**Rectangles**

**Learning objective: To investigate the relationship between length, width, perimeter and area of a rectangle**

In this investigation you will be working out the perimeter and area of different sized rectangles.

**Your task:**

For each of these rectangles, measure the length and width, then work out the perimeter and the area.

* Can you explain how you worked out the perimeter and area?
* Is there more than one way to do it?
* Compare your method with others in the class.
* Can you write a mathematical rule linking area, length and width?
* Can you write a mathematical rule linking perimeter, length and width?
* In the table below, write lengths and widths that make area = 24.

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| Length | Width |
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* On the grid, plot the length and width of all rectangles with area 24. Join up the points. What shape have you made?
* Repeat with different sized rectangles.
* In the next table, write lengths and widths that make a rectangle with perimeter = 24.

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| Length | Width |
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* On another grid, plot the length and width of all rectangles with perimeter = 24. Join up the points. What shape have you made?
* Repeat with different sized rectangles.

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**Things to think about:**

* Does a larger perimeter mean a bigger area?
* Is there more than one way to work out the perimeter of a rectangle if you know the length and width?
* Is there more than one way to work out the area?
* If you know the perimeter and the length, can you work out the width?
* If you know the area and the length, can you work out the width?
* Does it matter which side we call the length and which the width?

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| **Key words**Rectangle, length, width, factor, perimeter, area, plotting, graph |

Now use the Level Ladder to achieve your target level.

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| **To get level:** | **You should:** |
| 2 | Measure the lengths and widths of at least three rectangles and work out the perimeter and area.Make at least one statement about the numbers that you have noticed (*I have found out that …).* |
| 3 | Work out lengths and widths that give an area = 24. Work out lengths and widths that give a perimeter = 24. |
| 4 | Use your results to draw a graph for area and a graph for perimeter. Say what you notice about these graphs. |
| 5 | Using **l** for length**, w** for width, **a** for area and **p** for perimeter, can you write a formula for area and a formula for perimeter.Test that your formulas work with some of the numbers you have worked out. |
| 6 | Extend what you have done in parts 3 and 4 above for other perimeters and areas. Draw the graphs. Can you predict where the graphs would be for other values? |
| 7 | Investigate what happens to the width if the length gets bigger but the area stays the same.Repeat for the perimeter. |

**Now use the Level Ladder to assess your work and decide on improvement targets.**

**NC requirements:**

* Use simple formulae (manipulation/substitution)
* Generate and describe linear number sequences (patterns/sequences)
* Express missing number problems algebraically (construct equations/solve equations/inequalities)
* Find pairs of numbers that satisfy an equation with two unknowns (graphs/functions)
* Enumerate possibilities of combinations of two variables
* Calculate and compare the area of rectangles (including squares)
* Use the properties of rectangles to deduce related facts and find missing sides and angles.
* Describe positions on a 2-D grid as coordinates in the first quadrant
* Recognise and use factor pairs and commutativity in mental calculations

**Key ideas:**

* The relationship between length, width and perimeter of a rectangle.
* The relationship between length, width and area of a rectangle.
* Drawing graphs can show relationships between variables.
* Graphs can be straight lines or curves.
* Use of symbols and expressions.

**Prior skills and understanding:**

* Multiplication and division of positive whole numbers
* Finding all possible factor pairs of a number
* Plotting coordinates in the first quadrant

**Key questions:**

* If you know the length and width of a rectangle, can you work out the perimeter and area?
* If you know the length and the area, can you work out the width?
* If you know the length and perimeter, can you work out the width?

**Solutions:**

* Perimeter = 2 x (length + width) or (2 x length) + (2 x width)
* Area = length x width
* Width = area $÷$ length
* Width = (perimeter $÷$ 2) – length

**Possible extensions:**

Extend to other 2-D shapes (triangles, parallelograms, kites, trapeziums).