



Pre-Leaving Certificate Examination 2026

Mathematics

(Option A)

Paper 2

Higher Level

2 hours 30 mins

300 marks

Name:
School:
Address:
Class:
Teacher:

For examiner	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Running 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	4 questions

Answer questions as follows:

- **any five** questions from Section A – Concepts and Skills
- **any three** questions from Section B – Contexts and Applications

Write your answers in blue or black pen. You may use pencil in graphs and diagrams only.

Anything that you write outside of the answer areas may not be seen by the examiner.

Write all answers into this booklet. There is space for extra work at the back of the booklet.

If you need to use it, label any extra work clearly with the question number and part.

The superintendent may give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination.

In general, diagrams are not to scale.

You will lose marks if your solutions do not include relevant supporting work.

You may lose marks if the appropriate units of measurement are not included, where relevant.

You may lose marks if your answers are not given in simplest form, where relevant.

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

--

Answer **any five questions** from this section.

Question 1

(30 marks)

For the local fete, Luke runs a dice game in which a player throws two standard six-sided dice, and the sum of the uppermost faces is calculated. If the sum is less than five, the player wins €21. If the sum is greater than eight, the player wins €9. Otherwise, the player receives no money.



- (a)** Complete the table below. Show your work in the grid below the table.

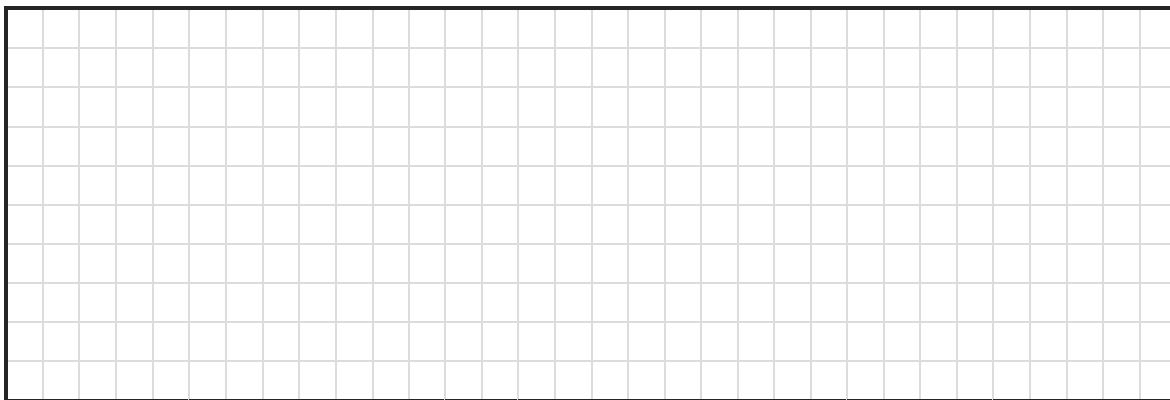
Amount won	€0	€10	€20
Probability			

A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 18 rows of squares. A thick black border surrounds the entire grid area.

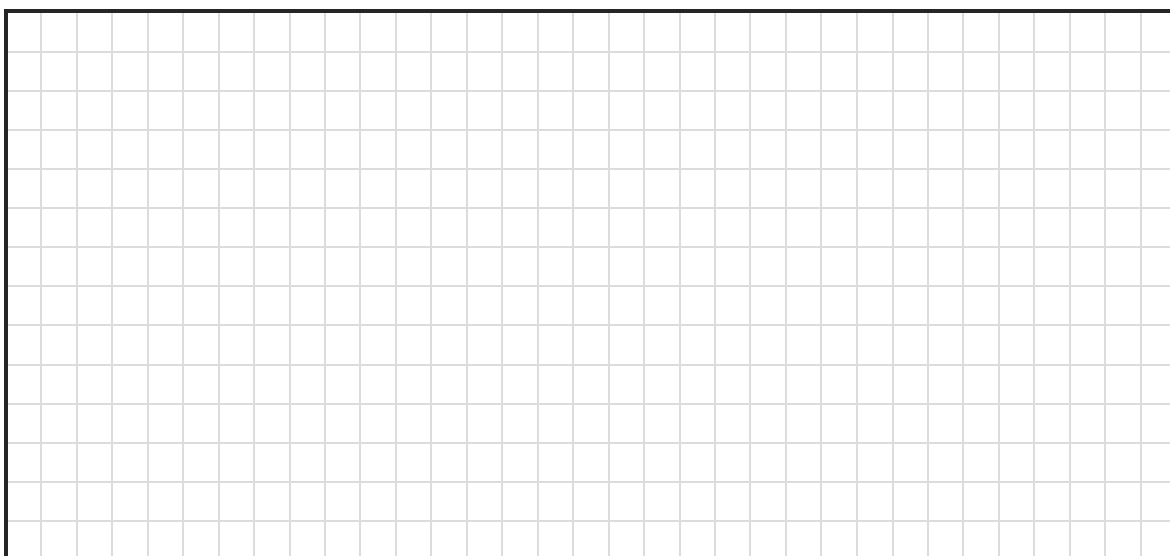
- (b)** What is the expected amount of money won by a player each time they play?



- (c) Dani decides to play the game. If Luke charges her €5 to roll two dice, who is likely to be better off in the long-term? Justify your answer.



- (d) Dani plays the game once. What is the probability that she wins any money? Give your answer as a fraction in its simplest form.

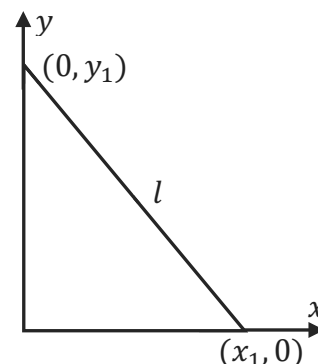
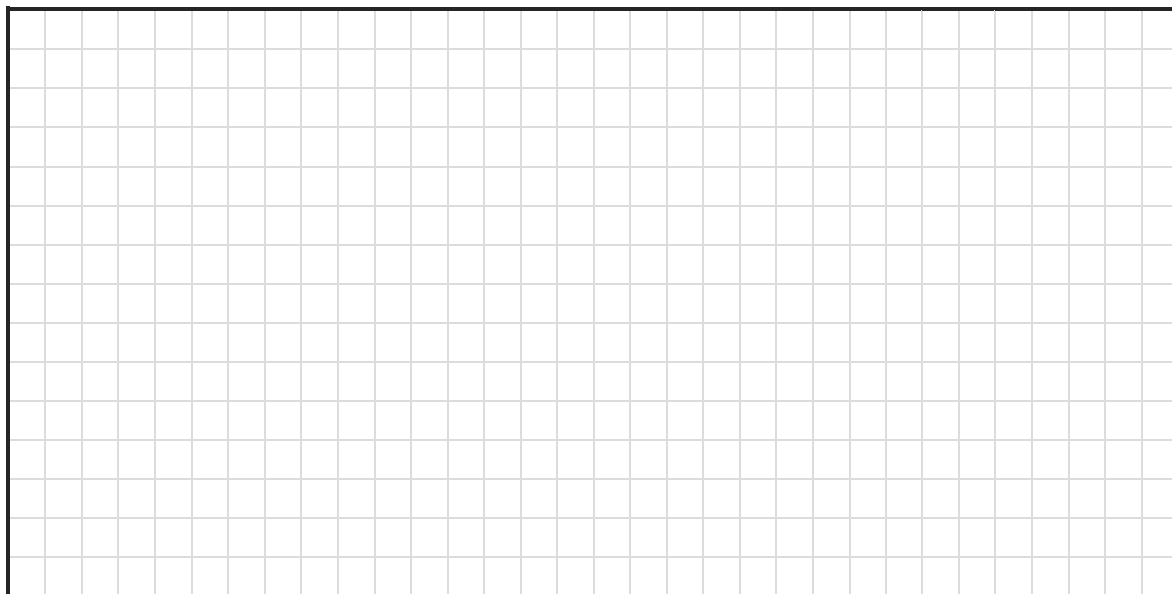


Question 2**(30 marks)**

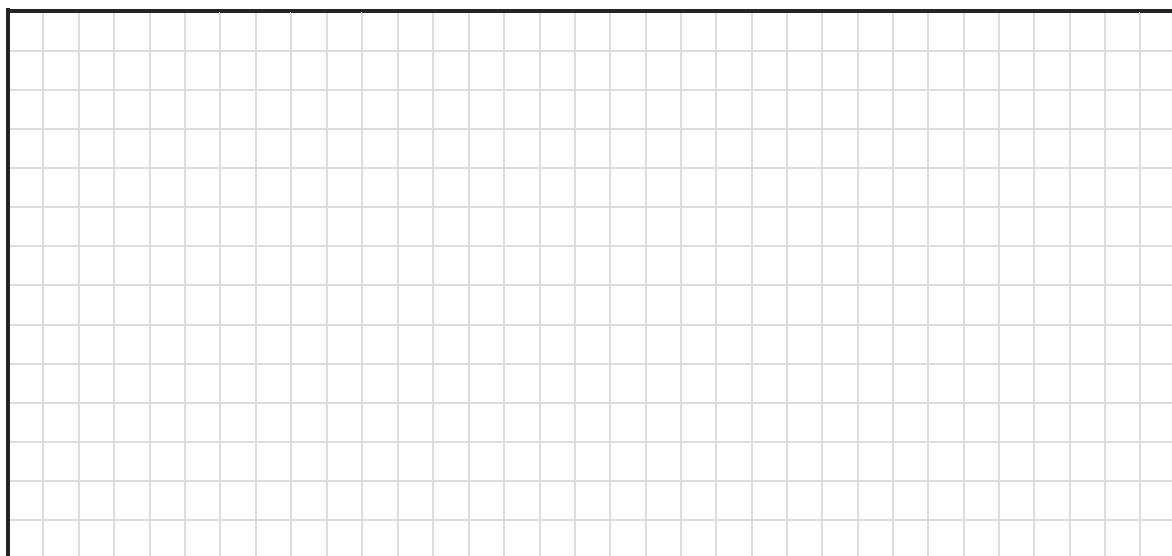
The line l passes through the point $(4, 2)$ so that the area of the triangle formed by l and the x -axis and the y -axis is 25 square units. The line cuts the x -axis at $(x_1, 0)$ and the y -axis at $(0, y_1)$.

- (a) Write an equation for the line in terms of m , the slope of the line, where $m \neq 0$.

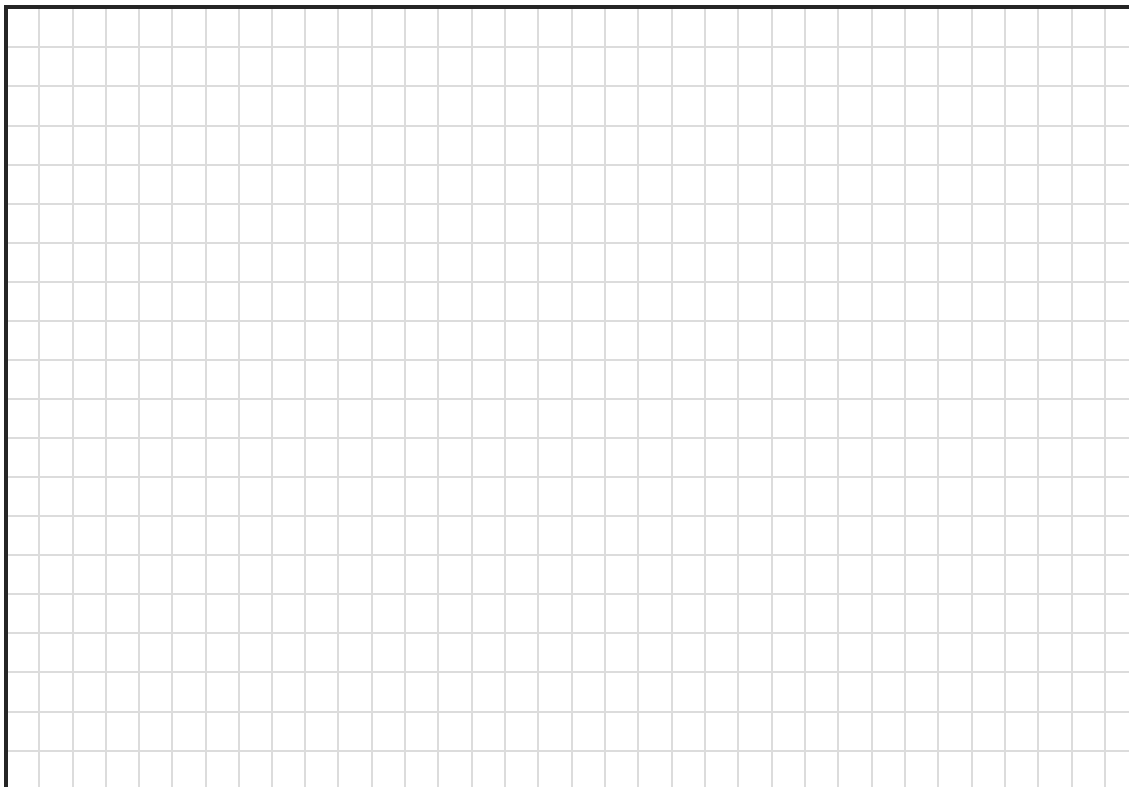
Give your answer in the form $ax + by + c = 0$.



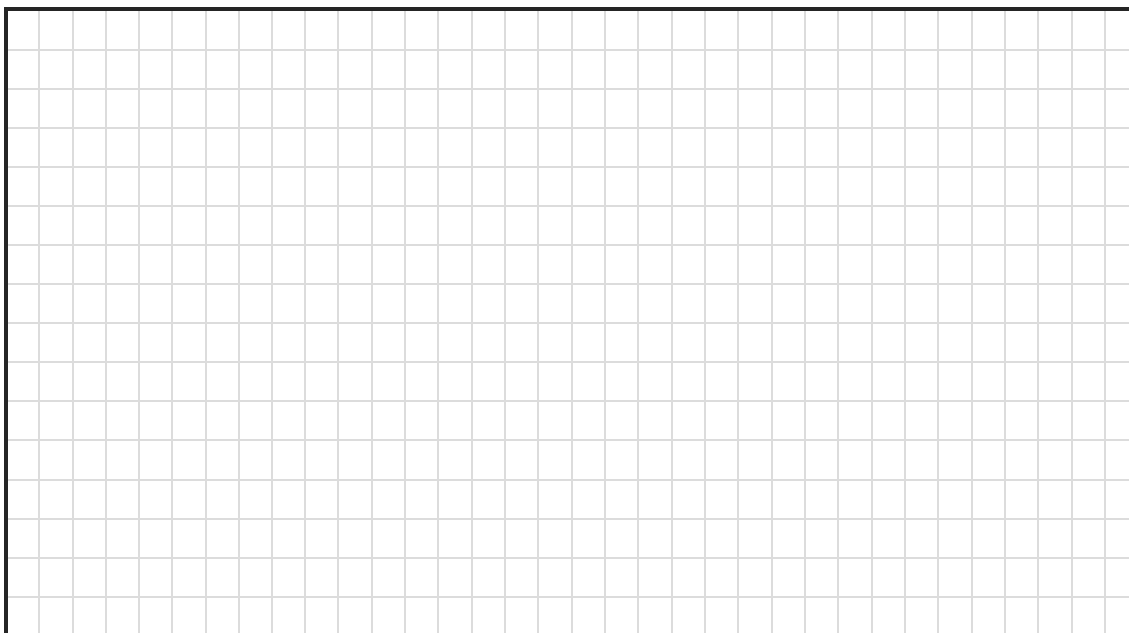
- (b) Hence, find where the line l cuts the x -axis and the y -axis. Give your answers in terms of m .



- (c) Use the area of the triangle to find the two possible values of m .



- (d) Work out the acute angle between these two lines.
Give your answer to the nearest degree.

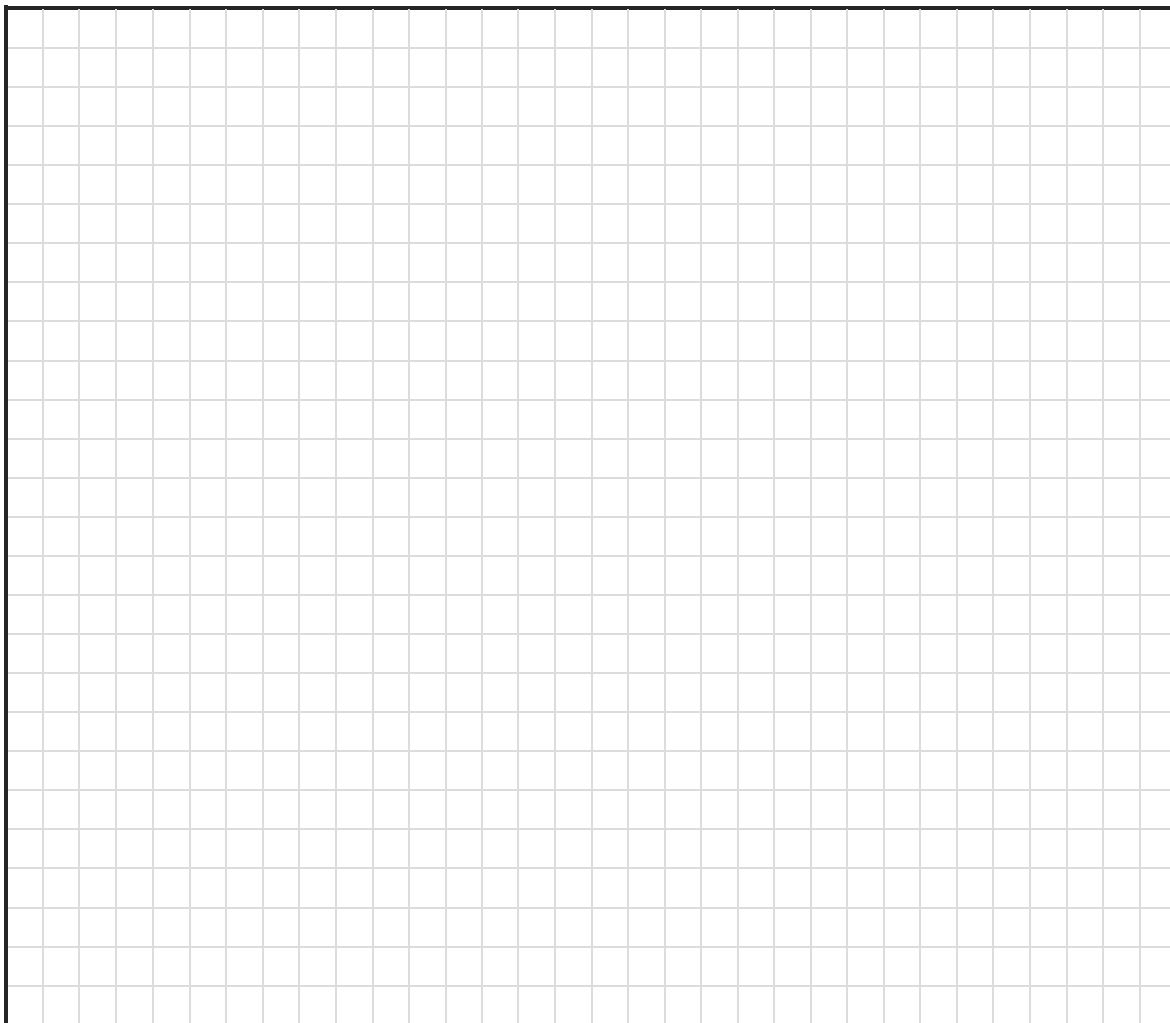


(30 marks)

- Centre = Radius =

-
- A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 20 rows of squares. A thick black border runs along the top, bottom, and left edges of the page, while the right edge is open.

- (b) The endpoints of a diameter of a circle are $P(2,4)$ and $Q(-4,0)$.
Find the equation of the circle.
Give your answer in the form $x^2 + y^2 + 2gx + 2fy + c = 0$, where $c, f, g \in \mathbb{R}$.



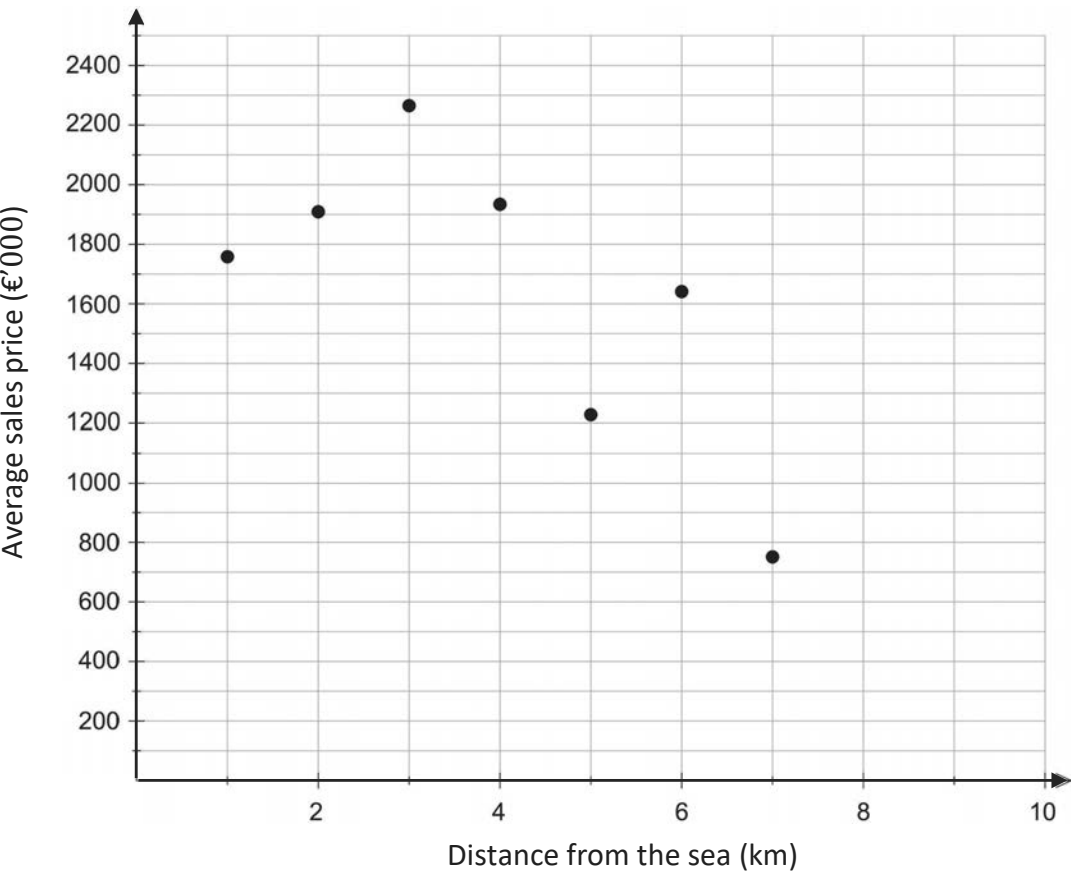
Question 4

(30 marks)

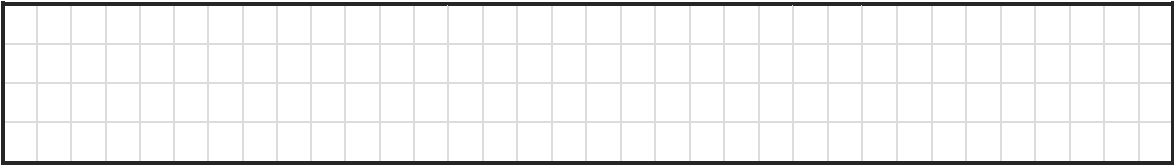
A real estate agent is analysing data on the sale of houses over the last six months. The table below shows the average sale price of houses, in thousands of euro (€'000), and their distance from the sea, correct to the nearest kilometre.

Distance from the sea (km)	1	2	3	4	5	6	7	8	9
Average sale price (€'000)	1758	1909	2265	1934	1228	1641	751	967	676

(a) On the scatterplot below, plot the last two data points from the table.



(b) On the scatterplot above, draw the line of best fit for the data, by eye.



- (c) Find the value of r , the correlation coefficient. Give your answer correct to 3 decimal places. Use this figure to describe the relationship between the average sales price of houses and the distance from the sea.

- (d) By taking suitable points from your diagram, **or otherwise**, find the equation for the line of best fit. Give the equation in the form $y = mx + c$, where m and $c \in \mathbb{Z}$.

- (e) Interpret the slope of the line of best fit from part (d) in the context of this question.

- (f) In six months time, a homebuyer will have saved enough money for a deposit on a house. He would like to live about four kilometres from the sea.

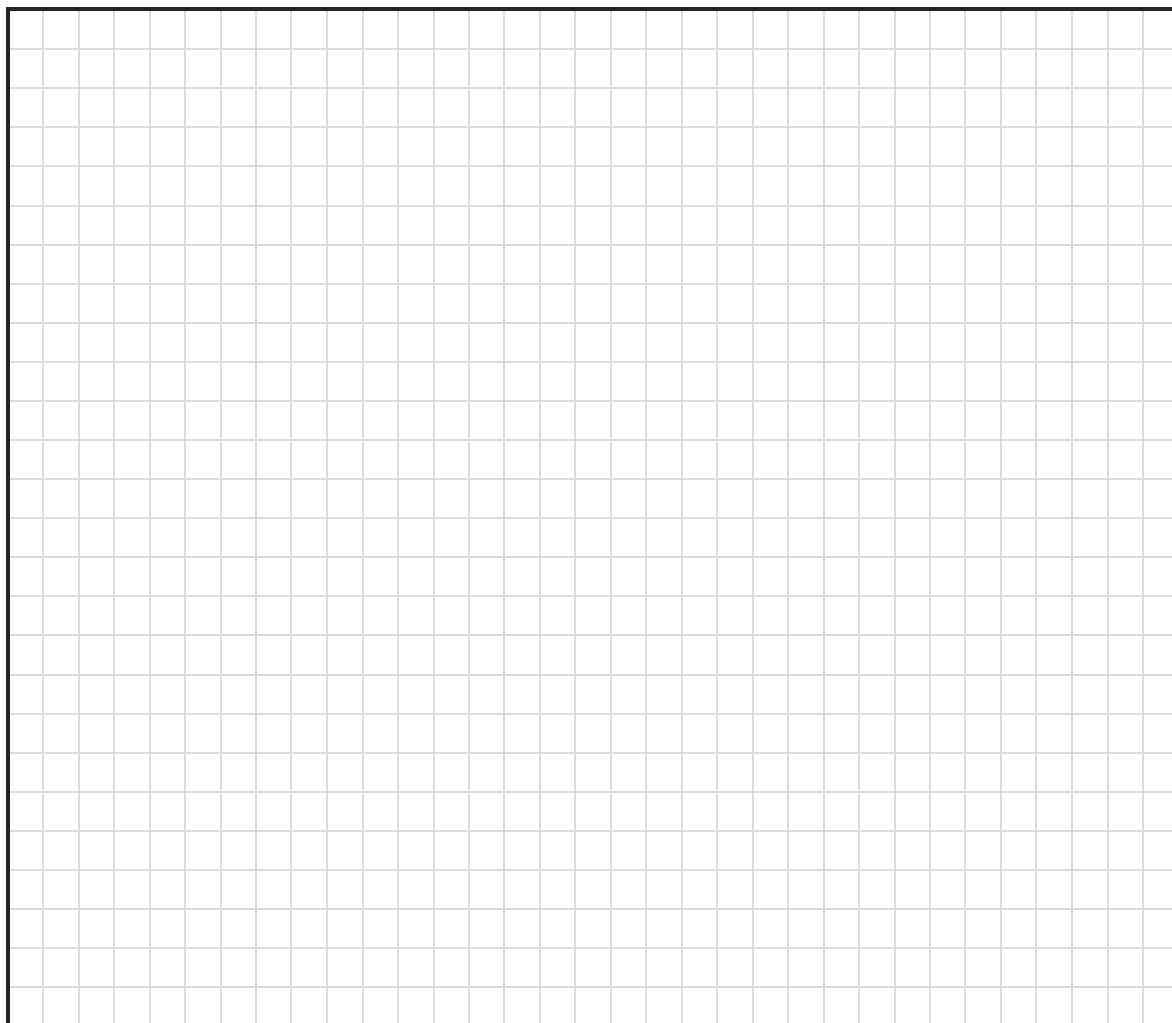
- (i) Use the equation of the line of best fit from part (d) to predict the average sale price of houses four kilometres from the sea.

- (ii) Explain why your prediction is different from the average sale price given in the table.

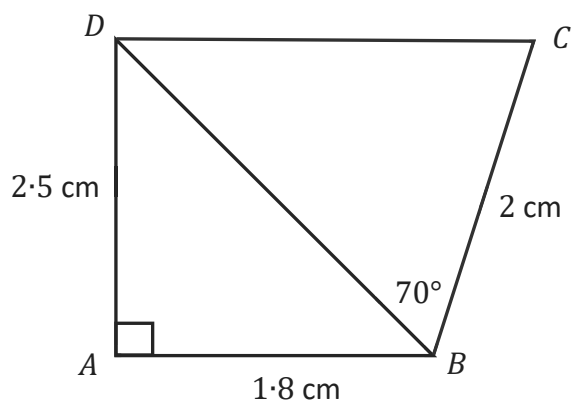
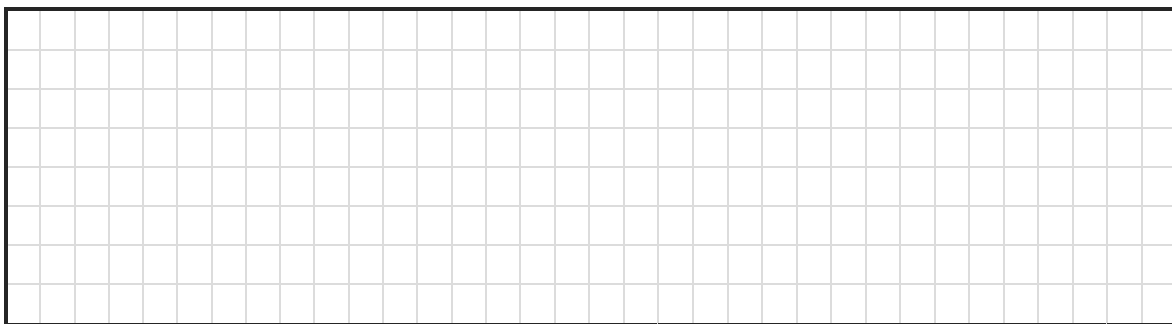
Question 5**(30 marks)**

- (a) Find **all four** solutions to the following equation in θ , where $0^\circ \leq \theta \leq 360^\circ$,

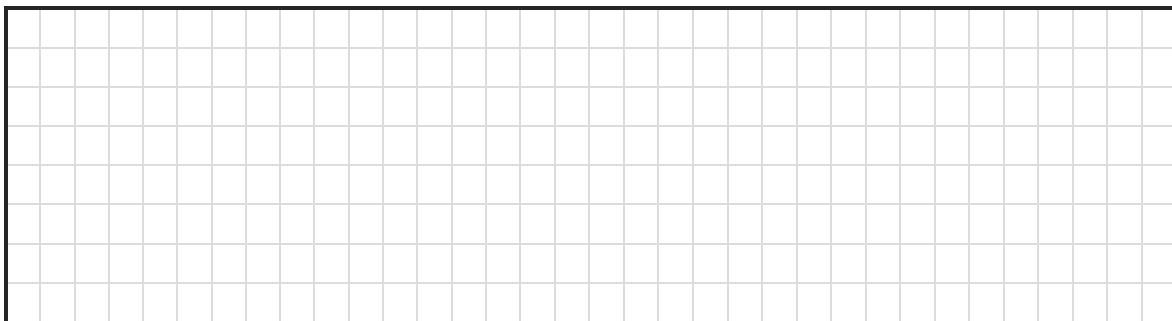
$$\tan 2\theta = -\frac{1}{\sqrt{3}}$$



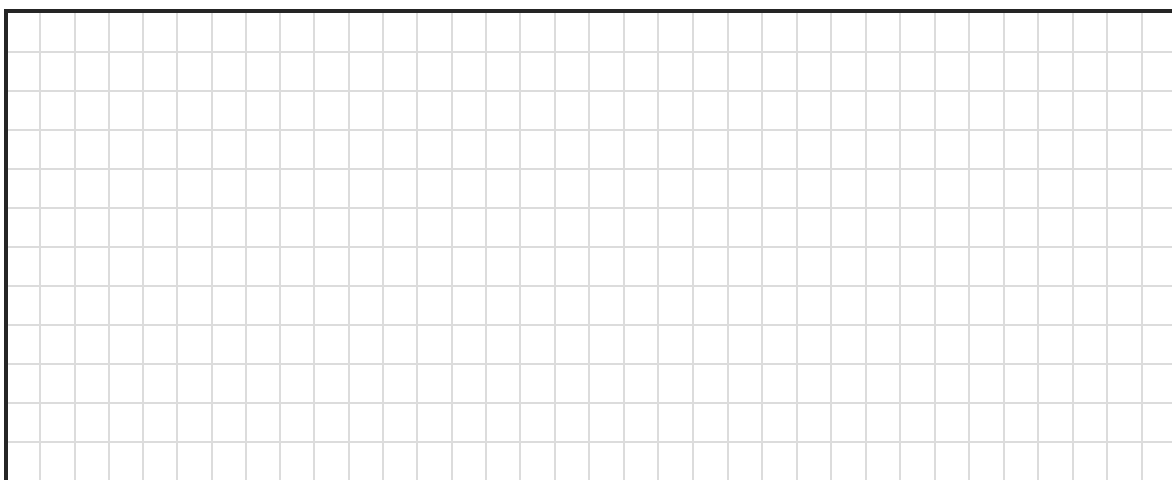
- (b)** The diagram shows the quadrilateral $ABCD$.
 AD is perpendicular to AB .
 $|AB| = 1.8 \text{ cm}$, $|CB| = 2 \text{ cm}$, $|AD| = 2.5 \text{ cm}$.
 $|\angle CBD| = 70^\circ$.
- (i)** Find $|DB|$, correct to 2 decimal places.



- (ii)** Find the area of triangle ABD .



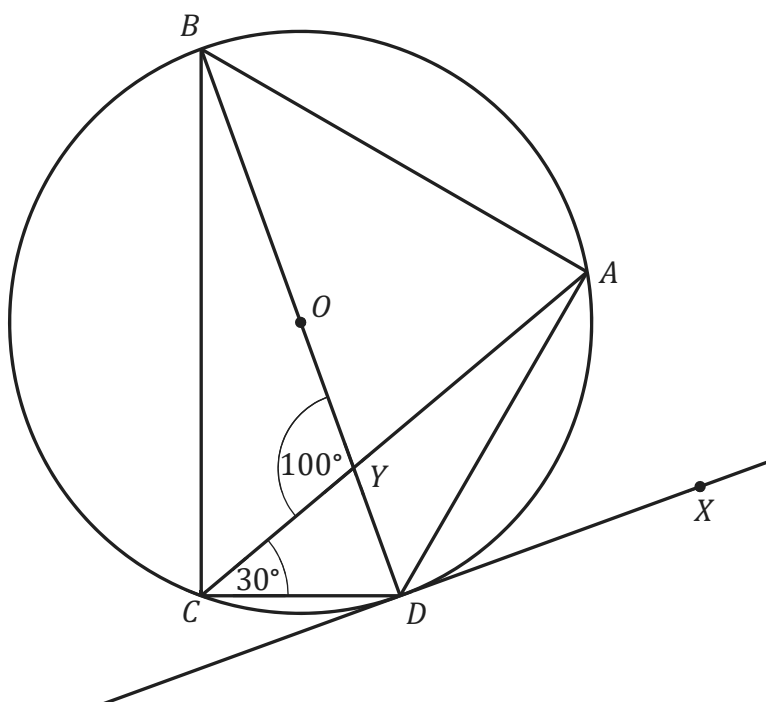
- (iii)** Hence, find the area of $ABCD$, correct to 2 decimal places.



Question 6

(30 marks)

- (a)** In the diagram, the points A, B, C and D are on the circumference of a circle, whose centre O lies on BD .
The chord AC intersects the diameter BD at Y .
The tangent at D passes through the point X .
 $|\angle CYB| = 100^\circ$ and $|\angle DCY| = 30^\circ$.



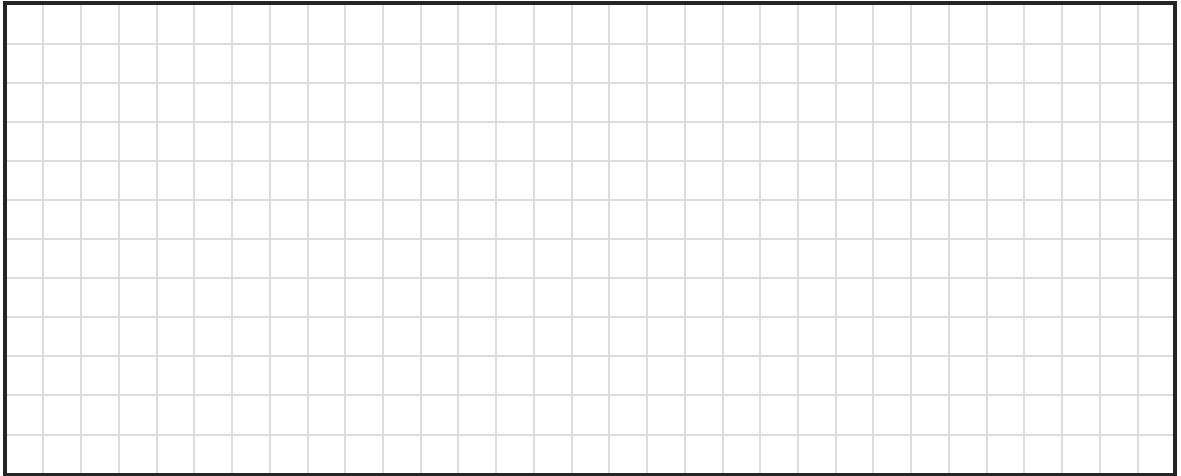
- (i) Find $|\angle BCY|$, giving reasons.

[illegible]

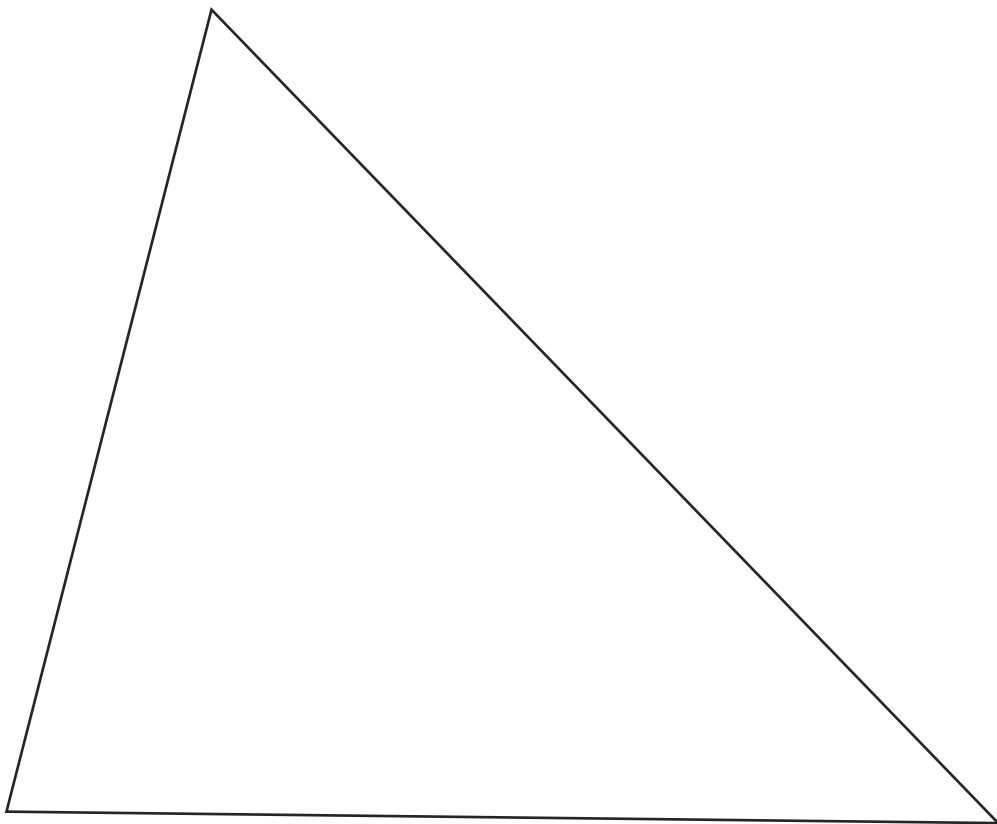
- (ii) Find $|\angle CAD|$, giving reasons.

[illegible]

(iii) Find $|\angle ADX|$, giving reasons.



(b) Construct the orthocentre of the triangle below.



Answer **any three** questions from this section.

Question 7

(50 marks)

- (a) Caroline is the goal shooter for her basketball team. During her matches, she has many attempts at scoring a goal. Assume that each attempt at scoring a goal is independent of any other attempt. In the long term, her scoring rate has been shown to be 80%.



- (i) What is the probability, correct to 4 decimal places, that her first 9 attempts at scoring a goal in a match are successful?

[illegible]

- (ii) What is the probability, correct to 4 decimal places, that Caroline misses her first 2 attempts and then scores a goal in **each** of her next 3 attempts?

[illegible]

- (iii) What is the probability, correct to 4 decimal places, that exactly 6 of her first 9 attempts at scoring a goal in a match are successful?

A large grid of graph paper, consisting of 20 columns and 10 rows of squares, intended for drawing a picture.

Assume instead that the success of an attempt to score a goal depends only on the success or fail of her previous attempt at scoring a goal. If an attempt at scoring a goal in a match is successful, then the probability that her next attempt at scoring a goal in the match is successful is 0.84.

However, if an attempt at scoring a goal in a match is unsuccessful, then the probability that her next attempt at scoring a goal in the match is successful is 0.64.

Her first attempt at scoring a goal in a match is successful.

- (b) (i) What is the probability, correct to 4 decimal places, that her next 8 attempts at scoring a goal in the match will be successful?

- (ii) What is the probability, correct to 4 decimal places, that exactly 2 of her next 3 attempts at scoring a goal in the match will be successful?

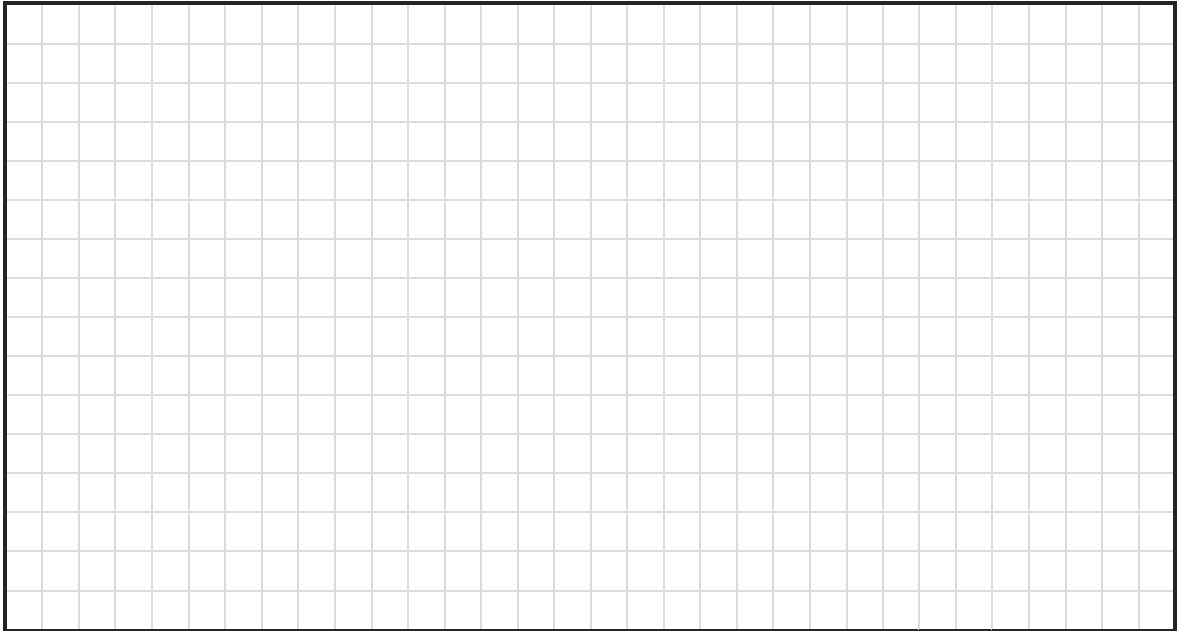
- (c) (i) Let p_n be the probability that Catherine is successful with her n^{th} shot at goal. The probability that she is unsuccessful on her n^{th} shot is therefore $(1 - p_n)$. Show that the probability that Catherine will be successful on her $(n + 1)^{\text{th}}$ attempt is:

$$p_{n+1} = 0.2p_n + 0.64$$

This question continues on the next page.

- (c) (ii) Assume that p is Catherine's success rate in the long run; that is, for large values of n , we have that p_{n+1} and p_n are approximately equal to p .

Use the result from part (c) (i) above, to show that $p = 0.8$.



Question 8

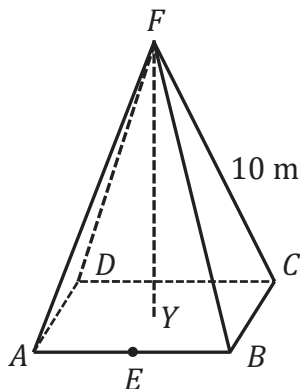
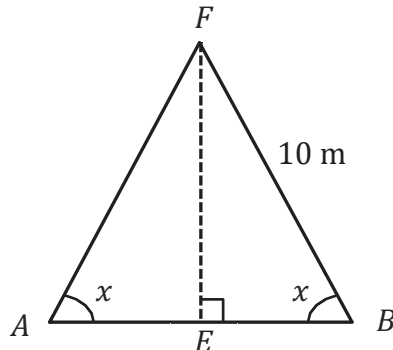
(50 marks)

An ancient civilisation buried its kings and queens in tombs in the shape of a square-based pyramid, as shown below.

$$AF = BF = CF = DF = 10 \text{ m.}$$

Each of the isosceles triangular faces is congruent to each of the other triangular faces.

The base angle of each of these triangles is x , where $45^\circ < x < 90^\circ$.



The point E is the midpoint of AB .

- (a) Find $|AB|$ and $|EF|$ in terms of x .

$ AB =$	$ EF =$
----------	----------

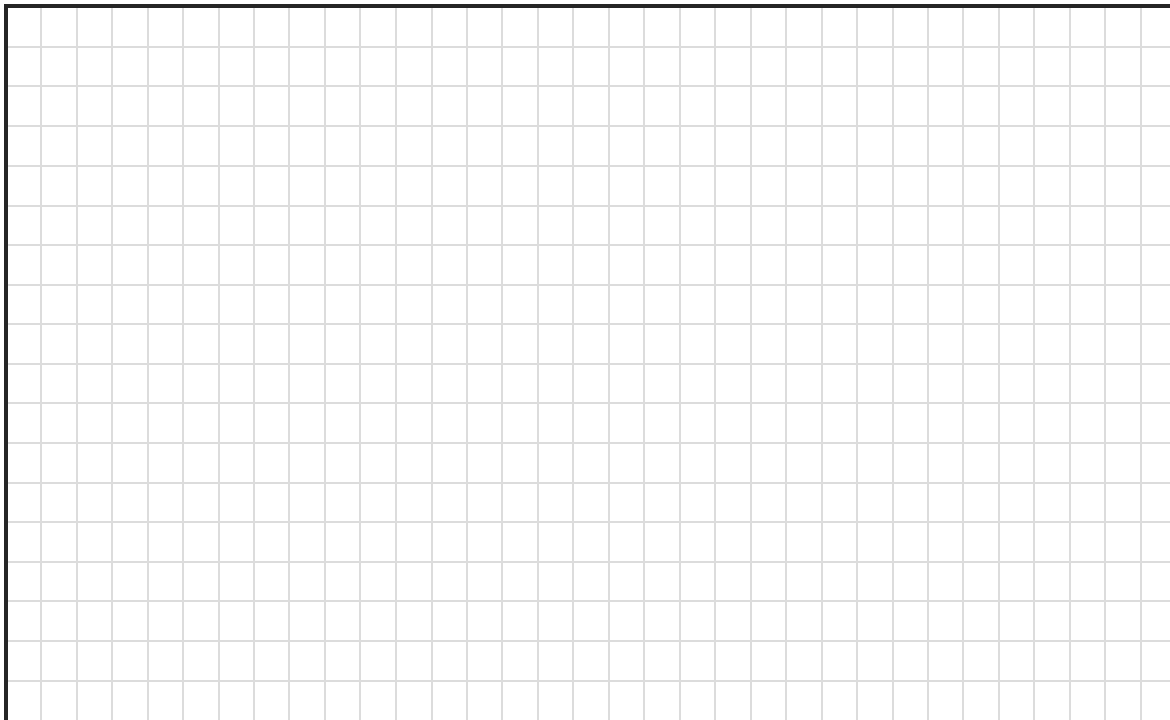
- (b) Show that the total surface area (including the base), $S \text{ m}^2$, of the pyramid is given by:

$$S = 400(\cos^2 x + \cos x \sin x).$$

--

This question continues on the next page.

- (c) Show that $|FY|$, the height of the pyramid, can be written as $10\sqrt{1 - 2\cos^2 x}$.



- (d) The volume of any pyramid is given by the formula:

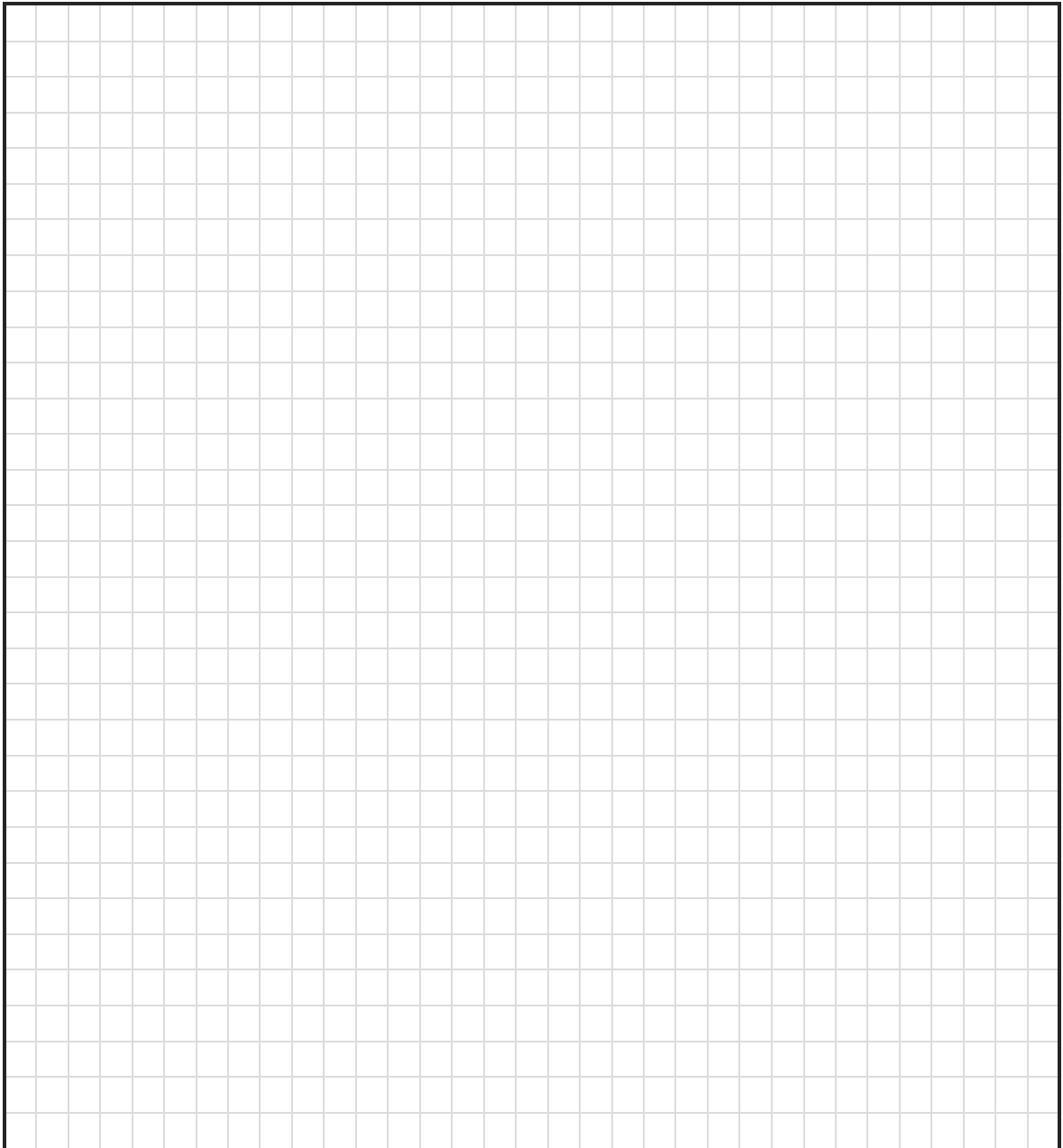
$$\text{Volume} = \frac{1}{3} \times \text{area of the base} \times \text{vertical height}$$

Show that the volume, V , in m^3 , of the pyramid can be written as:

$$V = \frac{4000}{3} \sqrt{\cos^4 x - 2\cos^6 x}$$



- (e) The pyramids were designed so that they had the **maximum possible volume**.
Using calculus, find the angle that will give the maximum volume, correct to the nearest degree. You do not need to verify that the volume is maximised at this angle.
Remember that $45^\circ < x < 90^\circ$.



(50 marks)

- 

where t is the number of years since the initial estimate was made and $\left(\frac{\pi}{2}t\right)$ is in **radians**.

-

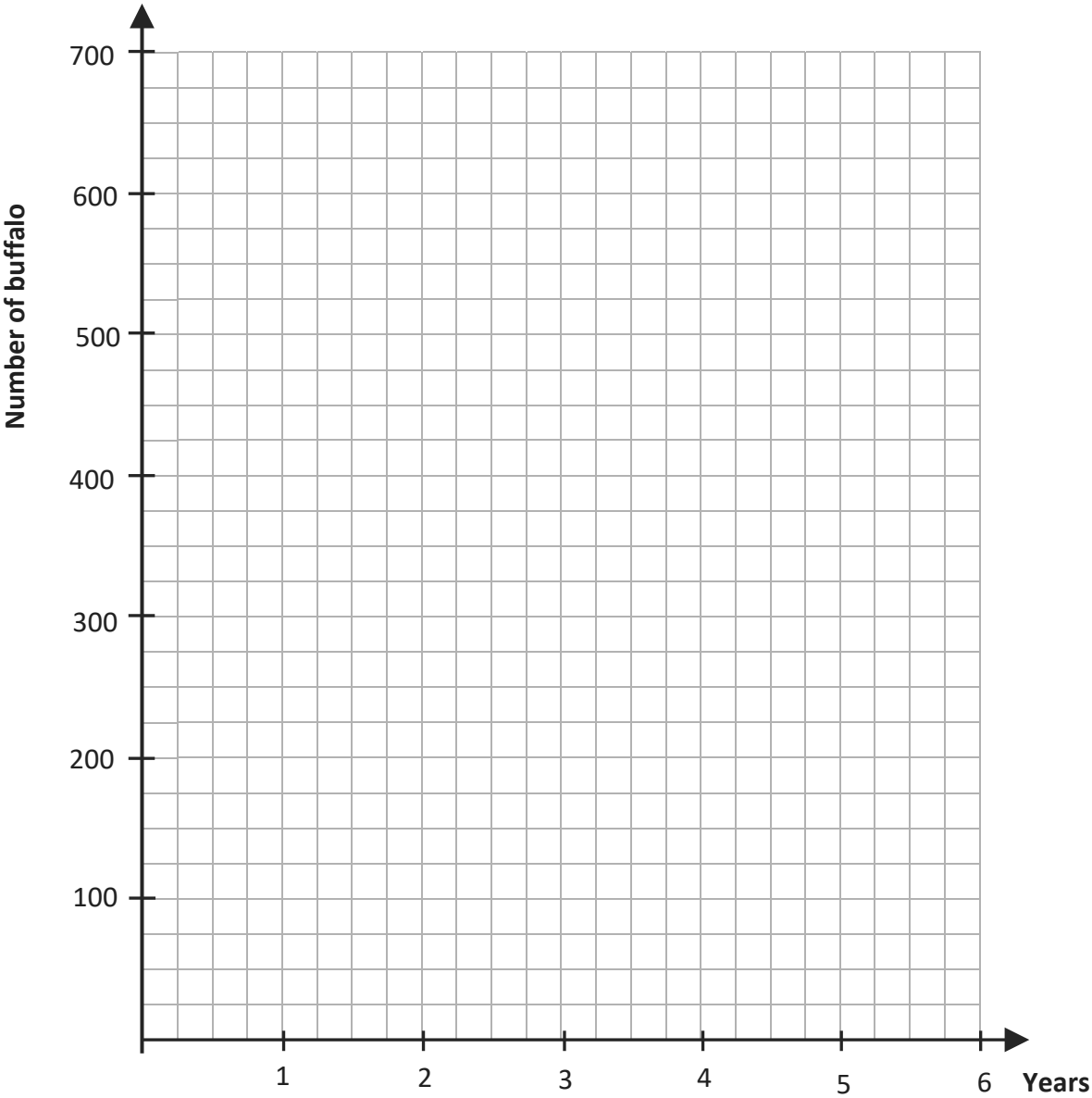
- 

-
- A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 20 rows of squares. A thicker black border runs along the top, bottom, left, and right edges of the page, framing the grid.

- (a) (iv) Use the population function, $P(t)$, to find the expected size of the herd $0 \leq t \leq 6$.

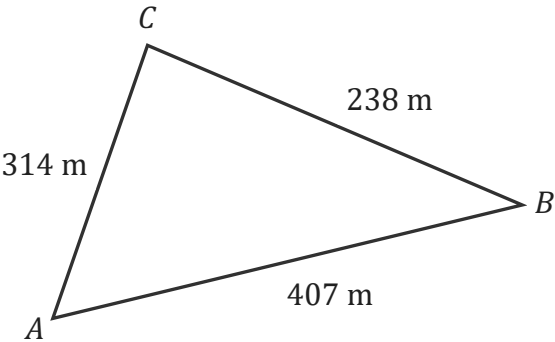
t (Years)	0	1	2	3	4	5	6
$P(t) = 400 + 250\sin\left(\frac{\pi}{2}t\right)$							

- (v) Sketch the graph of $P(t)$ over the six years.

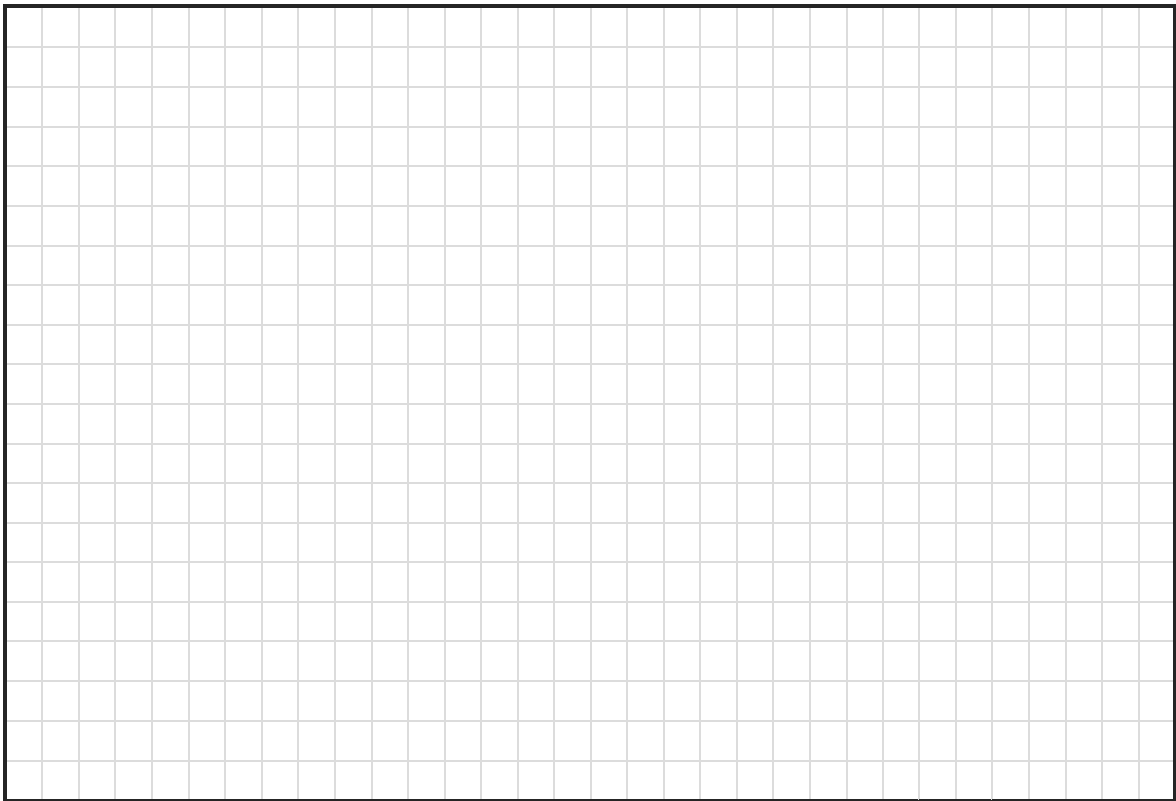


This question continues on the next page.

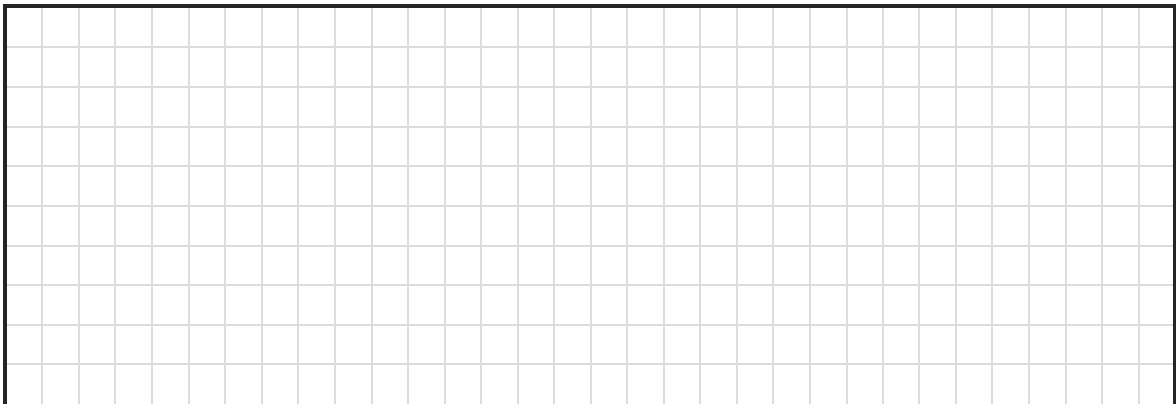
The herd of buffalo live on a national park, in a fenced-off region ABC , as shown below.



- (b) (i) Find the size of angle ACB , correct to the nearest degree.



- (ii) Find the area of the region ABC .
Give your answer in hectares, correct to 2 decimal places.
Note 1 hectare = 10 000 m².

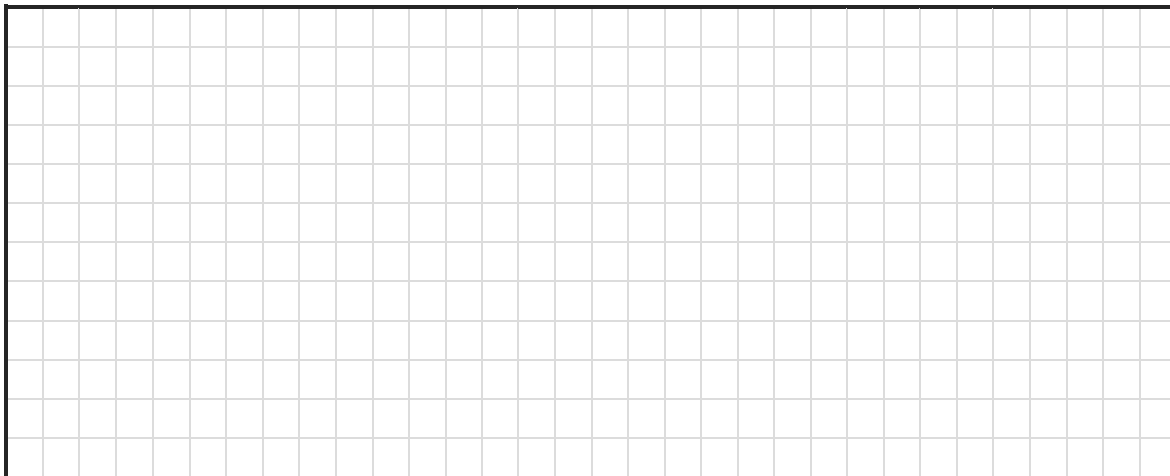


Question 10

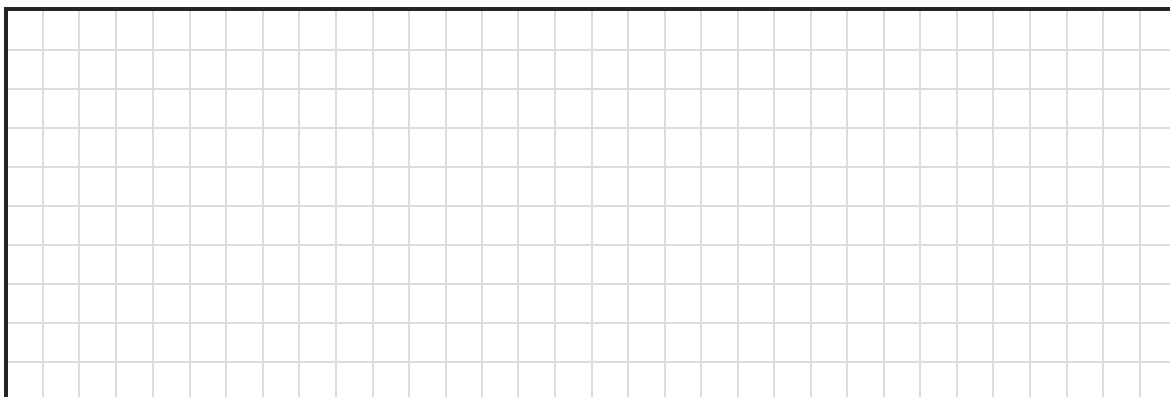
(50 marks)

The scores in a university examination with a large number of candidates are normally distributed, with mean 58 and standard deviation 15.

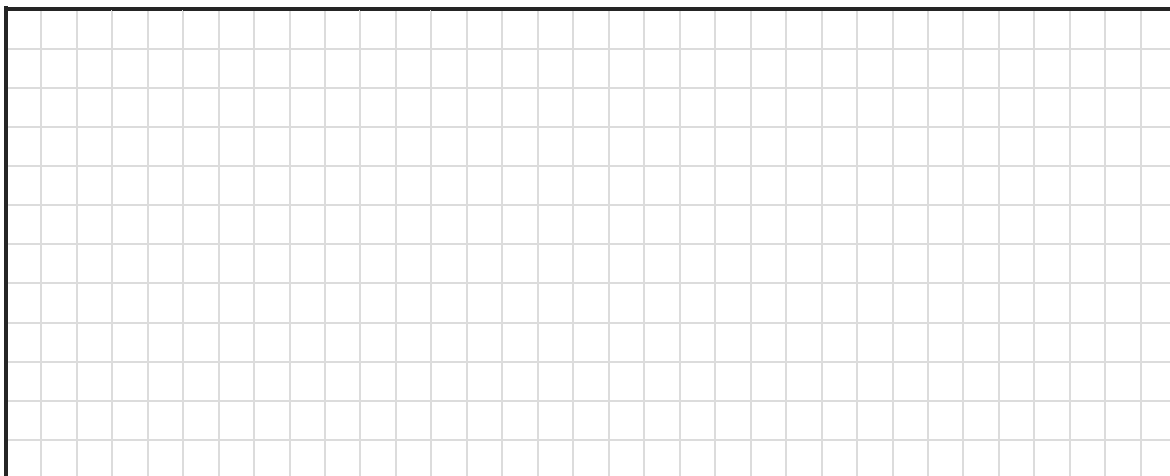
- (a) (i) By calculating a z-score, find the percentage of scores that are between 58 and 70.



- (ii) Explain why the percentage of scores between 46 and 70 is **twice** your answer to part (i).



- (iii) Find an approximate minimum score that a candidate would need to be placed in the top 10% of the candidates.



- (b)** The amount of sleep time per night taken for secondary school students is normally distributed, with a mean of 7.6 hours and a standard deviation of 1.24 hours. Research suggests that secondary school students should get at least 8 hours' sleep per night.

- (i)** Based on this distribution, what percentage of secondary school students do not get enough sleep? Give your answer correct to 2 decimal places.

- (ii)** A survey of 200 randomly selected students at a particular secondary school found that the mean amount of sleep time per night was 7.8 hours. Using this sample data, construct a 95% confidence interval for the mean amount of sleep time per night of these students.

The principal issues a note to the parents of students at the school, claiming that, on average, the school's students are not getting enough sleep.

- (iii)** Does the confidence interval from part **(ii)** support the principal's claim? Justify your answer.

Based on her survey, the principal carried out a hypothesis test, at the 5% level of significance, to see if the population mean of 7.6 hours' sleep per night was the same for her school.

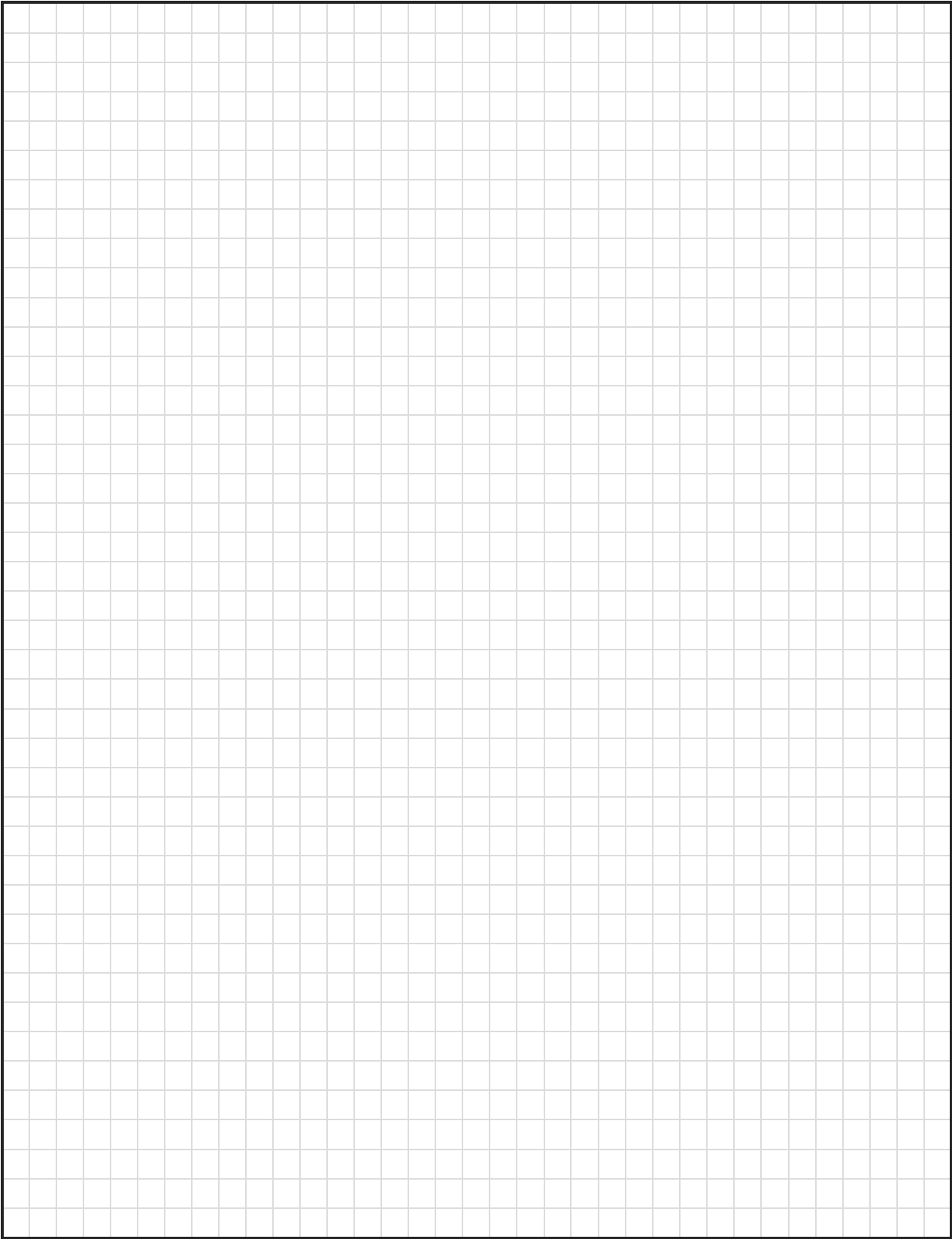
The null hypothesis was that the mean was 7.6 hours.

The alternative hypothesis was that it was **not** 7.6 hours.

- (iv) Calculate the test statistic (z-score) of the sample mean.
Give your answer correct to 2 decimal places.

- (v) Hence, calculate the p -value based on this test statistic **and** state the conclusion of the hypothesis test.

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





Page for extra work.

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