



**Pre-Leaving Certificate Examination, 2016**  
**Triailscrúdú na hArdteistiméireachta, 2016**

# Mathematics

Paper 2

Higher Level

2½ hours

300 marks

Name:
School:
Address:
Class:
Teacher:

For examiner	
Question	Mark
1	
2	
3	
4	
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6	
7	
8	
9	
Total	

Running total	
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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.**

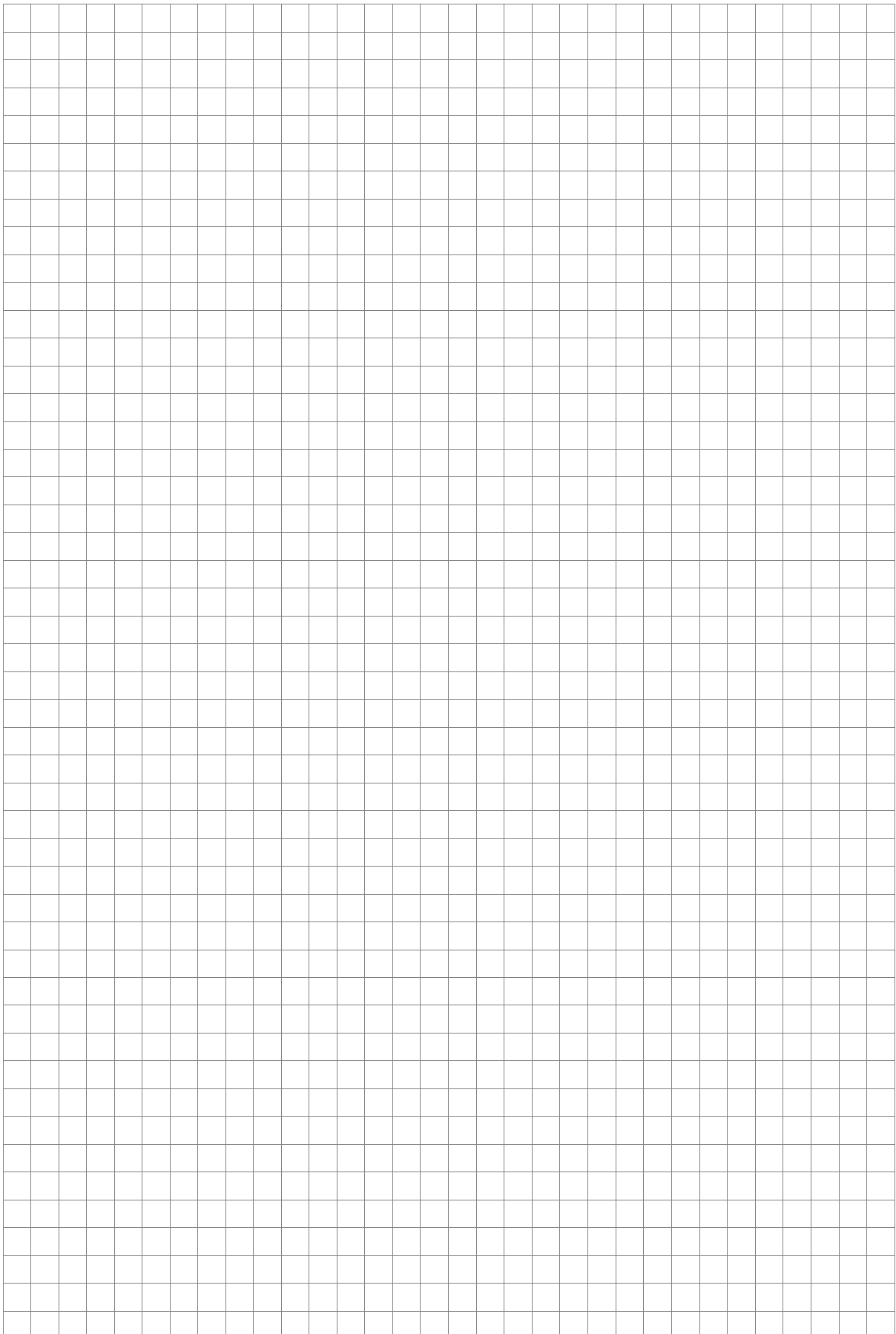
**Answers should include the appropriate units of measurement, where relevant.**

**Answers should be given in simplest form, where relevant.**

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



- (b) A bag contains 3 red marbles, 4 blue marbles and  $x$  green marbles. Given that the probability of choosing 2 green marbles is  $\frac{5}{26}$  calculate the number of marbles in the bag.



**Question 2**

**(25 marks)**

**(a)** The weights of the players,  $W$ , at a football match are normally distributed with a mean of 79 kg and a standard deviation of 3 kg.

**(i)** Find  $P(W \leq 80.1 \text{ kg})$ .

**(ii)** Find  $P(75.5 \text{ kg} \leq W \leq 81 \text{ kg})$ .

- (b) The attendance at a GAA match depends on the weather. The probability of a large crowd attending the match is 0.9. The probability of large crowd attending if it is raining is 0.3. The probability of it raining on match day is 0.2. Calculate the probability of a large crowd attending the match given it is raining.

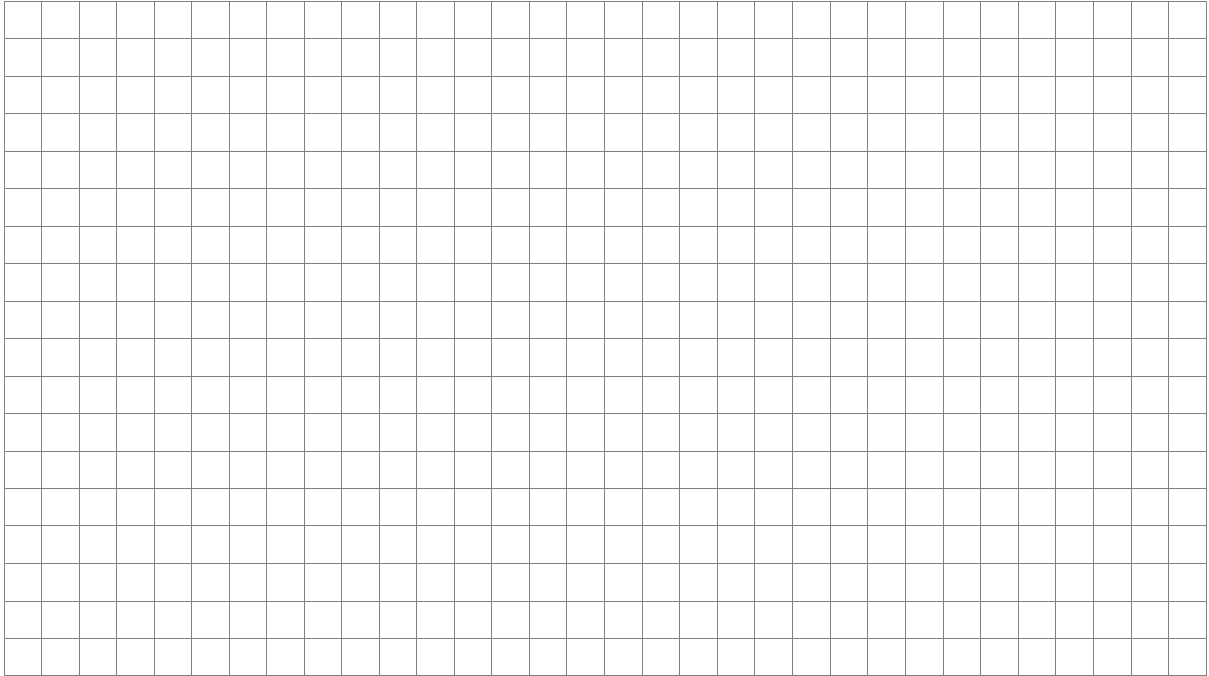


**Question 3**

**(25 marks)**

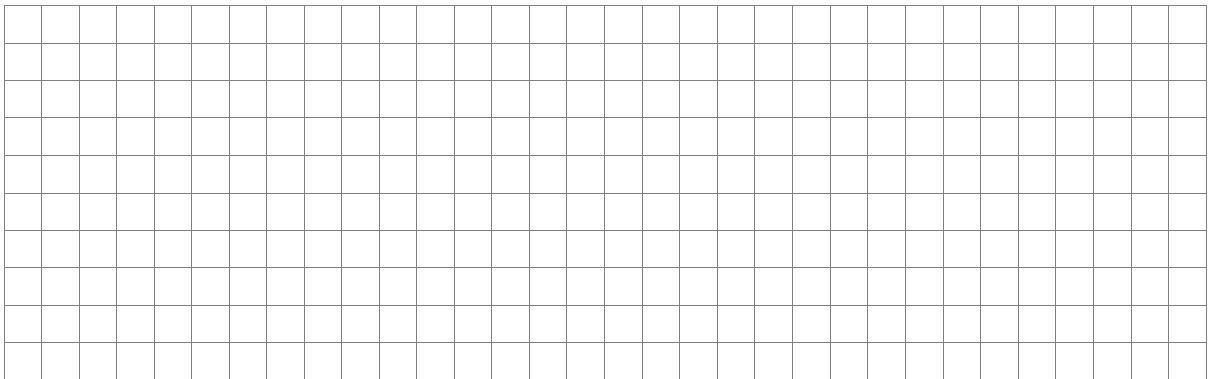
The line  $L$  passes through the point  $(6, 4)$  and has a slope of  $m$ .

- (a) Write down the equation of the line  $L$ , in terms of  $m$ , in the form  $ax + by + c = 0$ .

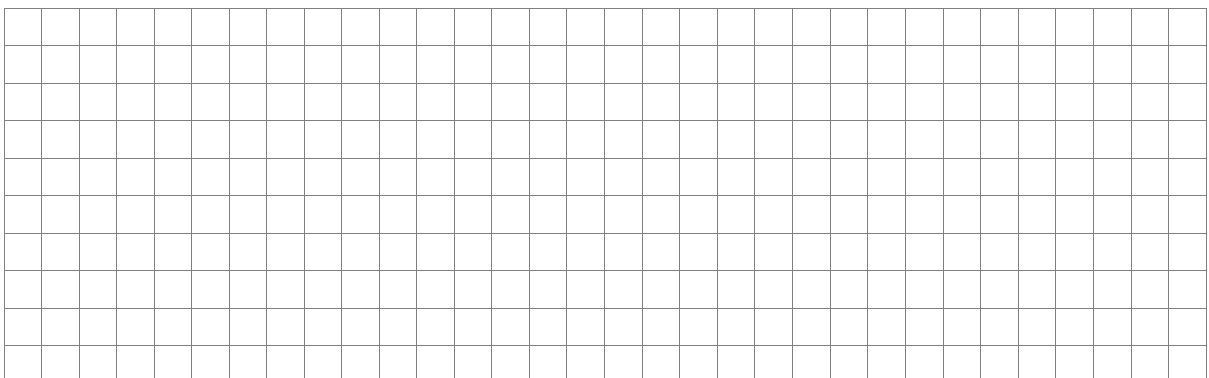


- (b) Find, in terms of  $m$ , the co-ordinates of the points where  $L$  cuts:

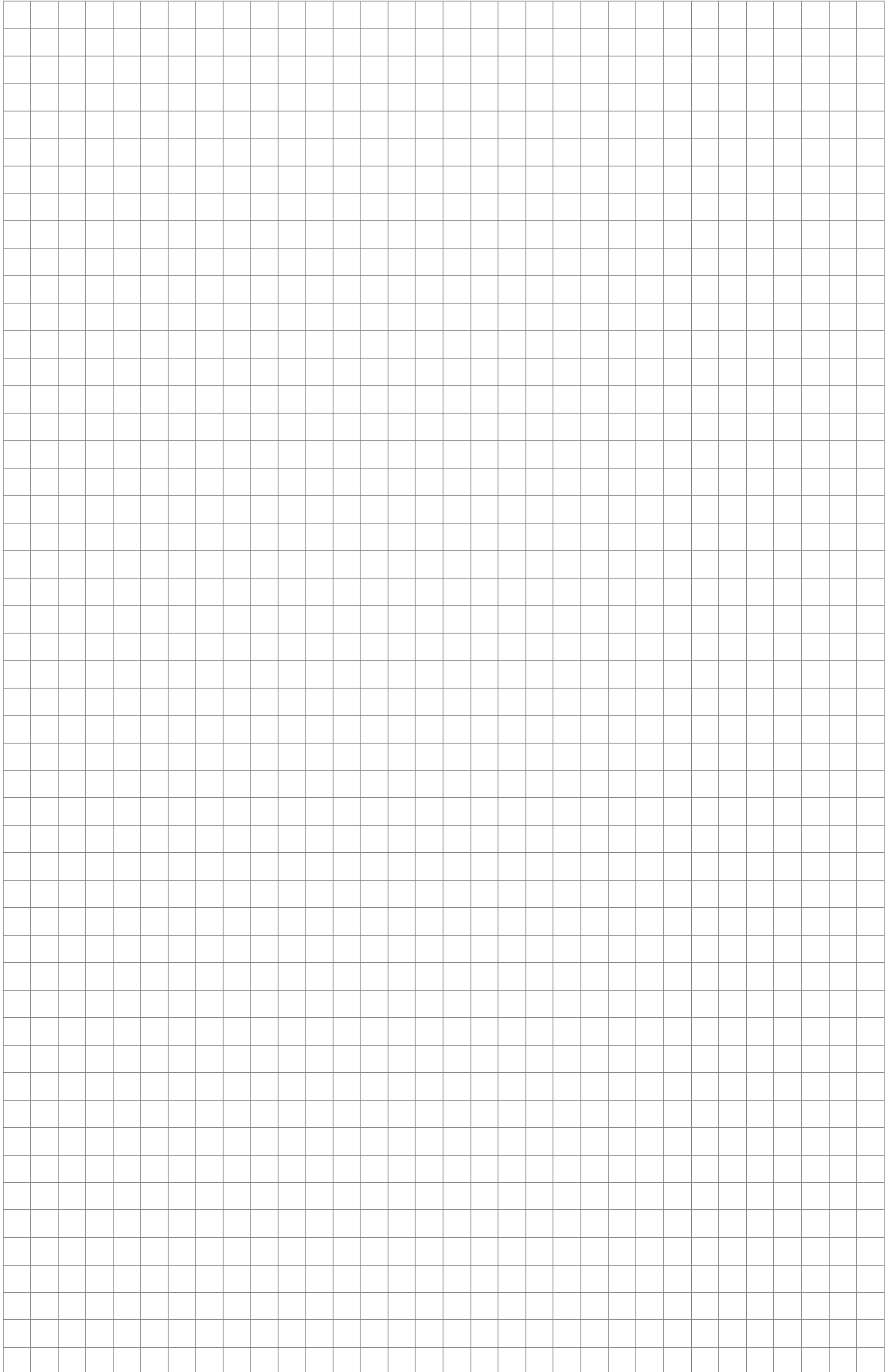
- (i) The  $x$ -axis.



- (ii) The  $y$ -axis.



- (c) The line  $L$  forms a triangle of area 49 square units with the axes. Find two values of  $m$ .

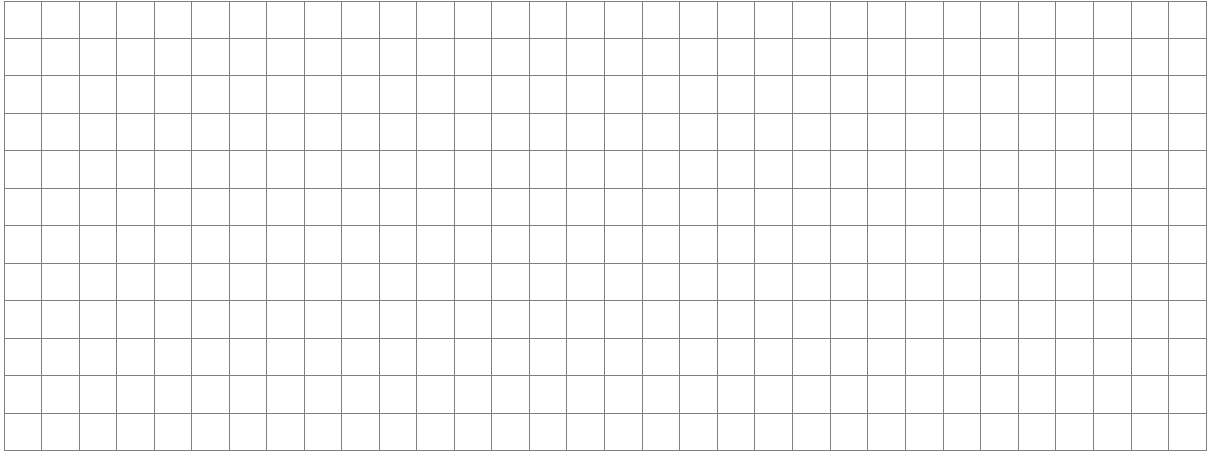




**Question 4**

**(25 marks)**

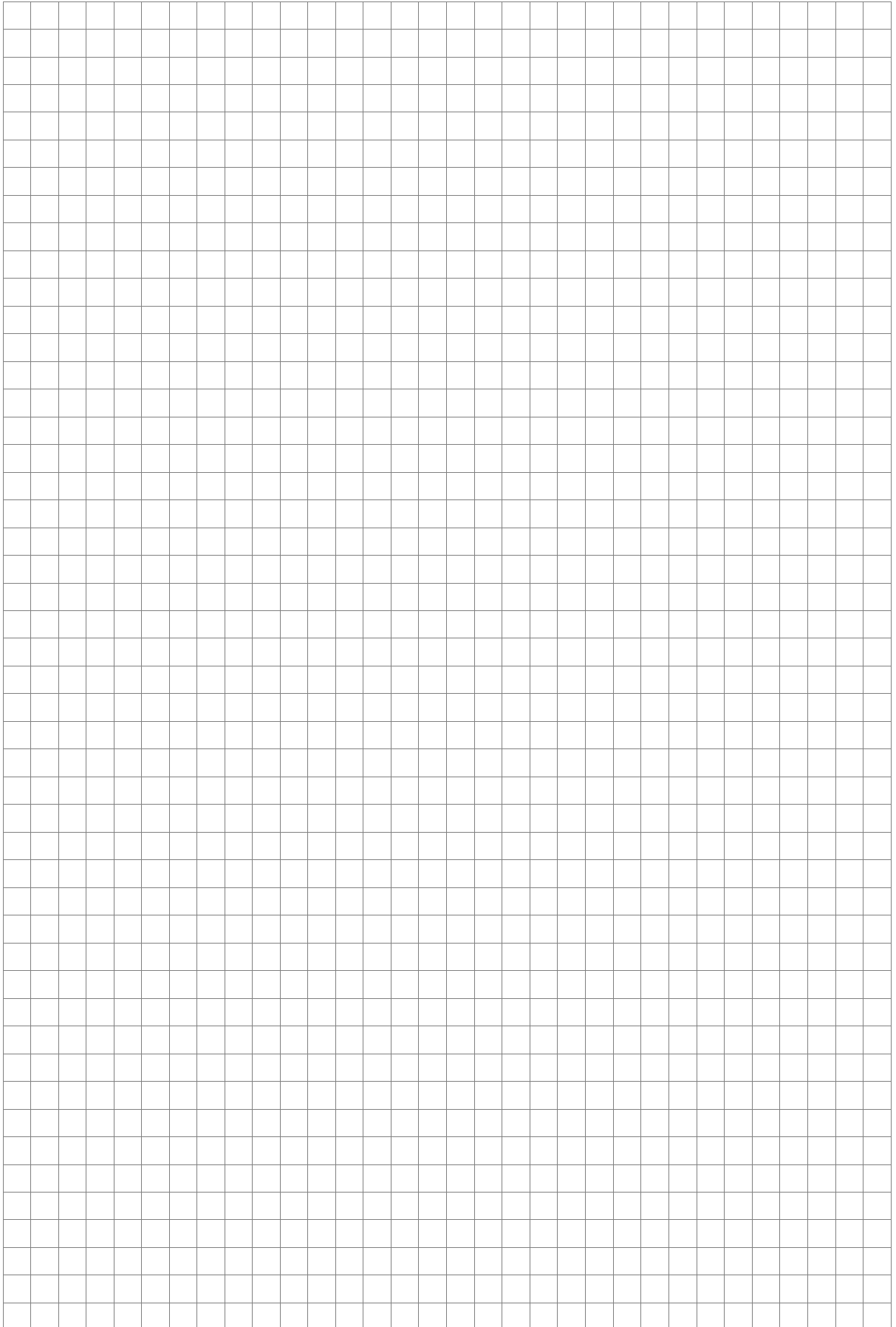
- (a) Find the centre and radius of the circle  $C_1 : x^2 + y^2 - 4x + 6y - 21 = 0$ .



- (b) Construct the circle  $C_1$ .



- (c) A second circle  $C_2$ , has radius length half of  $C_1$  and touches  $C_1$  internally at the point  $(5, 2)$ . Find the equation of the circle  $C_2$ .

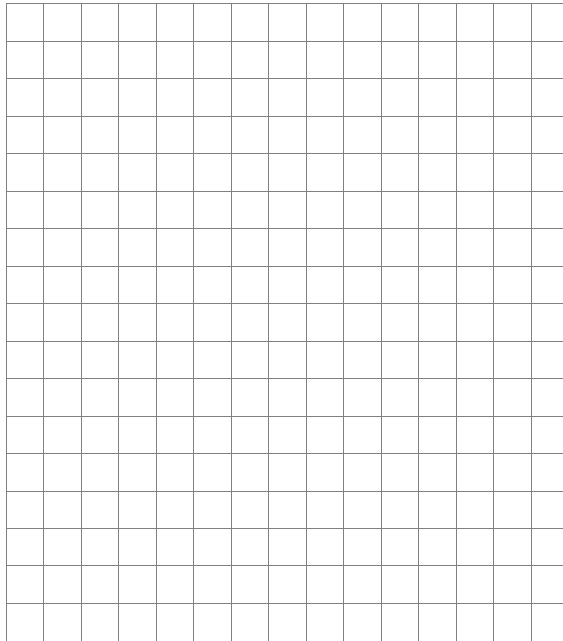
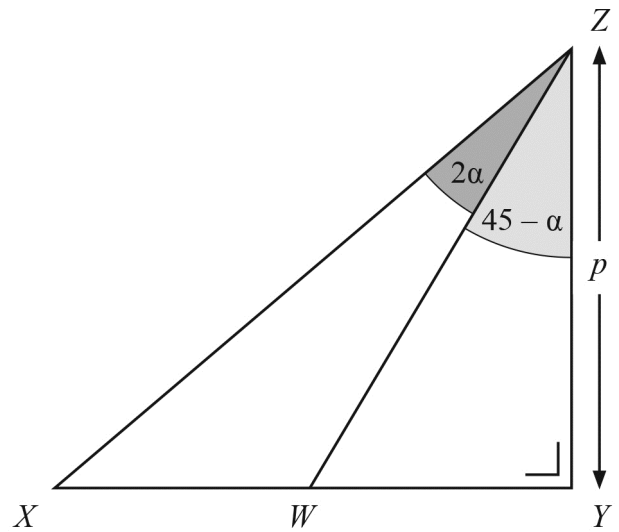


**Question 5**

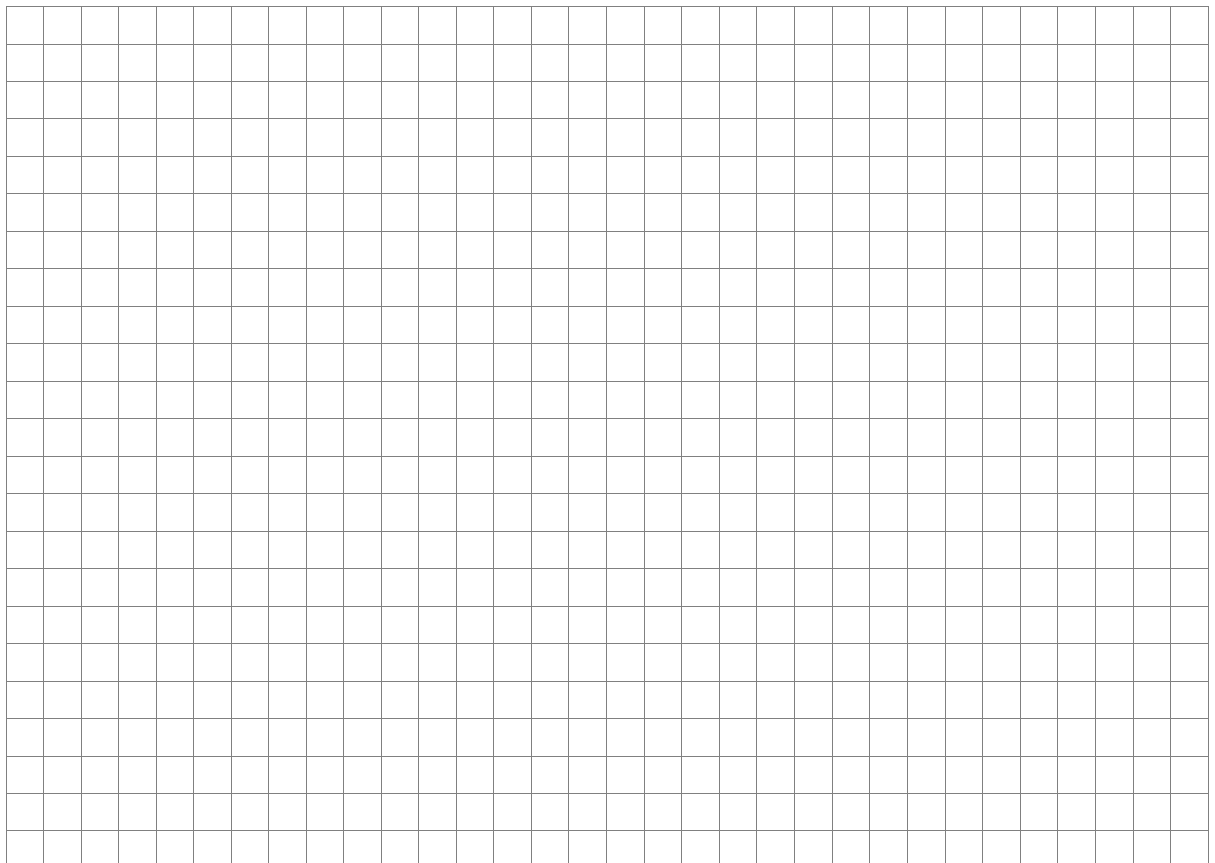
**(25 marks)**

- (a) In the triangle  $XYZ$ ,  $|\angle XYZ| = 90^\circ$  and  $|YZ| = p$ .

- (i) Show that  $|WY| = p \tan(45^\circ - \alpha)$ .



- (ii) Hence, or otherwise, show that  $|XW| = 2p \tan 2\alpha$ .







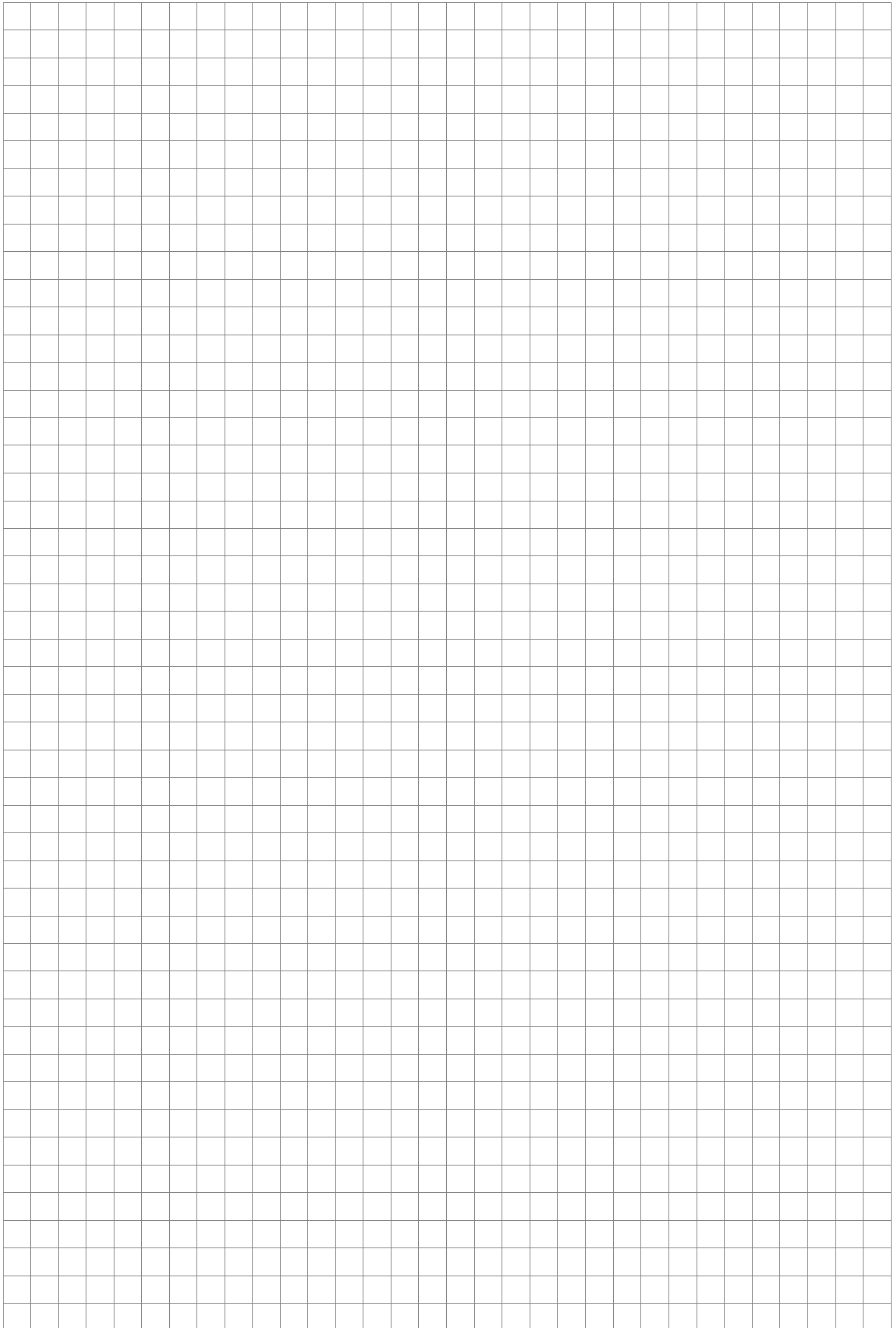
**Question 6**

**(25 marks)**

- (a) The area of a sector of a circle of radius 9 cm is  $13.5 \text{ cm}^2$ . Find, in radians, the measure of the acute angle in the sector.

- (b) Show that  $(\cos \alpha + \sin \alpha)^2 = 1 + \sin 2\alpha$ .

(c) Solve the equation  $\cos 3\theta = \frac{1}{\sqrt{2}}$  for  $0 \leq \theta \leq 360^\circ$ .

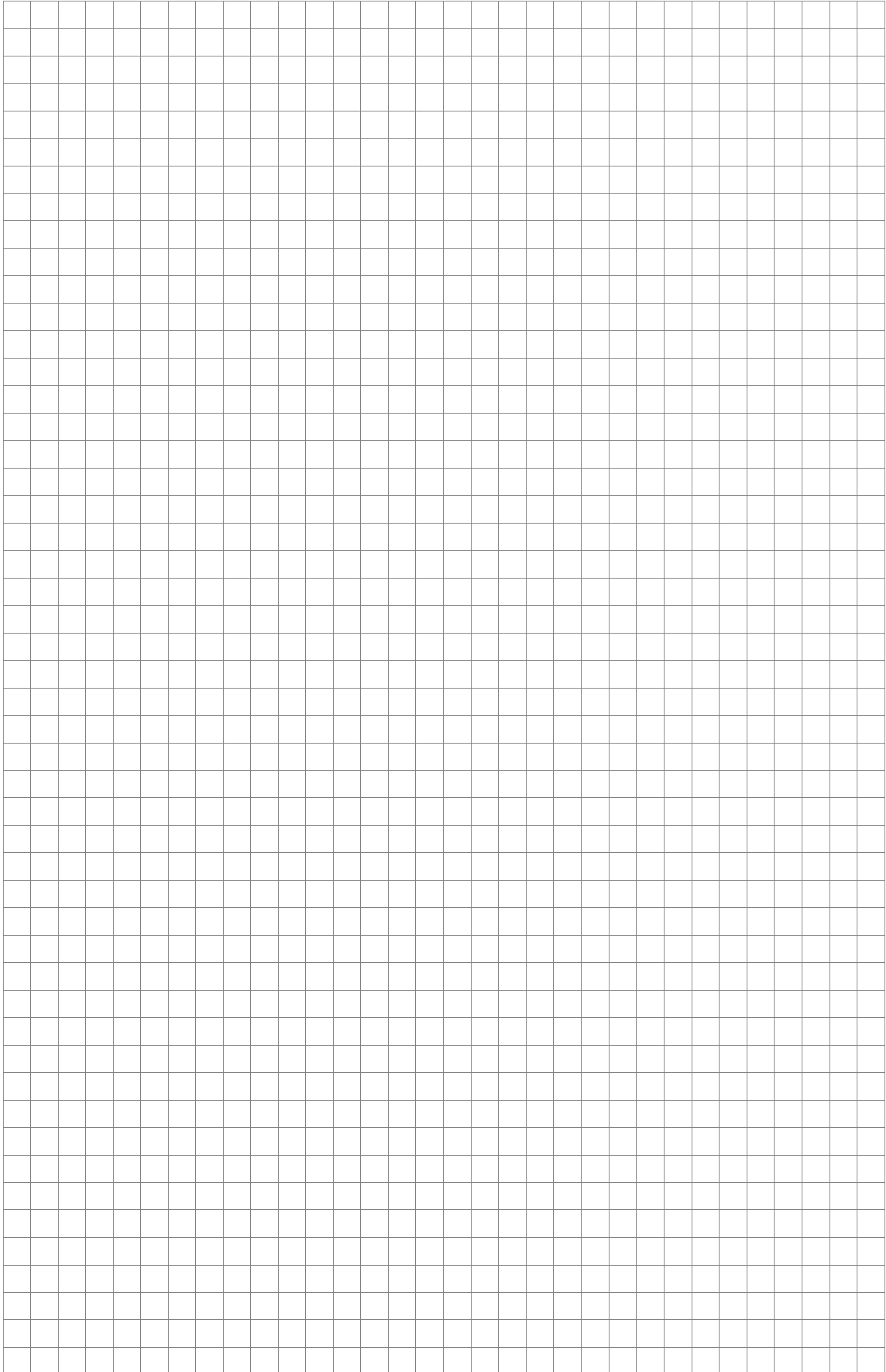








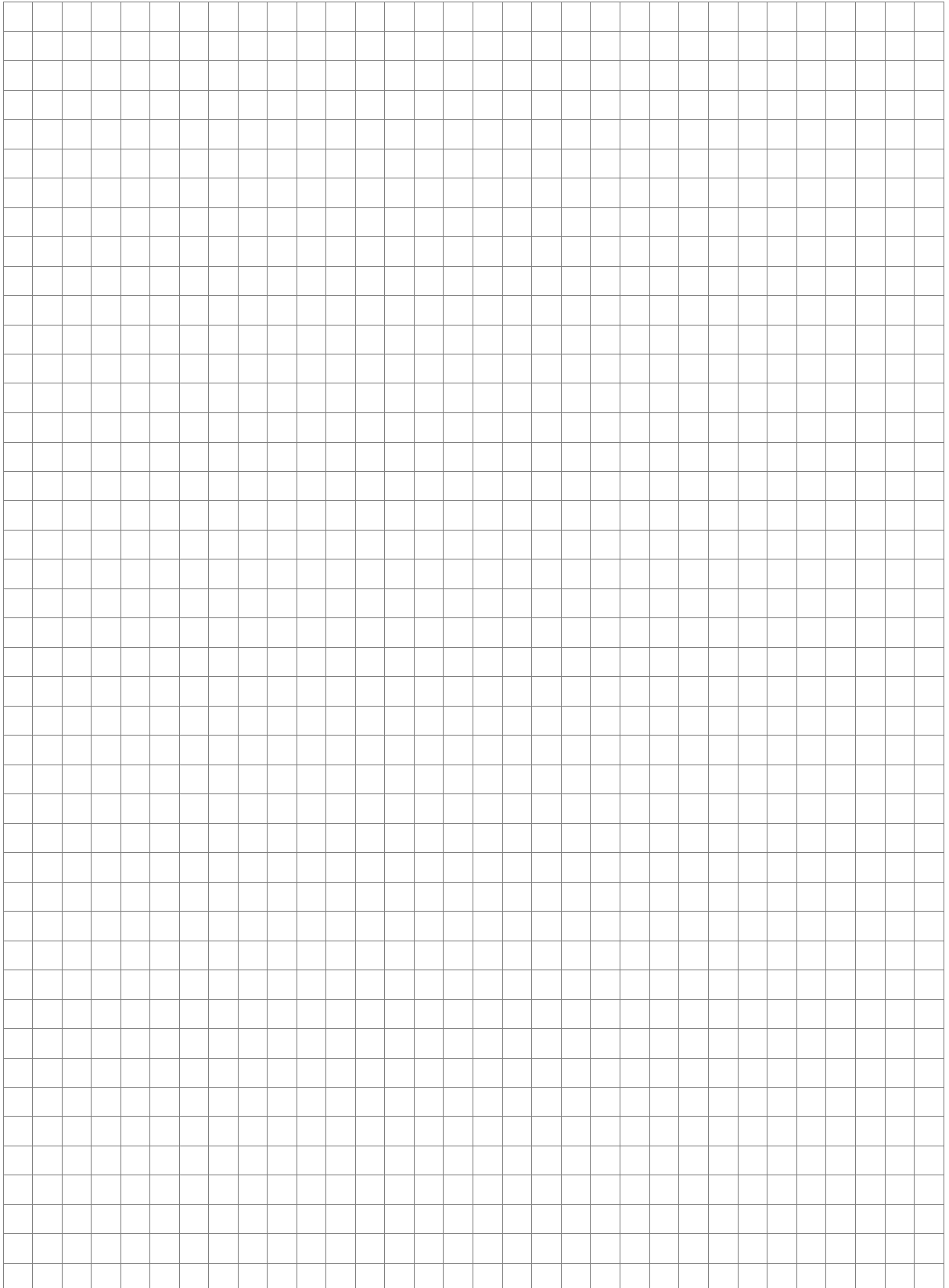
(c) Display the number of likely voters on a suitable graphical display.



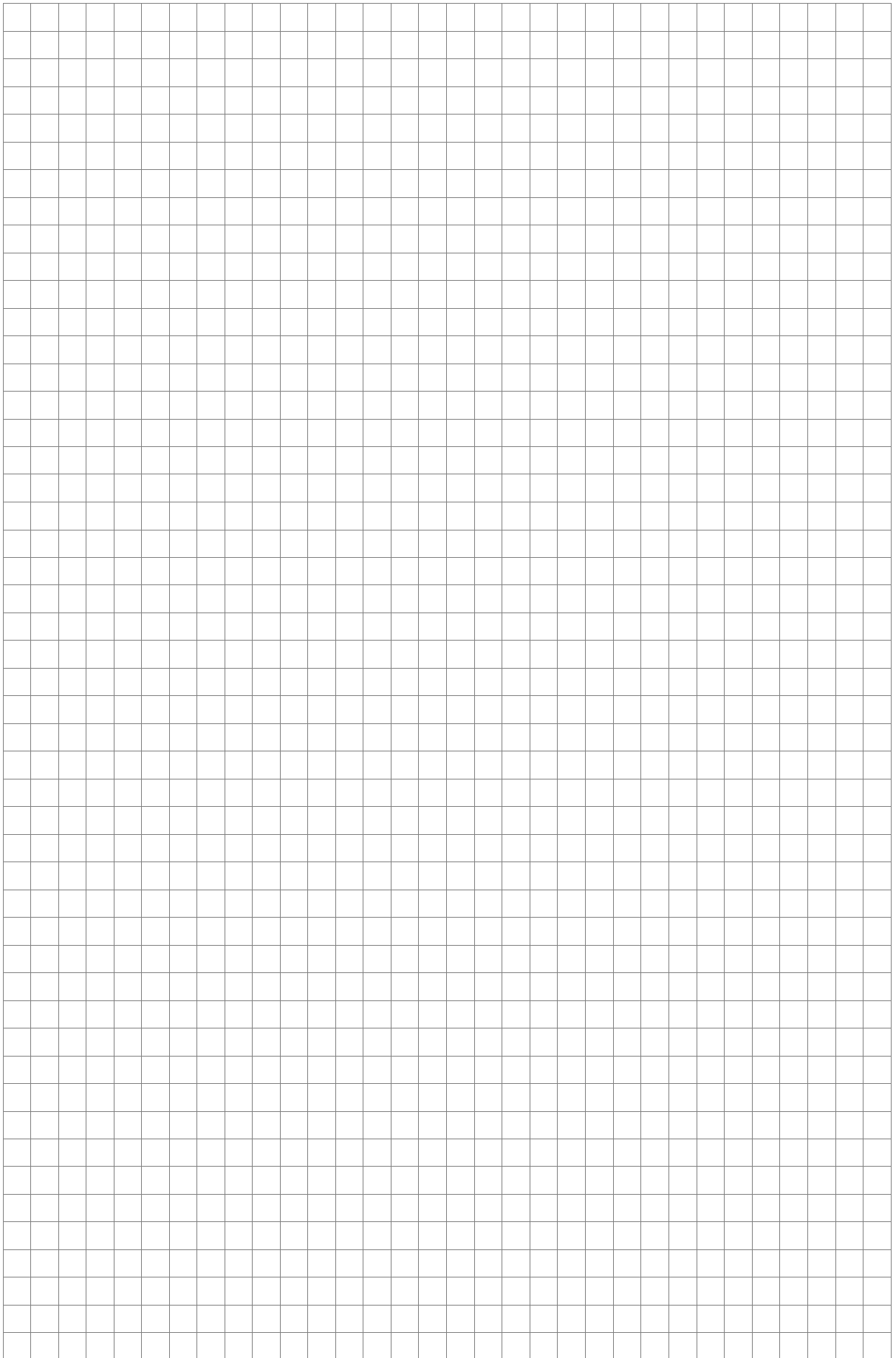
- (d) In a poll carried out by a rival marketing and research company, a sample of  $x$  voters was surveyed. 60% of the sample claimed that they voted in the last general election. A 95% confidence interval for the proportion of voters who said they voted was:

$$0.55706 \leq p \leq 0.64294$$

- (i) Calculate the number of voters who were surveyed.

A large grid of graph paper, consisting of 20 columns and 30 rows of small squares, intended for the student to perform calculations to solve the problem.

- (ii) How many voters would have to be sampled in order to cut the margin of error by 25% at the 95% confidence interval?

A large grid of graph paper, consisting of 20 columns and 30 rows of small squares, intended for working out the solution to the problem above.



**(b)** The graph of the animal's temperature over time can be represented as the function:

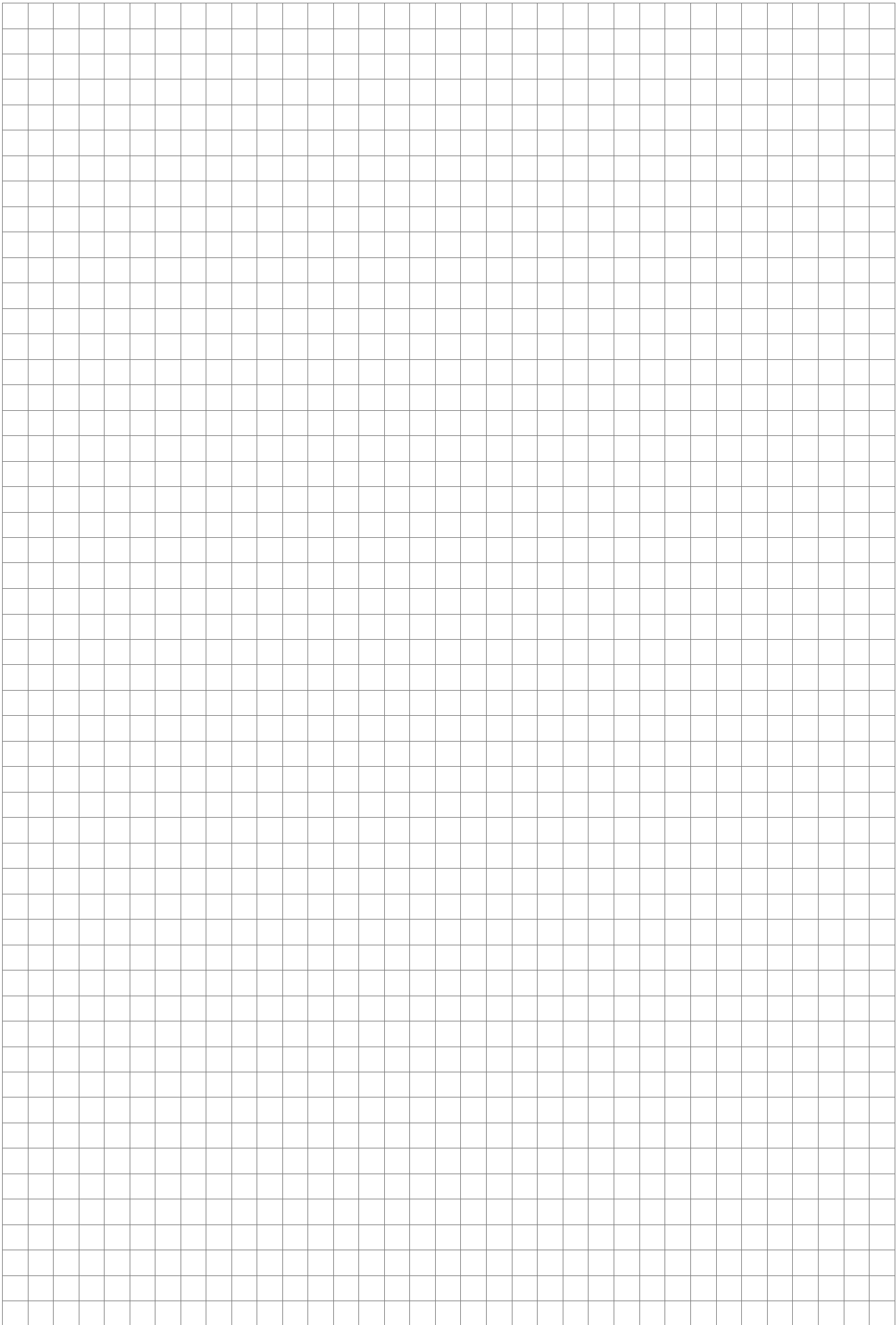
$$f(t) = a + b\sin(ct).$$

**(i)** Using the information in part **(a)** Write down the function  $f(t)$ .

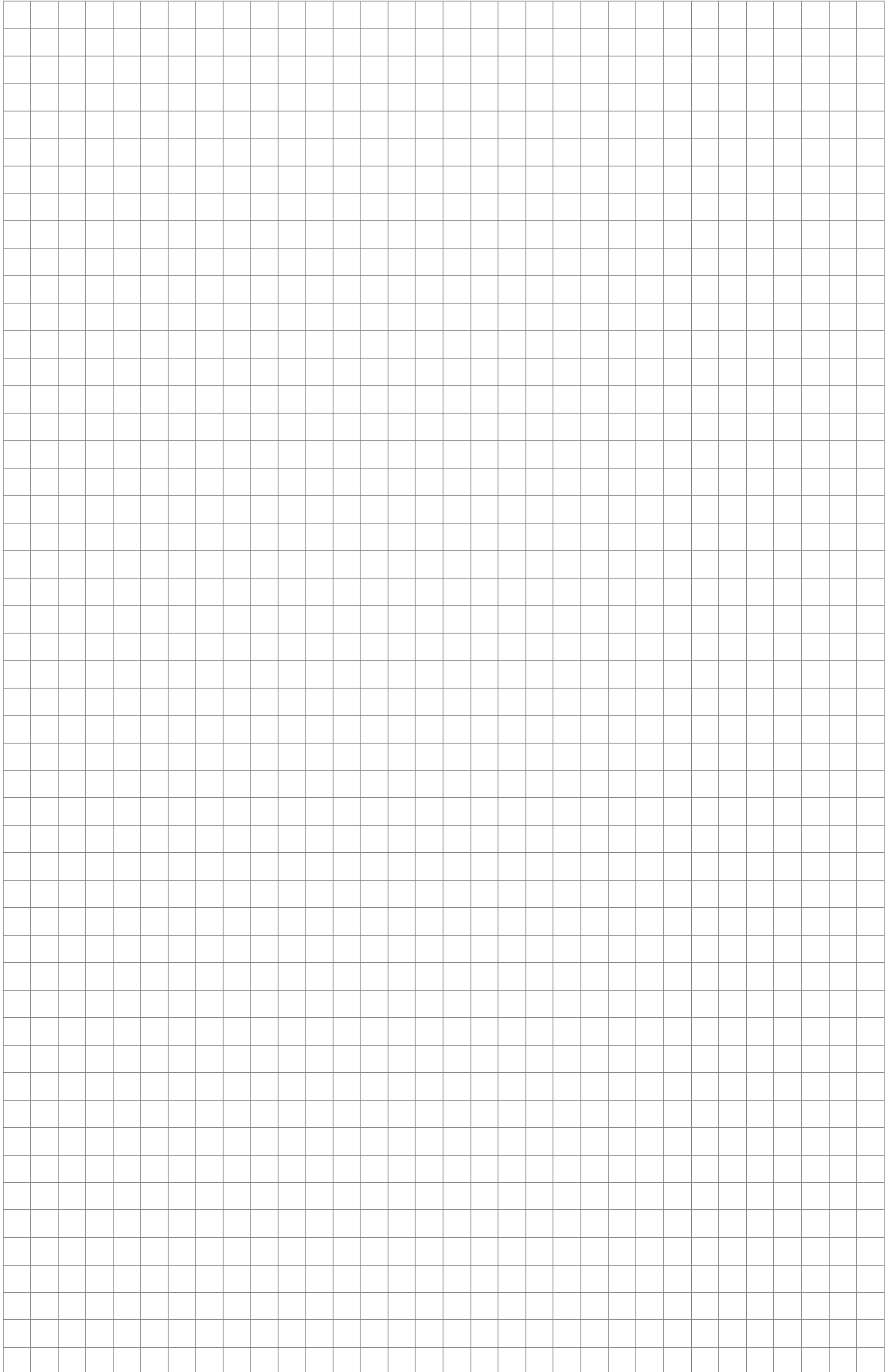
A rectangular grid consisting of 20 columns and 10 rows, intended for the student to write the function  $f(t)$ .

**(ii)** Draw the function  $f(t)$  over the period of the two hour operation.

A large rectangular grid consisting of 20 columns and 30 rows, intended for the student to draw the graph of the function  $f(t)$  over a two-hour period.



**(iii)** What is the animal's temperature after 26 minutes?

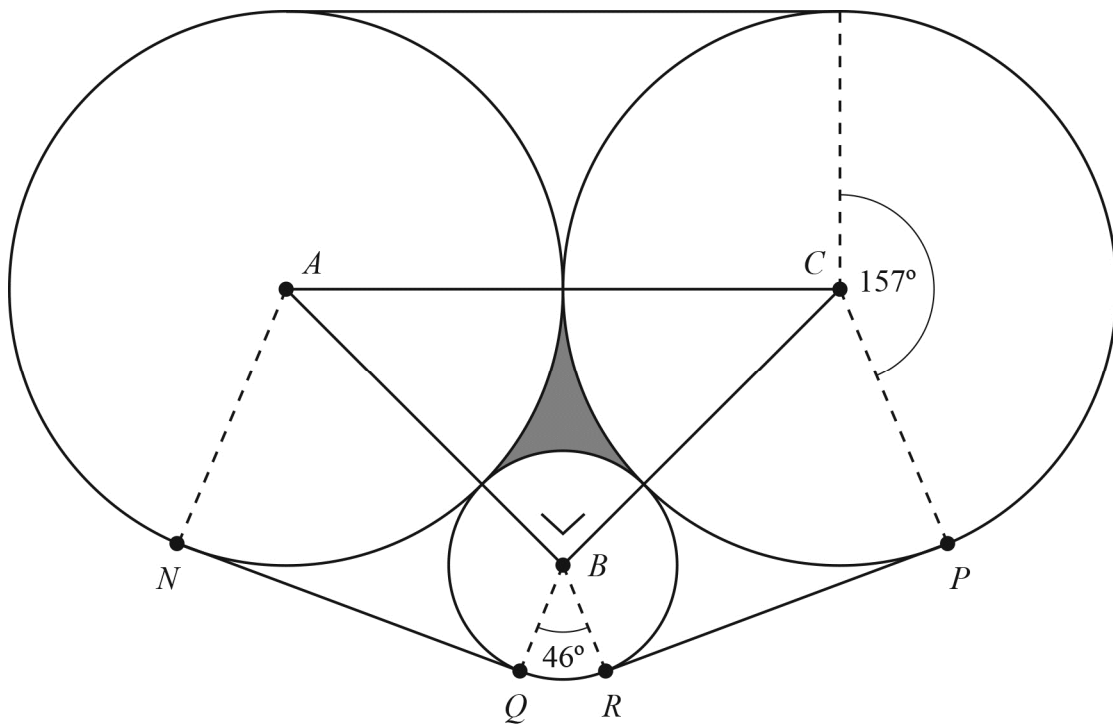




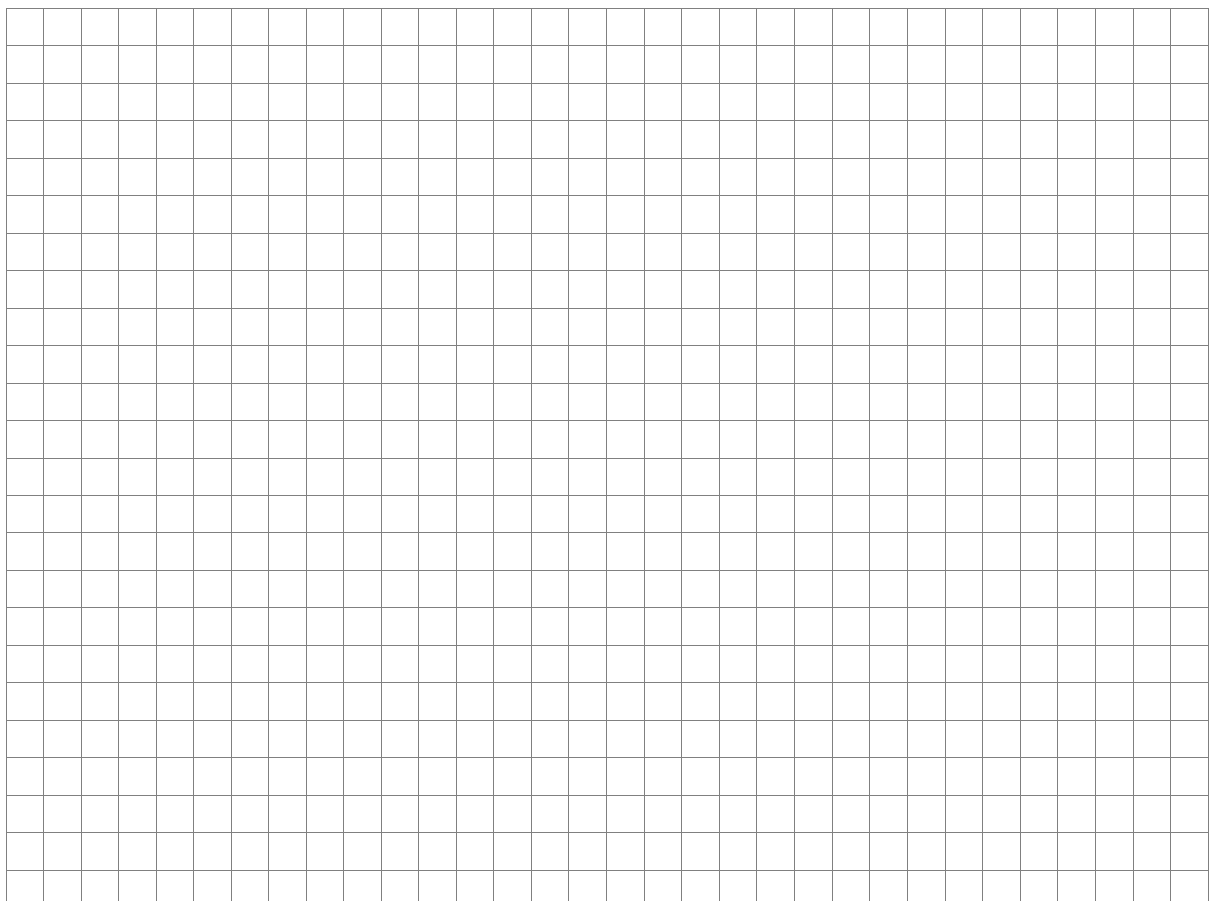
**Question 9**

**(45 marks)**

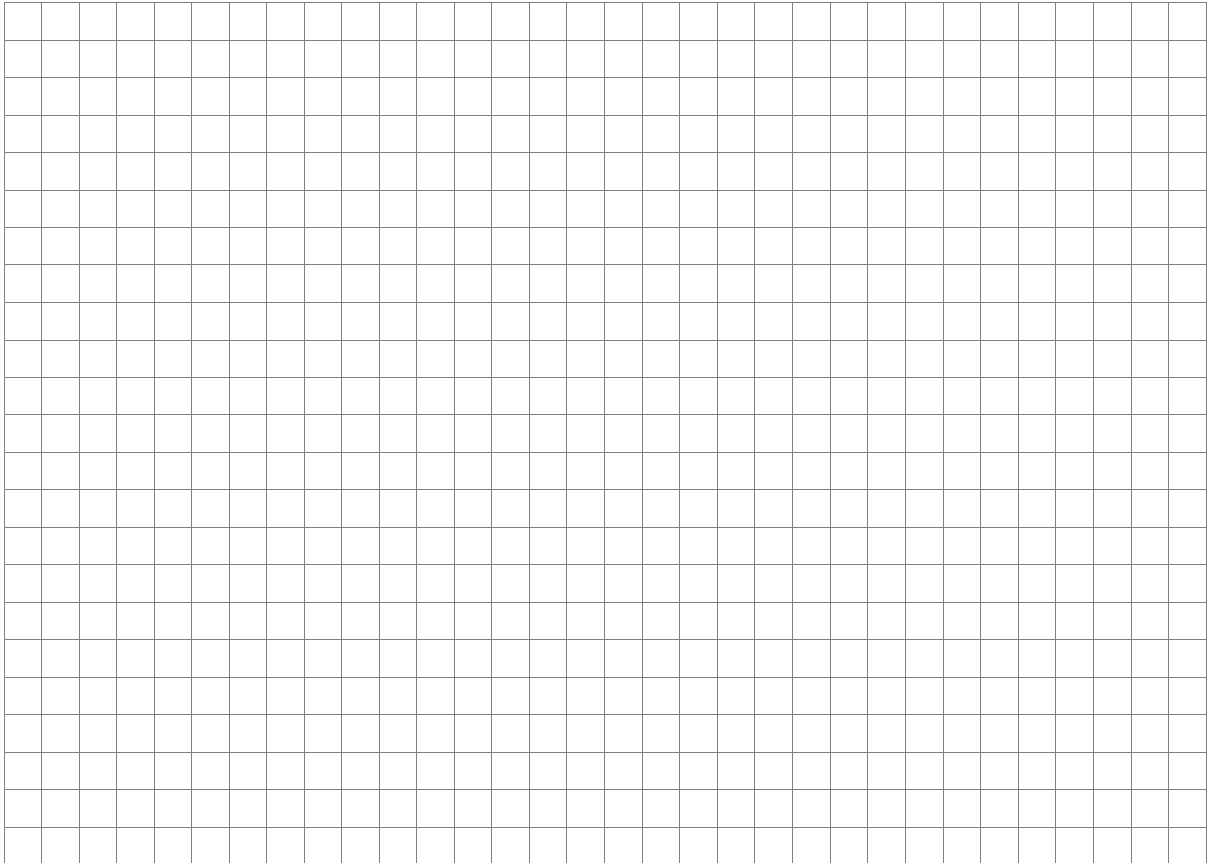
Three cogs in a machine are designed as shown. The centres of the cogs are connected with metal bars. A belt runs on the outside of the three cogs. The larger cogs both have radius  $3\sqrt{2}$  cm.



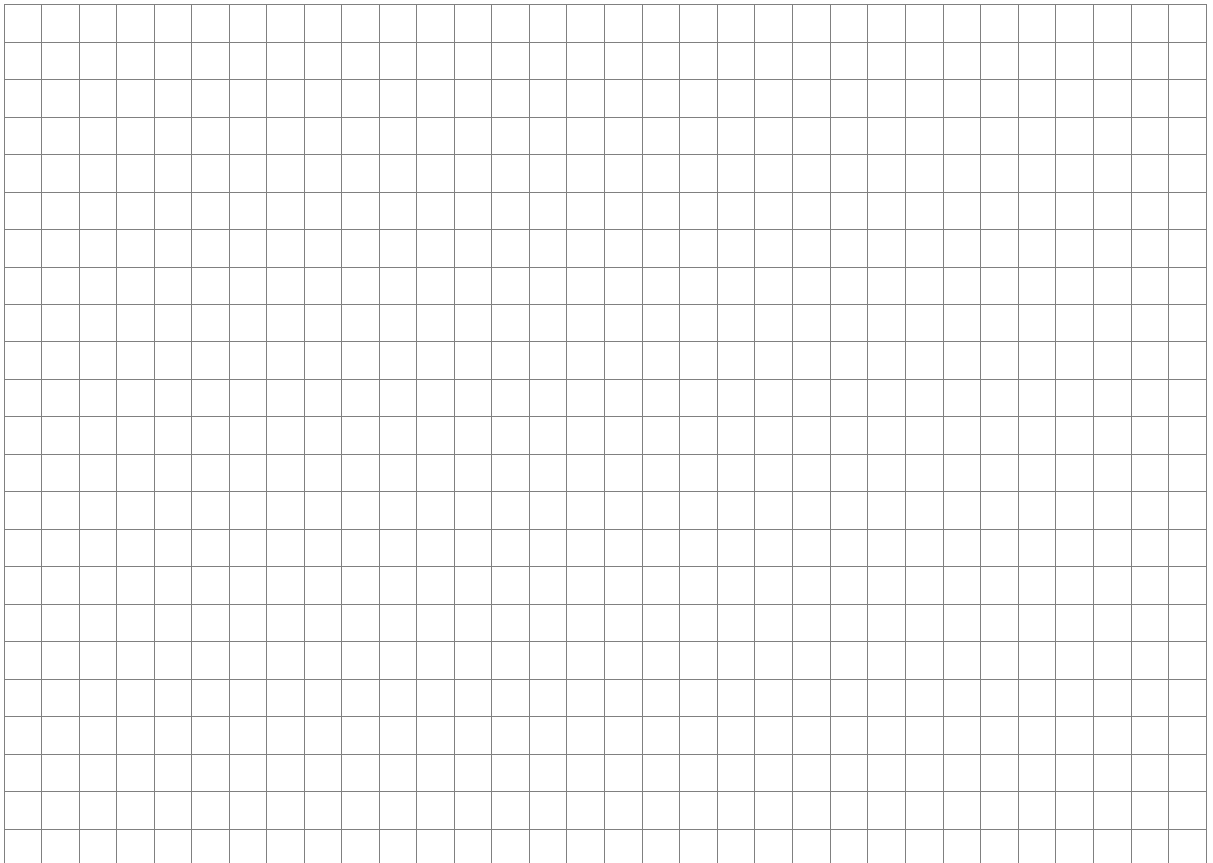
- (a) Show that the radius of the small cog is  $(6 - 3\sqrt{2})$ cm.



(b) Given that  $|CP| \parallel |BR|$ , show that  $|RP| = 5.46$  cm.



(c) Calculate the length of the belt that runs over the cogs, correct to two decimal places.



- (d) The cogs are lubricated by oil, which is stored in the shaded region of the mechanism. If the container is 3 cm in depth, find the volume of oil it contains.



**You may use this page for extra work.**

