"Until [the observed effects] filter down into the lower atmosphere, computer models will struggle to accurately predict our surface weather in the coming weeks. Even once this does happen, small errors in the forecast simulations could result in very different weather a few days ahead."

https://www.bbc.co.uk/weather/features/55662527

$y_n \rightarrow$ Number of Quizzles in year n

$y_0 \rightarrow$ Starting number of Quizzles

$$y_{n+1} = ky_n$$

$x_n \rightarrow$ The proportion of the maximum number of Quizzles that there are in year n

(For example, $x_3 = 0.5$ means that in year 3 the population of Quizzles is half of the maximum possible population)

$$x_{n+1} = kx_n(1 - x_n)$$

$$x_{n+1} = 2x_n(1 - x_n)$$

If $x_0 = 0.3$ what is x_1, x_2 and x_3?

What happens as the years increase?

What if you started with a different x_0?

1. Can you find a parameter where the population dies out?
2. Can you find a parameter so that the population settles to a non-zero constant value?
3. Can you find a parameter so that the population eventually oscillates between two values? Or eventually cycles between three or four values?
4. Why have we chosen 0 and 4 as limits for the *k* slider?

$$x_{n+1} = 1.5x_n(1 - x_n)$$

$$0.6 \leq x_0 \leq 0.8$$

$$x_{n+1} = 3.5x_n(1 - x_n)$$

$$0.6 \leq x_0 \leq 0.8$$

$$x_{n+1} = 3.7x_n(1 - x_n)$$

$$0.6 \leq x_0 \leq 0.8$$

$$x_{n+1} = 3.7x_n(1 - x_n)$$

$$0.69 \leq x_0 \leq 0.71$$

$$x_{n+1} = 3.7x_n(1 - x_n)$$

$$0.699 \leq x_0 \leq 0.701$$

Logistic Map

$$x_{n+1} = kx_n(1 - x_n)$$

Some ideas to explore further:

- You could explore the maths of the logistic map further.
- You could research the use of maths in studying population dynamics
- You could research the maths in weather forecasting.
- You could explore other applications where maths is used to make predictions.
- You could explore the mathematical concept of Chaos further.

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