

SAMPLE PAPER 5

Leaving Certificate

Mathematics

Paper 2

Higher Level

Time: 2 hours, 30 minutes

300 marks

Examination number

Centre stamp

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

Grade

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 will 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.

Marks will be lost 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 the make and model of your calculator(s) here:

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

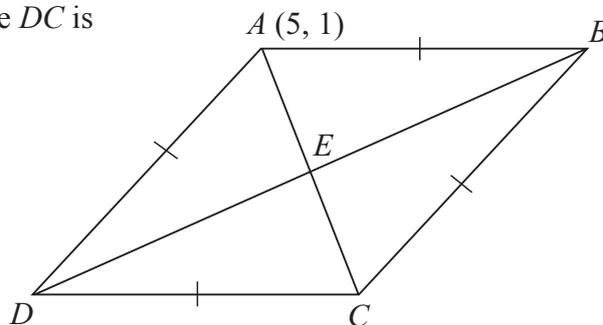
Question 1

(25 marks)

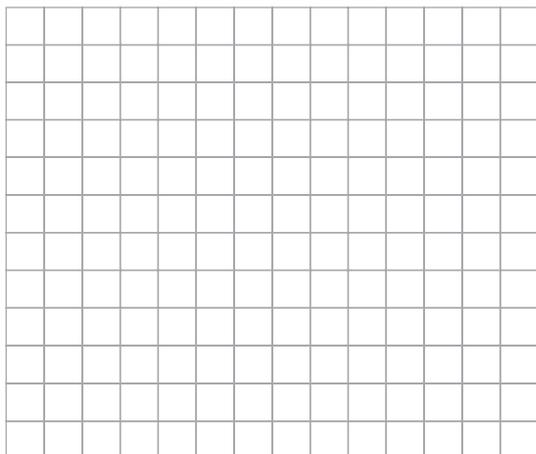
$ABCD$ is a rhombus with $A(5, 1)$. The equation of side DC is

$2x + y - 5 = 0$. The equation of AC is $x - y - 4 = 0$.

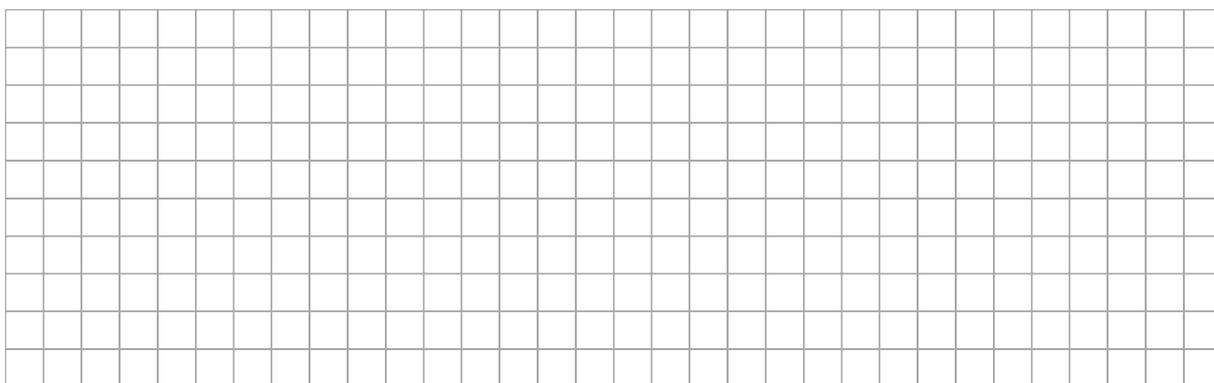
In a rhombus, the diagonals intersect at right angles.



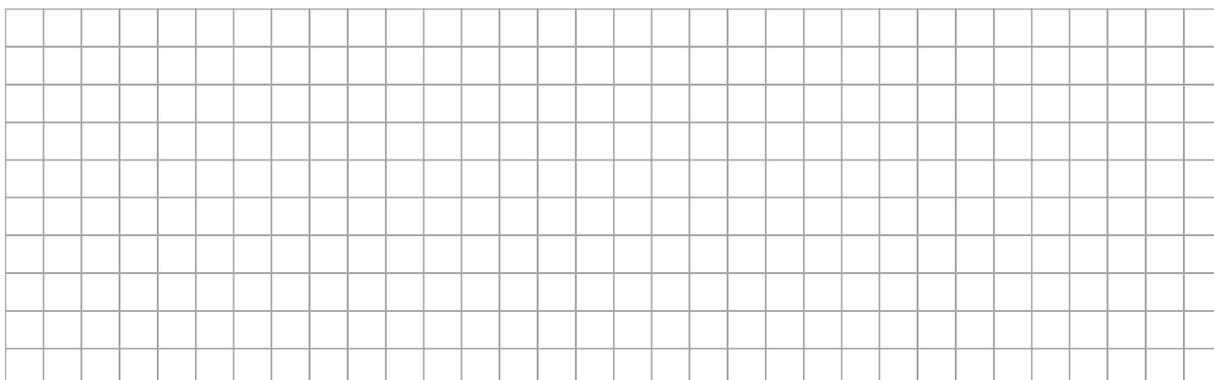
- (a) Find the coordinates of points C and E .



- (b) Find the equation of DB .



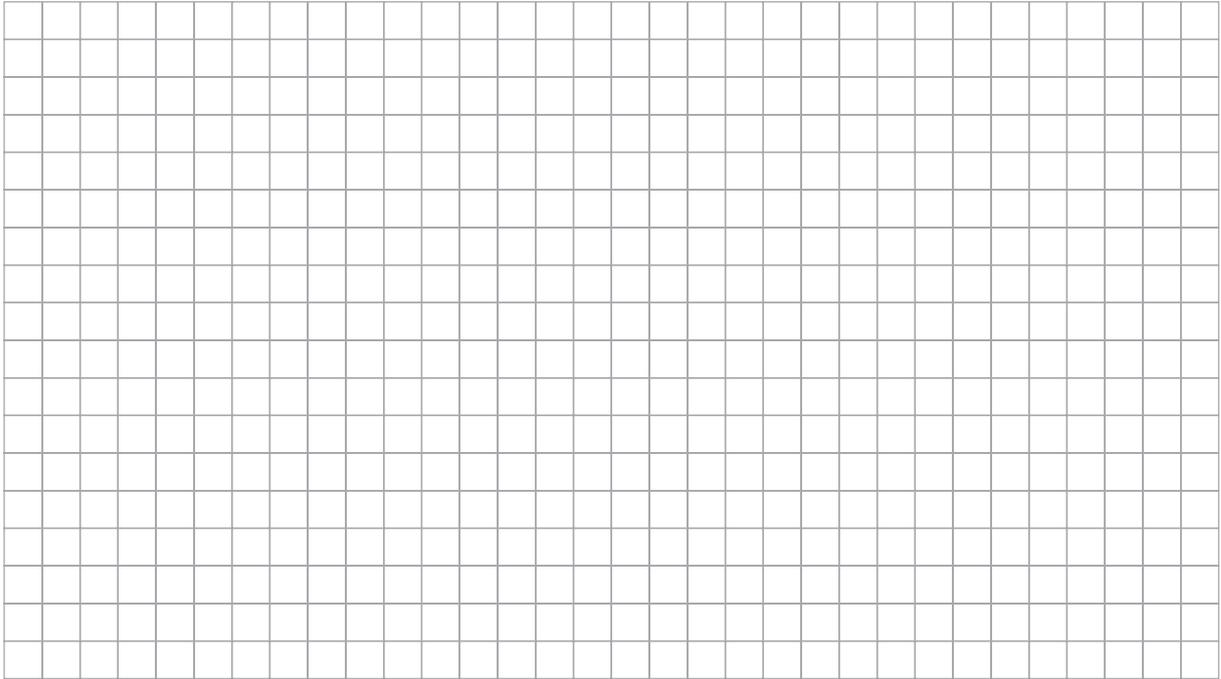
- (c) Find the coordinates of points D and B .



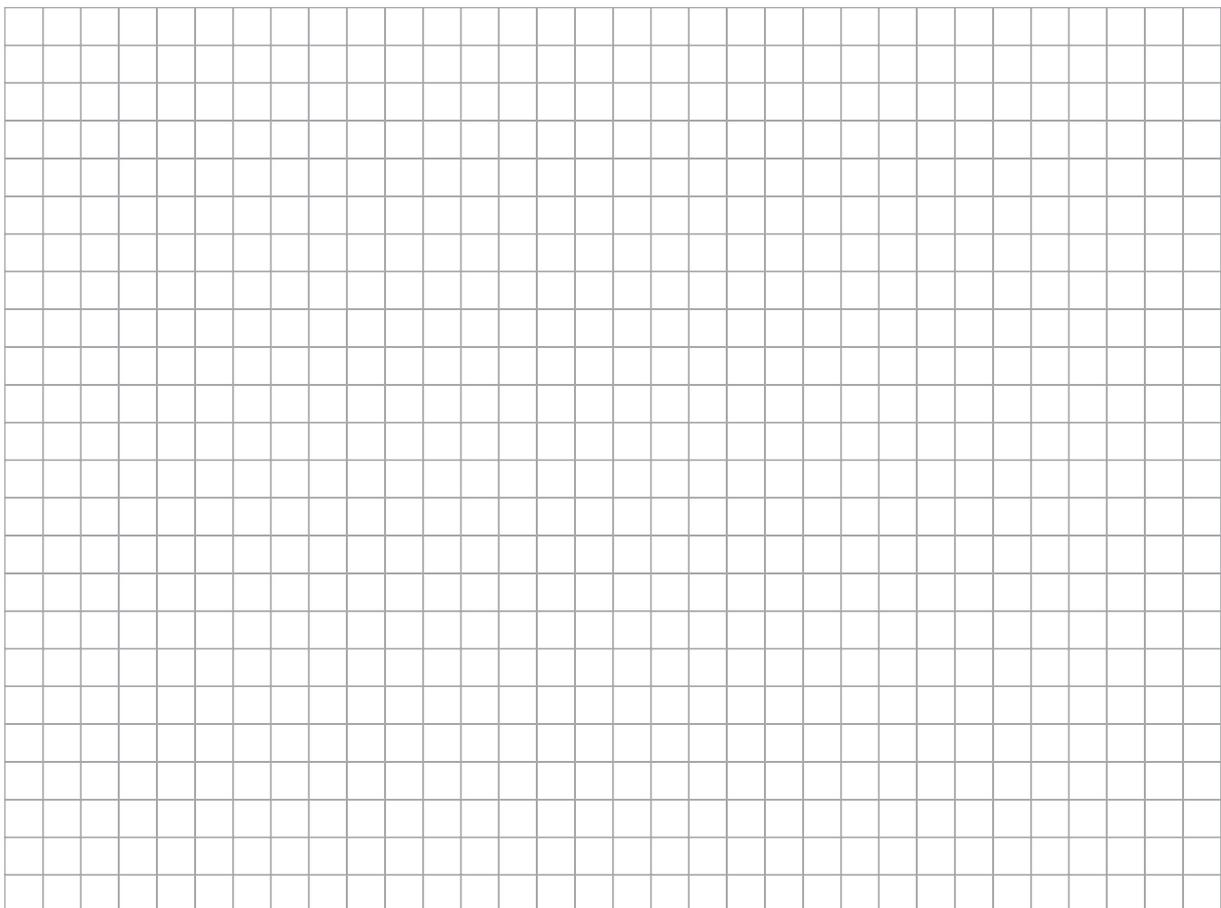
Question 2

(25 marks)

- (a) If the length of the tangent from $Q(2, -1)$ to the point of contact P to the circle $s : x^2 + y^2 - 2x - 4y + k = 0$ is 5, find k .



- (b) $U(-2, 6)$, $V(-3, -1)$ and $R(0, 0)$ are three points that lie on a circle. Show RU is perpendicular to RV . Why can you say that UV is the diameter of the circle? Find the equation of the circle through R , U and V . Write the equation in the form $x^2 + y^2 + 2gx + 2fy + c = 0$.

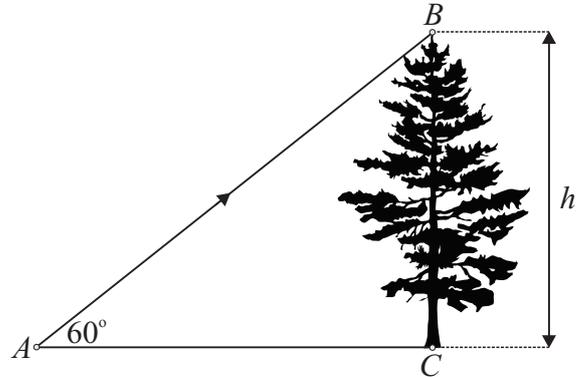
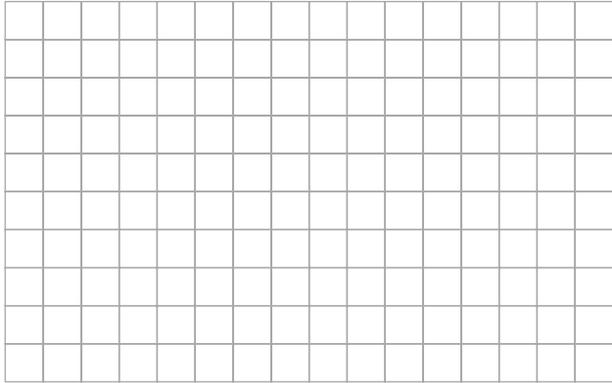


Question 3

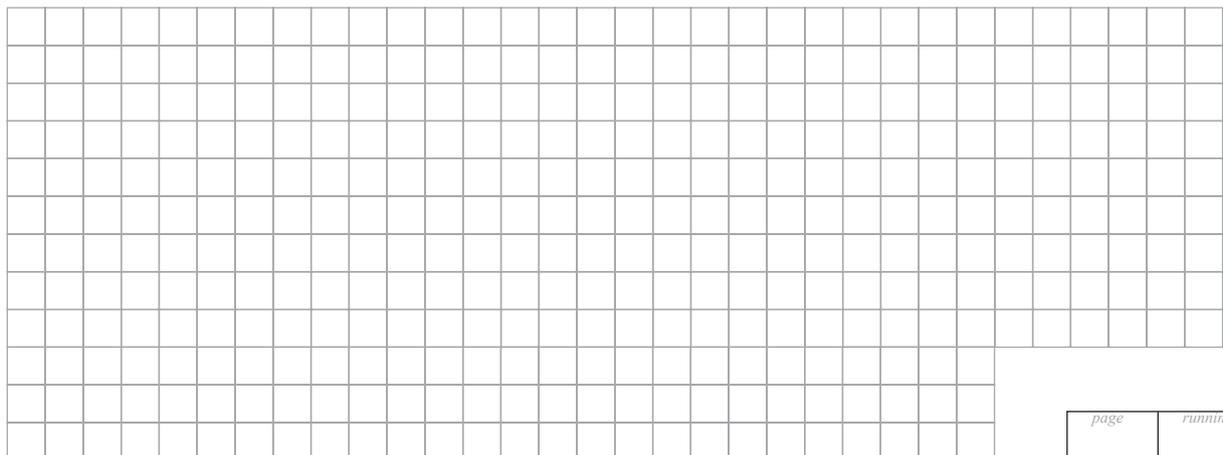
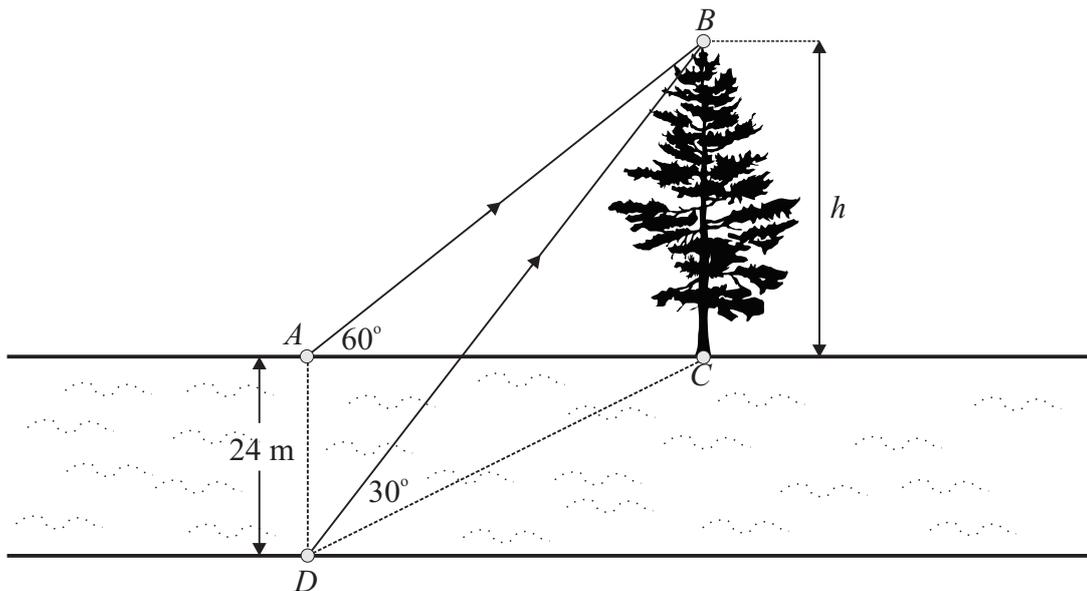
(25 marks)

The forestry department have sent two foresters to carry out a survey of the trees in a plantation. Part of the survey is to measure the heights of the different types of trees.

- (a) Standing at A , one forester measures the angle of elevation to the top of the tree using a clinometer. Express $|AC|$ in terms of h .



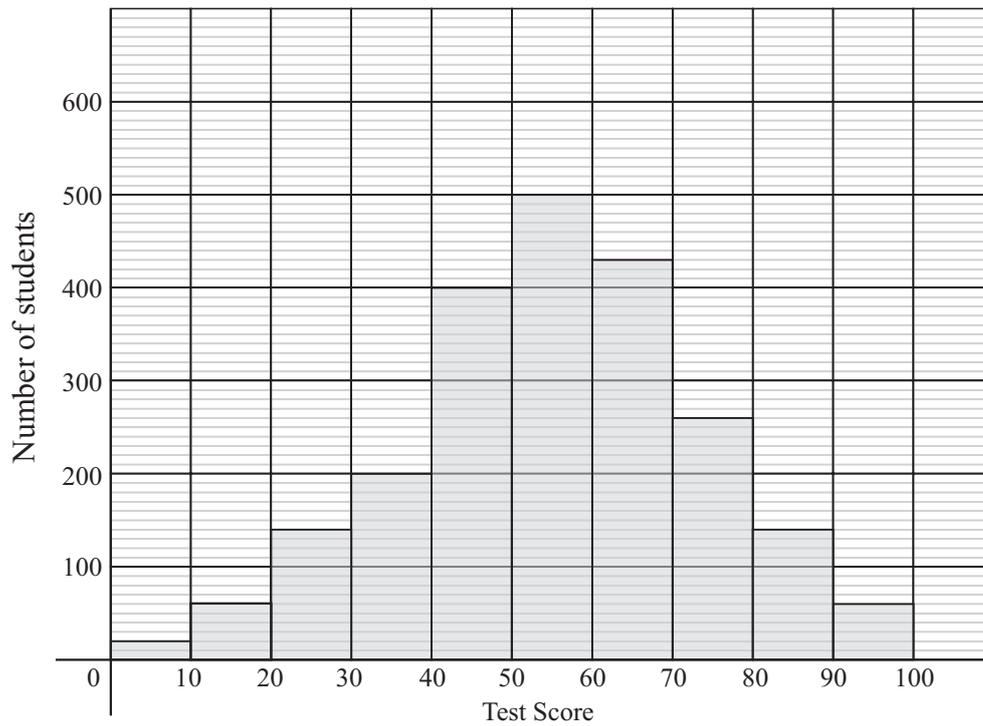
- (b) The other forester is on the far side of a river at point D . They know the width of the river is 24 m wide for a section where its banks are parallel to each other. The foresters stand at points A and D on either side of the river in a line perpendicular to the banks. The angle of elevation of the tree from D is 30° . Find the height of the tree, to one decimal place.



Question 4

(25 marks)

The histogram below shows the number of students against their scores in a national Maths test.

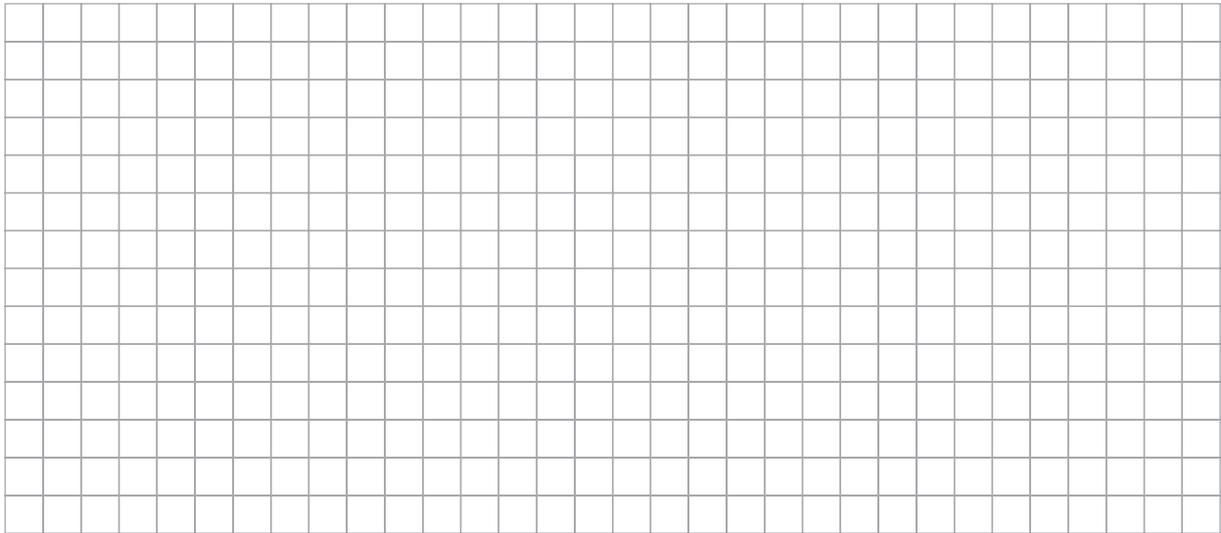


- (a) Convert this information into a grouped and cumulative frequency table using the layout below. Denote the mid-interval values in each class by x and the frequency by f . The cumulative frequency (CF) is a running total of the frequency values.

Score	f	x	fx	CF
0-10				
10-20				
20-30				
30-40				
40-50				
50-60				
60-70				
70-80				
80-90				
90-100				

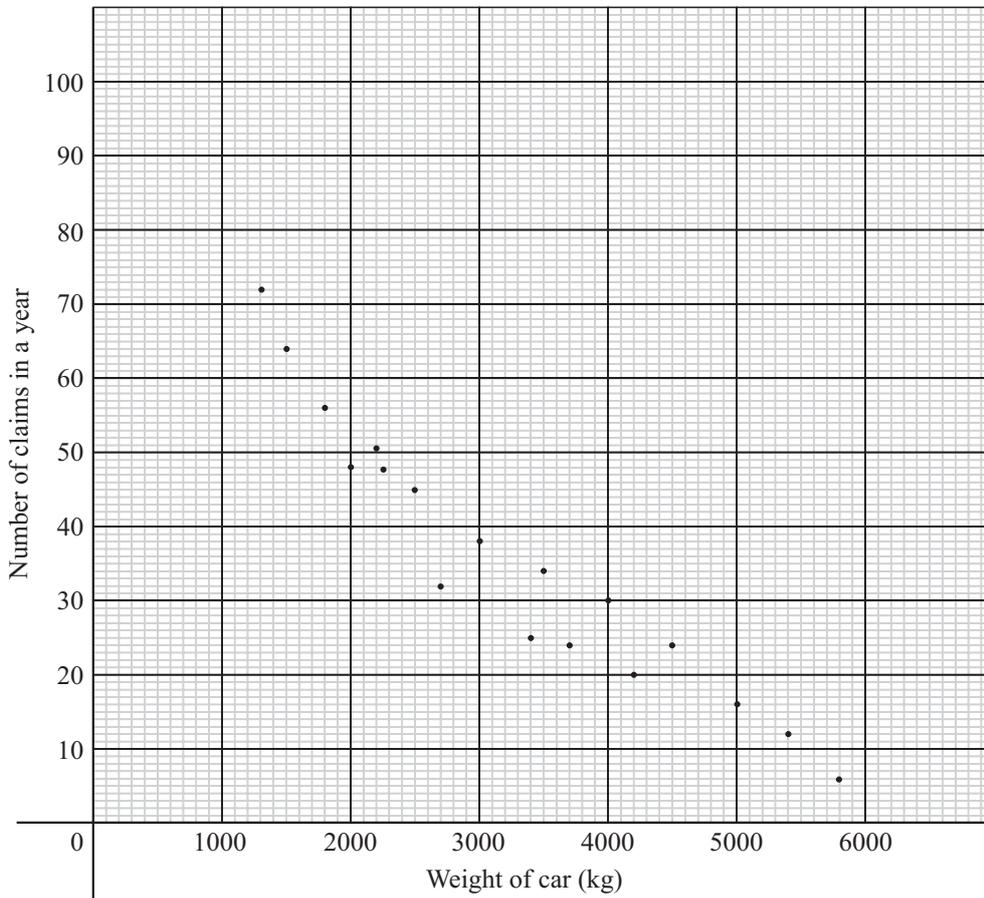
- (d) Each policy carries an excess of €500, that is the company only pays out money in excess of €500 to the claimant. If the company wants its expected profit to be €200 per car insured, how much should the premium M be per year? Use the table below:

Profit per car (€)	M	$M - 500$	$M - 4500$	$M - 9500$
Probability	0.8	0.15	0.04	0.01

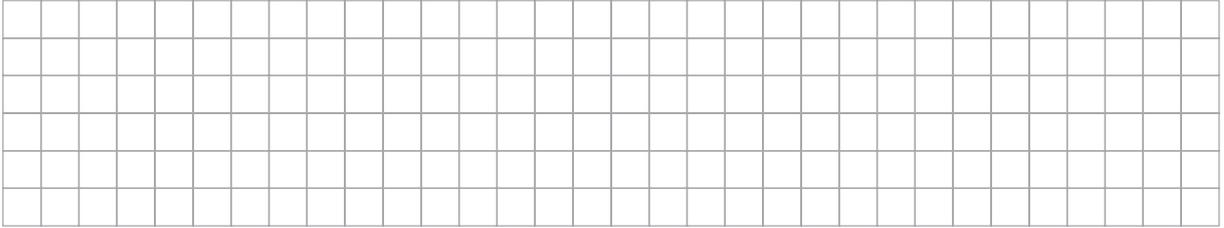


The insurance company decides to examine its statistics on decided claims that have been settled in order to assess risk. It looks at two sets of bivariate data affecting the number of claims.

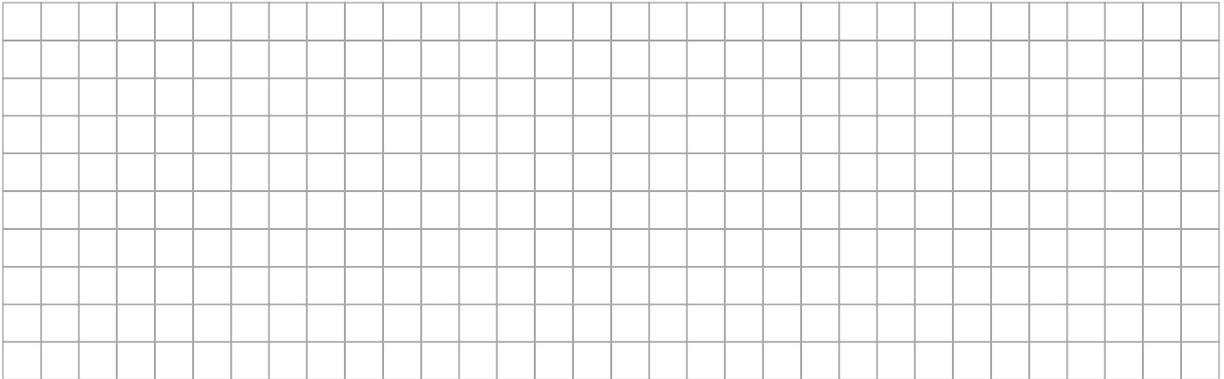
- (e) A scatter plot is drawn of the number of claims in a year versus car weight.



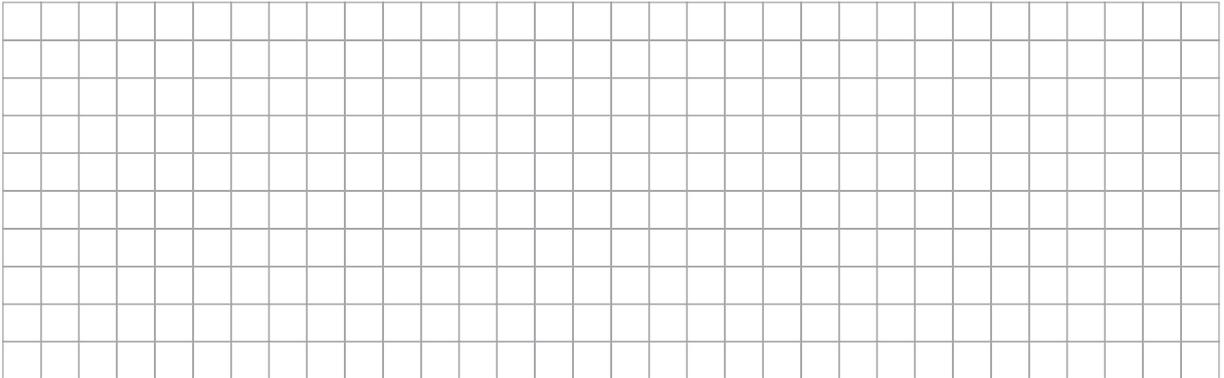
(i) Draw the line of best fit and comment on the correlation, if any.



(ii) Picking two points on this line, find its slope, to two decimal places.



(iii) Is it right to conclude that heavier cars have fewer accidents? Explain your answer.



Question 8

(35 marks)

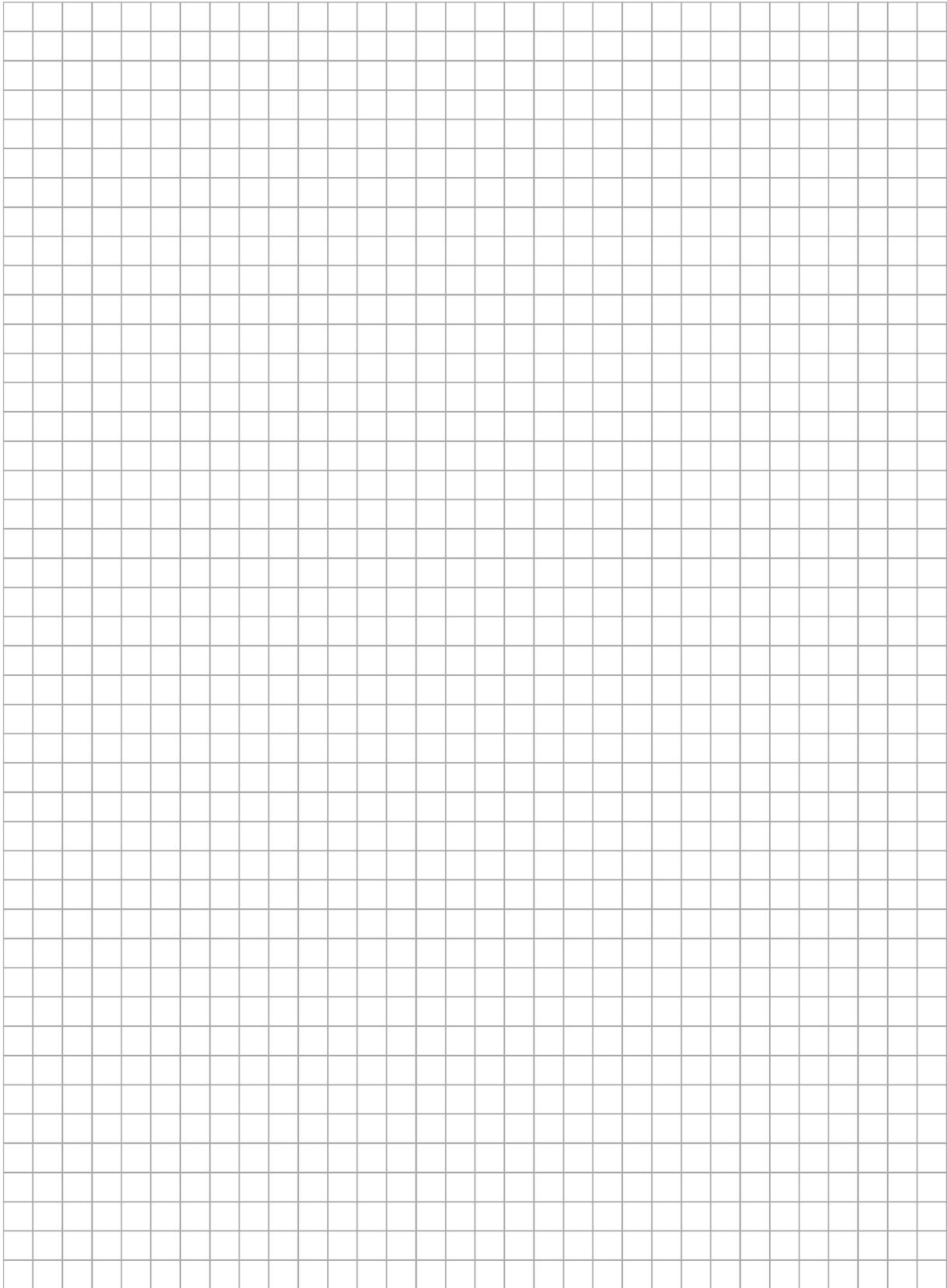
A shopping centre wants to be equidistant from the centres of three towns: Alphaville (A), Betaburg (B) and Coolcity (C). The distances between the towns are as follows: $|AB| = 25$ km, $|BC| = 39$ km and $|AC| = 40$ km.

- (a) Construct this triangle to scale, taking $1\text{ cm} = 5\text{ km}$. Use a measuring ruler and compass in your construction.

CONSTRUCTION

- (b) On the diagram above, construct the circumcircle of this triangle putting in the radius r .
- (c) Find $\cos|\angle ABC|$, writing your answer in the form $\frac{p}{q}$, where $p, q \in \mathbb{N}$.

(d) Hence, find the distance of the shopping centre to each town, to two decimal places.

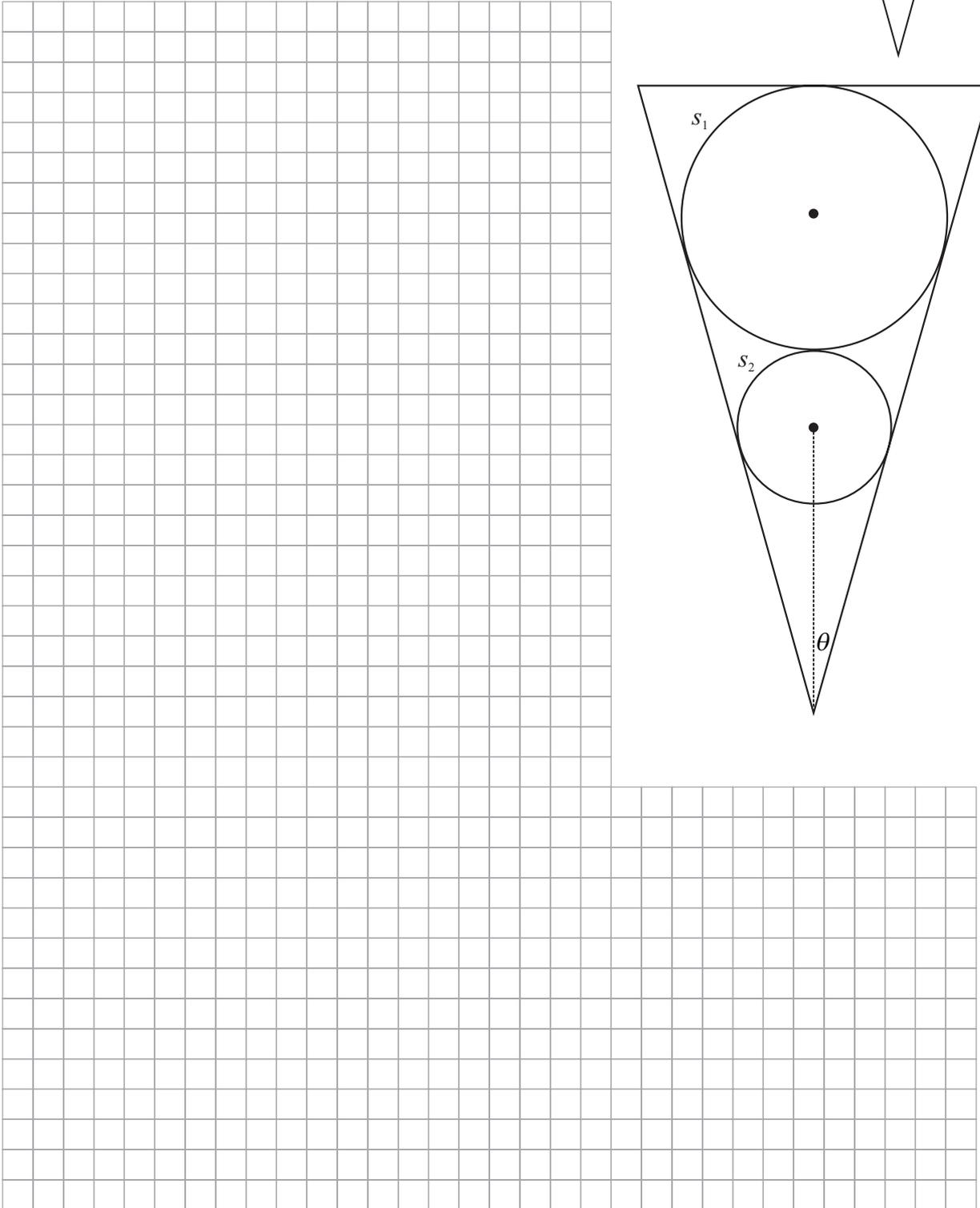
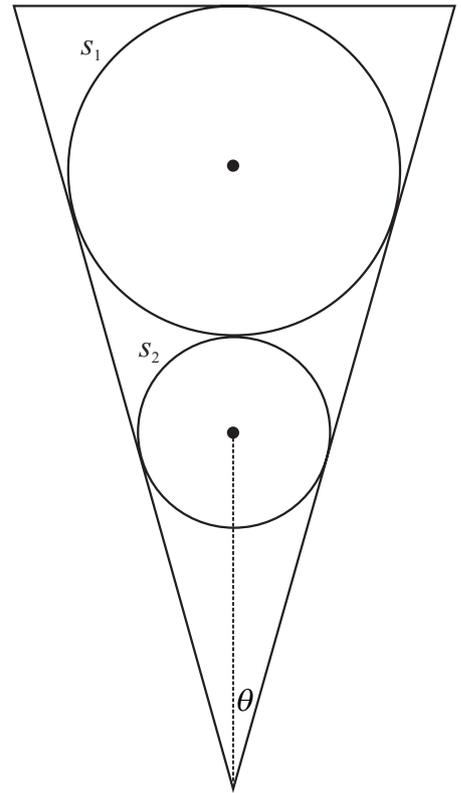
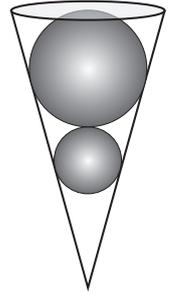


Question 9

(40 marks)

Two ball bearing spheres, s_1 and s_2 , are packed into a cone, as shown, with both spheres touching the sides. s_1 has radius 2.75 cm and s_2 has radius 1.5 cm, with the larger sphere touching the base.

- (a) Find, by using similar triangles or otherwise, θ , to one decimal place.
Show all the construction lines clearly on the diagram shown.



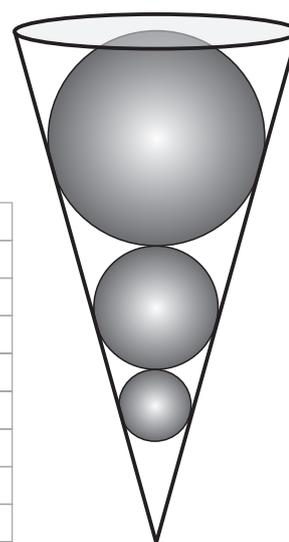
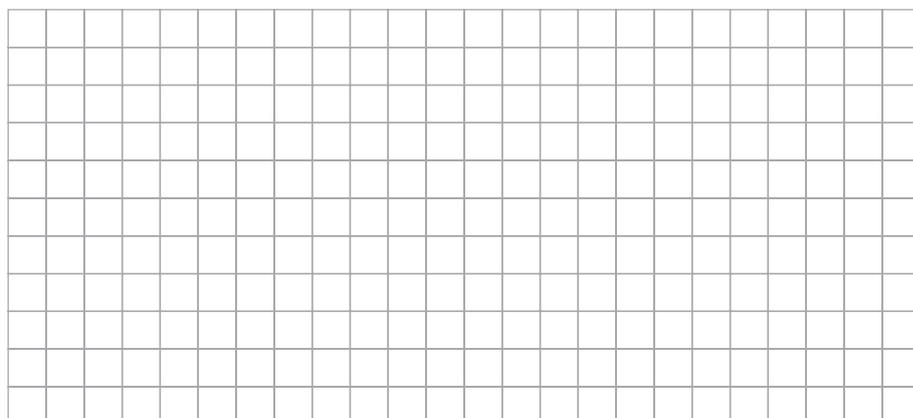
(b) Find the height and radius of the base of the cone, to two decimal places.

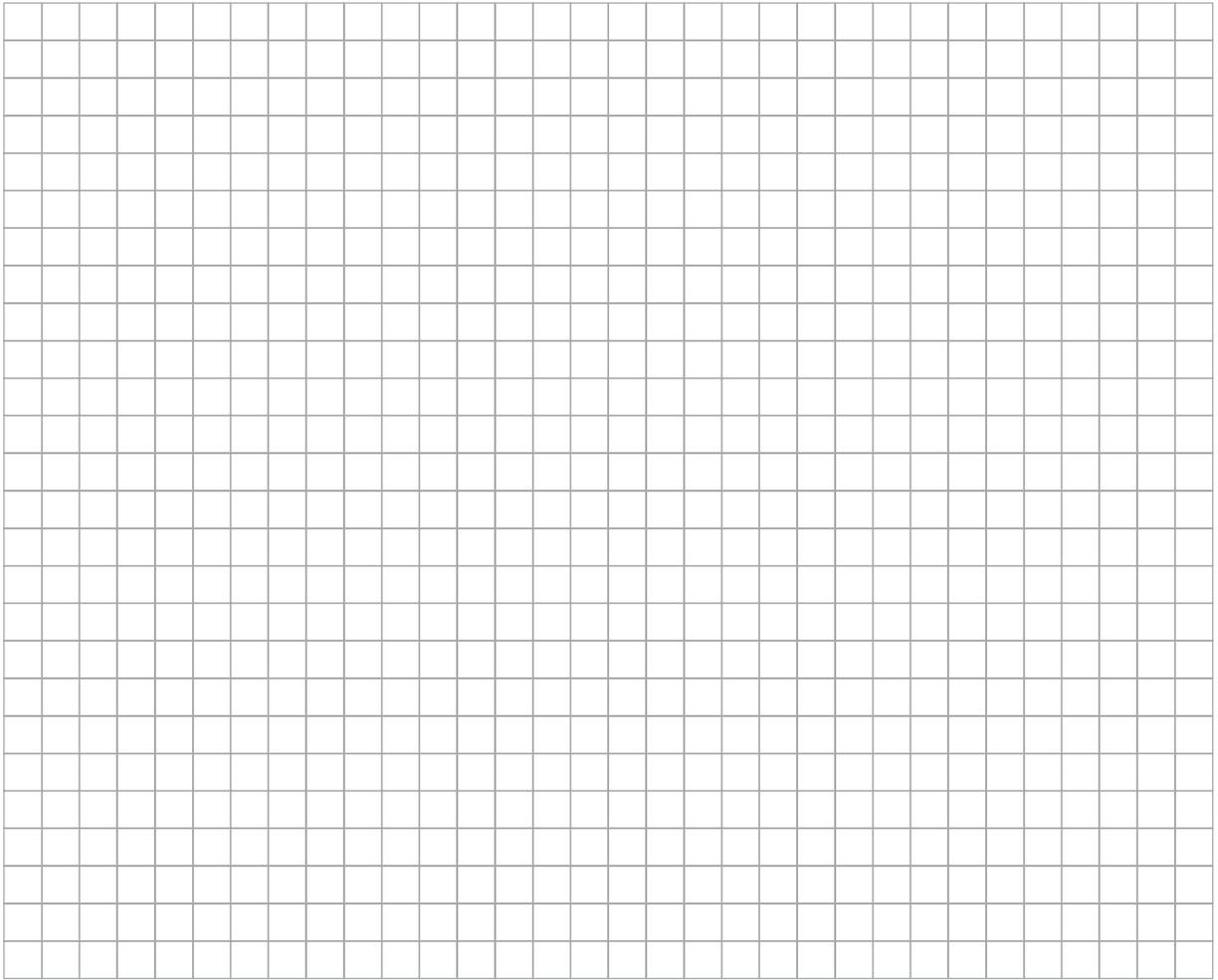


(c) Find the volume of the cone, to the nearest centimetre cubed.



(d) The manufacturer would like to pack a third sphere, as shown, to reduce the amount of empty space in the packing. Calculate the radius of this sphere, to two decimal places. Calculate the percentage decrease in empty space in the cone, to two decimal places, as a result of adding this sphere.





You may use this space for extra work.

