



Coimisiún na Scrúduithe Stáit  
State Examinations Commission

Junior Certificate Examination 2014  
Sample Paper

Mathematics  
(Project Maths – Phase 2)

Paper 2

Higher Level

Time: 2 hours, 30 minutes

300 marks

Examination number

Centre stamp

Running total

For examiner

Question	Mark	Question	Mark
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8			
9			
10		Total	

Grade

## Instructions

There are 17 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 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 the make and model of your calculator(s) here:

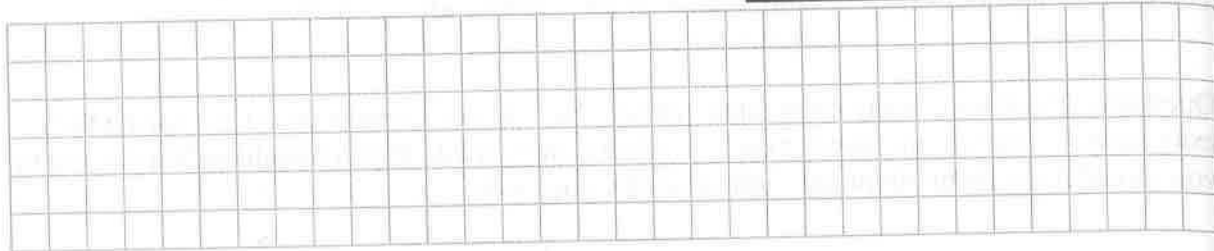
### Question 1

(Suggested maximum time: 20 minutes)

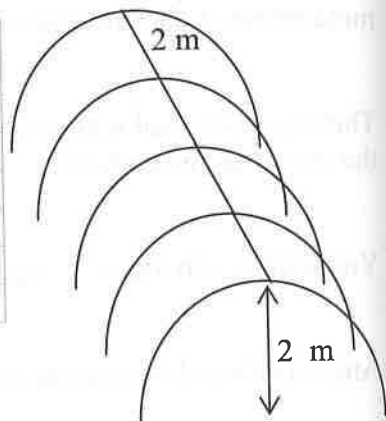
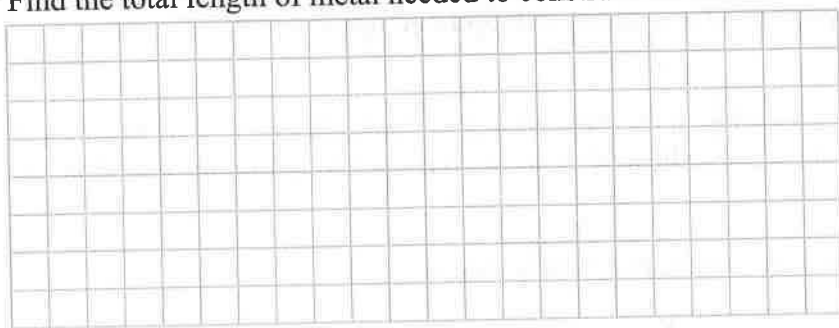
Deirdre constructs a "polytunnel" on a level part of her back garden. Five vertical, semicircular metal hoops, each of radius 2 m, are attached to brackets at ground level and covered with a polythene sheet. The hoops are 2 m apart.



- (i) Find the area of ground covered by the tunnel.



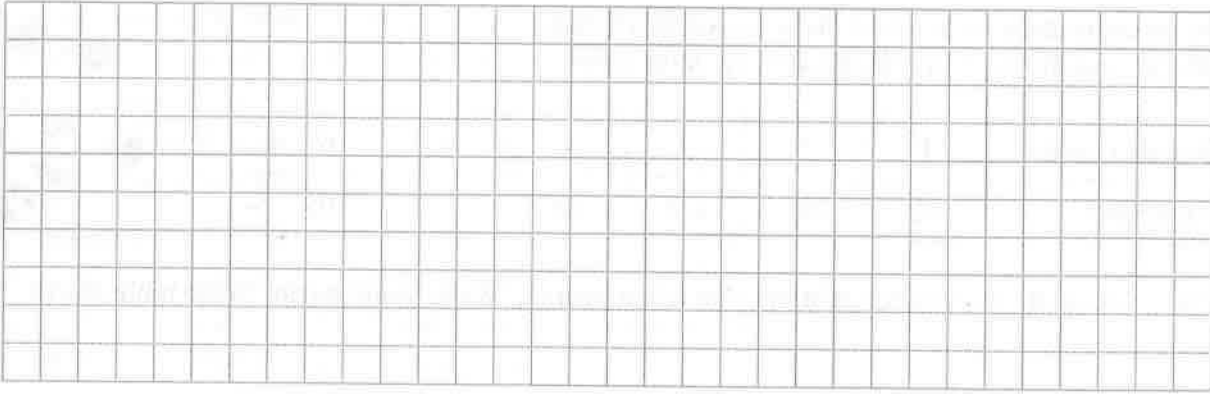
- (ii) The hoops are also held in place by a straight piece of metal attached at the top of each hoop. Find the total length of metal needed to construct the tunnel.



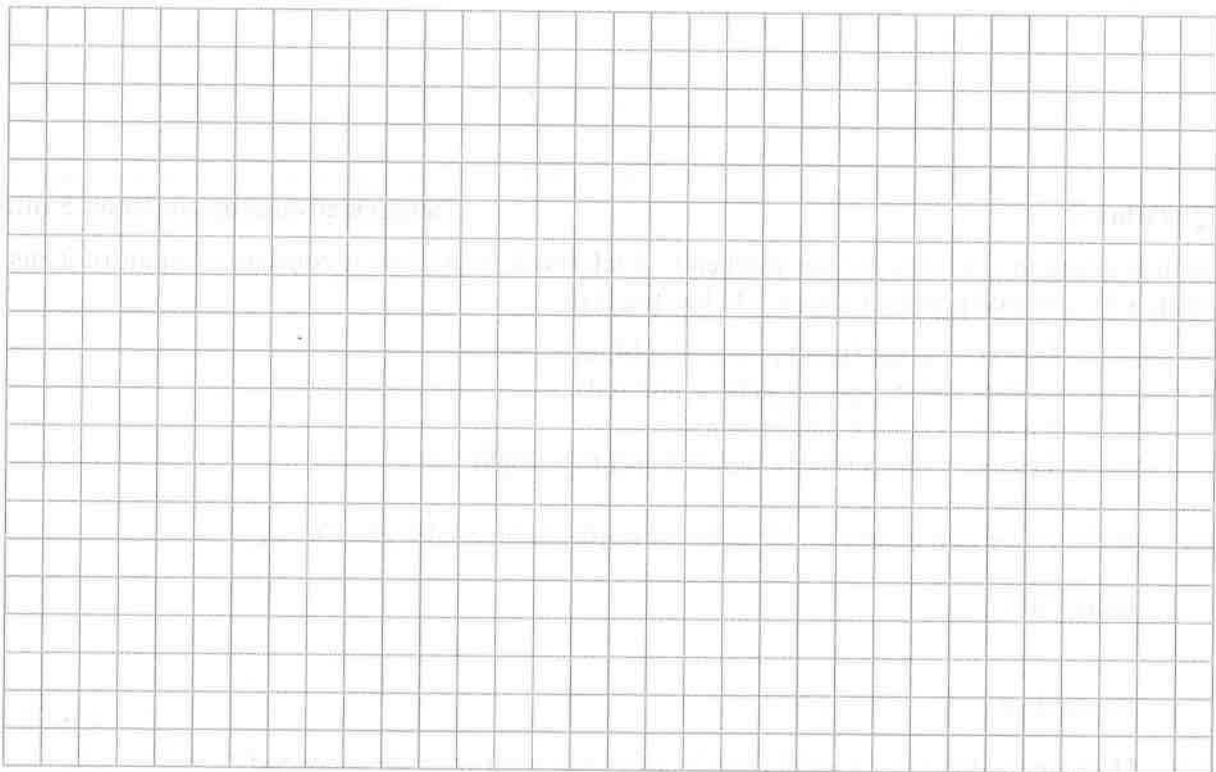
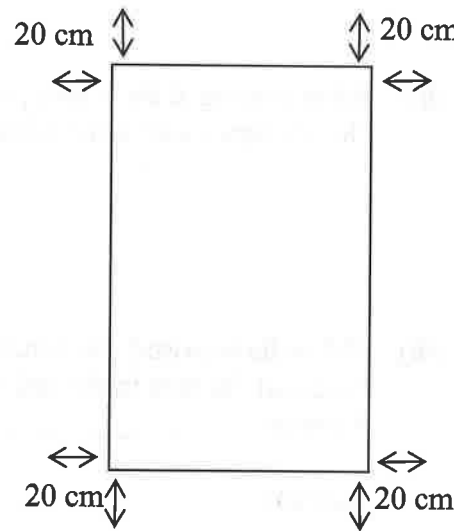
- (iii) The polythene is buried in the ground to a depth of 25 cm all around the tunnel (including both ends). Find the dimensions and area of the smallest rectangular sheet of polythene that can be used.

Length:	Width:	Area:
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(iv) Find the volume of air in the tunnel.



(v) To finish, Deirdre constructs a rectangular raised bed of height 25 cm inside the tunnel. There is a space of 20 cm between the bed and each side of the tunnel. The bed is then filled with topsoil. Soil costs €80 per tonne and  $1 \text{ m}^3$  of soil weighs 0.75 tonnes. Find the cost of filling the bed with soil.





**Question 4**

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

35 people coming back from America were asked if they had visited New York, Boston or San Francisco. The results were as follows:

20 had visited New York

13 had visited Boston

16 had visited San Francisco

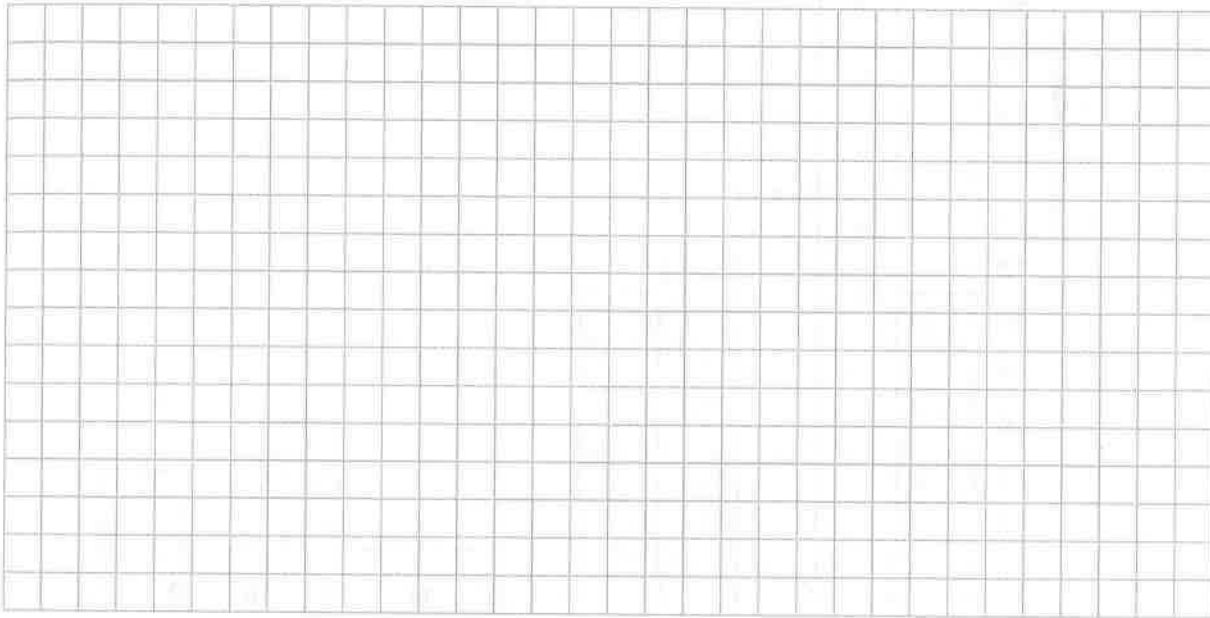
7 had been to all three cities

3 had been to both New York and San Francisco, but not Boston

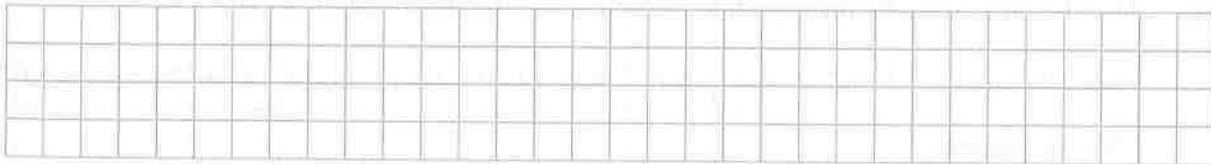
1 had been to both New York and Boston, but not San Francisco

8 had been to Boston and San Francisco.

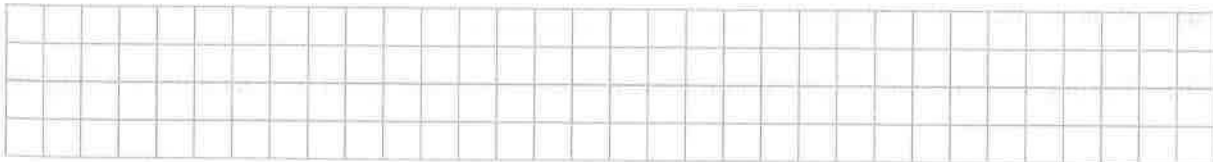
- (i) Display this information in a Venn diagram.



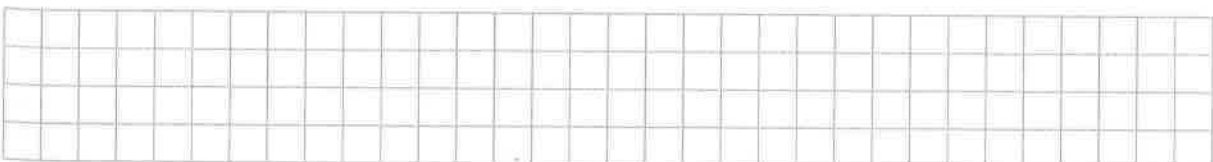
- (ii) If one person is chosen at random from the group, what is the probability that the person had not visited any of the three cities?



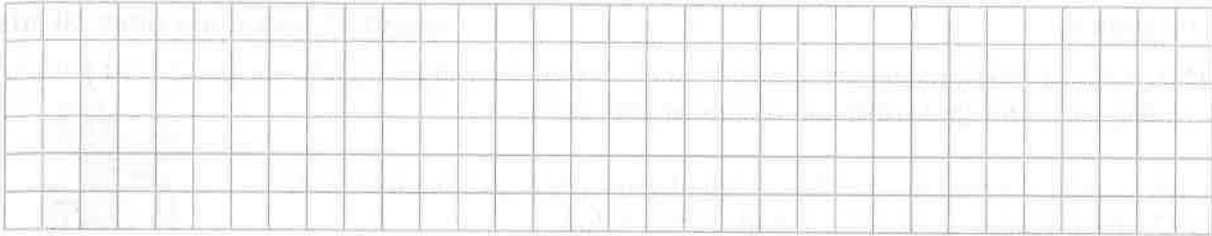
- (iii) If one person is chosen at random, what is the probability that the person had visited New York only?



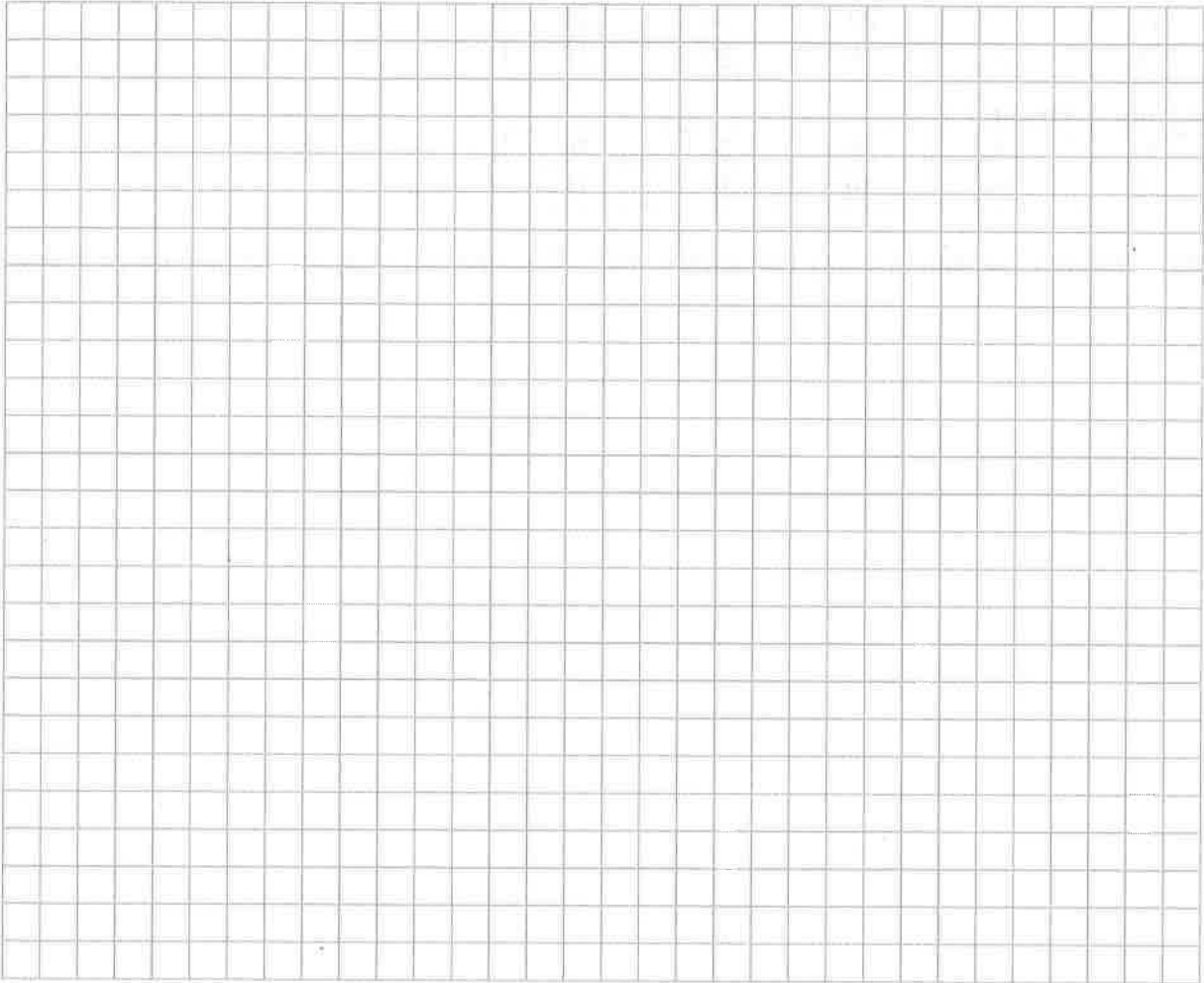
- (iv) If one person is chosen at random, what is the probability that the person had visited Boston or New York?







- (iv) John is conducting a survey on computer usage by students at his school. His questionnaire asks the same question. He plans to carry out his survey by asking the question to twenty first-year boys on the Monday after the mid-term break. Give two reasons why the results from John's question might not be as representative as those in the histogram.





(Suggested maximum time: 10 minutes)

### Question 6

Three groups of 10 students in a third-year class were investigating how the number of jelly beans in a bag varies for three different brands of jelly beans.

Each student counted the number of jelly beans in a bag of brand A or B or C. Their results are recorded in the tables below.



#### Group 1 (Brand A)

23	25	25	26	26
32	32	33	34	35

#### Group 2 (Brand B)

17	22	22	24	24
29	29	29	29	29

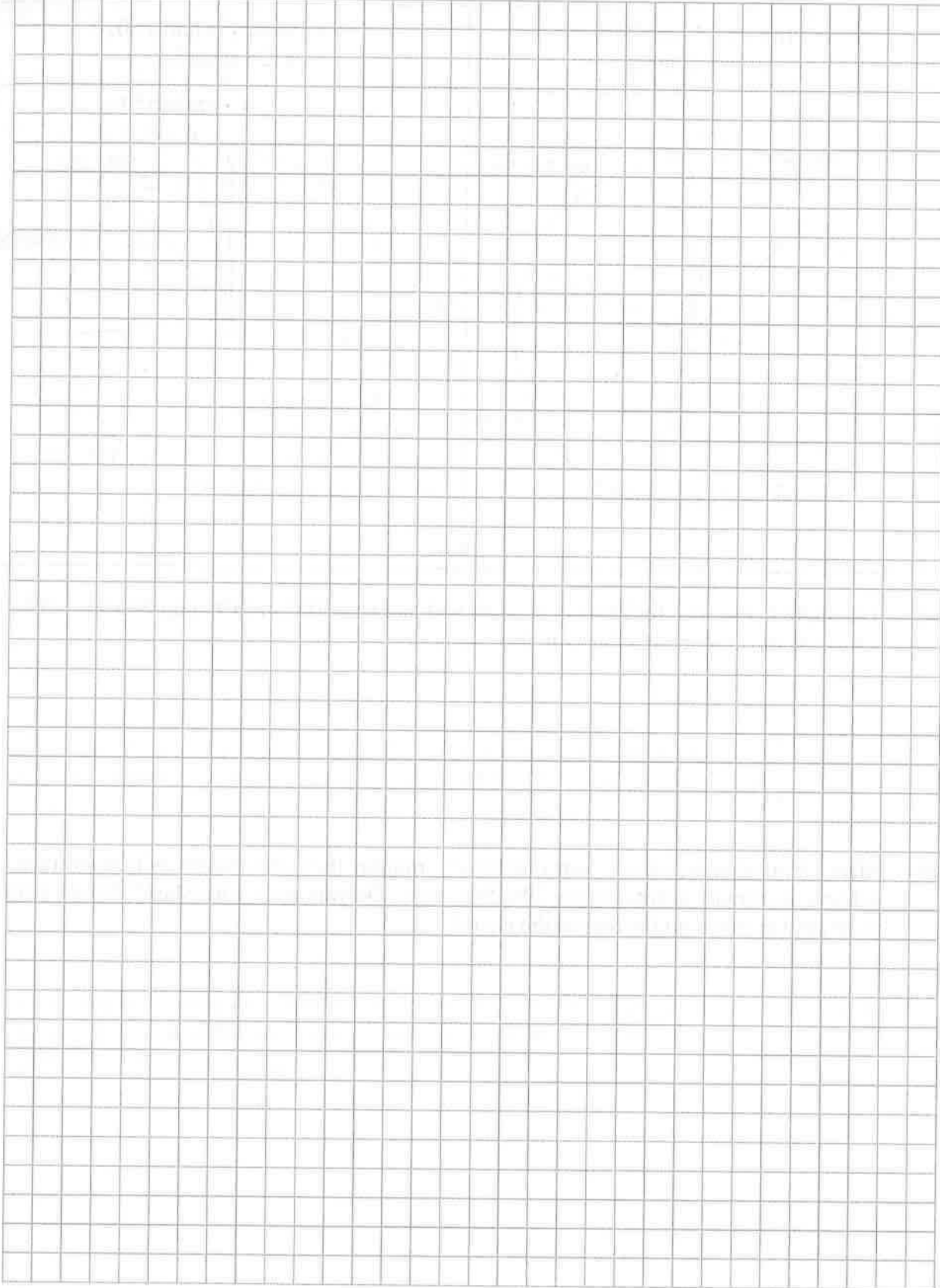
#### Group 3 (Brand C)

25	25	25	26	26
29	29	30	30	31

- (i) Display the data in a way that allows you to describe and compare the data for each brand.

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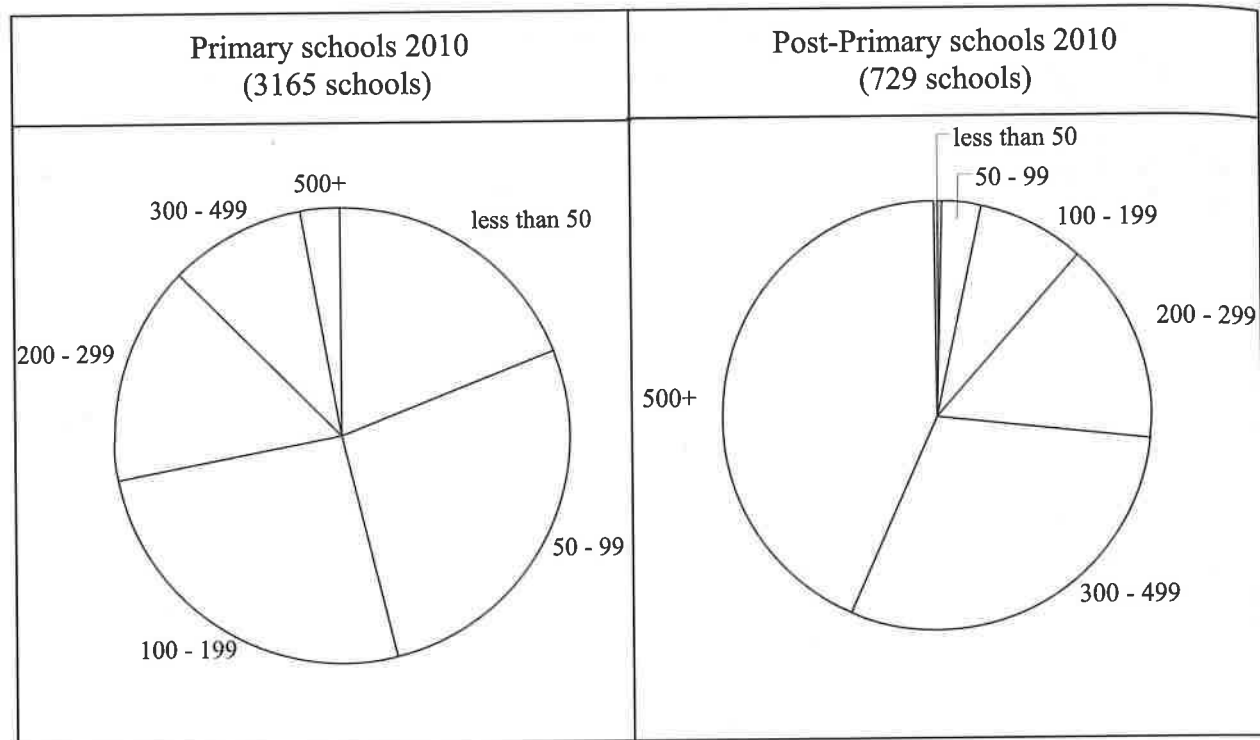
- (ii) If you were to buy a bag of jelly beans which brand would you buy? Give a reason for your answer based on the data provided in the tables. In your explanation you should refer to the **mean** number of jelly beans per bag, and the **range** or **spread** of the number of jelly beans per bag for each brand.

A large grid of graph paper, consisting of approximately 25 columns and 40 rows of small squares, intended for writing an answer to the question above.

Question 7

(Suggested maximum time: 5 minutes)

The number of students attending primary and post-primary schools in Ireland in 2010 is illustrated in the pie-charts below.



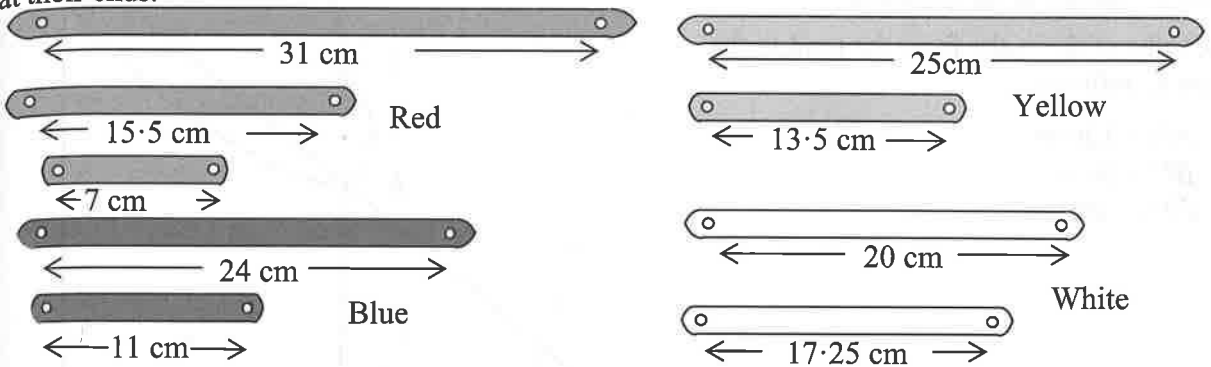
- (i) The angle in the slice for Primary schools with between 100 and 199 pupils is  $93.725^\circ$ . Calculate the number of schools in this category.


- (ii) Mary claims that the charts show that there is roughly the same number of post-primary schools as primary schools in the 200-299 range. Do you agree with Mary? Give a reason for your answer based on the data in the charts.


### Question 8

(Suggested maximum time: 10 minutes)

Monica has a set of nine coloured plastic strips (long red, middle red, short red, etc.) as shown below. The strips can be joined together, to form geometrical objects, by pins through small holes at their ends.



- (i) Is it possible to make an object in the shape of an isosceles triangle using any three of the nine strips? Give a reason for your answer.

Answer:

Reason:

- (ii) Monica would like to join four strips together to form an object in the shape of a parallelogram. Explain why it is not possible to do this.

- (iii) The long yellow, long blue and short red strips are used to form an object in the shape of a triangle. Monica thinks that this might be a right-angled triangle. Investigate if she is correct.

- (iv) Monica uses the long blue and the long white strips to form the arms of a right angle. Find the length of a strip that would be needed to complete this triangular shape. Give your answer correct to two decimal places.

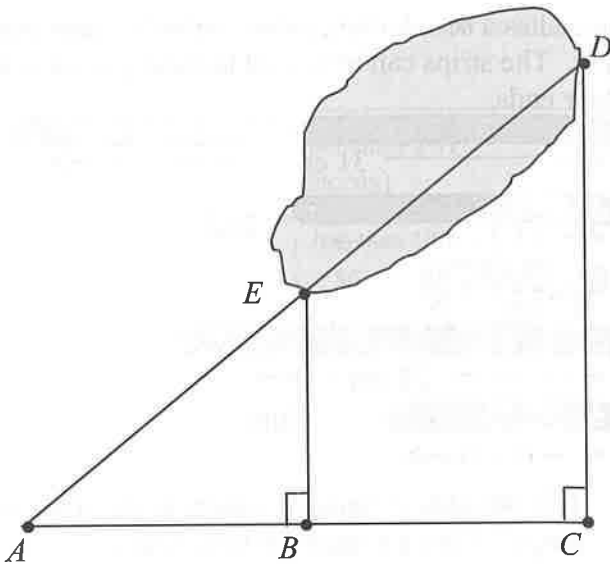
**Question 9**

(Suggested maximum time: 5 minutes)

Three paths,  $[AE]$ ,  $[BE]$  and  $[CD]$ , have been constructed to provide access to a lake from a road  $AC$  as shown in the diagram.

The lengths of the paths from the road to the lake are as follows:

- $|AE| = 120$  m
- $|BE| = 80$  m
- $|CD| = 200$  m.



- (i) Explain how these measurements can be used to find  $|ED|$ .

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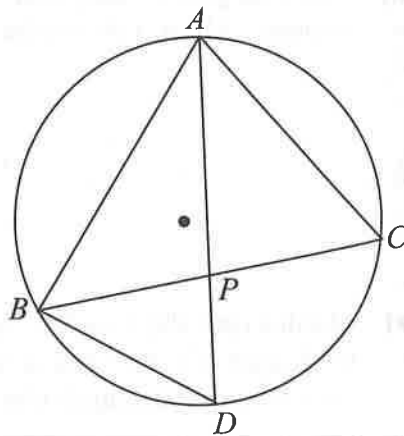
- (ii) Find  $|ED|$ .

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**Question 10**

(Suggested maximum time: 5 minutes)

$A$ ,  $B$ ,  $C$ , and  $D$  are four points on a circle as shown.  
 $[AD]$  bisects  $\angle BAC$ .  
 $P$  is the point of intersection of  $AD$  and  $BC$ .



- (i) Show that  $\triangle ADB$  and  $\triangle APC$  are similar.

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- (ii) Show that  $|AC| \times |BD| = |AD| \times |PC|$ .

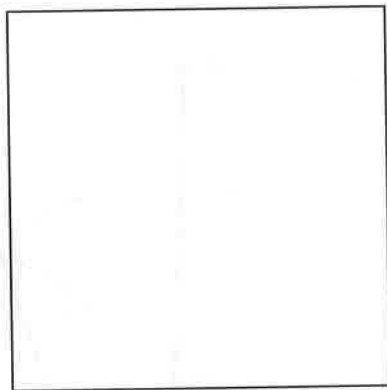
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Question 12

(Suggested maximum time: 5 minutes)

- (a) The diagram shows a square.  
Draw in all its axes of symmetry.



- (b) Each of the four diagrams A, B, C and D shows the object in Figure 1 and its image under a transformation. For each of A, B, C and D, state one transformation (translation, axial symmetry or central symmetry) that will map the object onto that image.

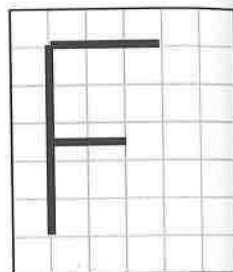


Figure 1

<p>A</p>	<p>B</p>	<p>C</p>	<p>D</p>
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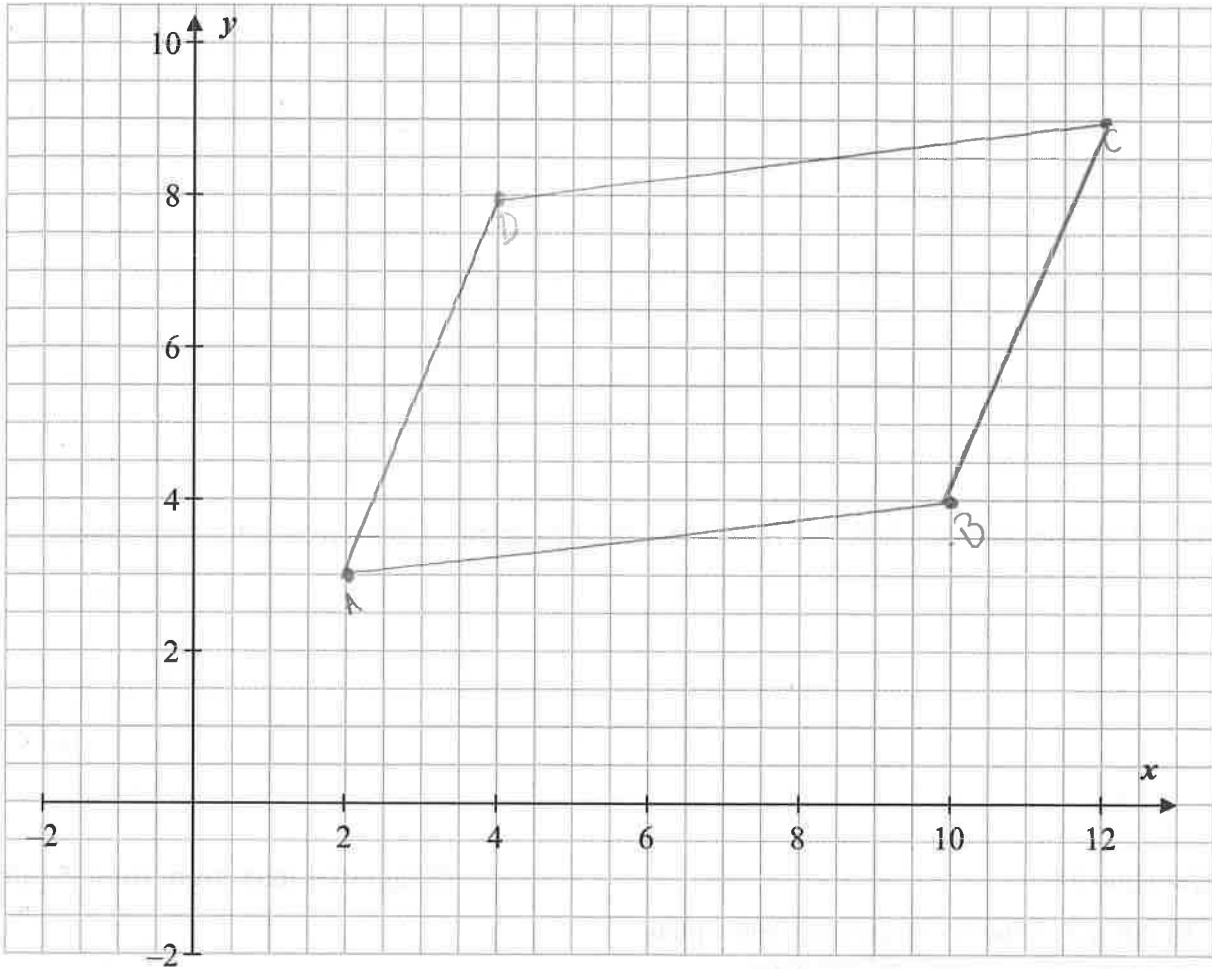
A  
B  
C  
D


**Question 13**

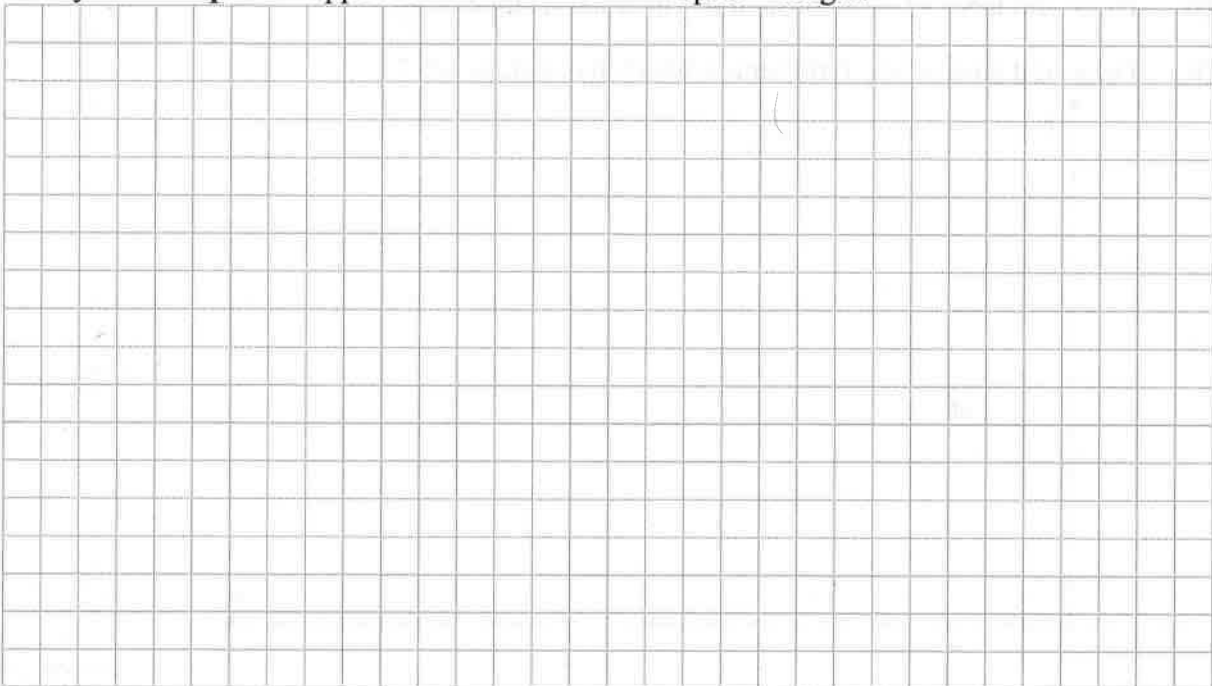
**(Suggested maximum time: 10 minutes)**

$A(2, 3)$ ,  $B(10, 4)$ ,  $C(12, 9)$ , and  $D(4, 8)$  are four points.

- (i) Plot the points on the co-ordinate plane below and join  $A$  to  $B$ ,  $B$  to  $C$ ,  $C$  to  $D$ , and  $D$  to  $A$  to form the quadrilateral  $ABCD$ .

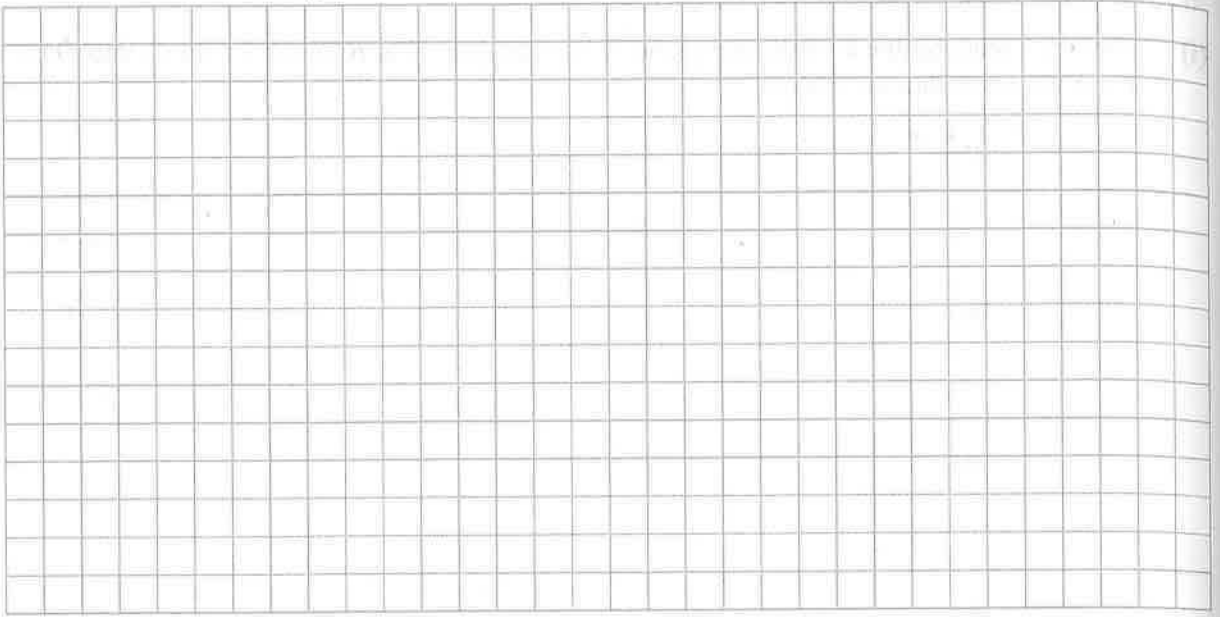


- (ii) Verify that **one pair** of opposite sides of  $ABCD$  are equal in length.

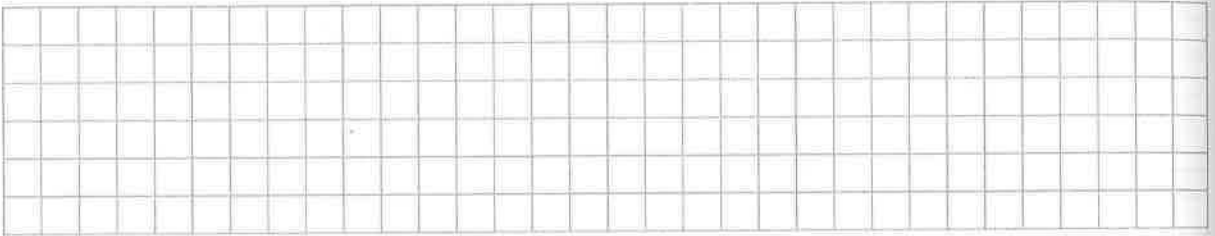




- (iii) By finding  $E$  and  $F$ , the midpoints of  $[AC]$  and  $[BD]$  respectively, verify that the diagonals of  $ABCD$  bisect each other.



- (iv) Can you now conclude that  $ABCD$  is a parallelogram? Give a reason for your answer.

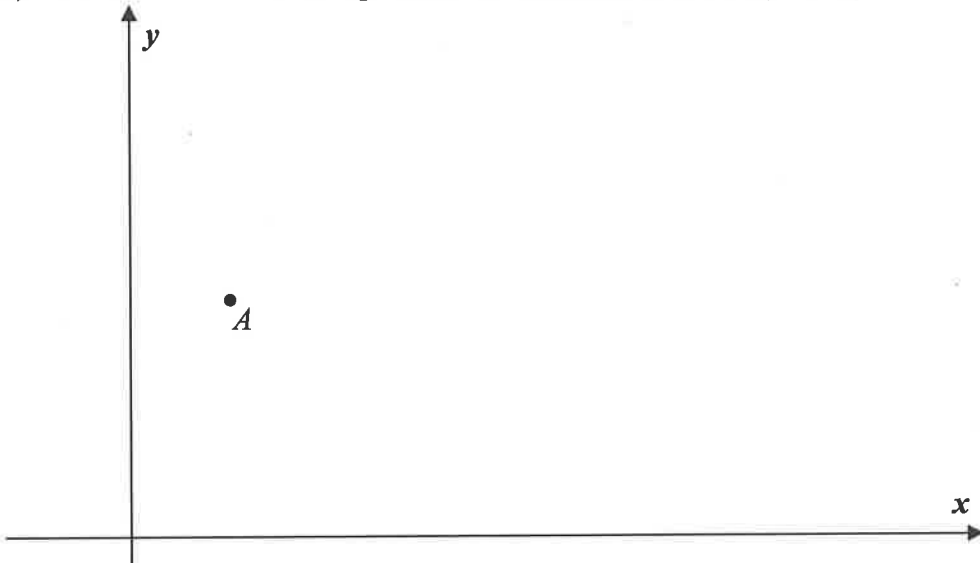


**Question 14**

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

The point  $A$  is shown on the coordinate plane.  
The same scale is used on both axes.

- (i) Draw and label a line  $l_1$  through  $A$  which has a slope of  $\frac{1}{2}$ .  
(ii) Draw and label a line  $l_2$  through  $A$  which has a slope of  $-2$ .

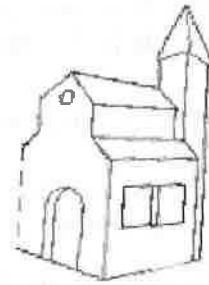
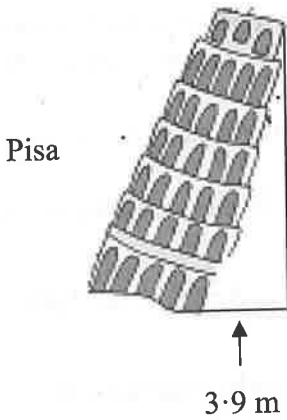




**Question 16**

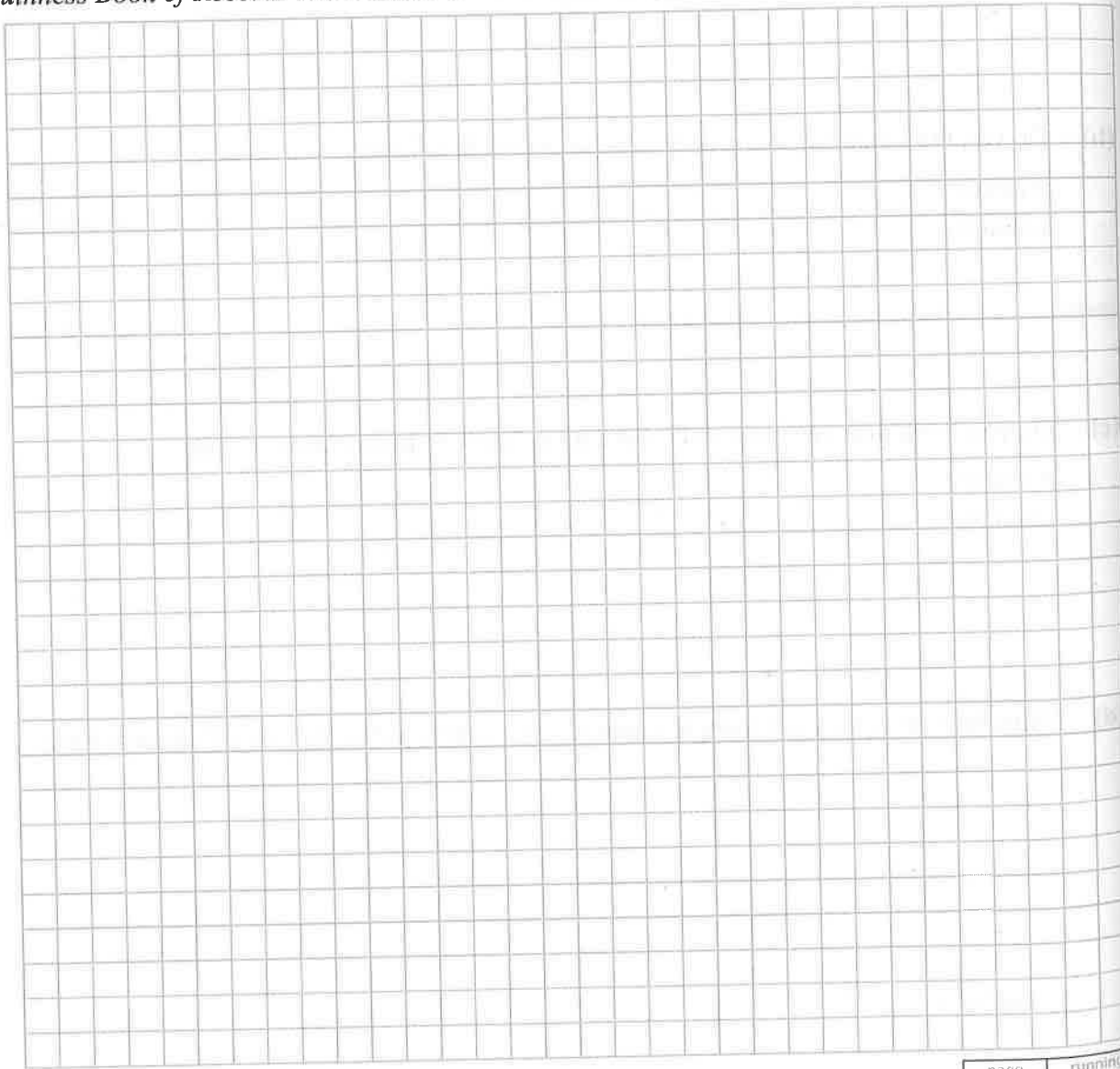
(Suggested maximum time: 10 minutes)

The Leaning Tower of Pisa is 55.863 m tall and leans 3.9 m from the perpendicular, as shown below. The tower of the Suurhusen Church in north-western Germany is 27.37 m tall and leans 2.47 m from the perpendicular.



Suurhusen

By providing diagrams and suitable calculations and explanations, decide which tower should enter the *Guinness Book of Records* as the **Most Tilted Tower in the World**.



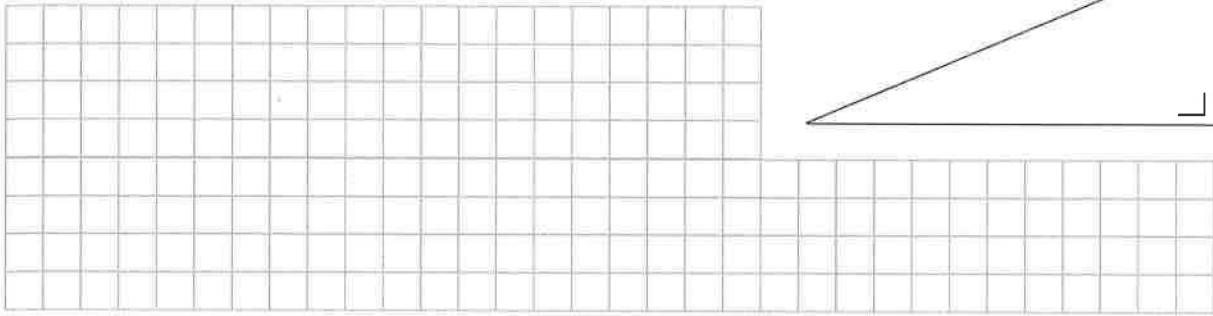
A large grid of squares for students to draw diagrams and perform calculations.

**Question 17**

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

In the right-angled triangle shown in the diagram, one of the acute angles is four times as large as the other acute angle.

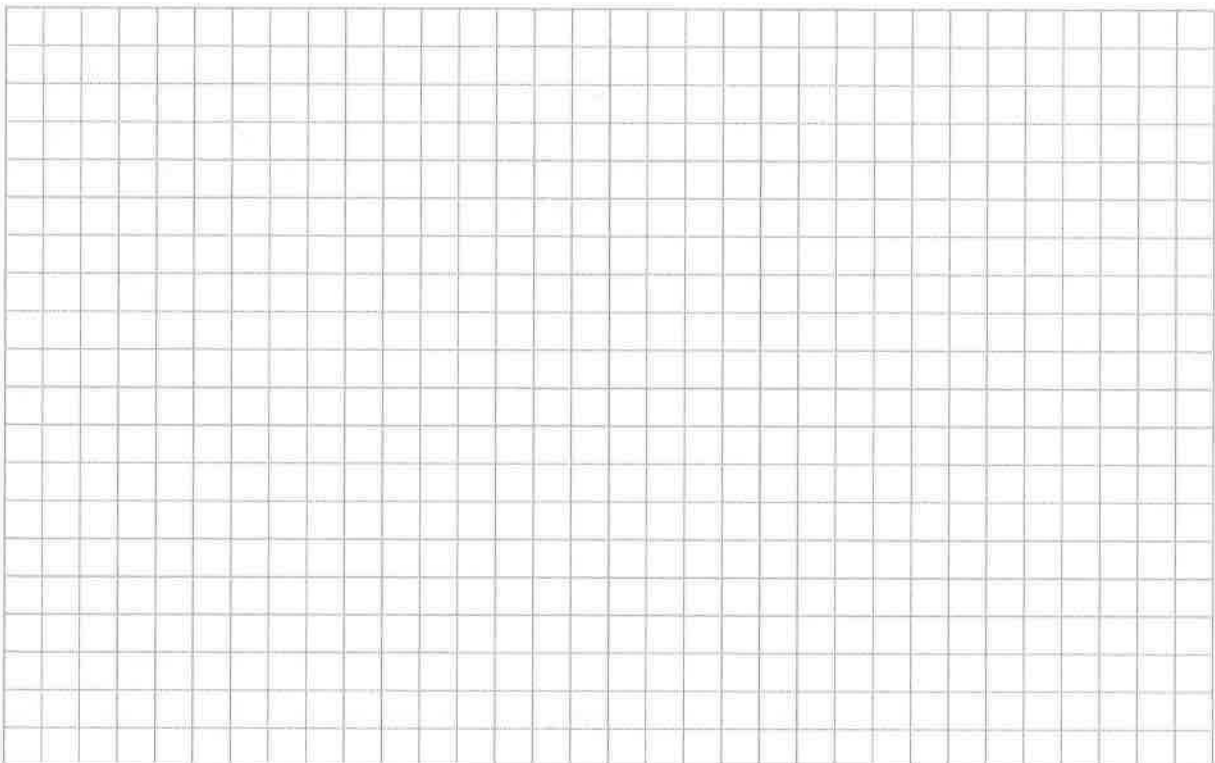
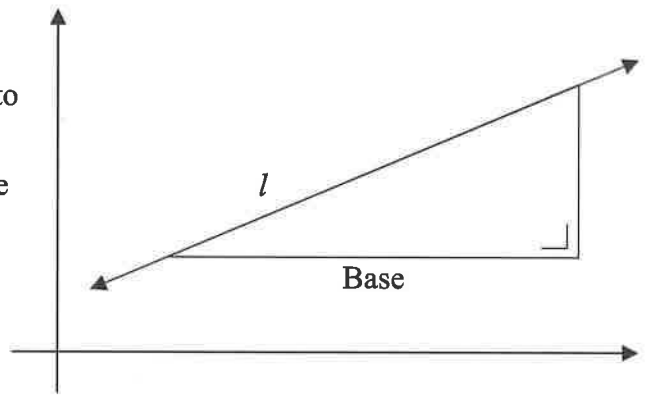
- (i) Find the measures of the two acute angles in the triangle.



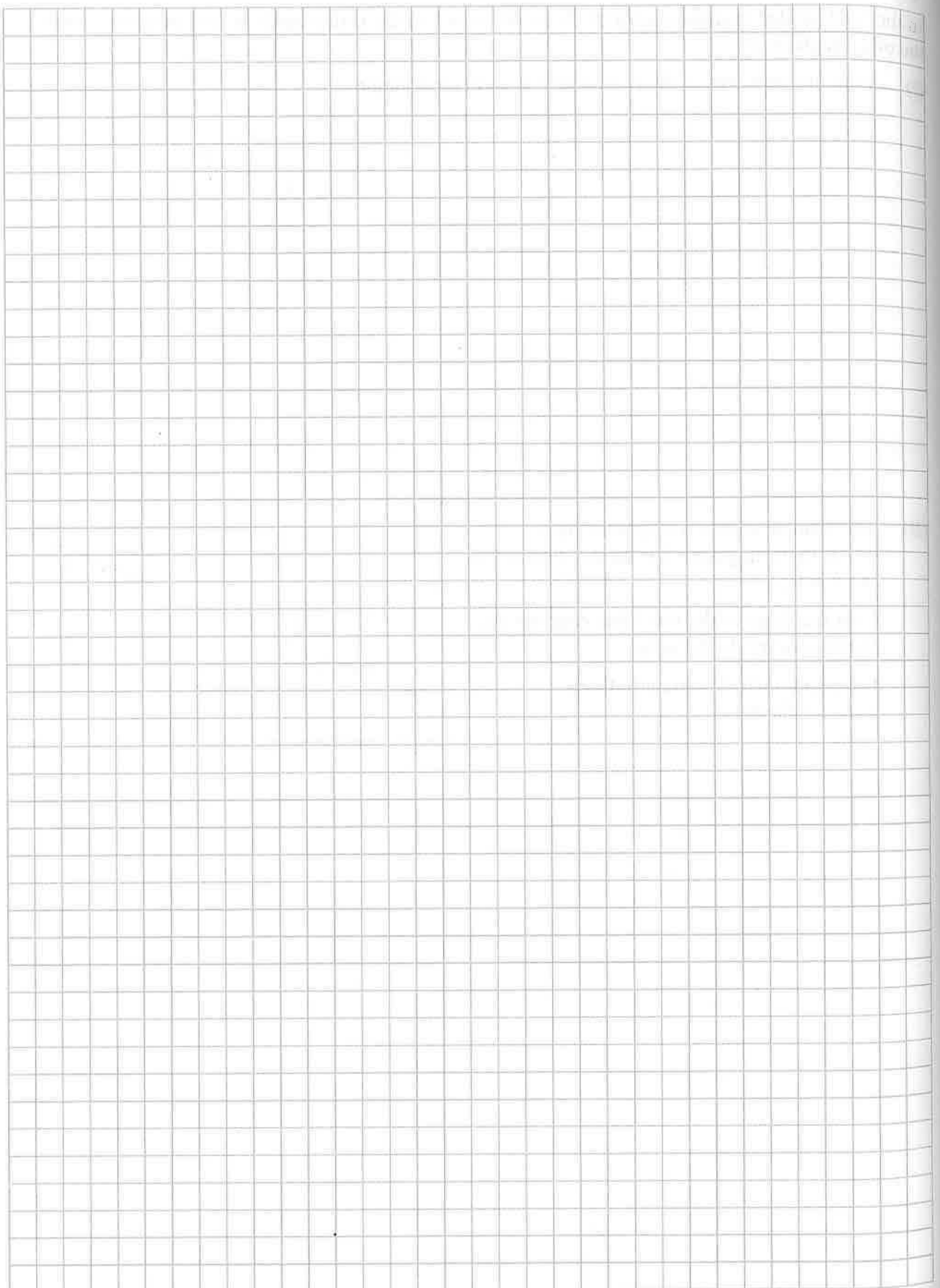
- (ii) The triangle in part (i) is placed on a co-ordinate diagram. The base is parallel to the  $x$ -axis.

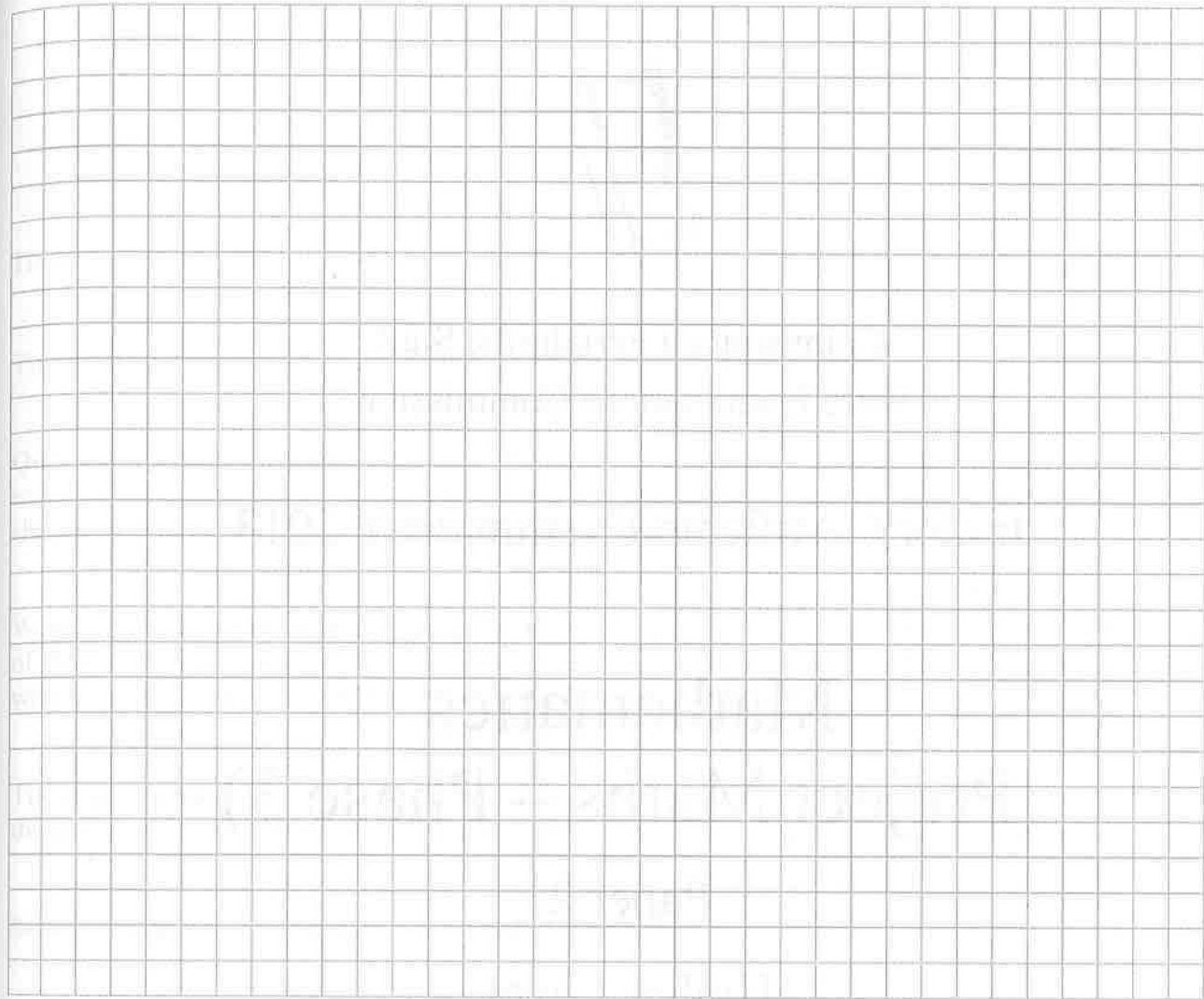
Find the slope of the line  $l$  that contains the hypotenuse of the triangle.

Give your answer correct to three decimal places.



You may use this page for extra work.





*Note to readers of this document:*

This sample paper is intended to help teachers and candidates prepare for the June 2014 examination in *Mathematics* under Phase 2 of *Project Maths*. The content and structure do not necessarily reflect the 2015 or subsequent examinations.

The number of questions on the examination paper may vary somewhat from year to year.

Junior Certificate 2014 – Higher Level

## Mathematics (Project Maths – Phase 2) – Paper 2

Sample Paper

Time: 2 hours, 30 minutes