Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/61**

Paper 6 Investigation and Modelling (Extended) **May/June 2025**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

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[Turn over

Section A

INVESTIGATION PRODUCTS OF PAIRS

You are advised to spend no more than 45 minutes on this section.

In this investigation you will look at the differences between the products of pairs of numbers in an increasing linear sequence of positive numbers.

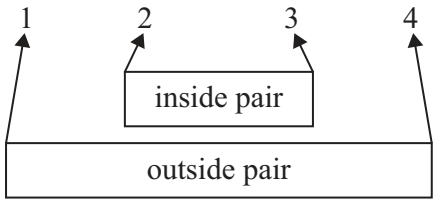
In each sequence:

- there are 3 or more terms
- the difference between each term is the *increase*
- the first term and the last term are the *outside pair*
- the terms next to the first and last terms are the *inside pair*.

To find the *product difference* multiply the numbers in each pair and find the difference.

Example

The sequence is



Product of inside pair $2 \times 3 = 6$
Product of outside pair $1 \times 4 = 4$

Product difference $6 - 4 = 2$

1 The sequences in this question have 4 terms.

(a) Complete the table.

Sequence				Increase	Product of		Product difference
					inside pair	outside pair	
1,	2,	3,	4	1	6	4	2
6,	8,	..... ,	12	.....	.....	72	.....
7.2,	..... ,	..... ,	16.2	.....	.....	116.64	18
..... ,	..... ,	96,	100	.....	.....	.....	.....
..... ,	..... ,	..... ,	.....	5	6000	.....	.....

[5]

(b) (i) Complete the table.
Use your answers in **part (a)** to help you.

Sequences with 4 terms	
Increase, n	Product difference
1	2
2	
3	18
4	
5	
6	

[2]

(ii) Find an expression, in terms of n, for the product difference.

..... [2]

(iii) A sequence of 4 terms has an increase of 11.

Use your expression in **part (b)(ii)** to find the product difference for this sequence.

..... [2]

(iv) Use a sequence of numbers to show that your answer to **part (b)(iii)** is correct.

[1]

2 **(a)** A sequence has 3 terms.
The multiplication of the inside pair is the middle number squared.

Example
The sequence is 1 2 3

Product of inside pair $2 \times 2 = 2^2 = 4$
Product of outside pair $1 \times 3 = 3$

Product difference $4 - 3 = 1$

(i) Complete the table.
Use your own sequences to help you.

Sequences with 3 terms	
Increase, n	Product difference
1	1
2	
3	
4	

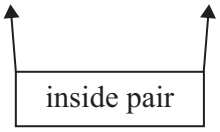
[2]

(ii) Write down an expression, in terms of n, for the product difference.

..... [1]

(b) A sequence has 5 terms.
The inside pair is the two terms that are one away from each end.

Example
The sequence is 1 2 3 4 5



Product of inside pair $2 \times 4 = 8$
Product of outside pair $1 \times 5 = 5$

Product difference $8 - 5 = 3$

(i) Complete the table.
Use your own sequences to help you.

Sequences with 5 terms	
Increase, n	Product difference
1	3
2	
3	
4	

[3]

(ii) A sequence with 5 terms has a product difference of 432.
An expression for the product difference is $3n^2$.

Find the increase for this sequence.

..... [1]

(c) **(i)** Complete the table.
Use your answers to **Question 1(b)(ii) and Question 2(a)(ii)** to help you.

Number of terms in sequence, x	Product difference
3	
4	
5	$3n^2$
6	

[1]

(ii) Find an expression, in terms of x and n, for the product difference.

..... [1]

(d) The number of terms in a sequence is equal to the increase.

Find a sequence with a product difference of 1859.
Write down the first and last terms of your sequence.

First term = ...

Last term = ...

[4]

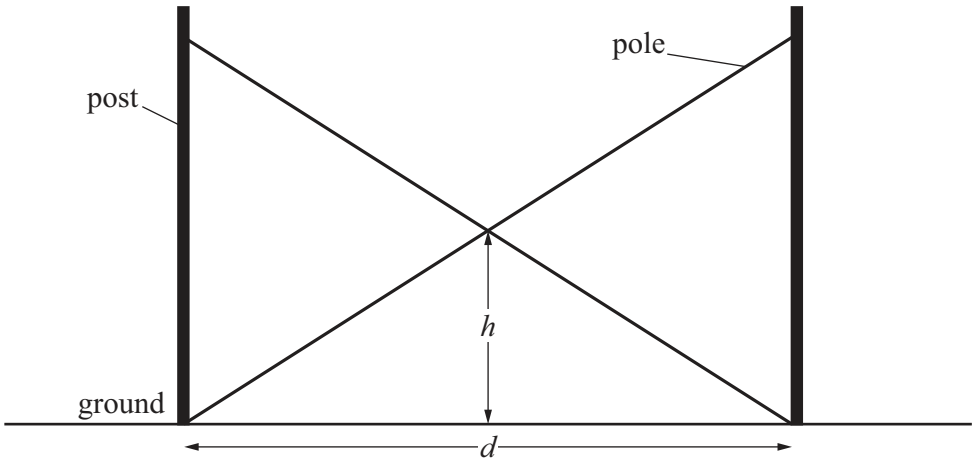
Section B

MODELLING CROSSED POLES

You are advised to spend no more than 45 minutes on this section.

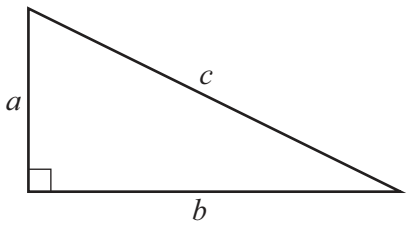
In this task you will be modelling the heights of triangles made below two poles when they cross.

Each triangle is made from 2 poles that lean between vertical posts.



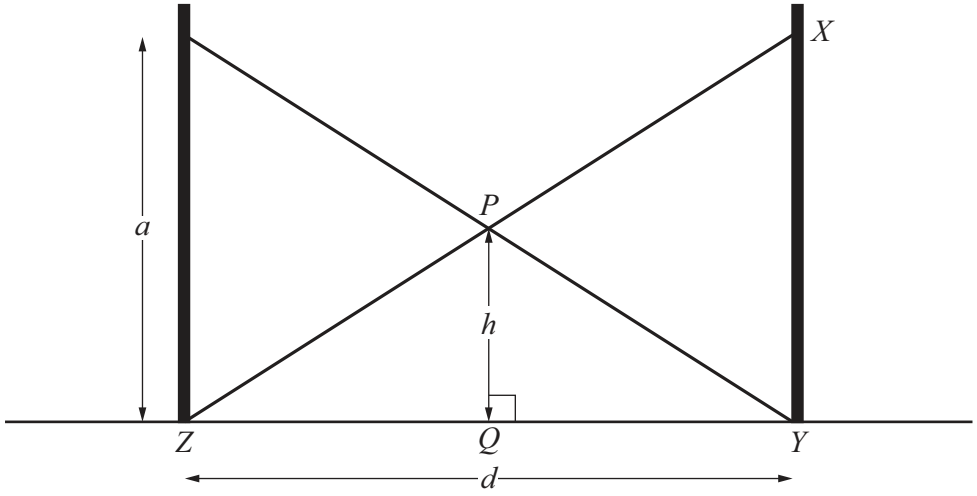
One end of each pole rests on the ground and the other end rests against a vertical post.
The posts are d metres apart on horizontal ground.
The poles cross each other h metres above the ground.

In this task you will find Pythagoras' theorem useful.



$$a^2 + b^2 = c^2$$

3 The poles are 10 m long.
Each pole touches one post on the ground and the other post a metres above the ground.



NOT TO SCALE

Q is the midpoint of ZY.

(a) (i) Complete the statement.

Triangle ...P..... is similar to triangle XYZ. [1]

(ii) Use similar triangles and a and h to complete this statement.

$$\frac{\frac{1}{2}d}{d} = \frac{\square}{\square}$$

[1]

(b) In this part $h = 4$.

(i) Write down the value of a.

..... [1]

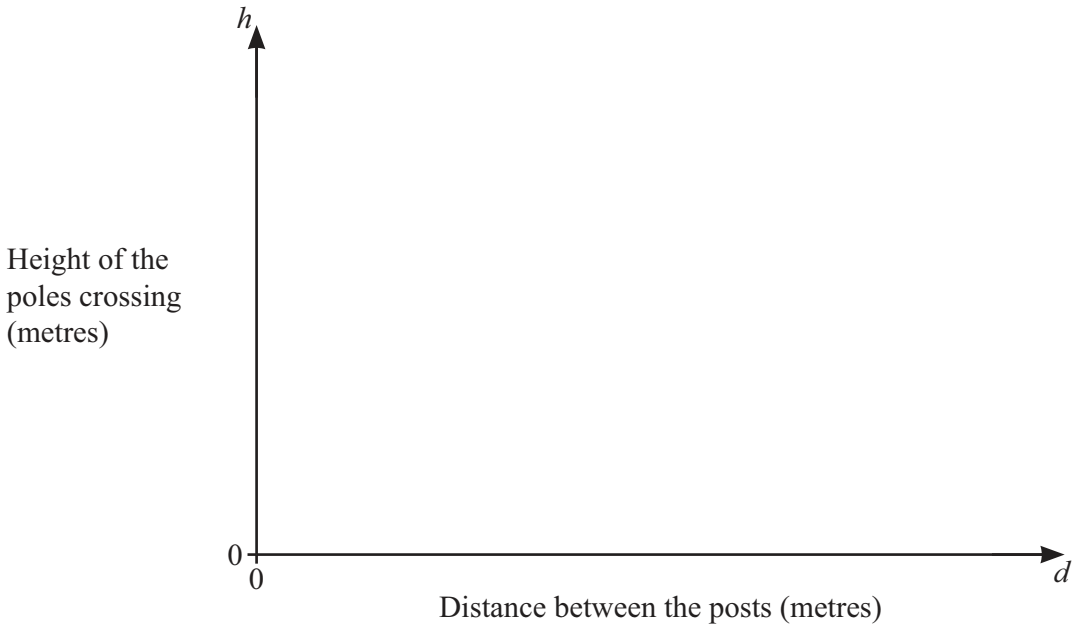
(ii) Use Pythagoras' theorem to find the value of d.

..... [2]

(c) **(i)** Show that a model for h in terms of d is $h = \frac{1}{2}\sqrt{100 - d^2}$.

[2]

(ii) Sketch the model for h.



[2]

(d) Look at the diagram on page 8.

(i) Describe the position of the poles when the curve meets the d-axis on the graph.

..... [1]

(ii) Give a reason why the model is not valid when the curve meets the h-axis on the graph.

..... [1]

4 Two poles are each 15 m long.

(a) Change the model in **Question 3(c)(i)** for poles of length 15 m.

..... [1]

(b) The poles cross at a height of 6 m.

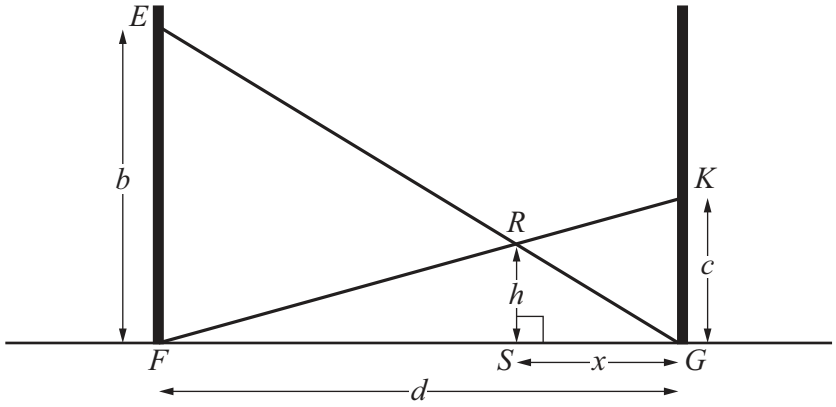
Find the distance between the posts.

..... [3]

5 In this question the lengths of the two poles are different.
One pole is 20 m long and the other pole is 15 m long.

The 20 m pole touches the left post at a height of b metres above the ground.
The 15 m pole touches the right post at a height of c metres above the ground.

The poles cross at R, which is x metres from the right post.



NOT TO SCALE

(a) (i) Use similar triangles to complete these statements.

In triangles RSG and EFG $\quad \frac{x}{d} = \frac{h}{\square}$.

In triangles RSF and KGF $\quad \frac{d-x}{d} = \frac{\square}{\square}$.

[1]

(ii) Use the equations in **part (a)(i)** to show that

$$\frac{h}{b}+\frac{h}{c}=1.$$

[1]

(iii) Use the equation in **part (a)(ii)** to show that

$$\frac{h}{\sqrt{400-d^2}}+\frac{h}{\sqrt{225-d^2}}=1.$$

[3]

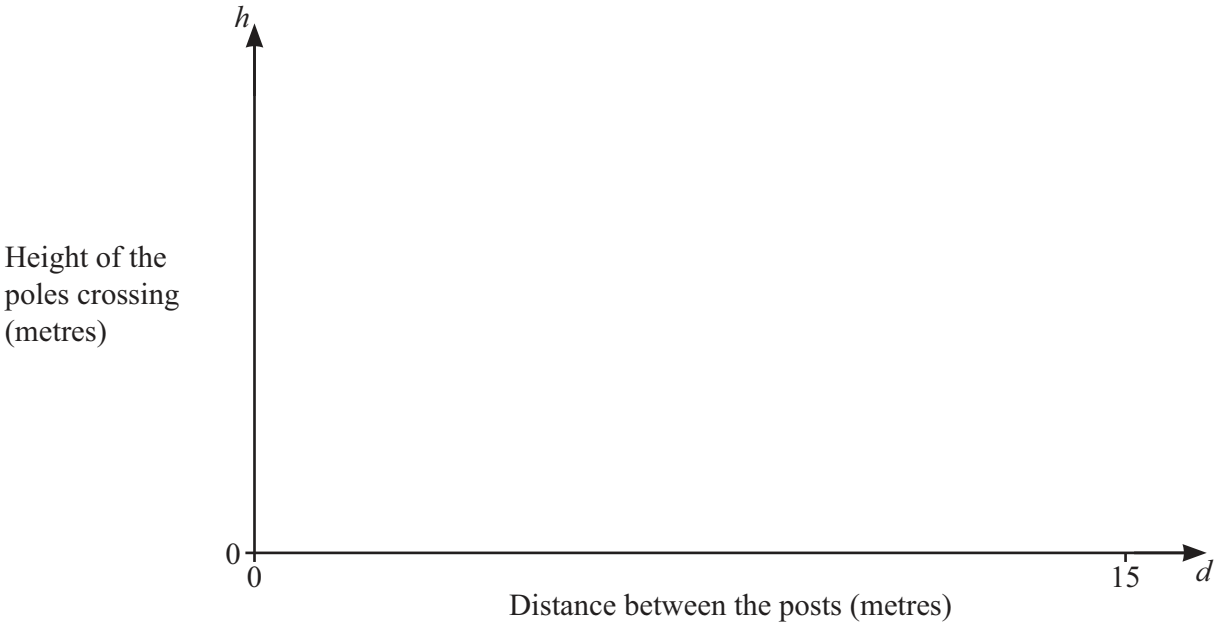
(iv) Rearrange the model in **part (a)(iii)** to show that a model for h in terms of d is

$$h=\frac{\left(\sqrt{400-d^2}\right)\left(\sqrt{225-d^2}\right)}{\left(\sqrt{225-d^2}+\sqrt{400-d^2}\right)}.$$

[1]

Questions 5(a)(v), (b)(i) and (b)(ii) are printed on the next page.

(v) Sketch the model for h in **part (a)(iv)** for values of d between 0 and 15.



[1]

(b) The distance between the posts is 8 m.

(i) Find the height where the poles cross.

..... [1]

(ii) Find the heights of the points where the poles touch the posts.

.....

.....

[2]