

## How long is a coastline? Teachers' notes

### Curriculum Links

This investigation is adaptable to several levels of the curriculum depending on the geometry and measurement understanding of the student. At Level 4 students are required to “relate three-dimensional models to two dimension representations and vice versa” (Geometry), and to “use appropriate scales, devices and units for length.” (Measurement). The demands of this task exceed the expectation of measuring simple perimeters and links the concept of fractals to a naturally occurring context: the coastline.

There are also links to physical geography in the Science curriculum and to the technology related to measuring devices and methods, such as satellite technology and surveying equipment.

### Background

The task requires the student to investigate the impact of magnification and device on the task of finding a perimeter of a complex object, a coastline. All statements about the length of a coastline are approximations as it is not feasible to measure it so accurately as to take into account going around each rock and “edge” that exists. The length will depend on the scale of the ruler and how “close” they get to the real coastline. Working with a map of the whole of New Zealand and a ruler that measures in centimetres will create a different answer to that produced by working with a series of more detailed maps and using a string to trace the coastline. The concept of infinity can be explored as the student may want to think about how accurate you could get, in theory, measuring around every grain of sand for example.

### Suggestions

The investigation affords many opportunities to introduce the student to geometric, measurement and geographical concepts. It also provides the opportunity to explore areas of interest in mapping, measurement devices and magnification or scaling.

If a student becomes interested in the area of fractals there are a number of paths to follow, whether these are exploring naturally occurring fractal patterns in nature, generated ones in art or understanding the mathematical principle of “fractional dimension.”

### Other resources

The following are two Level 4 Geometry Figure It Out activities related to fractals. The teachers' notes for these are available online.

<http://www.nzmaths.co.nz/resource/fantastic-fractals>

<http://www.nzmaths.co.nz/resource/golden-spirals>

This link is a digital learning object that allows students to generate fractals:

<http://illuminations.nctm.org/Activity.aspx?id=3513>

This link is an article on fractals in art and nature written for teachers.

<http://nrich.maths.org/7002>