

What's a fair share of Square Island? - Teachers' Notes

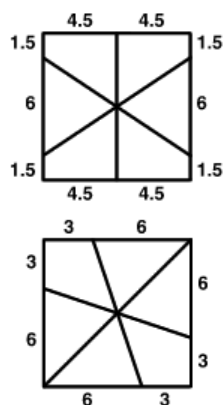
Curriculum Links

This problem requires students to come up with 2 different plans to divide the area and the perimeter of a square into 6 equal sections. Working with perimeter and area of regular polygons is an expectation of Level 4 and Level 5 of the NZC, as is using multiplicative strategies to work with decimals and fractions.

Background and solution

This problem not only requires a student to make the appropriate "cuts" to create the 1/6 portions, but also asks them to defend their subdivision with calculation proof. This involves understanding triangles and calculating the area of triangles ($\frac{1}{2} b \times h$) as well as dividing the perimeter into 6 equal pieces of coastline.

Two possible solutions are:



Here is one way to consider this problem. Calculations: If we look at the second diagram and think of 1/2 the island being shared by 3 people, there will be a coastline of 18 km so each section will get 6 km of coastline.

The area of the whole island is 81 sq km (9×9), so 1/2 will be 40.5 sq km. If we take one of the triangles with a base of 6km we know the height will be 4.5 km (1/2 of the 9km side because the vertex of the triangle is at the centre of the square) and the area of a triangle is $\frac{1}{2} b \times h$ or $\frac{1}{2} \times 6 \times 4.5 = 13.5$ sq km. In each half there are 2 equal shaped sections, $13.5 + 13.5 = 27$ sq km and the total area for 1/2 the island is 40.5 sq km. If we subtract the 2 equal sections from the area for the half we get $40.5 - 27 = 13.5$. So the corner section has the same area as the other two.

Suggestions

Students are prompted to think about working with halves to make the problem more accessible and they are also encouraged to express their solution as a general rule. They should be able to articulate that the centre of the square is key to ensuring that each triangular section has an equal area as long as the length of "coastline" is equal. Ask students to explore with other shapes or numbers to test their rule.