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**CAMBRIDGE INTERNATIONAL MATHEMATICS****0607/53**

Paper 5 Investigation (Core)

May/June 2023**1 hour 10 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 36.
- The number of marks for each question or part question is shown in brackets [].

This document has **8** pages. Any blank pages are indicated.

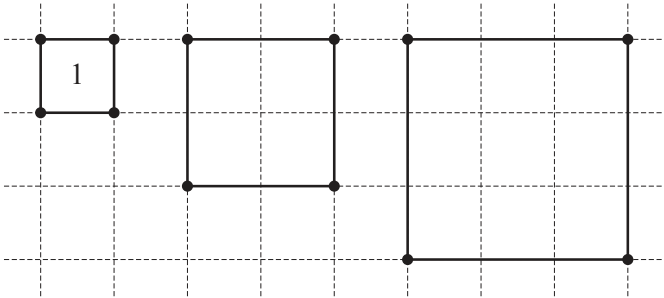
Answer **all** the questions.

INVESTIGATION

AREA OF A RHOMBUS

This investigation looks at the area of a rhombus drawn on a square grid.

1



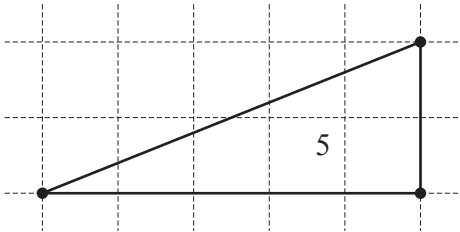
The first square has area 1.

Find the area of each square in the diagram.
Write your answer inside each square.

[2]

2 Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

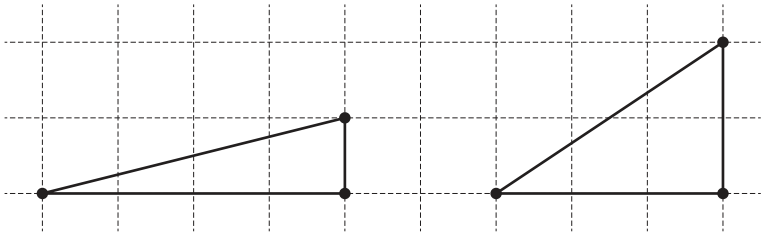
(a)



Show that the area of this triangle is 5.

[1]

(b)

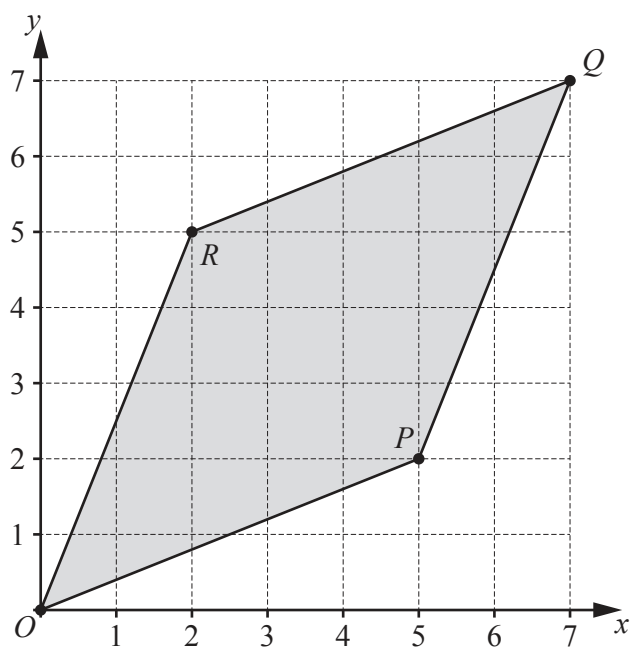


Find the area of each triangle.
Write your answer inside each triangle.

[3]

3

3 (a)

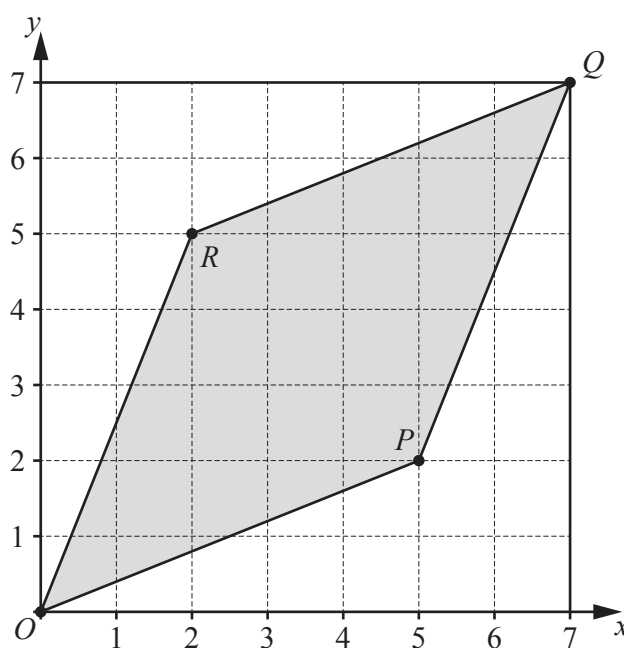


Give a reason why $OPQR$ is a rhombus.

..... [1]

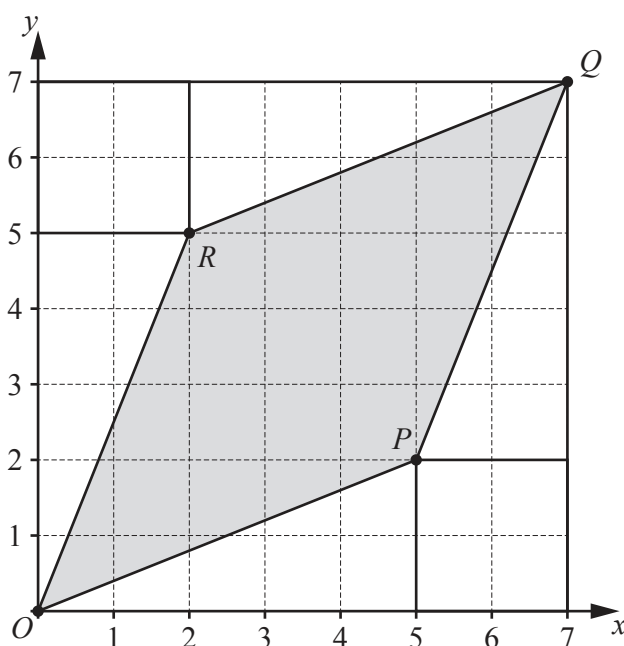
- (b) These steps are the start of a method to find the area of the rhombus $OPQR$.

Step 1 Draw a square around the rhombus.



Step 2

Fill the space between the square and the rhombus with two congruent squares and four congruent triangles.



- (i) Find the area of the large square that goes around the rhombus.

..... [2]

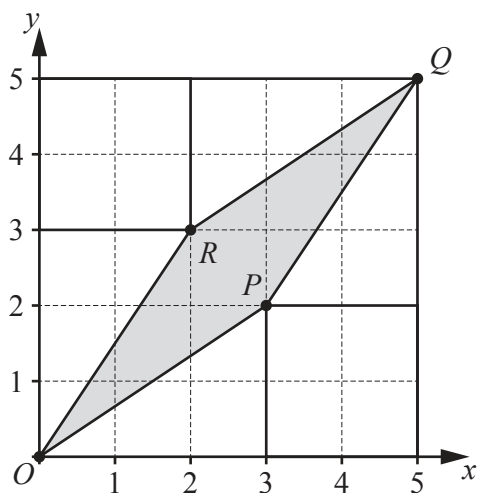
- (ii) Use some of the results in **Question 1** and **Question 2** to write the areas of the two congruent squares and the four congruent triangles inside each shape. [1]

- (iii) Use your answers to **part (i)** and **part (ii)** to show that the area of the rhombus is 21.

[1]

5

4

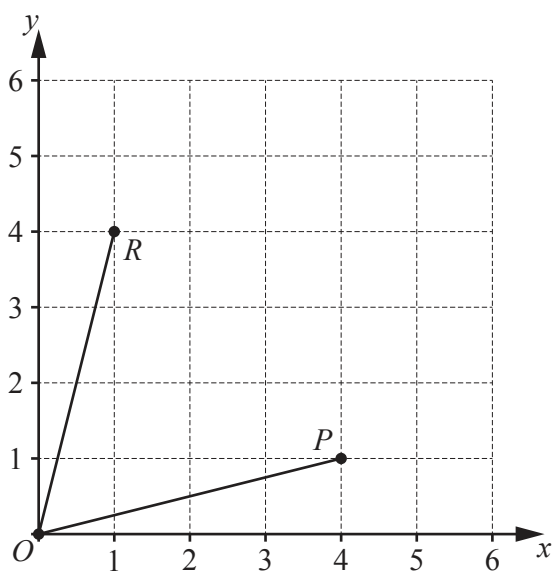


The diagram shows another rhombus $OPQR$.

Use the method of **Question 3(b)** to find its area.

..... [4]

5 (a)



On the diagram, complete the rhombus $OPQR$.

[1]

(b) Use the method of **Question 3(b)** to find the area of rhombus $OPQR$ that you completed in part (a).

..... [4]

6

6 Throughout this investigation, O is the origin, and the x -coordinate and the y -coordinate of Q are always equal.

Complete the table using your answers to **Question 4** and **Question 5** and any patterns you notice.

	Area of rhombus $OPQR$	P	Q	
Question 4	21	(5, 2)	(7, 7)	$5^2 - 2^2 = 21$
		(3, 2)	(5, 5)	$3^2 - 2^2 =$
Question 5		(4, 1)		$4^2 - 1^2 =$
	33	(7, 4)	(11, 11)	$= 33$
	56	(9, 5)		
	27		(9, 9)	$6^2 - 3^2 =$

[8]

7

7 $OPQR$ is a rhombus with $O(0, 0)$ and $P(a, b)$ where $a > b$.

(a) Use the table in **Question 6** to

(i) write down the coordinates of Q in terms of a and b

(..... ,) [1]

(ii) write an expression for the area of rhombus $OPQR$ in terms of a and b .

..... [1]

(b) Q is the point $(10, 10)$.
 a and b are natural numbers.

(i) Use your answers to **part (a)** to find all the possible areas of the rhombus.

..... [4]

(ii) What is the mathematical name of the shape when the rhombus has an area of 100?

..... [2]

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