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>
=>
> $FP\left(\frac{(1+9x)}{3+x}, x\right)$
[-0.162277660, 6.162277660] (2)

> $SFP\left(\frac{(1+9x)}{3+x}, x\right)$
[6.162277660] (3)

>

>

>

>

>

#2

#k=1

> $evalf(Orb(x \cdot (1-x), x, 0.5, 1, 1000));$
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0.001029180910, 0.001028121697, 0.001027064663, 0.001026009801, 0.001024957105,
0.001023906568, 0.001022858183, 0.001021811944, 0.001020767844, 0.001019725877,
0.001018686036, 0.001017648315, 0.001016612707, 0.001015579206, 0.001014547805,
0.001013518498, 0.001012491278, 0.001011466139, 0.001010443075, 0.001009422080,
0.001008403147, 0.001007386270, 0.001006371443, 0.001005358660, 0.001004347914,
0.001003339199, 0.001002332509, 0.001001327839, 0.001000325182, 0.0009993245315,
0.0009983258820, 0.0009973292274, 0.0009963345618, 0.0009953418792,
0.0009943511737, 0.0009933624394, 0.0009923756705, 0.0009913908610,
0.0009904080051]

>

> #k=2

> evalf(Orb(2·x·(1-x), x, 0.5, 1, 1000));

[0.50, 0.5000, 0.50000000, 0.5000000000, 0.5000000000, 0.5000000000, 0.5000000000,
0.5000000000, 0.5000000000, 0.5000000000, 0.5000000000, 0.5000000000,
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(5)


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0.5000000000, 0.5000000000, 0.5000000000, 0.5000000000 ]  
>  
> #k= 2.5  
> evalf(Orb(2.5·x·(1-x), x, 0.5, 1, 1000));  
[0.625, 0.5859375, 0.6065368652, 0.5966247410, 0.6016591485, 0.5991635438,  
0.6004164790, 0.5997913268, 0.6001042278, 0.5999478590, 0.6000260638,  
0.5999869665, 0.6000065162, 0.5999967418, 0.6000016290, 0.5999991855,  
0.6000004072, 0.5999997965, 0.6000001018, 0.5999999490, 0.6000000255,  
0.5999999872, 0.6000000065, 0.5999999968, 0.6000000015, 0.5999999992,  
0.6000000005, 0.5999999998, 0.6000000000, 0.6000000000, 0.6000000000,  
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(6)

0.8269407062, 0.5008842111, 0.8749972637, 0.3828196827, 0.8269407062,
0.5008842111, 0.8749972637, 0.3828196827, 0.8269407062, 0.5008842111,
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0.5008842111, 0.8749972637, 0.3828196827, 0.8269407062, 0.5008842111,
0.8749972637, 0.3828196827, 0.8269407062, 0.5008842111, 0.8749972637]

>
> *#For k=1, x gets smaller and smaller. For k=2, it is constantly 0.5. For k = 2.5, it is constantly
0.6. For k = 3.1 and 3.5, it oscillates between a few values. (As k varies, the equilibria
change).*

> #3

> **TwoOrb** := **proc**(*f*, *x*, *y*, *x0*, *x1*, *K1*, *K2*) **local** *x2*, *x3*, *temp*, *i*, *L* :
 *#Method for solving second order nonlinear recurrence (x represents x[n-1] and y represents
 x[n-2])*
 x2 := x0 :
 x3 := x1 :
 temp := x3 :
 for *i* **from** 1 **to** *K1* **do**
 temp := x3 :
 x3 := subs(x = x3, y = x2, f) :
 x2 := temp :

*#we don't record the first values of K1, since we are interested in the long-time behavior of
 the orbit*

od:

L := [x1] :

for *i* **from** *K1* **to** *K2* **do**

temp := x3 :
 x3 := subs(x = x3, y = x2, f) : #we compute the next member of the orbit
 x2 := temp :

```
L := [op(L), x3] : #we append it to the list
```

```
od:
```

```
L : #that's the output
```

```
end:
```

```
> evalf( TwoOrb( (x + 9 y) / (x + 4 y), x, y, 0.5, 0.7, 1, 1000 ) )
```

```
[0.7, 1.740595611, 2.019623511, 1.968934790, 2.005044945, 1.996345417, 2.000868517,  
1.999547067, 2.000132104, 1.999941486, 2.000019062, 1.999992242, 2.000002682,  
1.999998956, 2.000000374, 1.999999857, 2.000000053, 1.999999980, 2.000000008,  
1.999999997, 2.000000001, 1.999999999, 2.000000001, 2.000000000, 2.000000001,  
2.000000000, 2.000000001, 2.000000000, 2.000000001, 2.000000000, 2.000000001,  
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(9)

2.000000000, 2.000000001, 2.000000000, 2.000000001, 2.000000000, 2.000000001,
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2.000000000, 2.000000001, 2.000000000, 2.000000001, 2.000000000, 2.000000001,
2.000000000, 2.000000001, 2.000000000, 2.000000001, 2.000000000, 2.000000001,
2.000000000, 2.000000001, 2.000000000, 2.000000001]

> *#This recurrence has steady states 2.000000000 and 2.000000001.*