How to knit a hyperbolic mushroom

These instructions were created by Madeleine Shepherd and Julia Collins for the Botanica Mathematica project in Edinburgh (UK). The aim of the project was to explore mathematical algorithms in nature, from the shapes of chanterelle mushrooms, kelp and kale, to the branching of trees and the patterns on seashells. [https://botanicamathematica.wordpress.com/](https://botanicamathematica.wordpress.com/)

To make these cute little mushrooms you can use any yarn in earthy mushroom colours. The ones in the photo above are knitted in slightly heavy double-knitting weight yarn on 4.5mm needles, but you can make them bigger or smaller by choosing different yarn and needles. Using circular needles will allow you to create bigger mushrooms because they can hold more stitches.

Method

1) Cast on 6 stitches and work a short stalk using stocking stitch (6 rows or so, alternately knitting then purling the rows).

2) After you have the stem of your mushroom you are going to start the increases.
   a. On knit rows, increase after every fourth stitch. The method is up to you: the mushrooms in the photo above were done using ‘knit front and back’, but you might prefer to try using yarn-overs to get a lacy pattern instead.
   b. On purl rows complete the row without any increases.

3) After about 20 rows (or until you can’t cope with the number of stitches on the needle!) cast off and you should have something that looks like one of the mushrooms in the photos.
Mathematics

The number of stitches on your needle is showing exponential growth: the more stitches you have, the faster the number of stitches grows. So although you may start off with only 6 stitches, you could easily end up with over a hundred by the end!

The type of shape that this kind of increasing creates is called **hyperbolic geometry**, and occurs often in biology because it is a shape which maximises surface area. This means it is great for plants trying to get the most nutrients from their environment. You can find it in leaves, seaweed and coral too.

If you enjoyed this project, pick up the instructions for crocheting a hyperbolic plane. The technique is essentially the same and will allow you to create beautiful shapes mimicking coral growth.