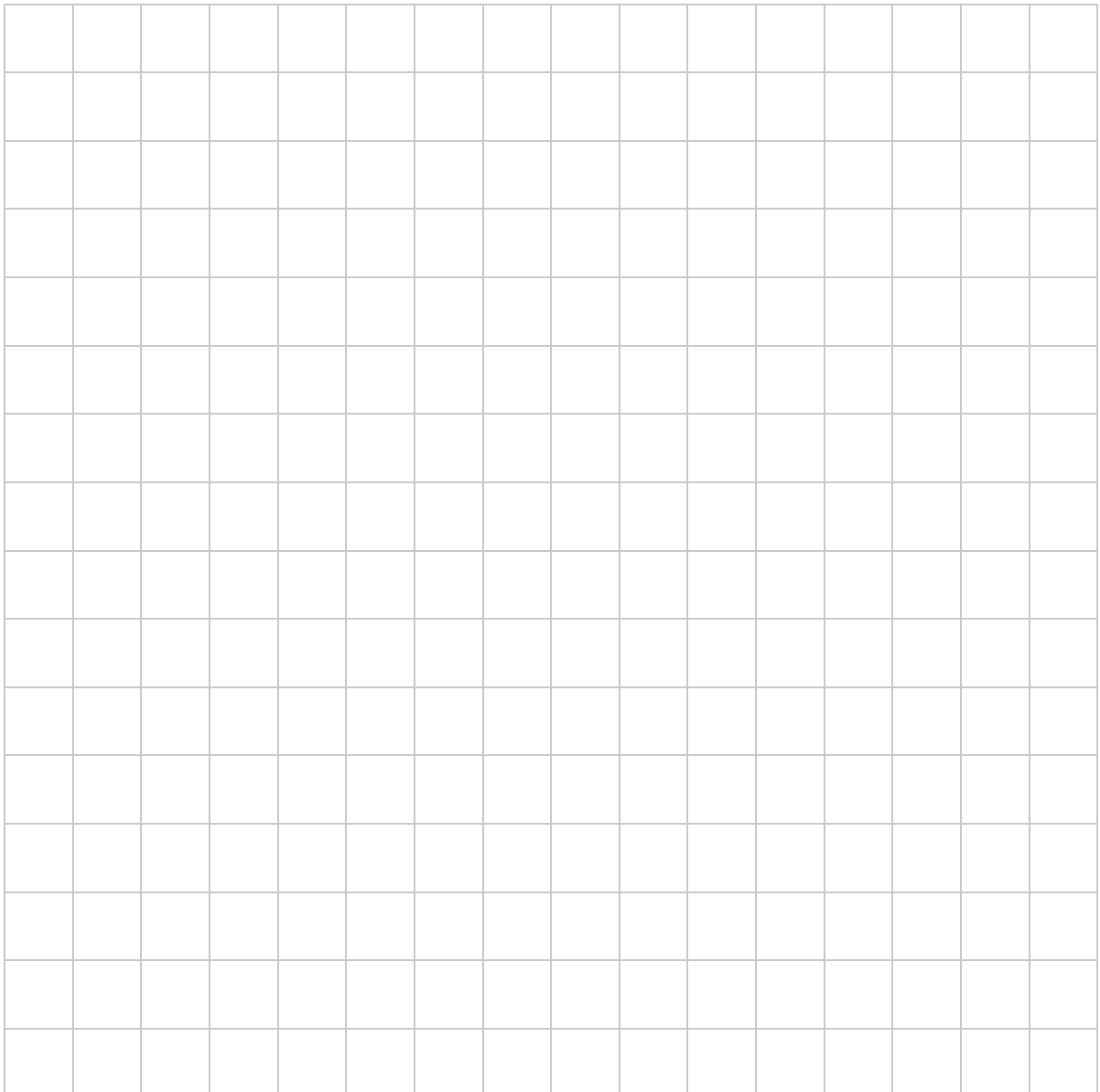
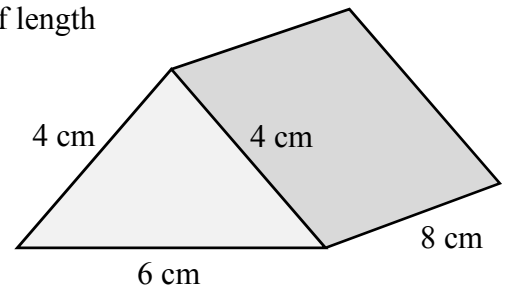
Justification: \_\_\_\_\_

**Question 12**

**(Suggested maximum time: 20 minutes)**

- (a) A packet of sweets is in the shape of a closed triangular-based prism. It has a height of 8 cm and a triangular base with sides of length 4 cm, 4 cm, and 6 cm.

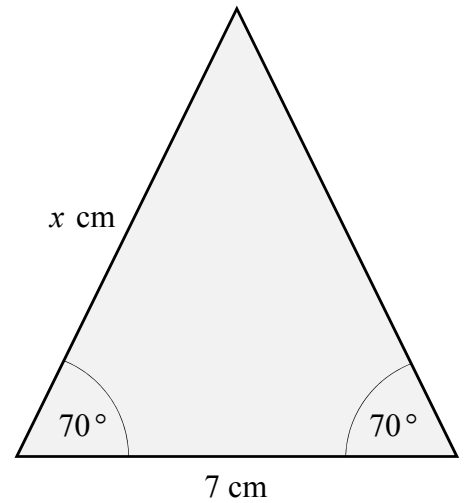
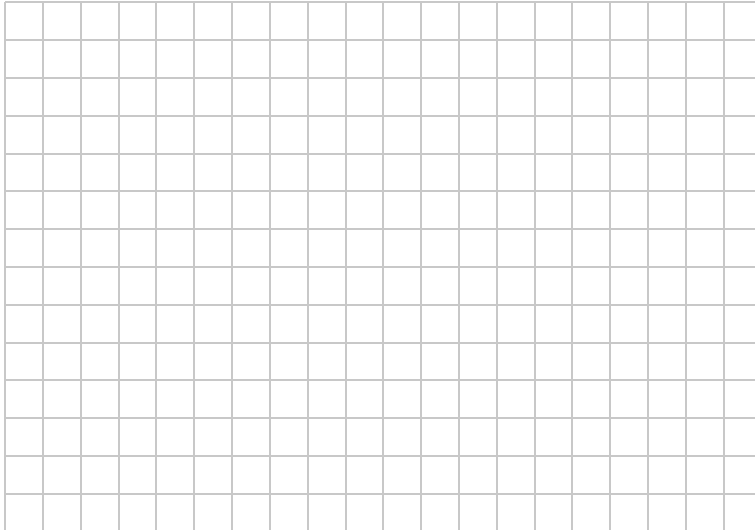
Construct an accurate **net** of the prism.  
Show all of your construction lines clearly.



(b) A different triangular-based prism has the base shown in the diagram on the right.

(i) Use trigonometry to find the length of the side marked  $x$  cm.

Give your answer correct to two decimal places.



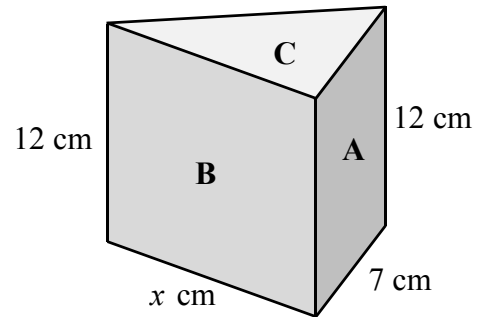
This prism is shown in the diagram on the right.

It has a height of 12 cm.

Three of its faces are labelled **A**, **B**, and **C**.

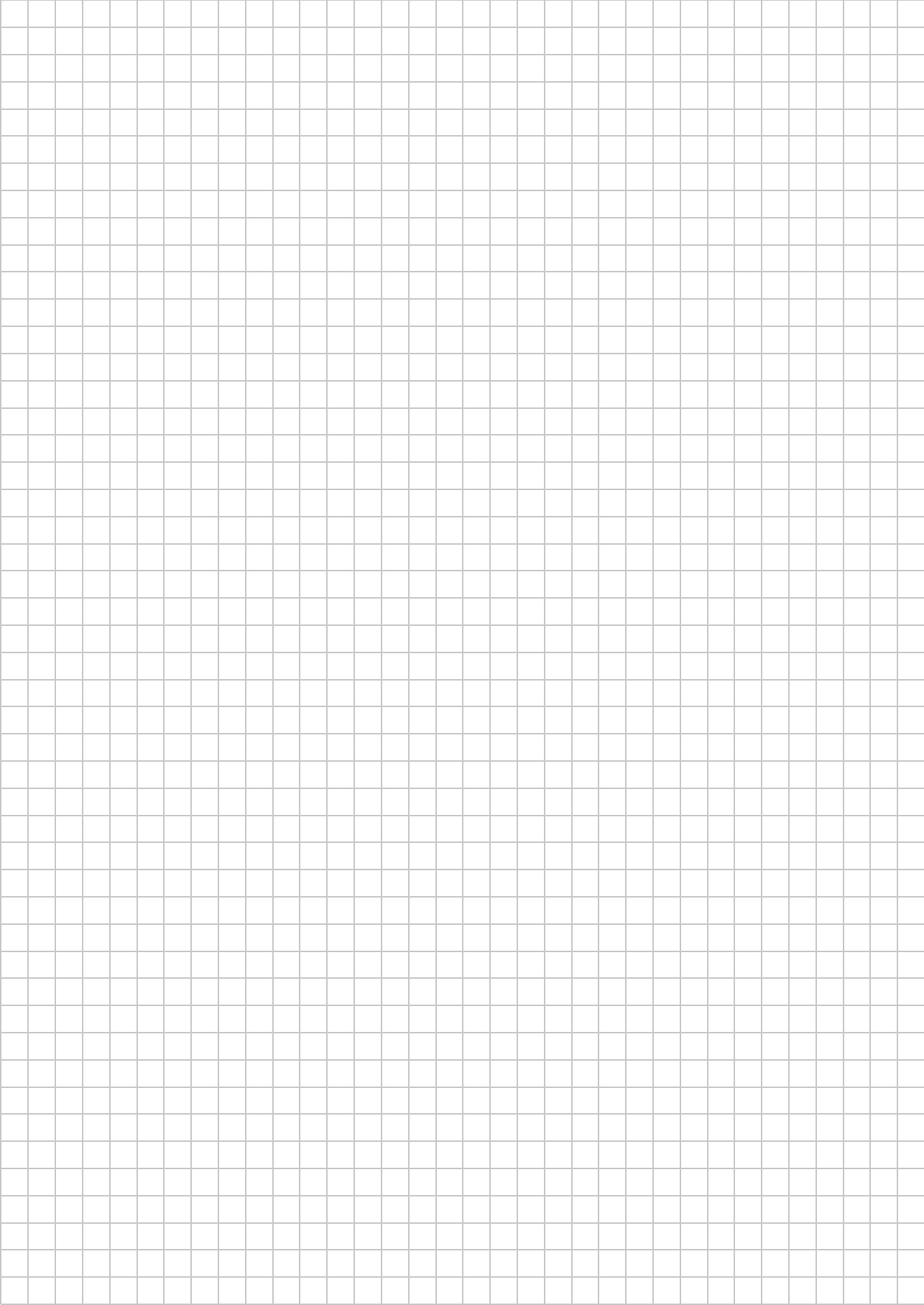
(ii) Find the area of each of the faces labelled **A**, **B**, and **C** in the diagram.

Give each answer correct to the nearest  $\text{cm}^2$ .

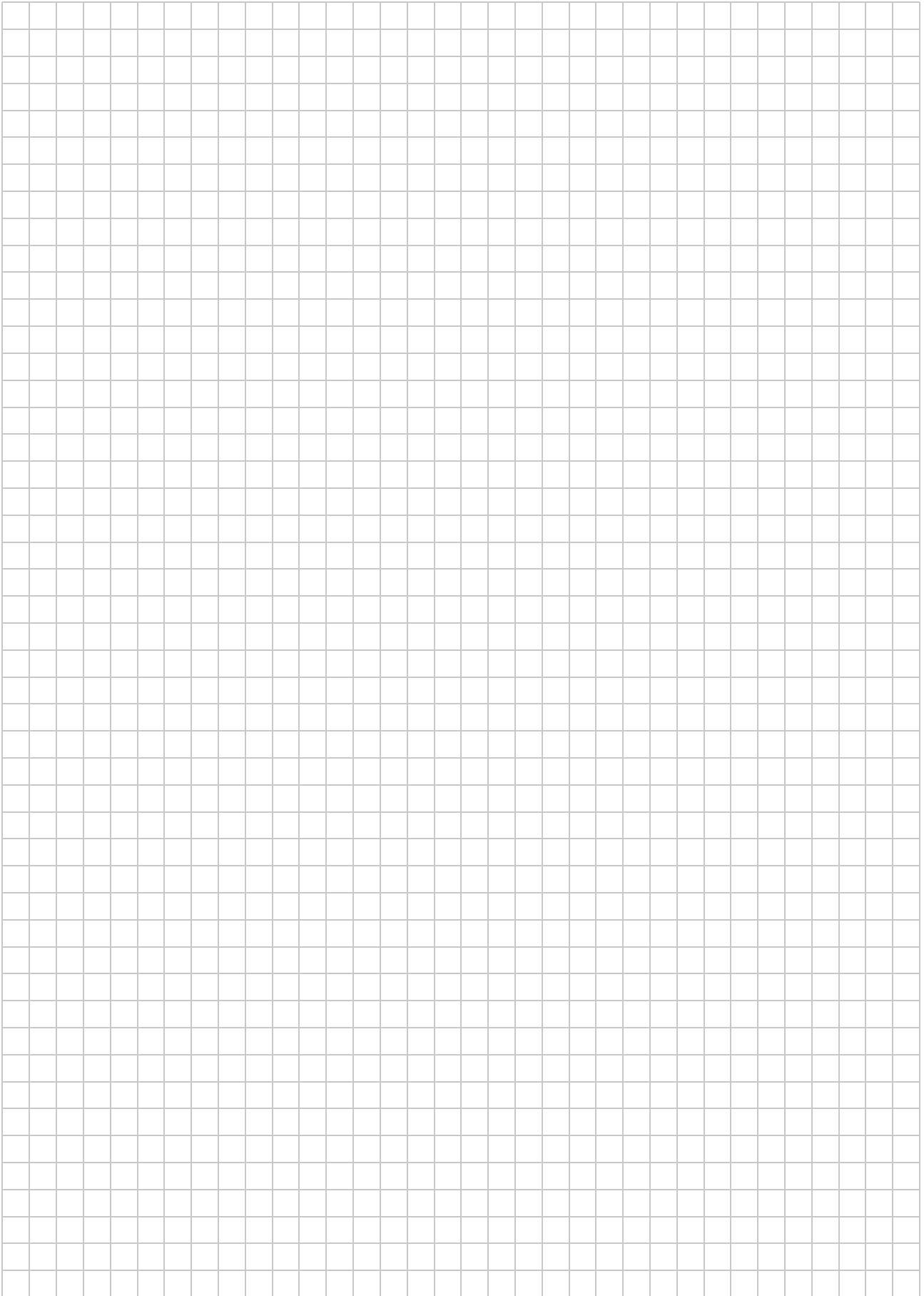


<p><b>A:</b></p>	<p><b>B:</b></p>
<p><b>C:</b></p>	

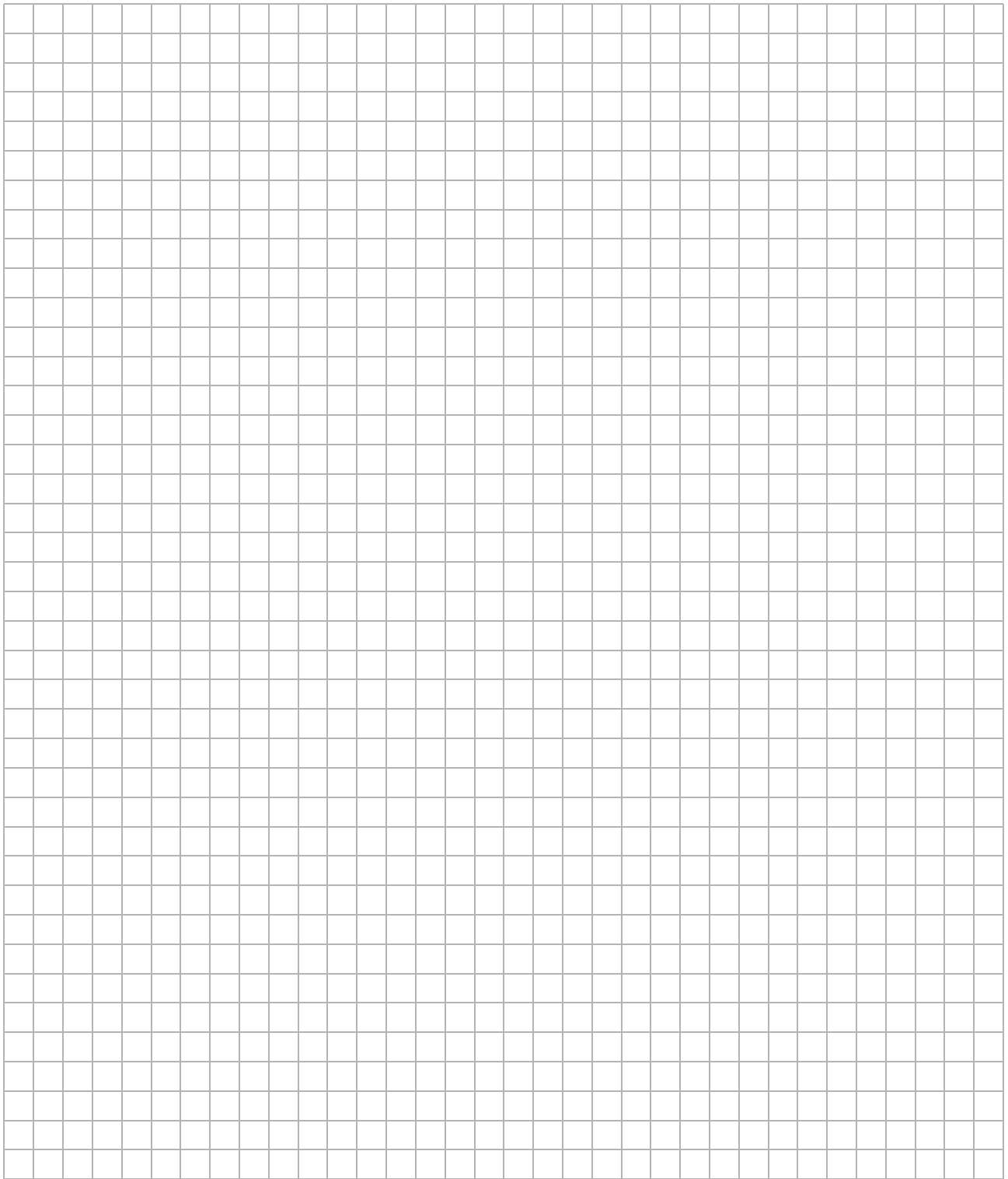
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