# Bifurcation Diagram Exploration!

## Chaos and Fractals

## College of the Atlantic

**Please do these before class on Thursday, 20 January**

General Instructions

- Do this with others if you like. It might be more fun that way.
- We'll go over this in class. There's nothing to hand in.
- Don't spend more than 10-15 minutes on these exploration (unless you want to).
- Use this web page for iterating: https://s3.amazonaws.com/complexityexplorer/DynamicsAndChaos/Programs/bifurcation.html.

In this exploration you will investigate the period-doubling route to chaos on the bifurcation diagram. In the bifurcation diagram we see that the behavior of the orbits shifts from period one (a fixed point) to period two at $r = 3.0$. This is a *bifurcation*—a sudden change in behavior. By zooming in on the bifurcation diagram, locate the $r$ values at which subsequent bifurcations occur. Try to determine these $r$ values to several decimal places, although this may not be possible.

1. Find the $r$ value at which the orbits shift from period 2 to period 4. 3.44 ish
2. Find the $r$ value at which the orbits shift from period 4 to period 8.
3. Find the 8 value at which the orbits shift from period 2 to period 16.