



## Instructions

There are 14 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. 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 may lose marks if your solutions do not include supporting work.

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

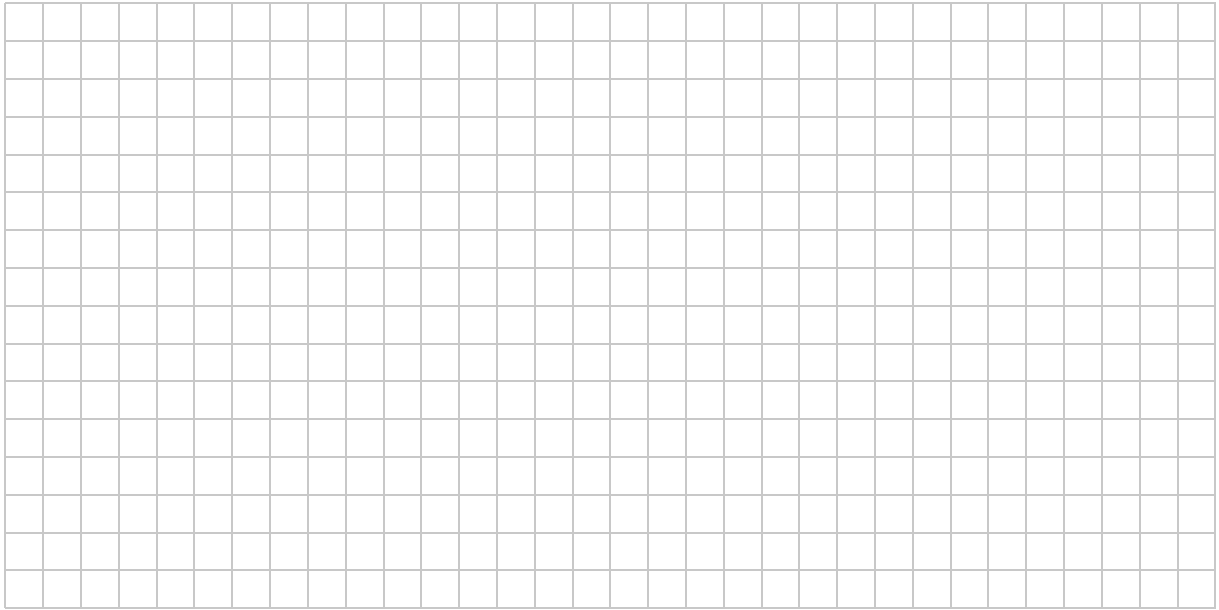
You may lose marks if you do not give your answers in simplest form, where relevant.

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





- (c) The cover that is put around the 36 boxes is made of plastic.  
Work out the **volume** of plastic in the cover.

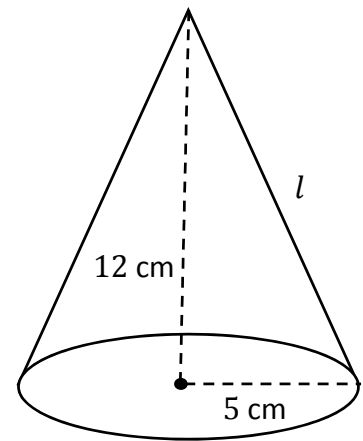


**Question 3**

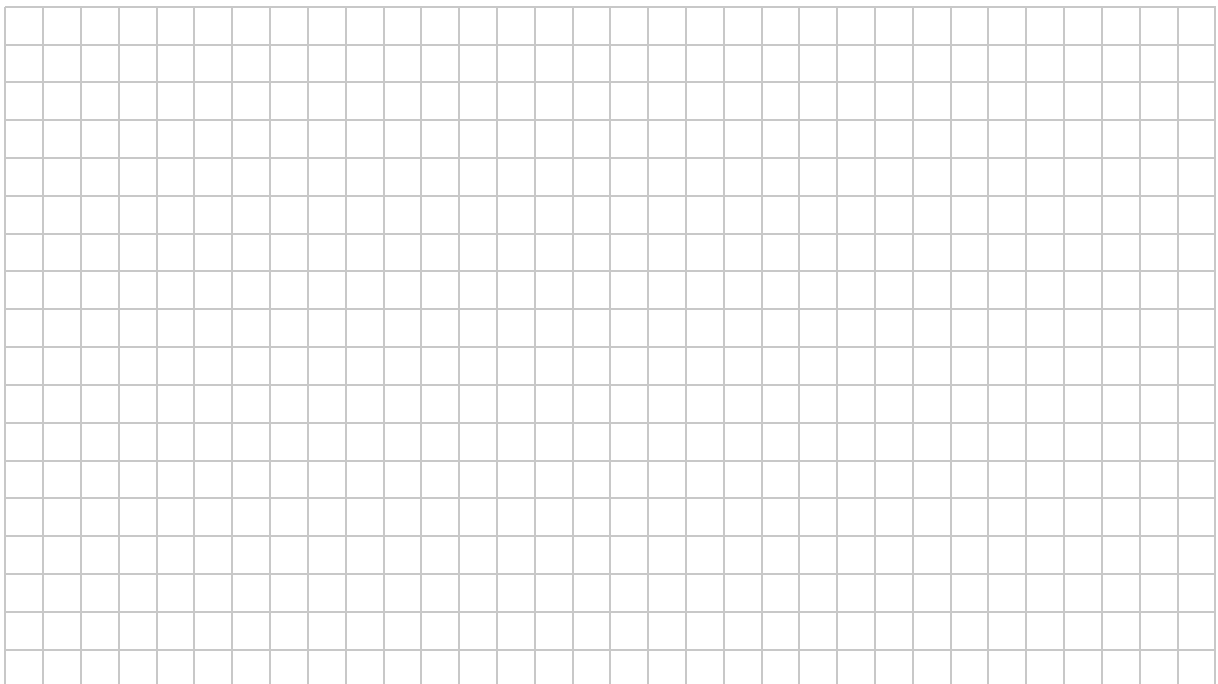
**(Suggested maximum time: 10 minutes)**

A solid cone has a radius of 5 cm and a vertical height of 12 cm, as shown.

- (a)** Use the theorem of Pythagoras to work out the value of  $l$ , the slant height of the cone.

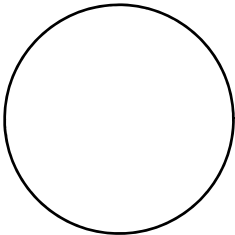
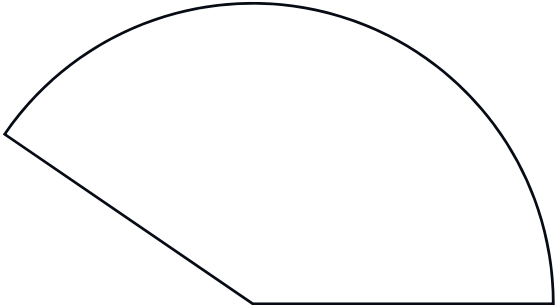


- (b)** Work out the **total surface area** of the cone.  
Give your answer in  $\text{cm}^2$ , correct to one decimal place.



- (c) The **net** of this cone is made up of two parts, a circle and a sector. These are shown in the table below.

Complete the table by filling in each of the four missing measurements. Give each value in cm, correct to one decimal place where necessary.

Circle		Sector of Circle	
			
Radius of the circle =		Radius of the sector =	
Circumference =		Length of the arc =	



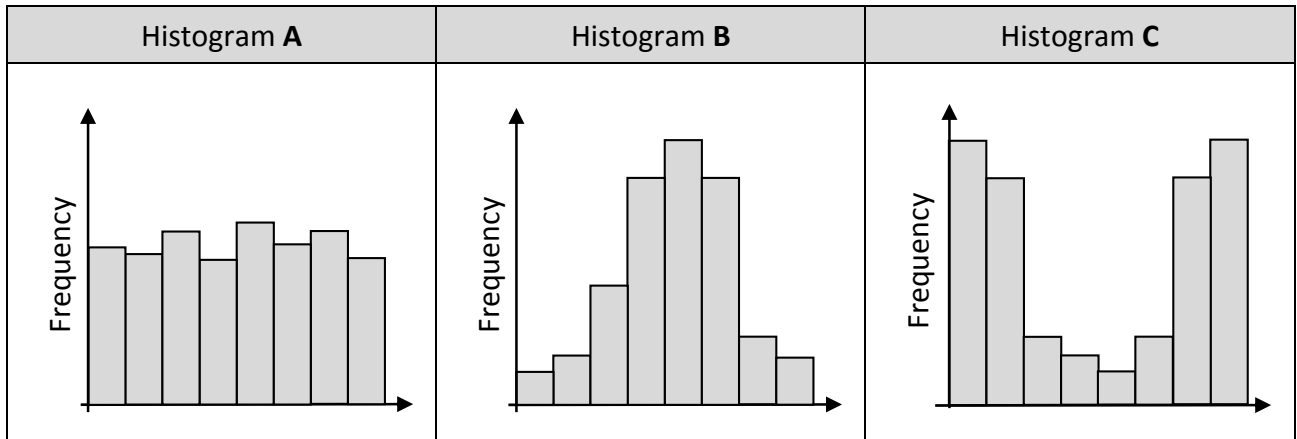








(b) The table below shows three histograms.



Each of the histograms above matches one of the statements in the table below.

Write **A**, **B**, and **C** in the correct places in the table to show which histogram matches each statement.

Statement	Histogram (A, B, or C)
Inter-quartile Range = $\frac{1}{4}$ of Range	
Inter-quartile Range = $\frac{1}{2}$ of Range	
Inter-quartile Range = $\frac{3}{4}$ of Range	

(c) Justify your answer for Histogram **B**.

**Question 6**

(Suggested maximum time: 20 minutes)

16 girls and 14 boys went on a school tour to Barcelona.  
The weight of each student's bag (in kg) is shown in the tables below.

Girls			
5.8	6.3	6.9	7.6
7.8	8.0	8.1	8.7
9.1	9.4	9.5	9.6
9.8	9.8	9.8	11.3

Boys			
5.9	6.8	7.4	8.5
8.6	8.7	8.8	9.2
9.4	9.5	9.5	9.7
9.7	10.5		

- (a) The mean weight of the girls' bags was 8.6 kg, correct to one decimal place.  
Work out the **mean weight** of the **boys'** bags, correct to one decimal place.


- (b) Use the data in the tables above to complete the following frequency table.

Weight (kg)	5 – 6	6 – 7	7 – 8	8 – 9	9 – 10	10 – 11	11 – 12
Number of Girls' bags		2					
Number of Boys' bags		1					

[Note: 5 – 6 means 5 kg or more but less than 6 kg, etc.]

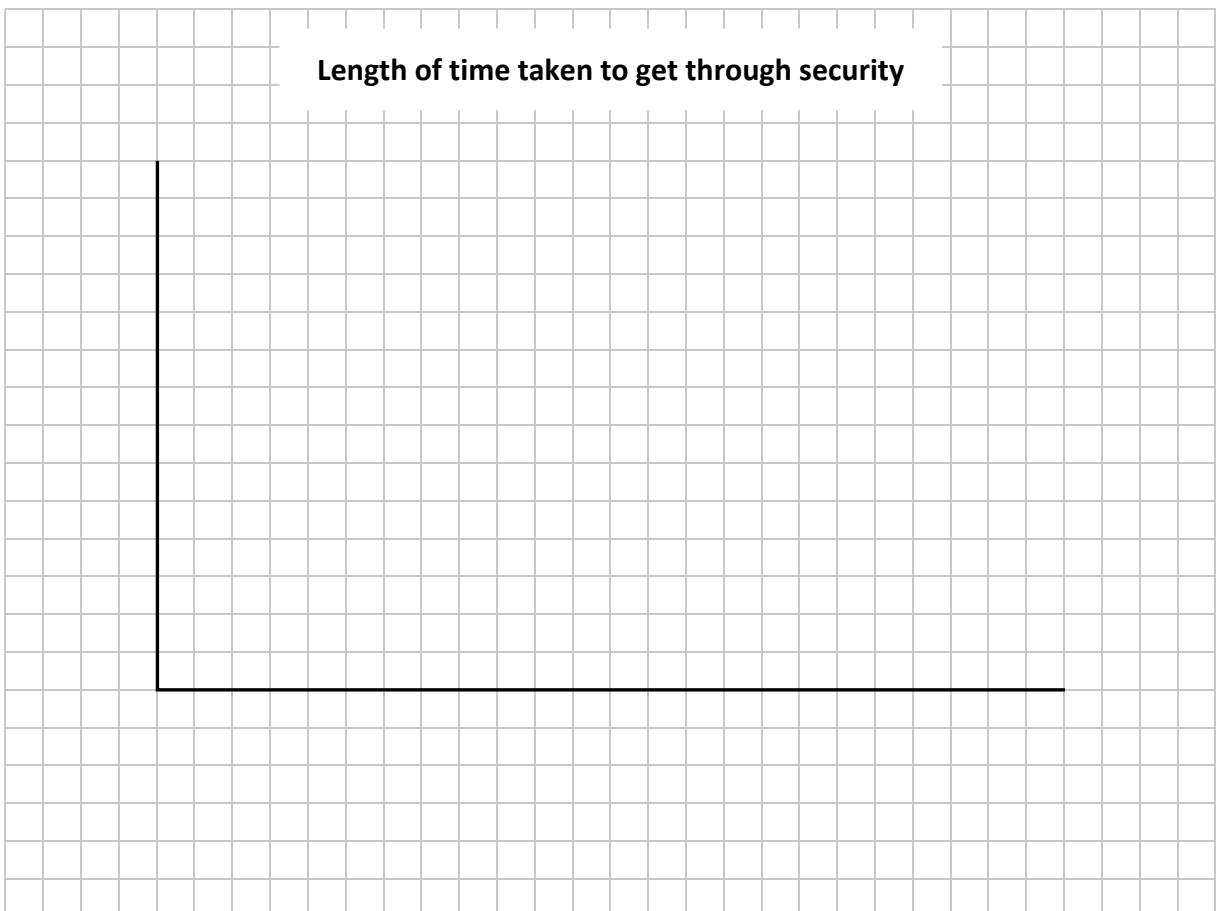

- (c) Eoin says: "In general, the girls took heavier bags than the boys did." Based on the data above, is Eoin correct? Give a **reason** for your answer.

The table below shows the length of time it took the students to get through security at the airport.

Time (minutes)	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30
Number of students	4	8	11	6	0	1

[Note: 5 – 10 means 5 minutes or more but less than 10 minutes, etc.]

- (d) Draw a **histogram** to represent this data. Label each axis clearly.



*This question continues on the next page.*

The table below shows the amount of money that the 30 students spent at the airport.

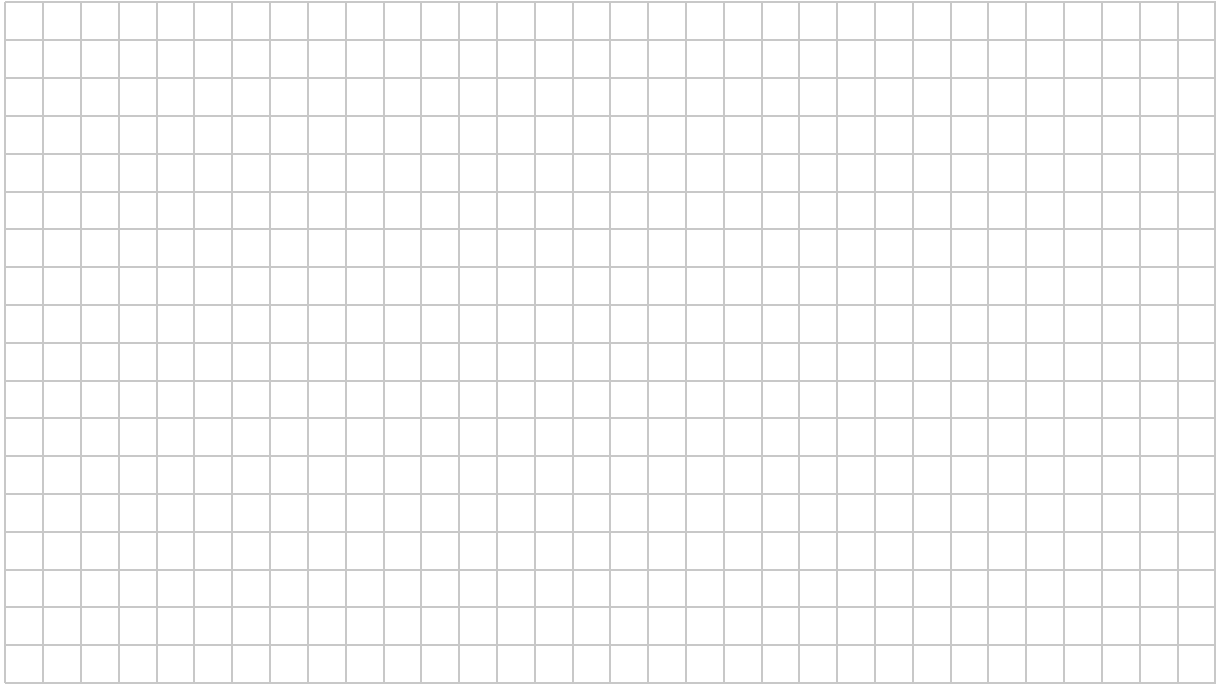
Amount of money (€)	0 – 5	5 – 10	10 – 20	20 – 30	30 – 50	50 – 100	100 – 150
Number of students	5	4	7	8	3	1	2

[Note: 5 – 10 means €5 or more but less than €10, etc.]

- (e) Use **mid-interval values** to estimate the **mean** amount of money spent. Give your answer in euro, correct to the nearest cent.

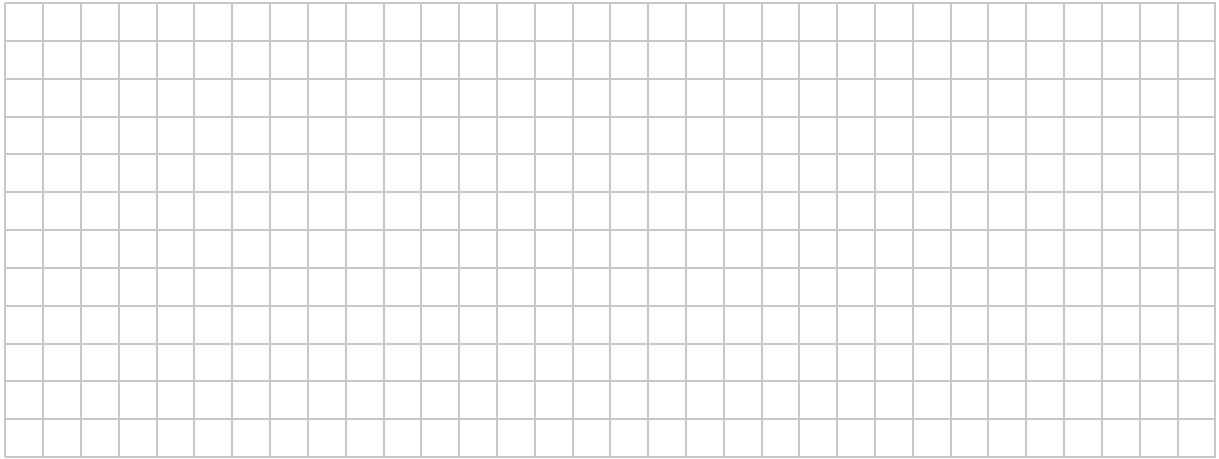
- (f) Use the values in the table to estimate the **median** amount of money spent, as accurately as you can. **Justify** your answer.

Remember that there were 30 students in total.

A large grid for working out the answer, consisting of 30 columns and 20 rows of small squares.







(ii) Use **algebra** to find the point of intersection of the lines  $k$  and  $l$ .

Line  $k$ :  $y = x - 1$

Line  $l$ :  $2x - 3y = 6$

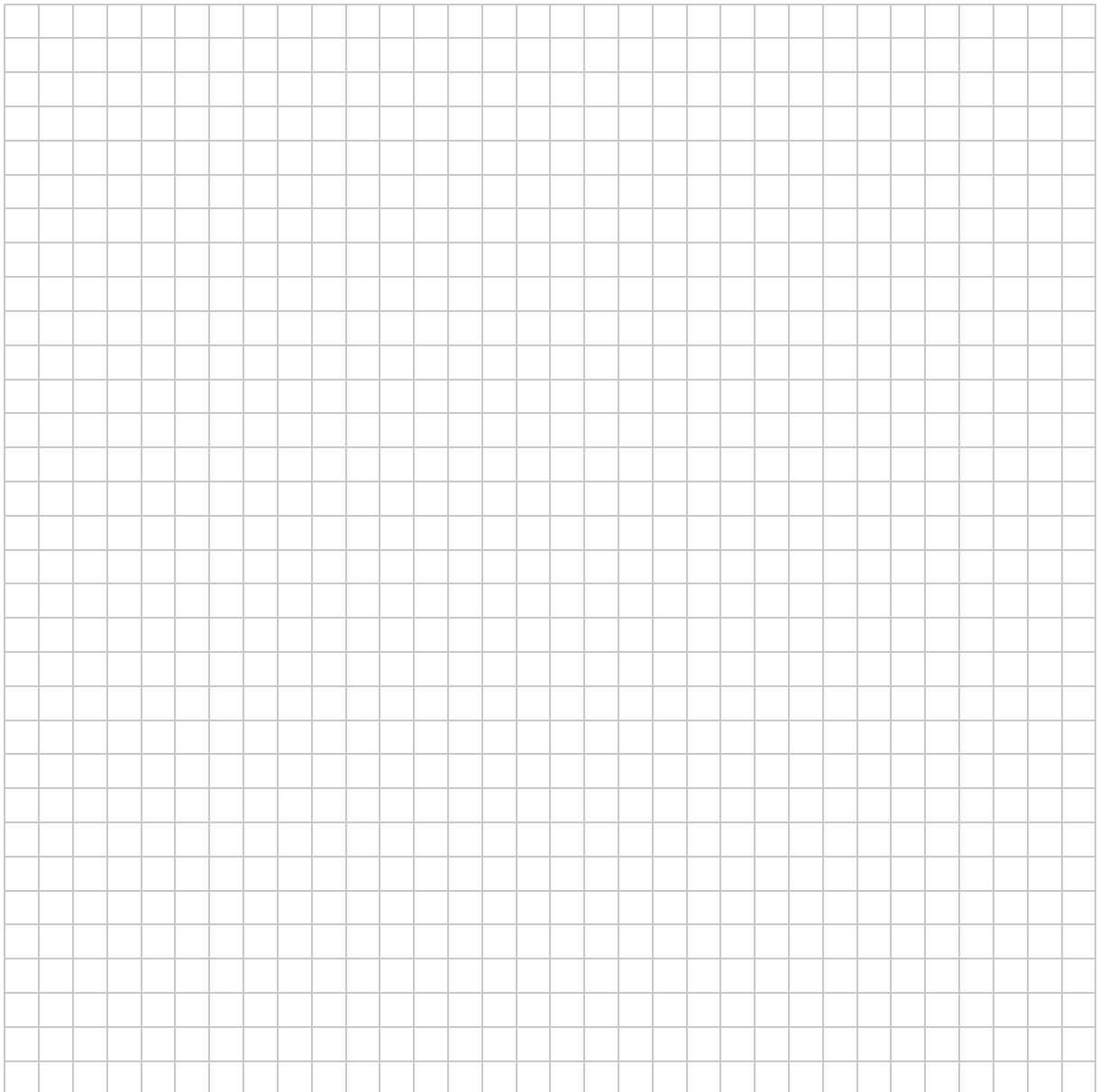


**Question 8**

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

The line  $h$  has a slope of  $-2$ . It passes through the point  $(1, 101)$ .

Find how many points on this line have co-ordinates that are both **positive whole numbers**, including the point  $(1, 101)$ . **Justify** your answer fully.



Answer =

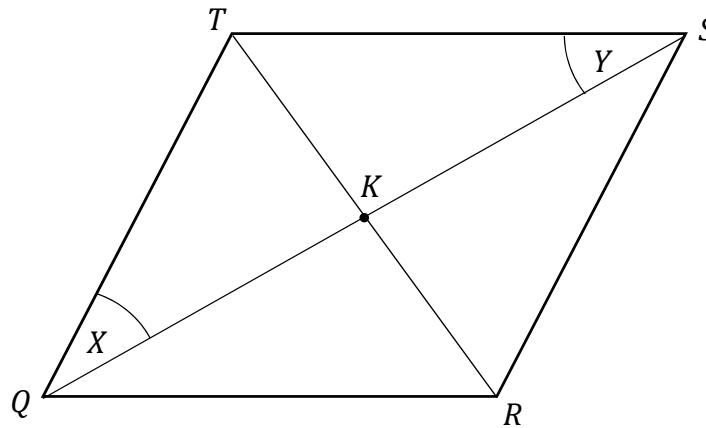
**Question 9**

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

The diagram shows the rhombus  $QRST$ .

It is a parallelogram in which all four sides are equal in length.

The diagonals cross at the point  $K$ . Two of the angles are marked  $X$  and  $Y$ .



Sanjay is trying to prove that the triangles  $QKT$  and  $SKT$  are congruent.

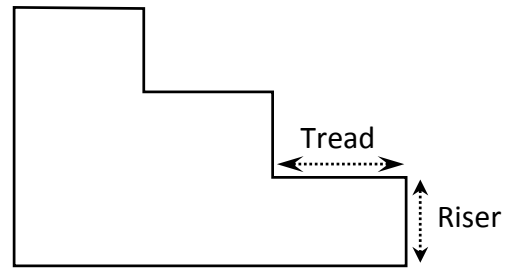
Fill in the missing statements and reasons in the table below to complete Sanjay's proof correctly.

	Statement	Reason
1.	$ QT  =  TS $	$QRST$ is a rhombus
2.	$QST$ is an isosceles triangle	
3.	$ \angle X  =  \angle Y $	
4.		The diagonals of a parallelogram bisect each other
5.	$QKT$ is congruent to $SKT$	

**Question 10**

(Suggested maximum time: 15 minutes)

Grace is putting some stairs into a new house. The diagram on the right shows three of the steps in the stairs. Each step consists of a riser and a tread. All of the risers in the stairs are the same size as each other, as are the treads.



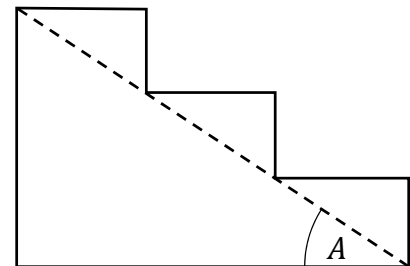
The table below shows measurements for stairs in private and public buildings. The optimum length is the best possible length.

	Tread (mm)		Riser (mm)	
	Minimum	Optimum	Optimum	Maximum
<b>Private</b>	220	250	175	220
<b>Public</b>	280	300	150	180

Grace's stairs will have the **optimum** size step for a **private** building.

- (a) Grace's stairs will climb a total vertical height of 2.1 m (i.e. the sum of the risers is 2.1 m). Work out the horizontal length of Grace's stairs (i.e. the sum of the treads).

- (b) The angle of elevation of Grace's stairs is marked *A* in the diagram on the right.



Using trigonometry, and **without** measuring, work out the size of the angle *A*.

Give your answer correct to the nearest degree.



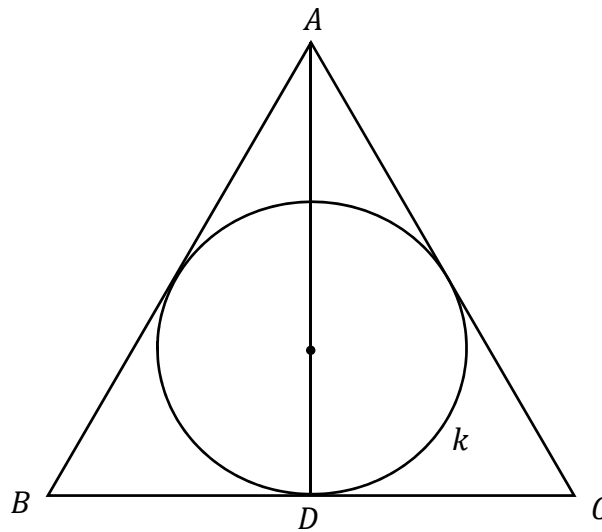
**Question 12**

**(Suggested maximum time: 15 minutes)**

The diagram below shows a Horcrux.

$ABC$  is an equilateral triangle.  $D$  is the midpoint of  $[BC]$ .  $AD$  is perpendicular to  $BC$ .

The circle  $k$  touches the three sides of  $ABC$ .

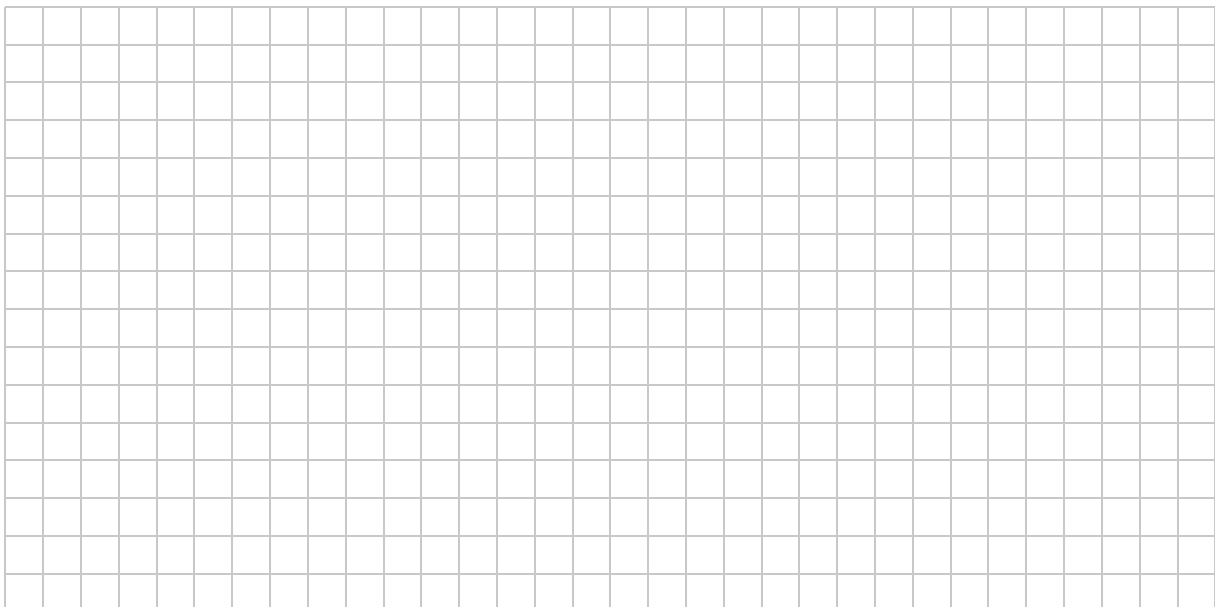


- (a) Write the correct transformation into the box below. Be as specific as you can.

" $ABD$  is the image of  $ACD$  under

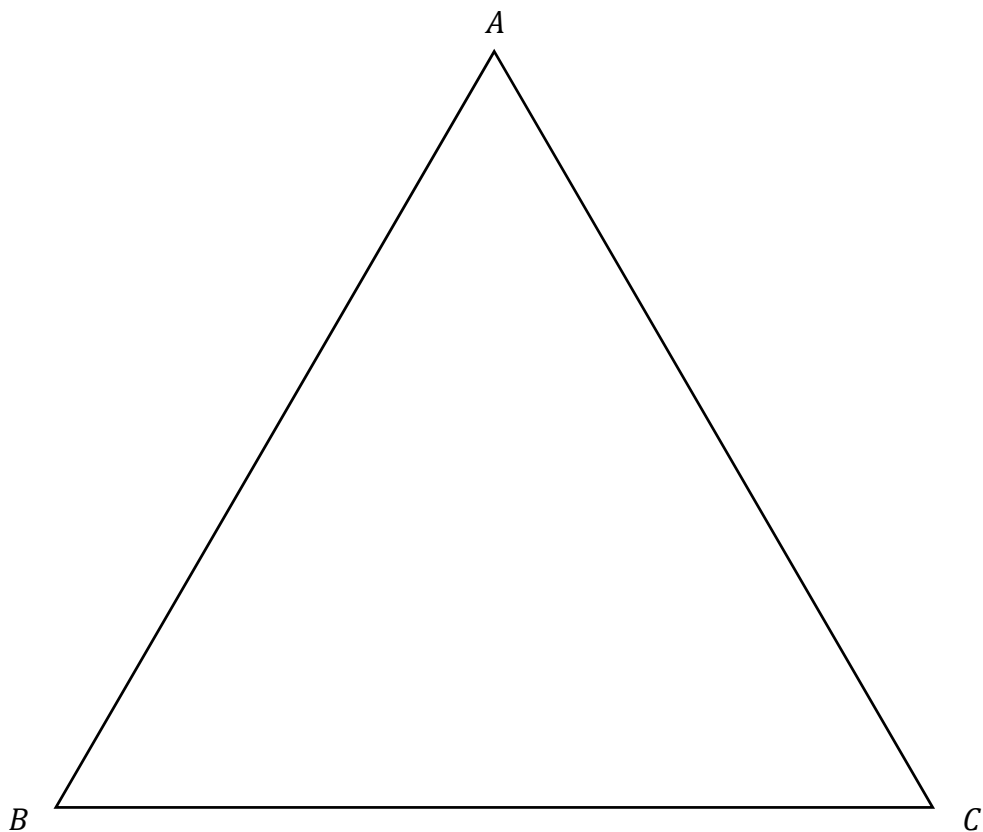
."

- (b)  $|AD| = 10$  cm. Work out the length  $|AB|$ .  
Give your answer in cm, in surd form.



- (c) The diagram below shows the triangle  $ABC$ .  
**Construct** the rest of the Horcrux, using the following facts:
- (i) The line  $AD$  is the **perpendicular bisector** of  $[BC]$ .
  - (ii) The centre of the circle  $k$  is the point of intersection of  $AD$  and the **bisector** of the angle at  $B$ .

You may only use a compass and straight edge. Show all of your construction lines clearly.







**Question 14**

(Suggested maximum time: 5 minutes)

A pizzeria has the following poster:

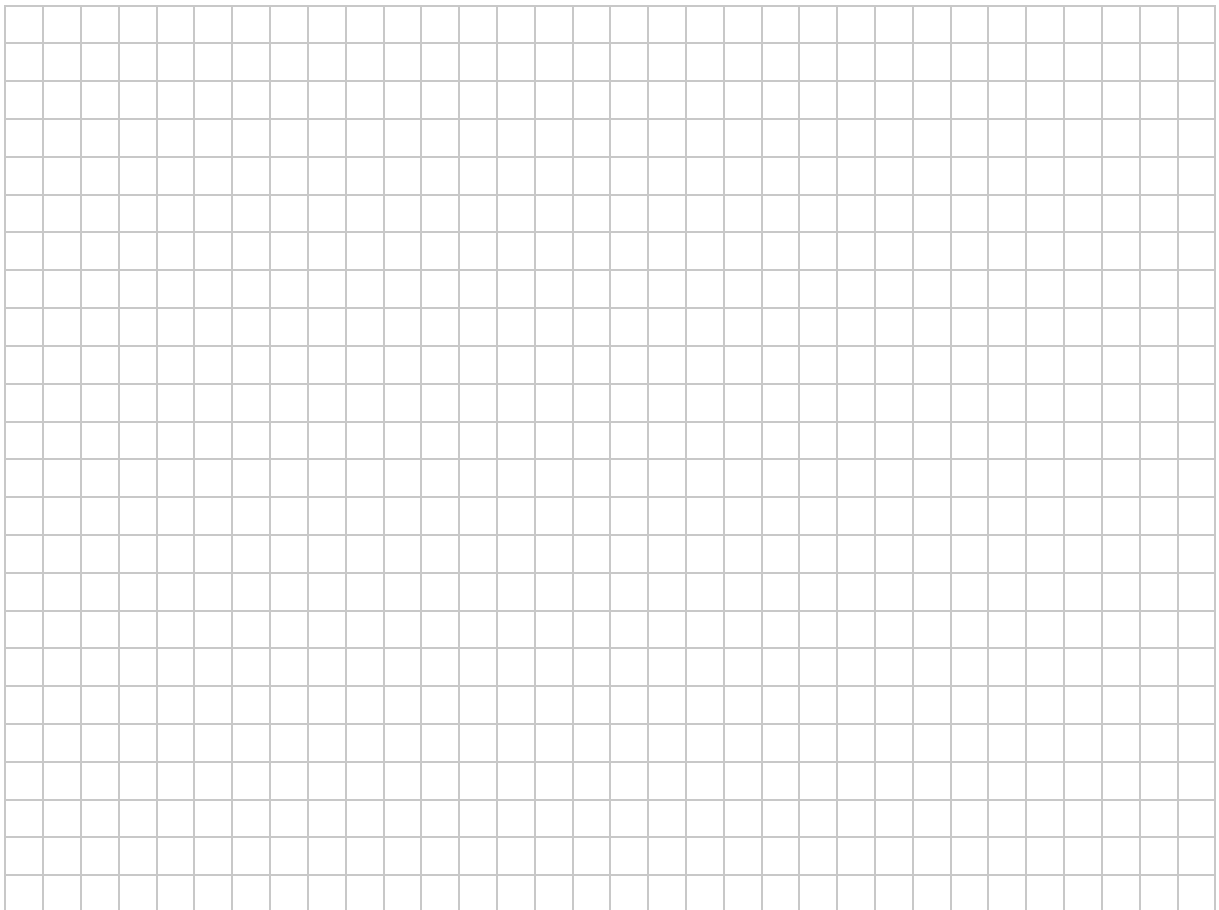


A 9 inch pizza is in the shape of a circle with a **diameter** of 9 inches.

Each Big Pizza is in the shape of a bigger circle, and is divided into **6 slices of equal area**.

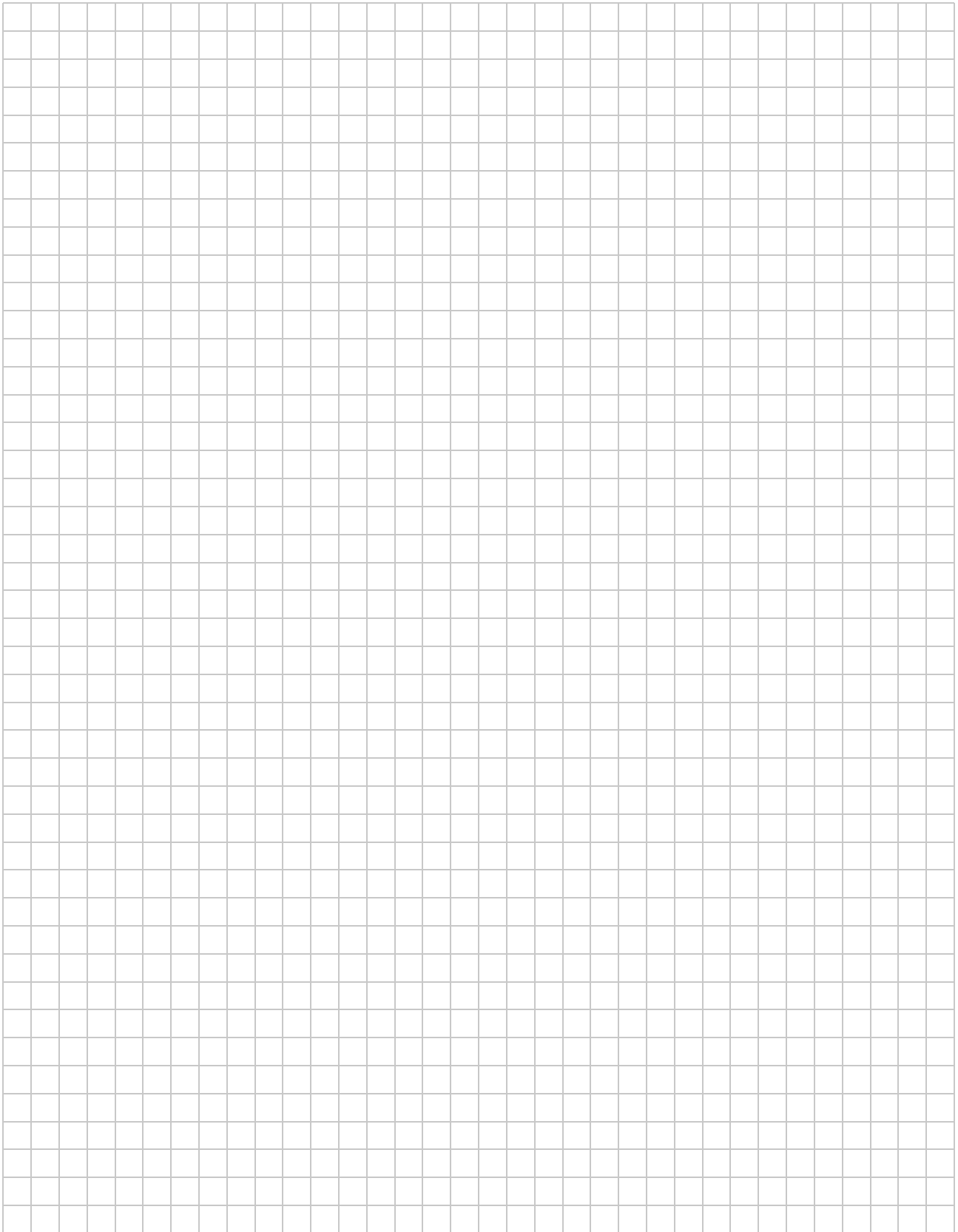
Use the information in the poster to work out the **radius** of a Big Pizza.

Give your answer in inches in the form  $\frac{3^p}{2}$ , where  $p \in \mathbb{Q}$ .



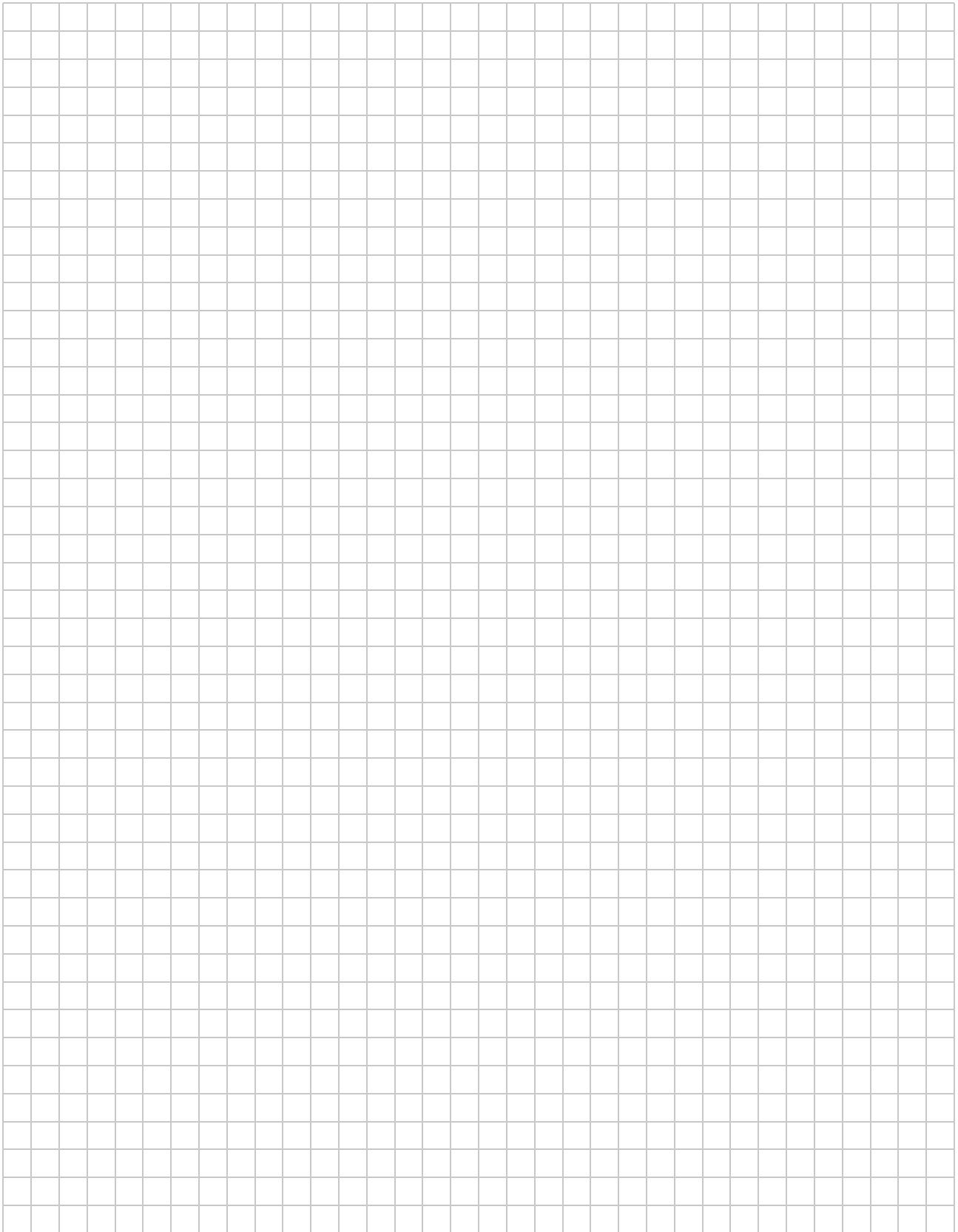
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Label any extra work clearly with the question number and part.



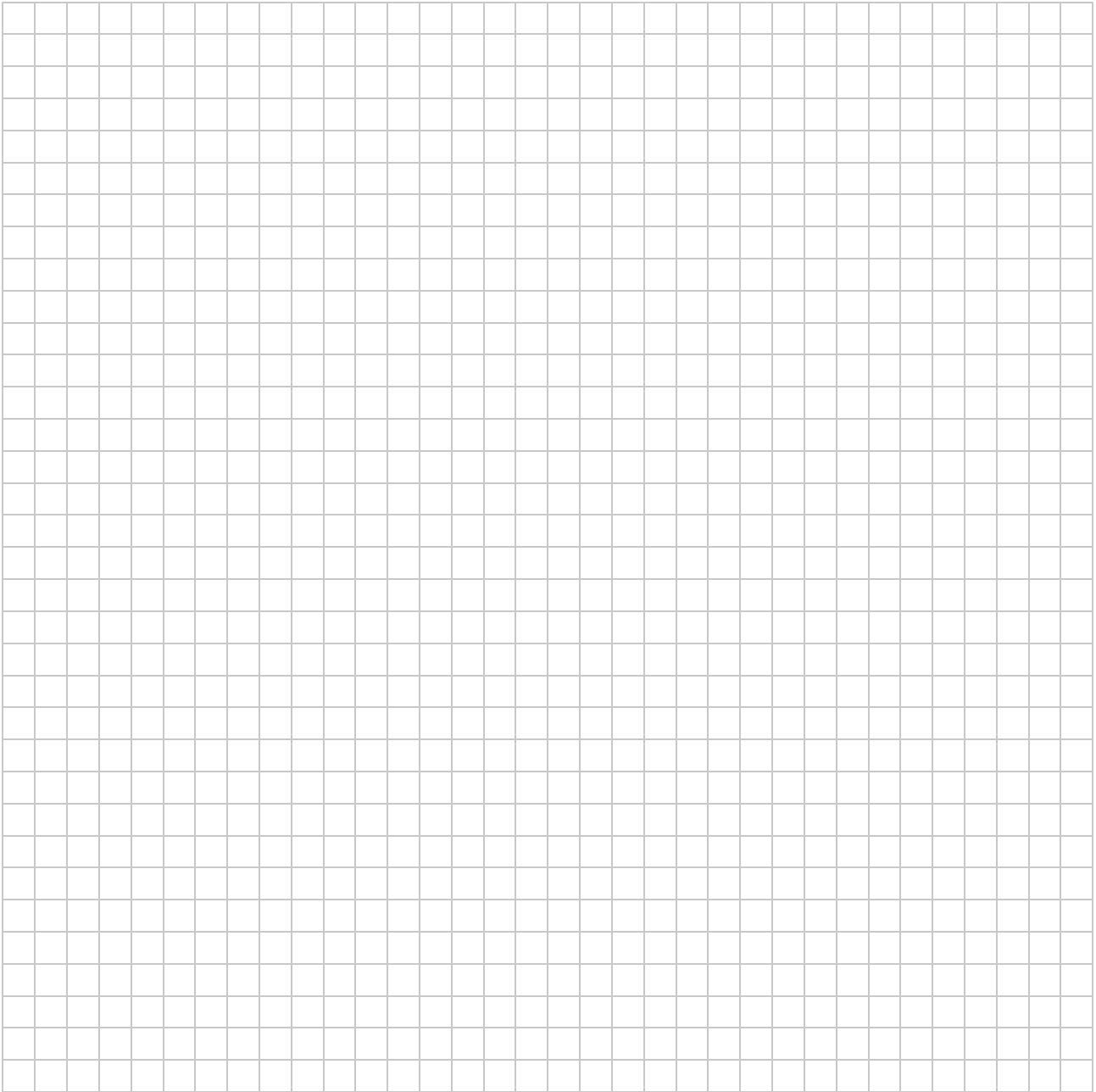
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Junior Certificate 2018

## Mathematics – Paper 2

Higher Level

Monday 11 June

Morning 9:30 to 12:00