

NCEA Level 2 Mathematics (Homework)

17. Number Sequences and Fractals

Reading

Go and watch...

Series of three videos:

<https://www.youtube.com/watch?v=ahXIMUkSXX0>

https://www.youtube.com/watch?v=10IP_Z_-0Hs

<https://www.youtube.com/watch?v=14-NdQwKz9w>

What's it good for?

People use sequences, series, and fractals for...

- Science: the study of fractals and chaotic patterns are increasingly important in modern science. According to Wikipedia,^a phenomena known to have fractal features include:

- | | |
|------------------------------|---------------------------------------|
| – River networks | – Heart sounds |
| – Fault lines | – Earthquakes |
| – Mountain ranges | – Snowflakes |
| – Craters | – Psychological subjective perception |
| – Lightning bolts | – Crystals |
| – Coastlines | – Blood vessels and pulmonary vessels |
| – Mountain goat horns | – Ocean waves |
| – Trees | – DNA |
| – Algae | – Soil pores |
| – Geometrical optics | – Rings of Saturn |
| – Animal coloration patterns | – Proteins |
| – Romanesco broccoli | – Surfaces in turbulent flows |
| – Pineapple | |
| – Heart rates | |



- Mathematics: The behaviour of finite sequences and series is connected with combinatorics (like we saw last week and will see next week), while the behaviour of infinite sequences and series is connected with calculus.

^ahttps://en.wikipedia.org/wiki/Fractal#Natural_phenomena_with_fractal_features

^bBy Jon Sullivan, <http://pdphoto.org/PictureDetail.php?mat=pdef&pg=8232>.

Questions

[This is a sample Ministry of Education L2 assessment task for this standard.]

This assessment activity requires you to create a fractal and use sequences and series to investigate features of the shape. Features of fractals include such things as length, area, number of items, volume.

Create your own fractal. Include:

- Details of how the fractal is created, i.e. the initial unit segment or shape, and how your fractals are formed, including diagrams.
- The values generated for at least three stages (after the initial stage) of the fractal for at least two of the features of the fractal.
- The totals for at least two features of the fractal for any given stage.
- Describe what will happen to the values and totals for each feature as the number of iterations increases.
- For your chosen features, will there be a point where the next iteration makes no significant difference to the feature? Describe the conditions under which this might happen.

The quality of your reasoning and how well you link this context to generalisations of arithmetic and geometric sequences will determine the overall grade. Include calculations, diagrams or formulae, as appropriate. Clearly communicate your method using correct mathematical statements where appropriate.