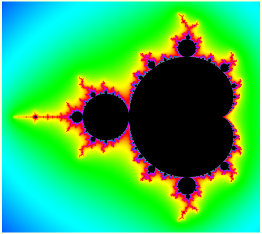
Creating the Mandelbrot Set

Start: Pick a number (real or complex) to be the seed s.
Next: Form the equation $z_n = z_{n-1}^2 + s$ and let $z_0 = 0$

1. Let $n = 0$
2. Add 1 to n
3. Evaluate $z_n = z_{n-1}^2 + s$
4. Go to step 2



As n increases, does this process lead to the seed *escaping* (the sequence of outputs growing without bound)? If so, the seed is **not** in the Mandelbrot set.

If instead, as n increases this process leads to the seed being *periodic* (the sequence of outputs bouncing between a few finite numbers) or being *attracted* (the sequence of outputs approaching a specific finite number), then the seed is in the Mandelbrot set.

Mandelbrot Set - Example

Start: Pick the point (1,0). Write as a complex number:

seed$= s = 1 + 0i = 1$

Next: Form the equation $z_n = z_{n-1}^2 + 1$

Note: Don't change the "+1" part while working with this seed.

- $z_0 = 0$
- $n = 1$: $z_1^2 = z_0^2 + 1 = 0^2 + 1 = 1$
- $n = 2$: $z_2^2 = z_1^2 + 1 = 1^2 + 1 = 2$
- $n = 3$: $z_3^2 = z_2^2 + 1 = 2^2 + 1 = 5$
- $n = 4$: $z_4^2 = z_3^2 + 1 = 5^2 + 1 = 26$
- $n = 5$: $z_5^2 = z_4^2 + 1 = 26^2 + 1 = 677$
- etc

Mandelbrot sequence associated with $s = 1 + 0i$:

$$\{0, 1, 2, 5, 26, 677\}$$

This sequence will continue to grow without bound.

Thus the point $(1, 0)$ is **not** in the Mandelbrot set, and we will give it a color based on how fast it is **escaping**.