



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2014
Sample Paper

Mathematics (Project Maths – Phase 3)

Paper 2

Ordinary 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, as follows:

In Section A, answer:

Questions 1 to 5 and

either Question 6A **or** Question 6B.

In Section B, answer Questions 7, 8, and 9.

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:

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

Question 1

(25 marks)

- (a) State the *fundamental principle of counting*.

- (b)** How many different ways are there to arrange five distinct objects in a row?

[illegible]

- (c) Peter is arranging books on a shelf. He has five novels and three poetry books. He wants to keep the five novels together and the three poetry books together. In how many different ways can he arrange the books?

[illegible]

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Question 2

(25 marks)

A biased die is used in a game. The probabilities of getting the six different numbers on the die are shown in the table below.

Number	1	2	3	4	5	6
Probability	0.25	0.25	0.15	0.15	0.1	0.1



- (a)** Find the expected value of the random variable X , where X is the number thrown.

[illegible]

- (b) There is a game at a funfair. It costs €3 to play the game. The player rolls a die once and wins back the number of euro shown on the die. The sentence below describes the difference between using the above biased die and using a fair (unbiased) die when playing this game. By doing the calculations required, complete the sentence.

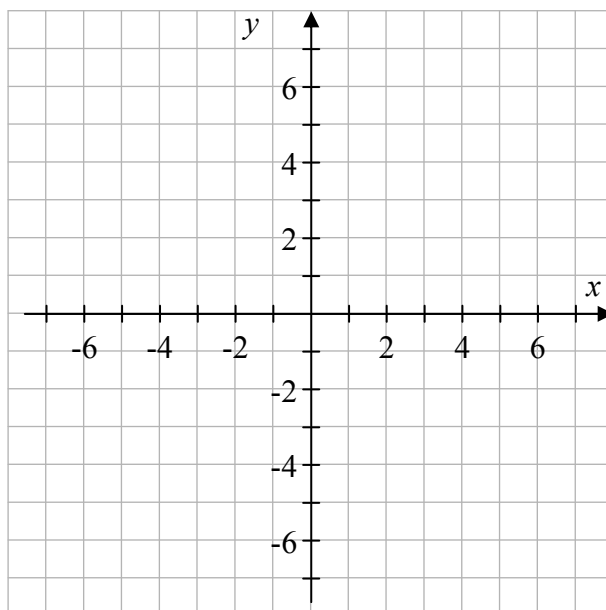
“If you play the game many times with a fair die, you will win an average of _____ per game, but if you play with the biased die you will lose an average of _____ per game.”

Question 3**(25 marks)**

The points A , B , and C have co-ordinates as follows:

 $A(3, 5)$ $B(-6, 2)$ $C(4, -4)$

- (a) Plot A , B , and C on the diagram.



- (b) Find the equation of the line AB .



- (c) Find the area of the triangle ABC .



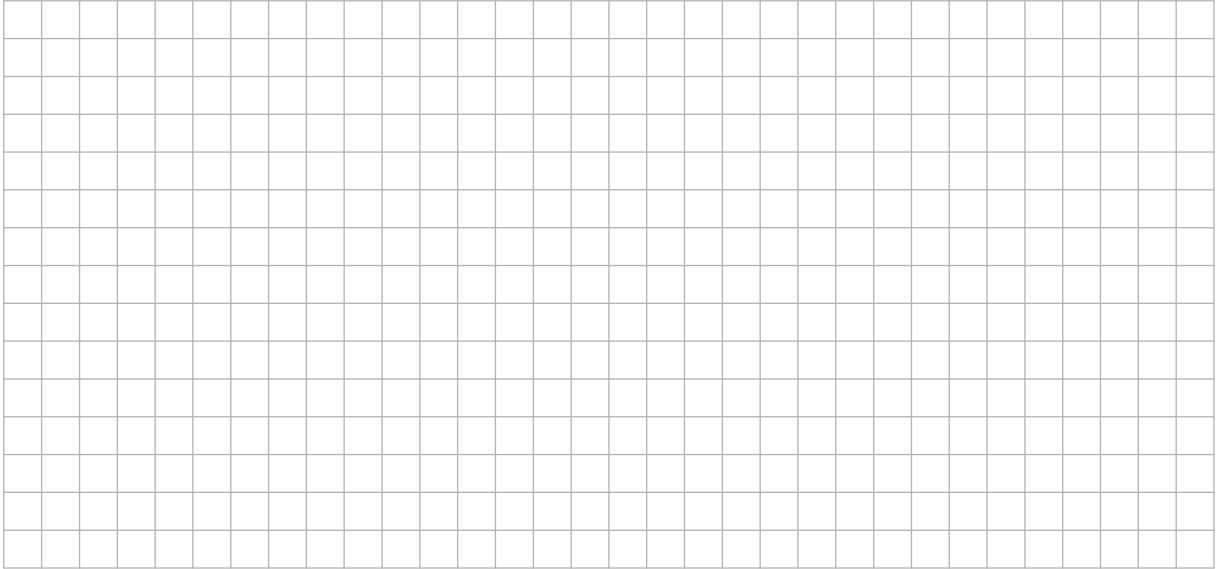
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Question 4**(25 marks)**

The circle c has centre $P(-2, -1)$ and passes through the point $Q(3, 1)$.

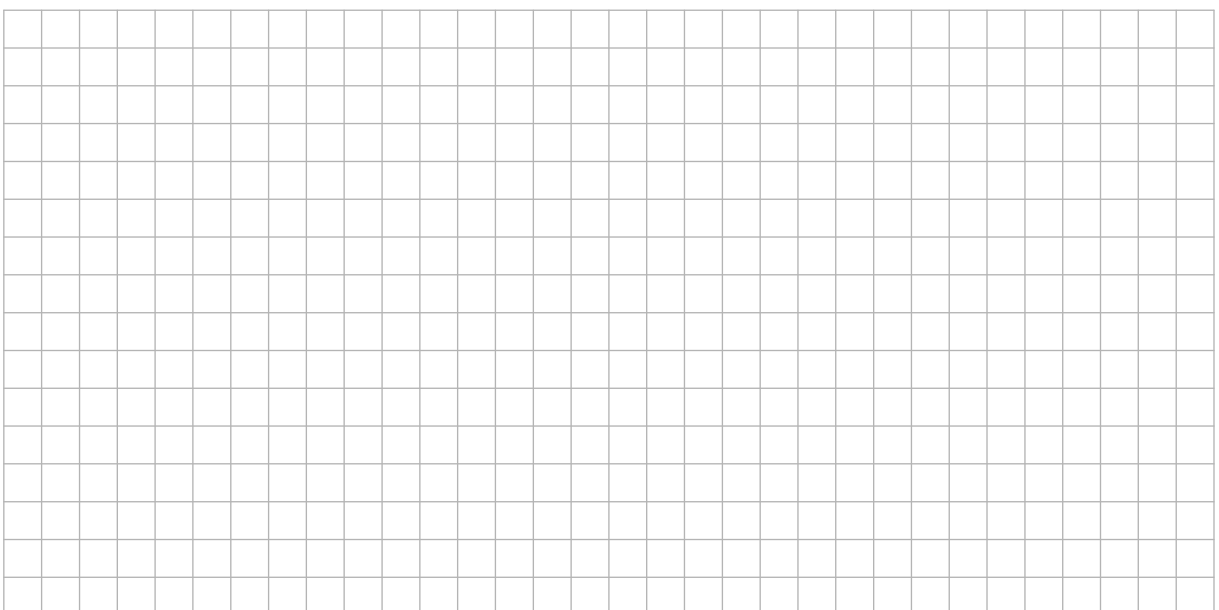
- (a) Show c , P , and Q on a co-ordinate diagram.



- (b) Find the radius of c and hence write down its equation.



- (c) R is the point $(1, 6)$. By finding the slopes of PQ and QR , show that QR is a tangent to c .

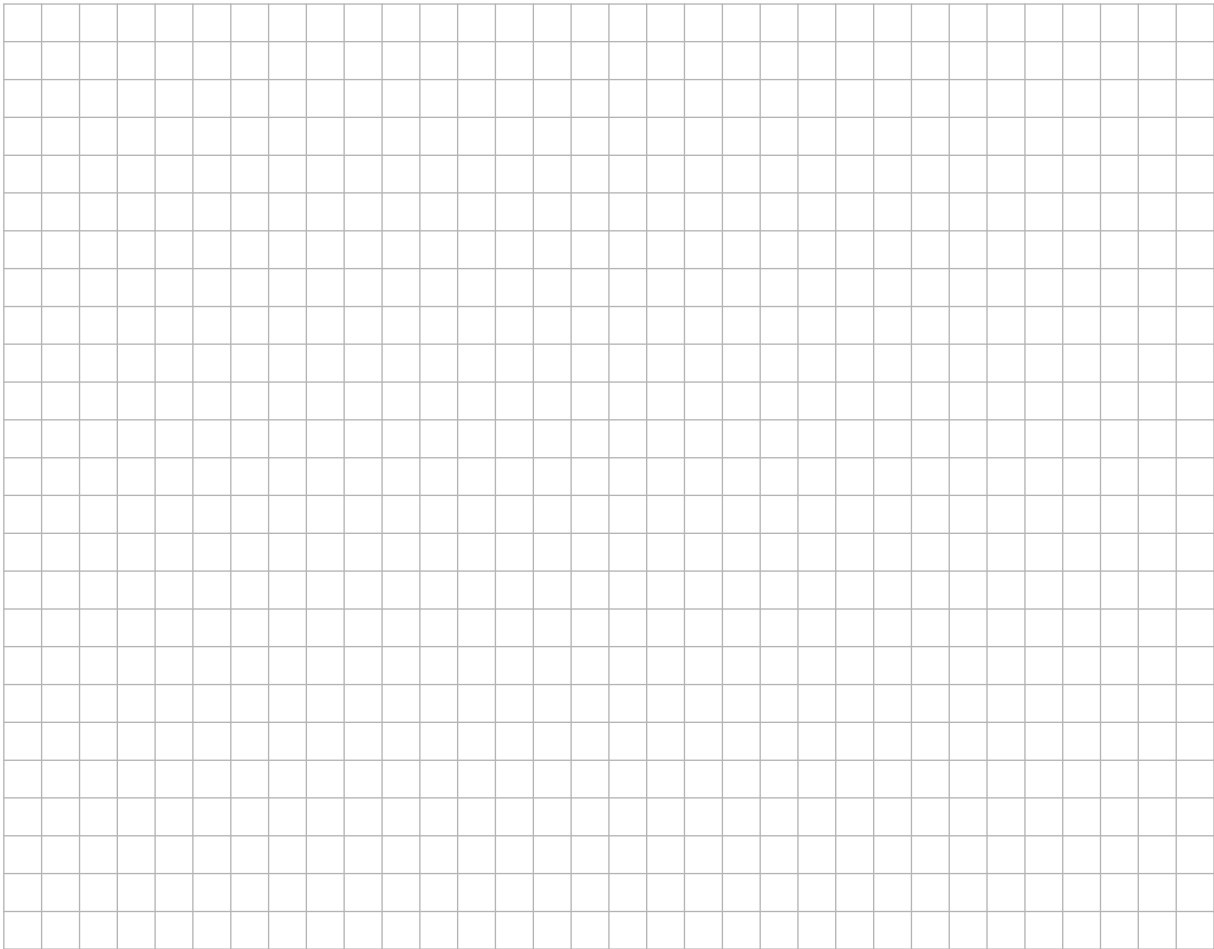
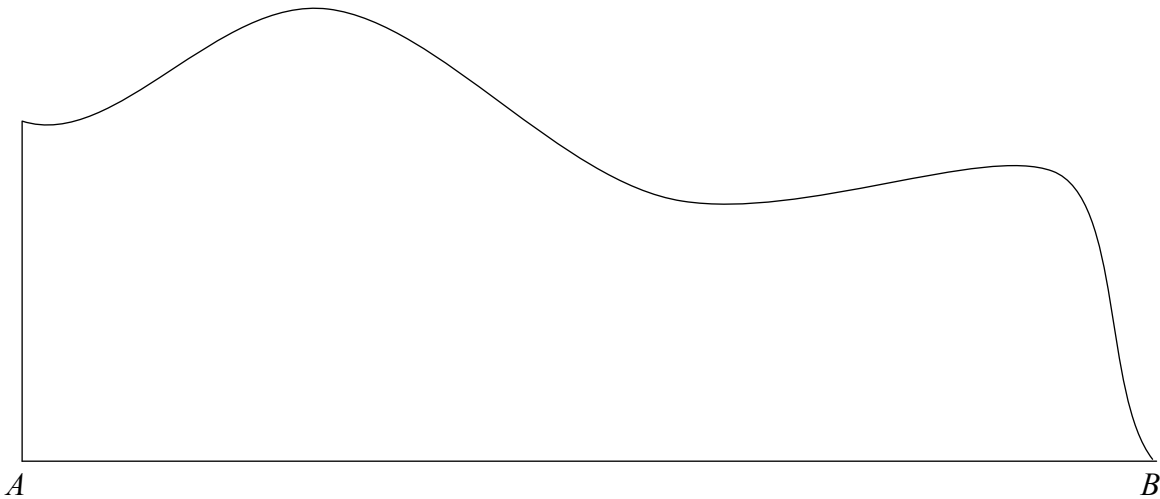


Question 5

(25 marks)

The diagram below shows a shape with two straight edges and one irregular edge. By dividing the edge $[AB]$ into five equal intervals, use the trapezoidal rule to estimate the area of the shape.

Record your constructions and measurements on the diagram. Give your answer correct to the nearest cm^2 .



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Question 6

(25 marks)

Answer **either** 6A **or** 6B.

Question 6A

- (a)** Explain what is meant by the *converse* of a theorem.

Explanation:

- (b)** There are some geometric statements that are true, but have converses that are false. Give one such geometric statement, and state also the (false) converse.

Statement:

Converse (false):

OR

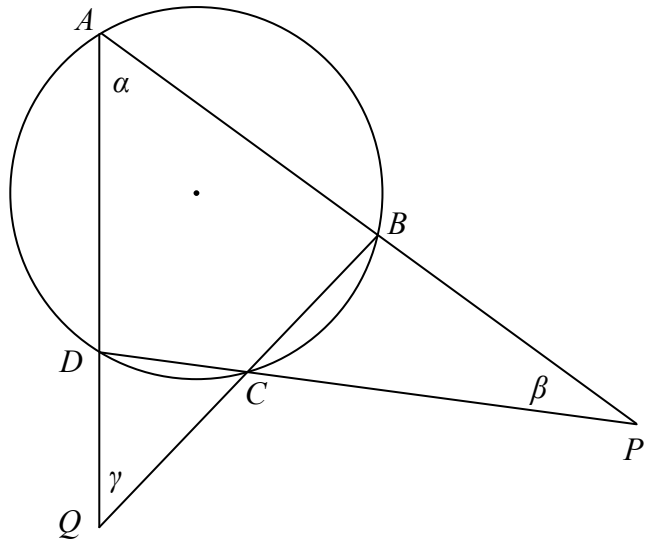
Question 6B

$ABCD$ is a cyclic quadrilateral.

The opposite sides, when extended, meet at P and Q , as shown.

The angles α , β , and γ are as shown.

Prove that $\beta + \gamma = 180^\circ - 2\alpha$.



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Answer Question 7, Question 8, and Question 9.

Question 7

(75 marks)

The *King of the Hill* triathlon race in Kinsale consists of a 750 metre swim, followed by a 20 kilometre cycle, followed by a 5 kilometre run.

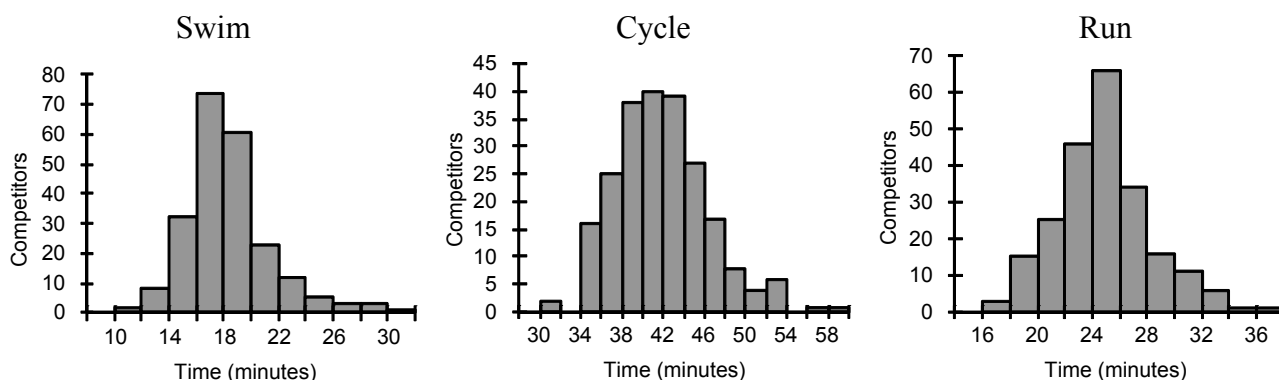
The questions below are based on data from 224 athletes who completed this triathlon in 2010.

Máire is analysing data from the race, using statistical software. She has a data file with each competitor's time for each part of the race, along with various other details of the competitors.



Lizzie Lee, winner of the women's event

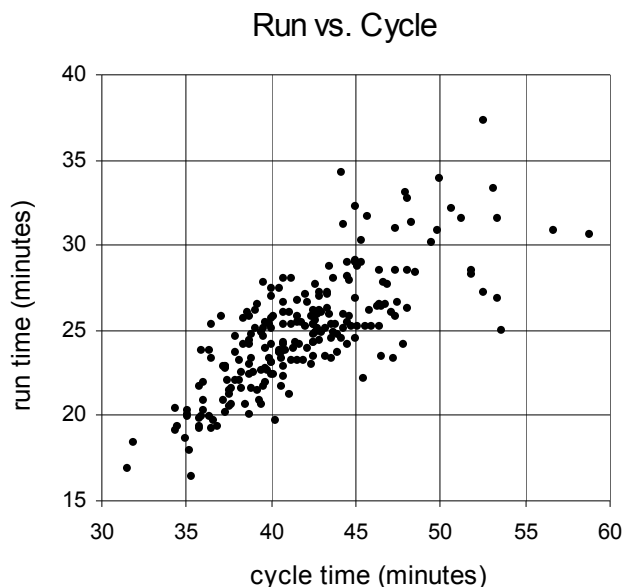
Máire produces histograms of the times for the three events. Here are the three histograms.



(a) Use the histograms to complete the following sentences:

- (i) The event that, on average, takes longest to complete is the _____.
- (ii) In all three histograms, the times are grouped into intervals of _____ minutes.
- (iii) The time of the fastest person in the swim was between _____ and _____ minutes.
- (iv) The median time for the run is approximately _____ minutes.
- (v) The event in which the times are most spread out is the _____.

- (b)** Máire is interested in the relationship between the athletes' performance in the run and in the cycle. She produces the following scatter diagram.



- (i) The correlation coefficient between the times for these two events is one of the numbers below. Write the letter corresponding to the correct answer in the box.

A. 0.95
B. 0.77
C. 0.13
D. -0.13
E. -0.77
F. -0.95

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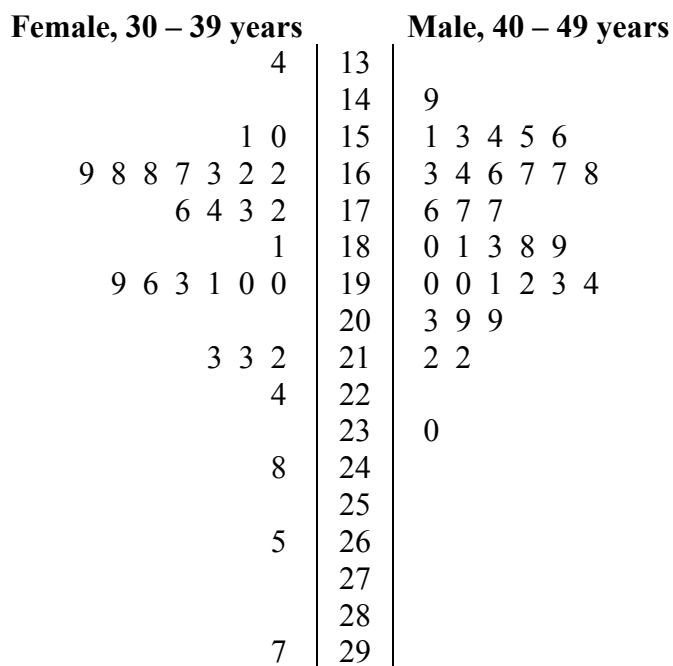
- (ii) Frank was the slowest person in the run. How many people took longer to complete the cycle than Frank did?

Answer:

- (iii) Brian did not enter this race. Suppose that he had, and suppose that he completed the cycle in 52 minutes and the run in 18 minutes. Explain why this performance would have been very unusual.

[illegible]

- (c) Máire knows already that the male athletes tend to be slightly faster than the female athletes. She also knows that athletes can get slower as they get older. She thinks that male athletes in their forties might be about the same as female athletes in their thirties. She decides to draw a back-to-back stem-and-leaf diagram of the times of these two groups for the swim. There were 28 females in their thirties, and 32 males in their forties. Here is the diagram:



Key: | 14 | 9 means 14.9 minutes.

- (i) Describe what differences, if any, there are between the two distributions above.

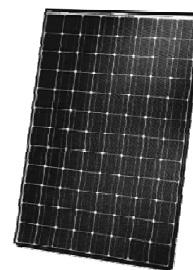
- (ii) Máire drew the diagram because she thought that these two groups would be about the same. Do you think that the diagram would cause Máire to confirm her belief or change it? Give reasons for your answer.

[illegible]

Question 8

(45 marks)

A stand is being used to prop up a portable solar panel. It consists of a support that is hinged to the panel near the top, and an adjustable strap joining the panel to the support near the bottom.



By adjusting the length of the strap, the angle between the panel and the ground can be changed.

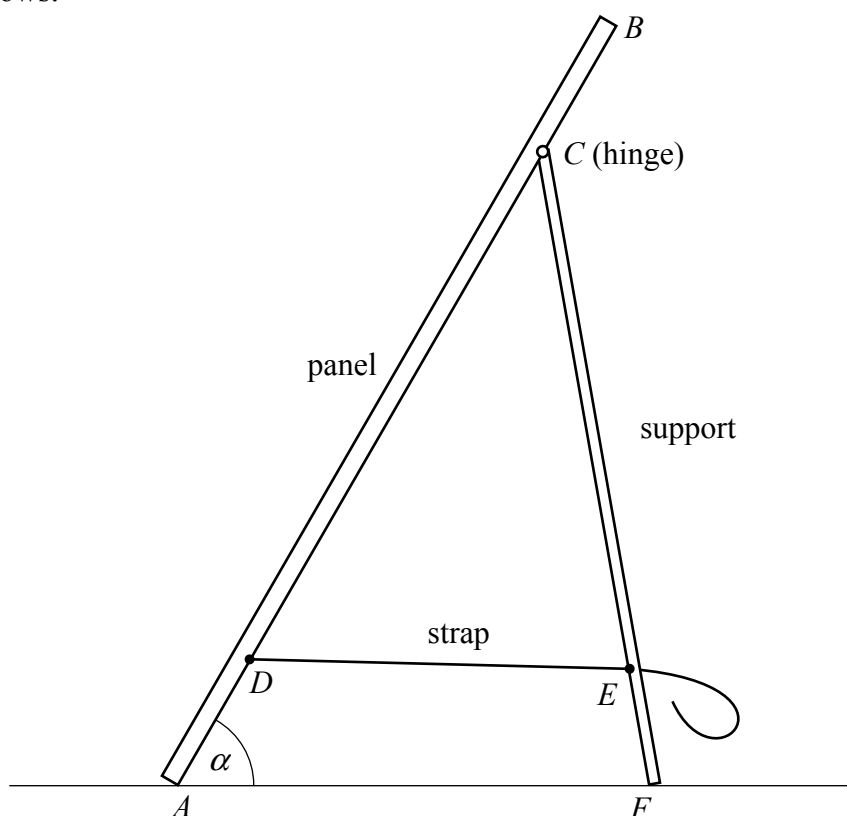
The dimensions are as follows:

$$|AB| = 30 \text{ cm}$$

$$|AD| = |CB| = 5 \text{ cm}$$

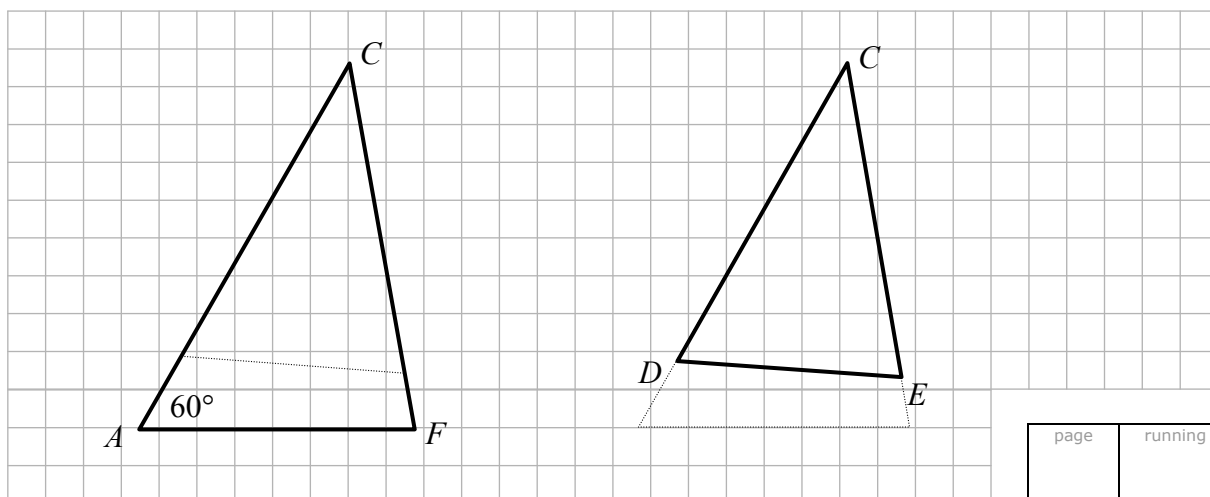
$$|CF| = 22 \text{ cm}$$

$$|EF| = 4 \text{ cm}.$$



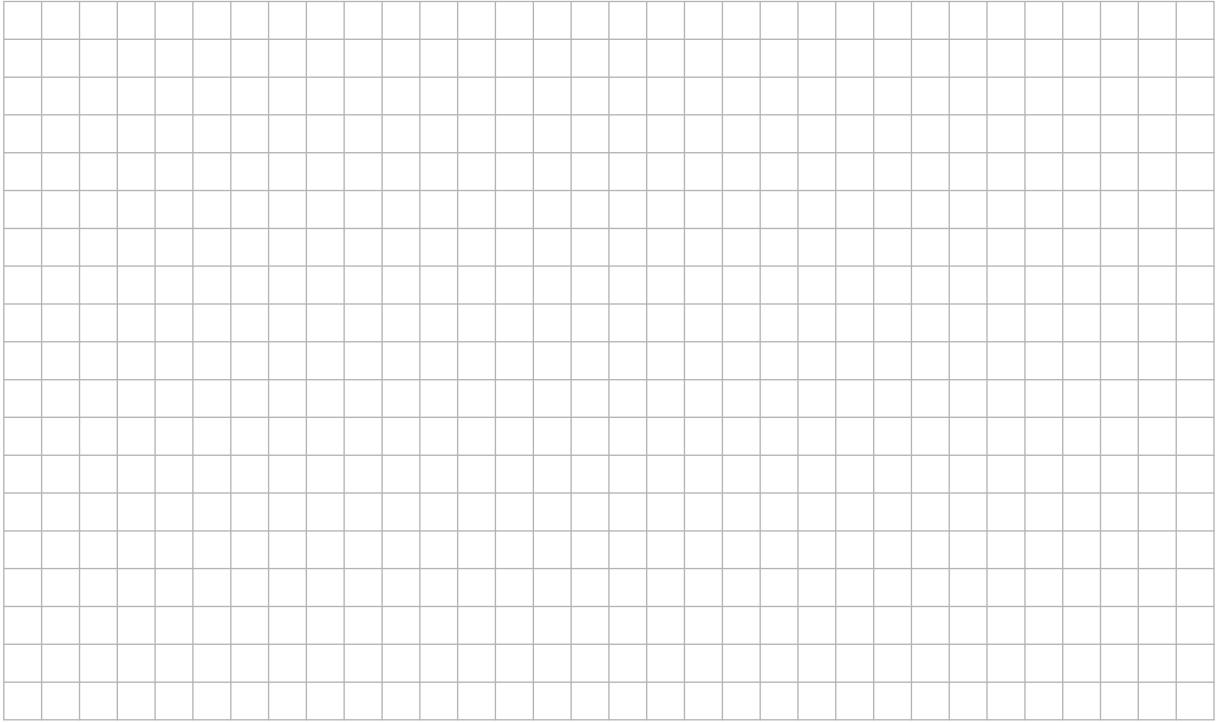
We want to find out how long the strap has to be in order to make the angle α between the panel and the ground equal to 60° .

- (a) Two diagrams are given below – one showing triangle CAF and the other showing triangle CDE . Use the measurements given above to record on the two diagrams below the lengths of **two** of the sides in **each** triangle.

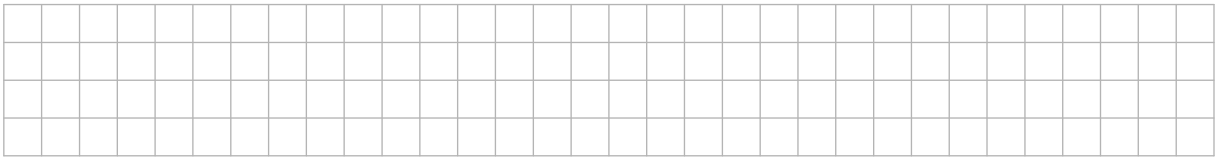


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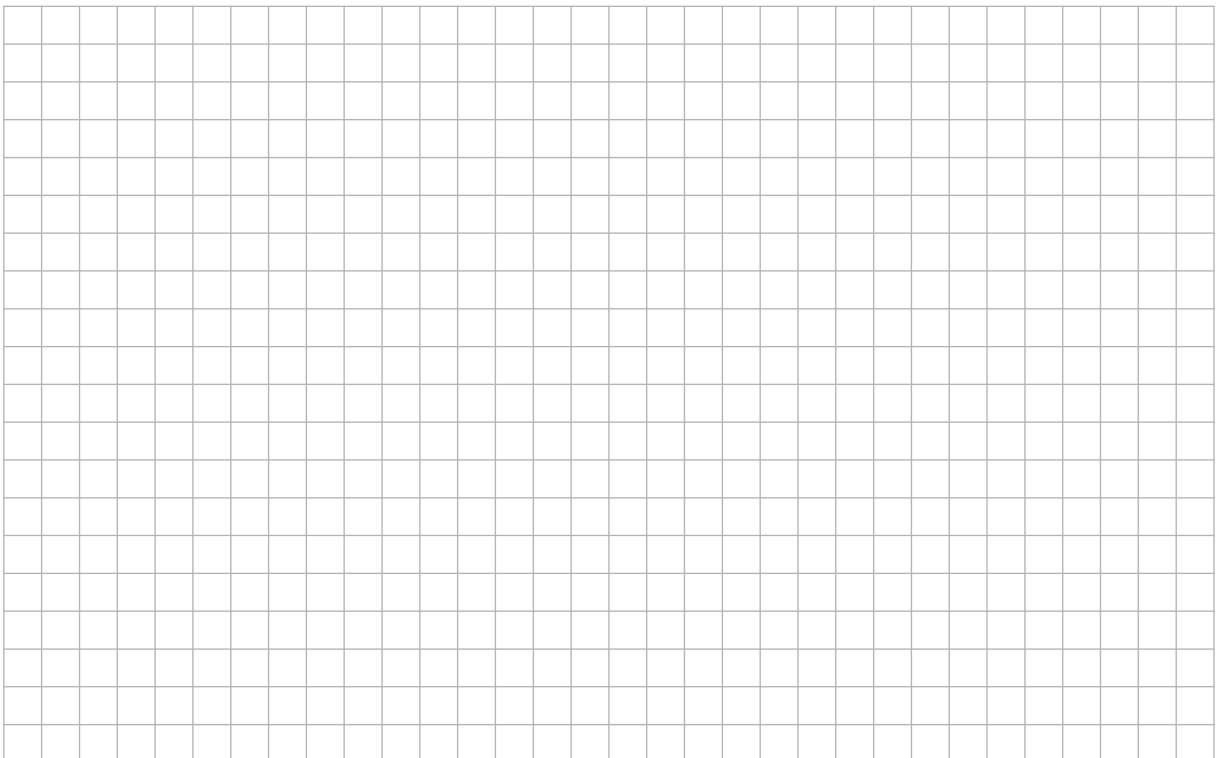
- (b) Taking $\alpha = 60^\circ$, as shown, use the triangle CAF to find $|\angle CFA|$, correct to one decimal place.



- (c) Hence find $|\angle ACF|$, correct to one decimal place.



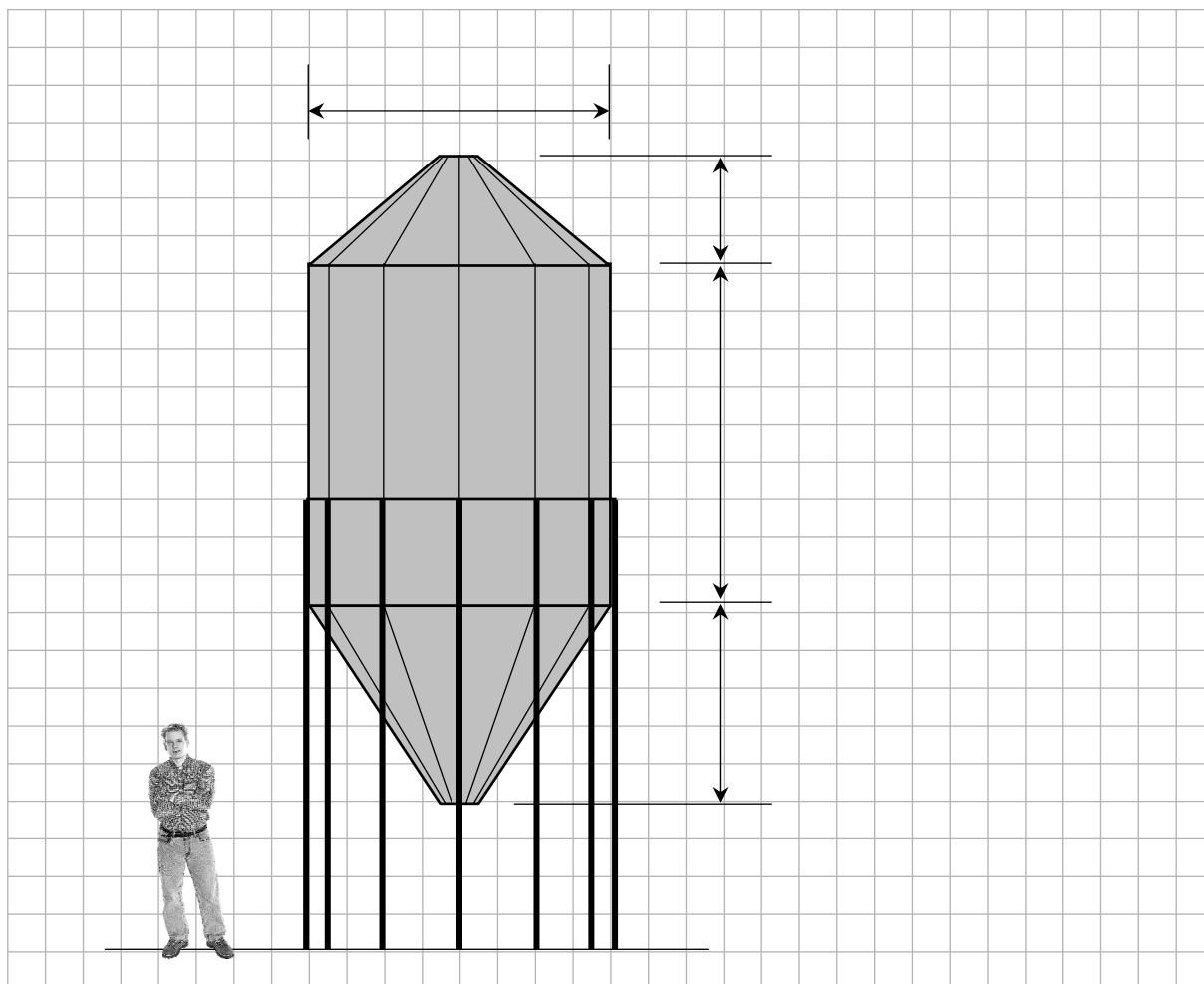
- (d) Use triangle CDE to find $|DE|$, the length of the strap, correct to one decimal place.



Question 9

(30 marks)

The diagram below is a scale drawing of a hopper tank used to store grain. An estimate is needed of the capacity (volume) of the tank. The figure of the man standing beside the tank allows the scale of the drawing to be estimated.

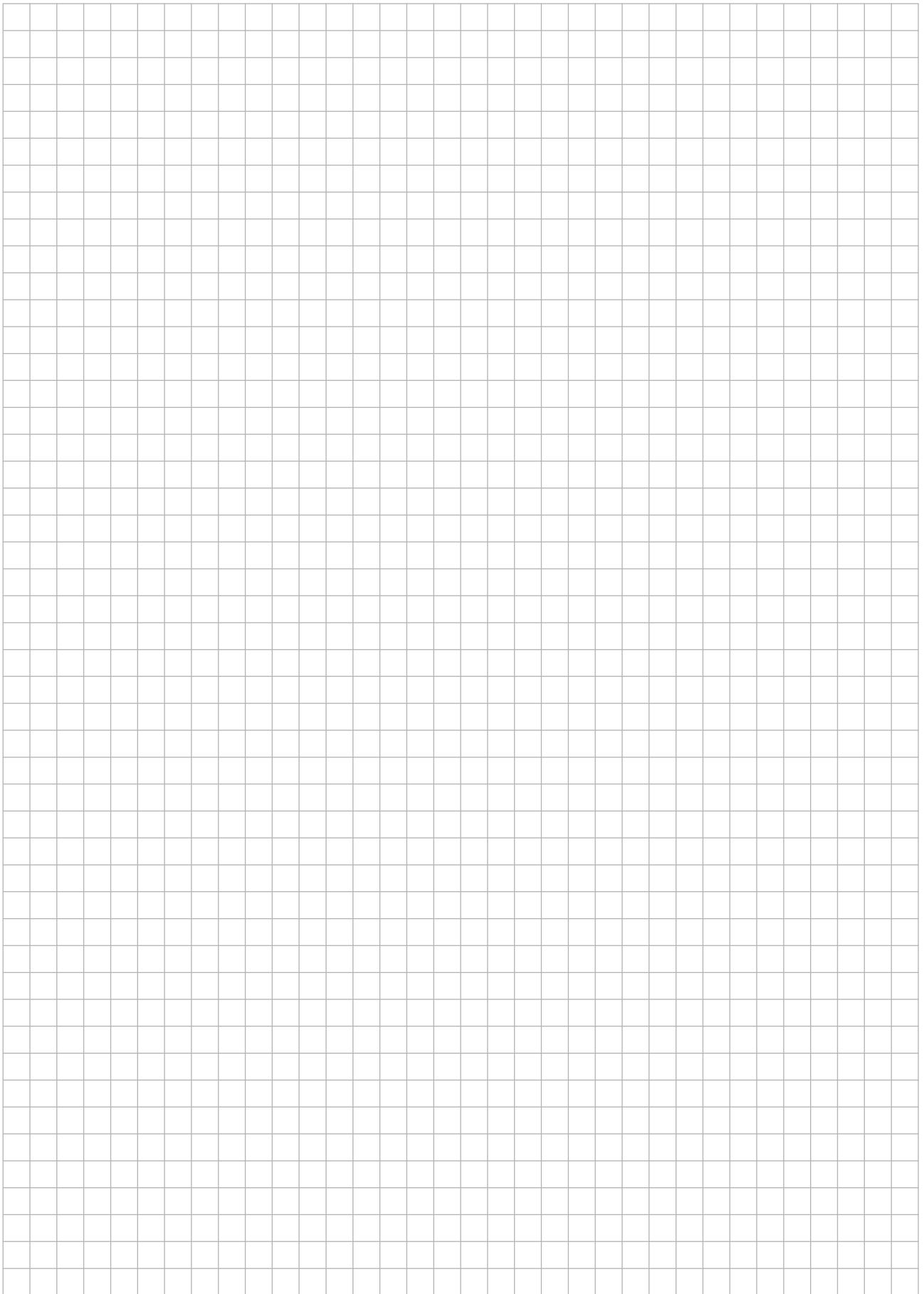


- (a) Give an estimate, in metres, of the height of an average adult man.

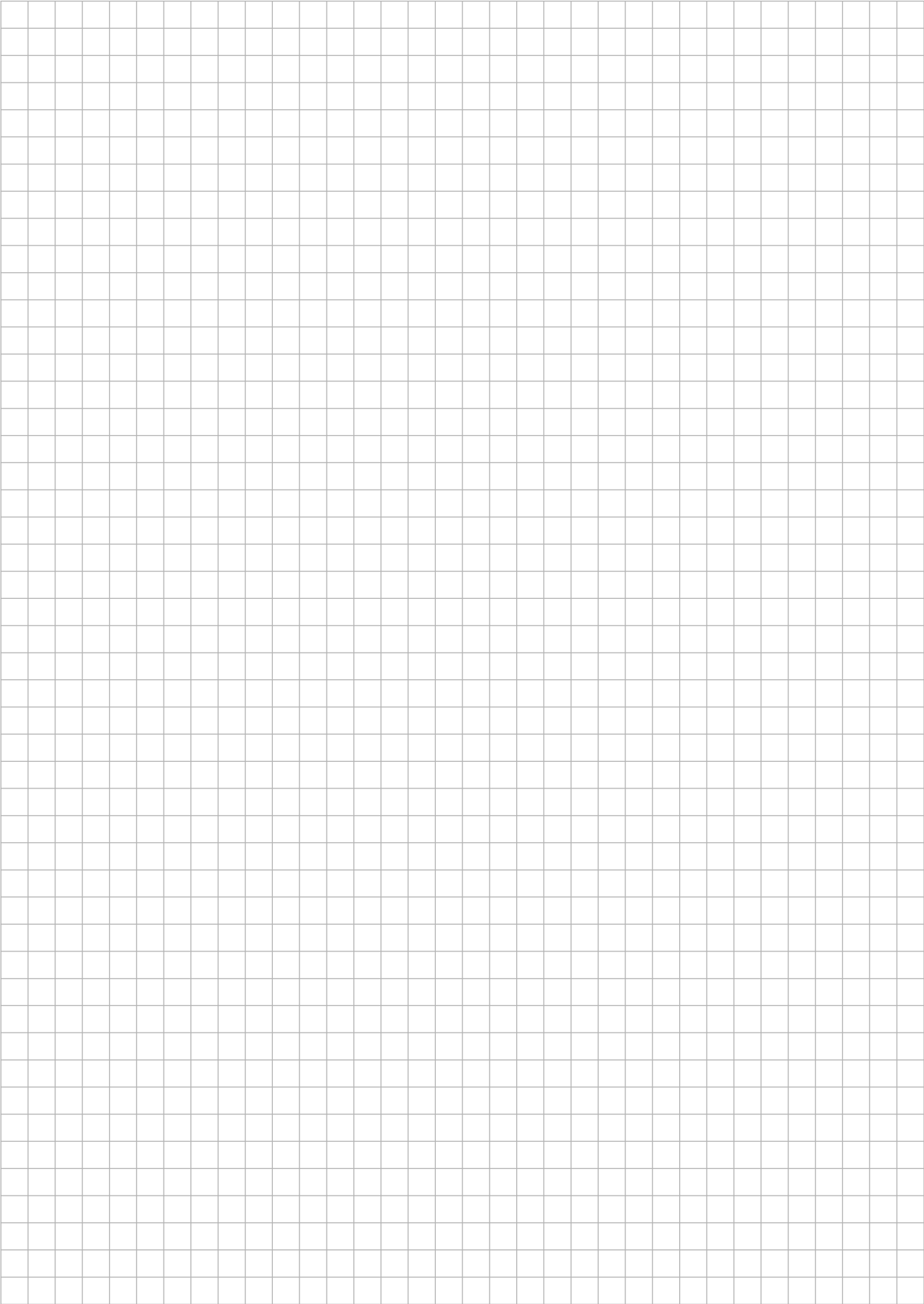
Estimate: _____

- (b) Using your answer to part (a), estimate the dimensions of the hopper tank. Write your answers in the spaces provided on the diagram.
- (c) Taking the tank to be a cylinder with a cone above and below, find an estimate for the capacity of the tank, in cubic metres.

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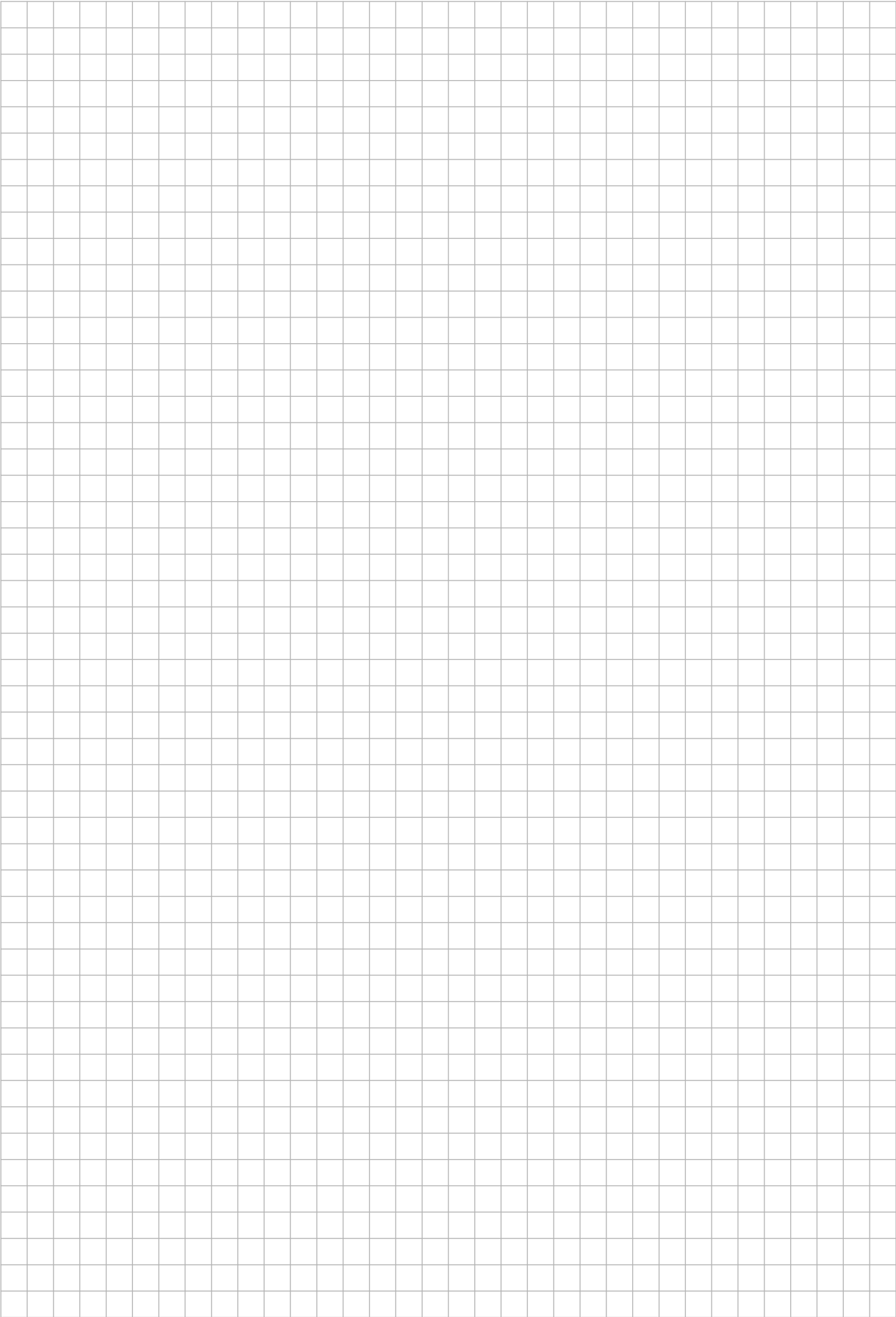


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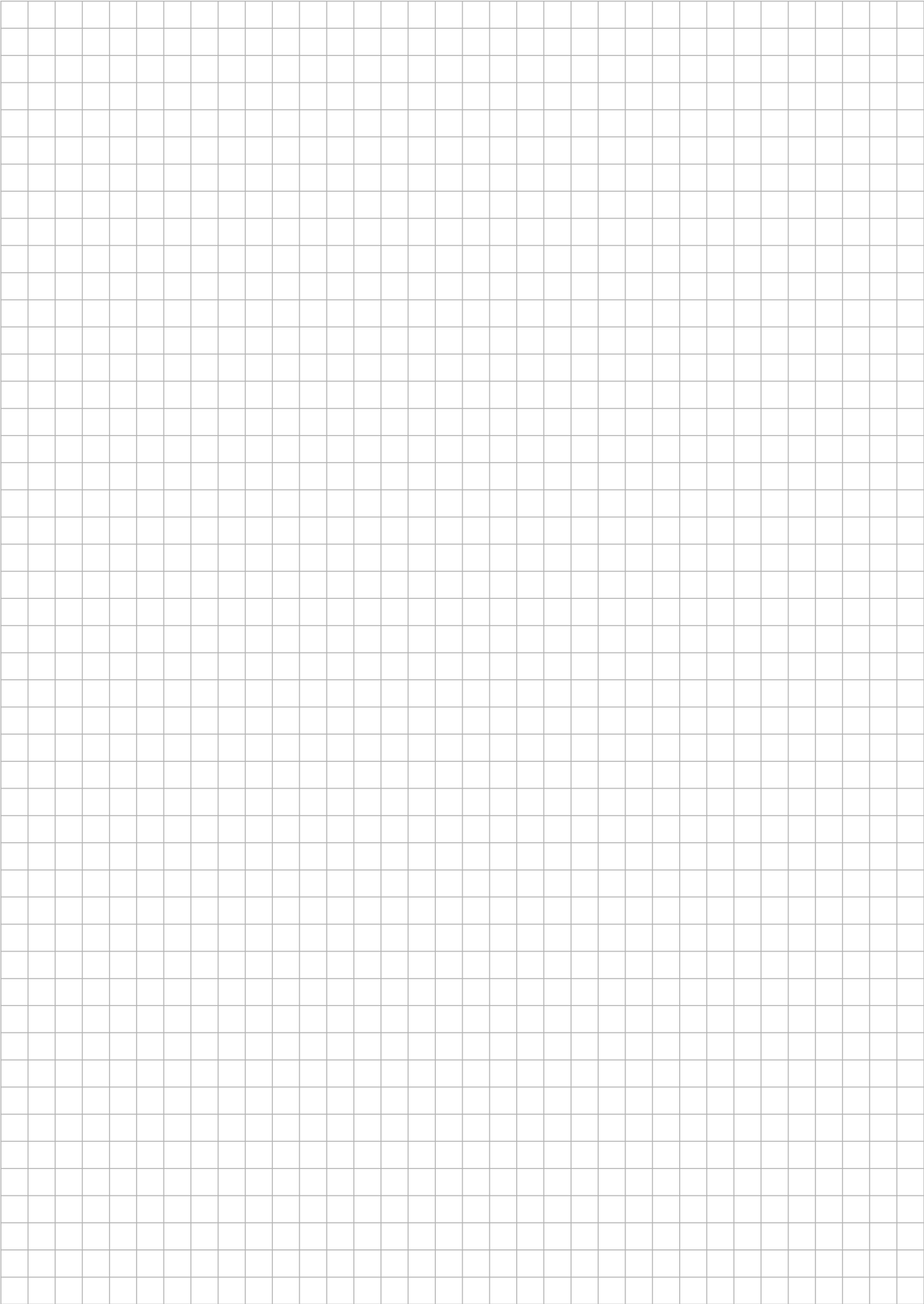


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Note to readers of this document:

This sample paper is intended to help teachers and candidates prepare for the June 2014 examination in *Mathematics* under Phase 3 of *Project Maths*. The content and structure do not necessarily reflect the 2015 or subsequent examinations.

Section A of the examination paper will consist of six questions, each carrying 25 marks. In accordance with the footnote in the syllabus in relation to geometry, there will be a choice within Question 6, as illustrated here.

Section B will consist of two, three, or four questions. These questions will not necessarily carry equal marks. The number of marks for each will be stated on the examination paper. The total number of marks for Section B will be 150.

Leaving Certificate 2014 – Ordinary Level

Mathematics (Project Maths – Phase 3) – Paper 2

Sample Paper

Time: 2 hours 30 minutes