

Homework for Lecture 8 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (as .pdf file) to

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by 8:00pm Monday, Oct. 6,, 2021.

Subject: hw8

with an attachment hw8FirstLast.pdf and/or hw8FirstLast.txt

Using

<http://sites.math.rutgers.edu/~zeilberg/Bio25/DMB8.txt>

1. Find ten random rational functions using `raRF(x,3)` .

For each of them find all the stable steady-states.

Then using `Orb(f,x,x0,2000,2020)`; for $x_0 = -100.1, -10.1, 10.1, 100.1$

verify that the orbit always converges to that stable steady-state.

2. Find the terms between 2000-th and 2030-th terms of the **orbit** starting at $x_0 = 0.5$ of the recurrence

$$x_n = kx_{n-1}(1 - x_{n-1}) \quad ,$$

for $k = 1, k = 2, k = 2.5, k = 3.1, k = 3.2, k = 3.3, k = 3.5$. What do you find?

3. By Playing “High-Low” find the smallest positive integer such that k ,

`f:=MakeNicePol([1,2,3,4,5,6,7,8],k,x);`

has two stable steady-states. Pick random x_0 from their neighborhood and verify that indeed the orbits converges to them.

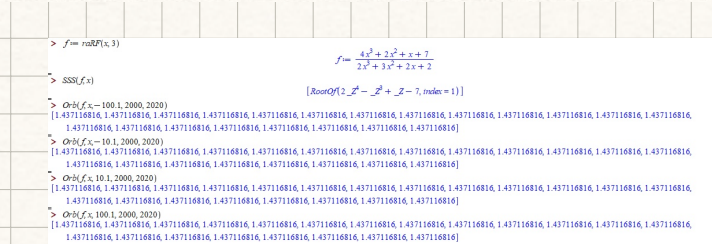
Then keep upping k to find the smallest integer such that it has four stable steady-states. Pick random x_0 from their neighborhood and verify that indeed the orbits converges to them.

1. Find ten random rational functions using `raRF(x,3)`.

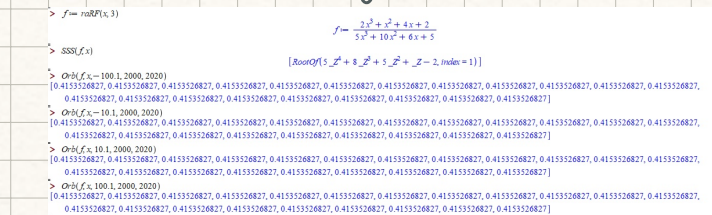
For each of them find all the stable steady-states.

Then using `Orb(f,x,x0,2000,2020)`; for $x_0 = -100.1, -10.1, 10.1, 100.1$

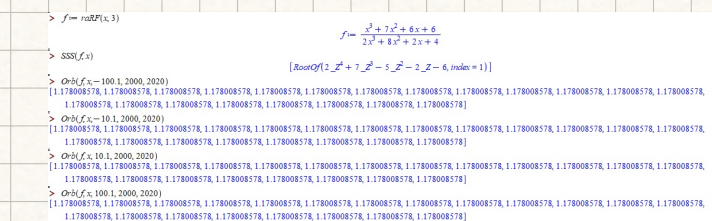
verify that the orbit always converges to that stable steady-state.



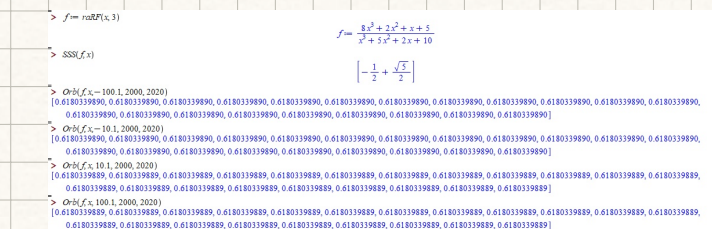
All orbits converge to 1.437...



All orbits converge to 0.415



All orbits converge to 1.178

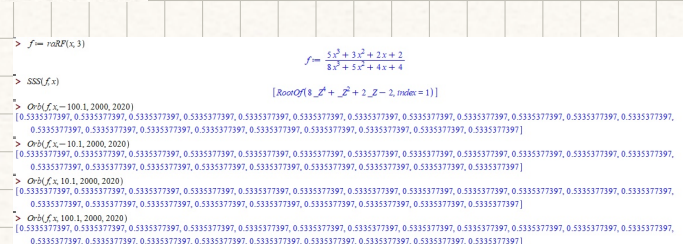
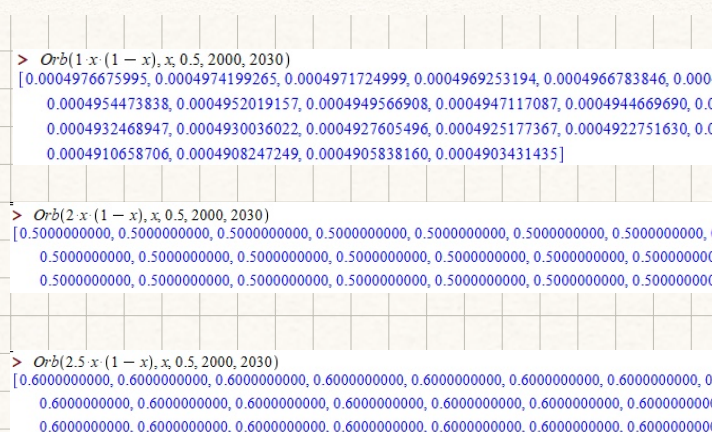


All orbits converge to 0.618

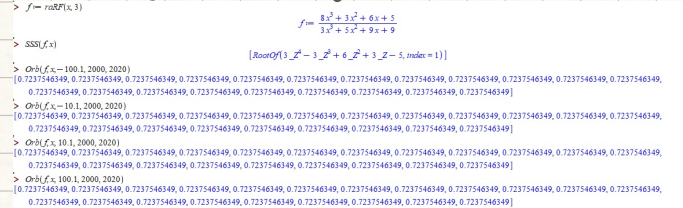
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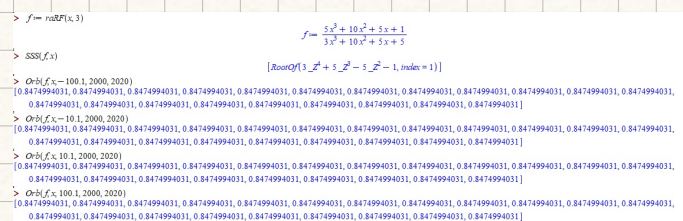
for $k = 1, k = 2, k = 2.5, k = 3.1, k = 3.2, k = 3.3, k = 3.5$. What do you find?



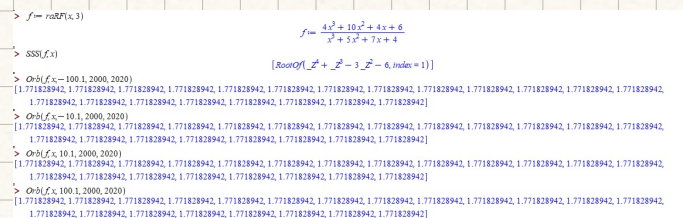
All orbits converge to 0.534



All orbits converge to 0.7237



All 61 bits converge to 0.847



All orbits converge to 1.772

$$k=1$$
$$K=2$$
$$K = 2.5$$

$$k = 3.1$$
$$k = 3.2$$
$$K = 3.3$$
$$K = 3.5$$

when $k = 3.1, 3.2, 3.3$ and 3.5 the orbitals bounce btwn 2 numbers so these are probably unstable ss

After testing a ton of integers, I determined that the smallest value that has 255 divisors is 361

After testing a ton of integers, I determined that the smallest value that has 4 SSS values is 2521