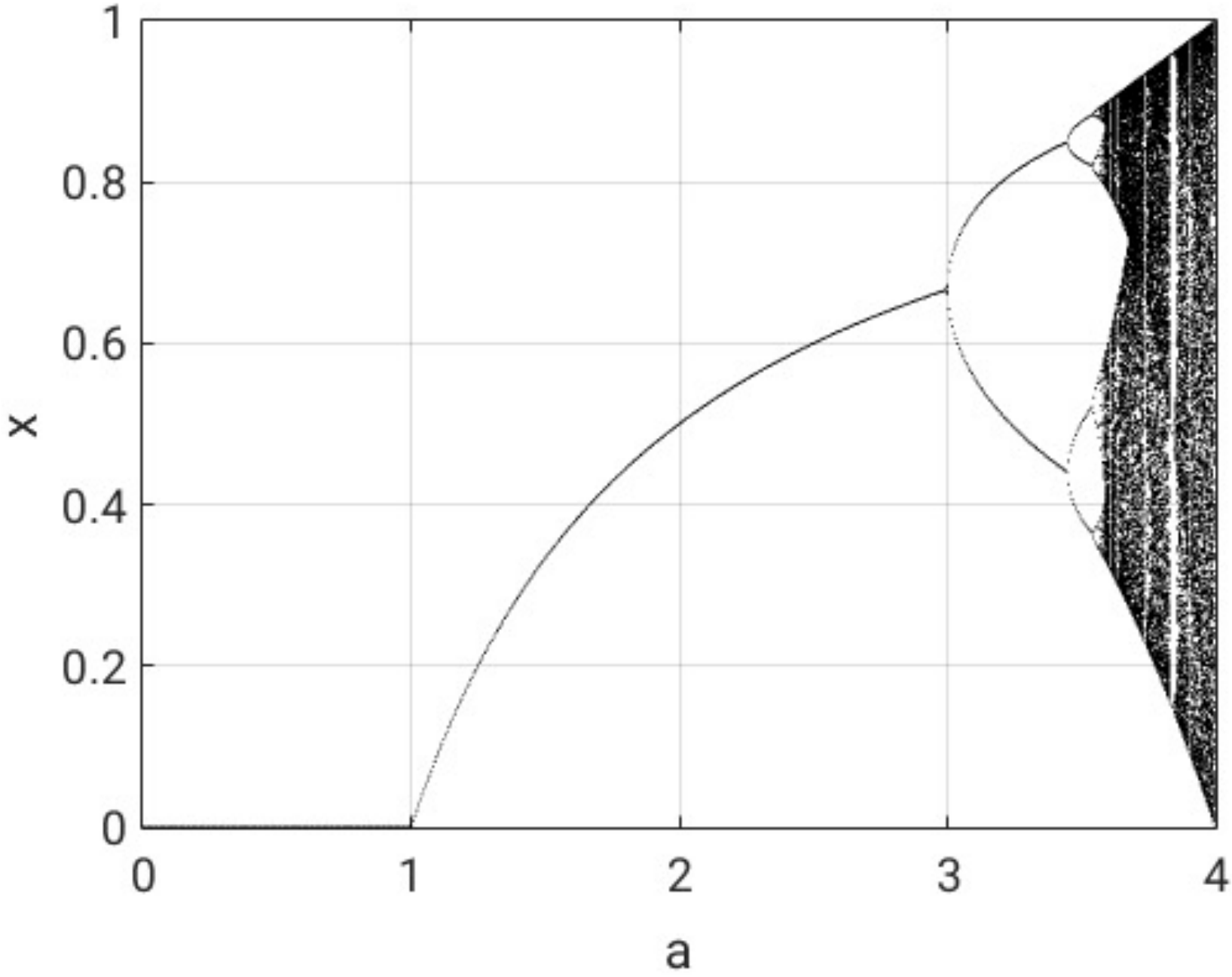
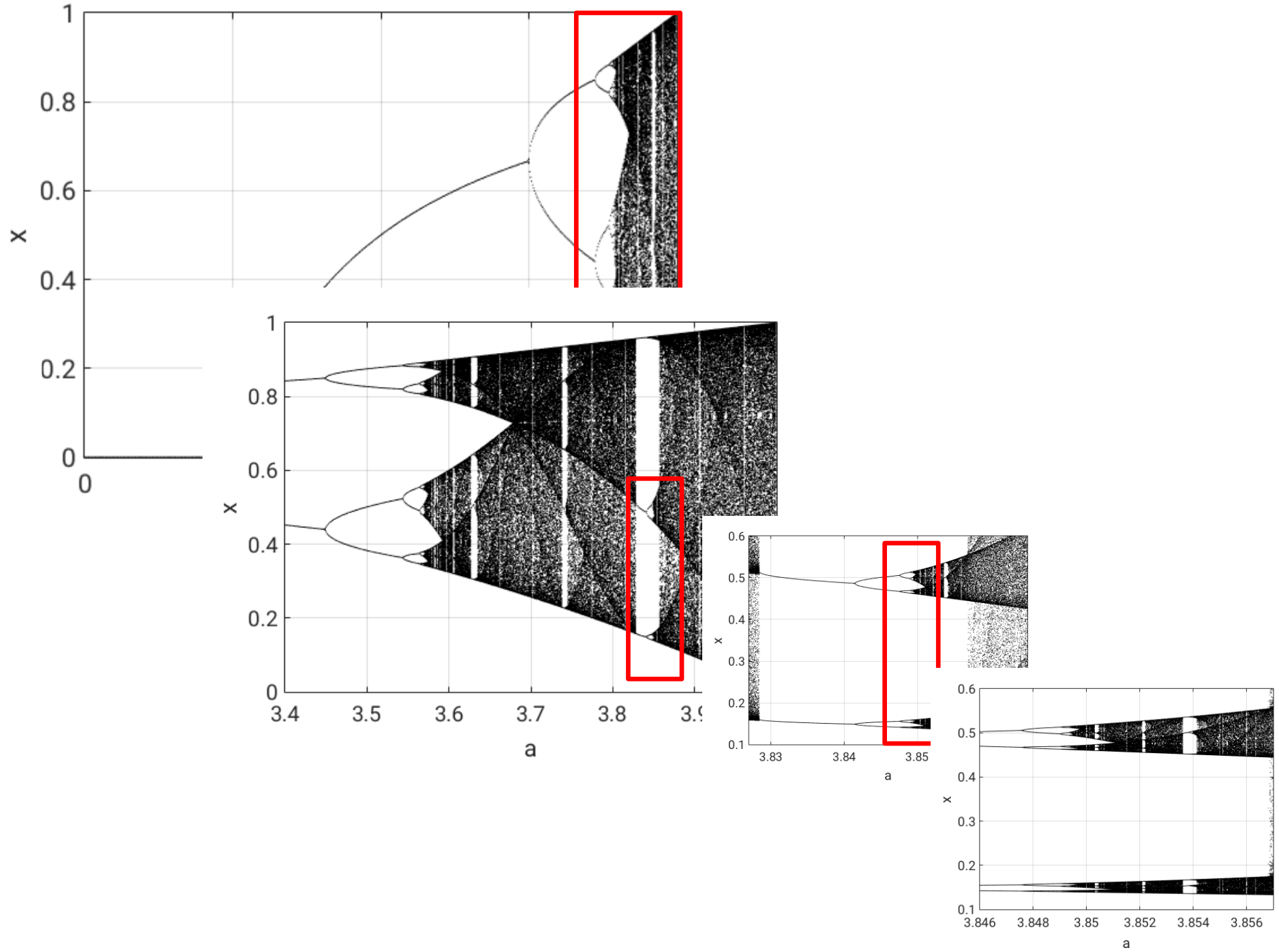
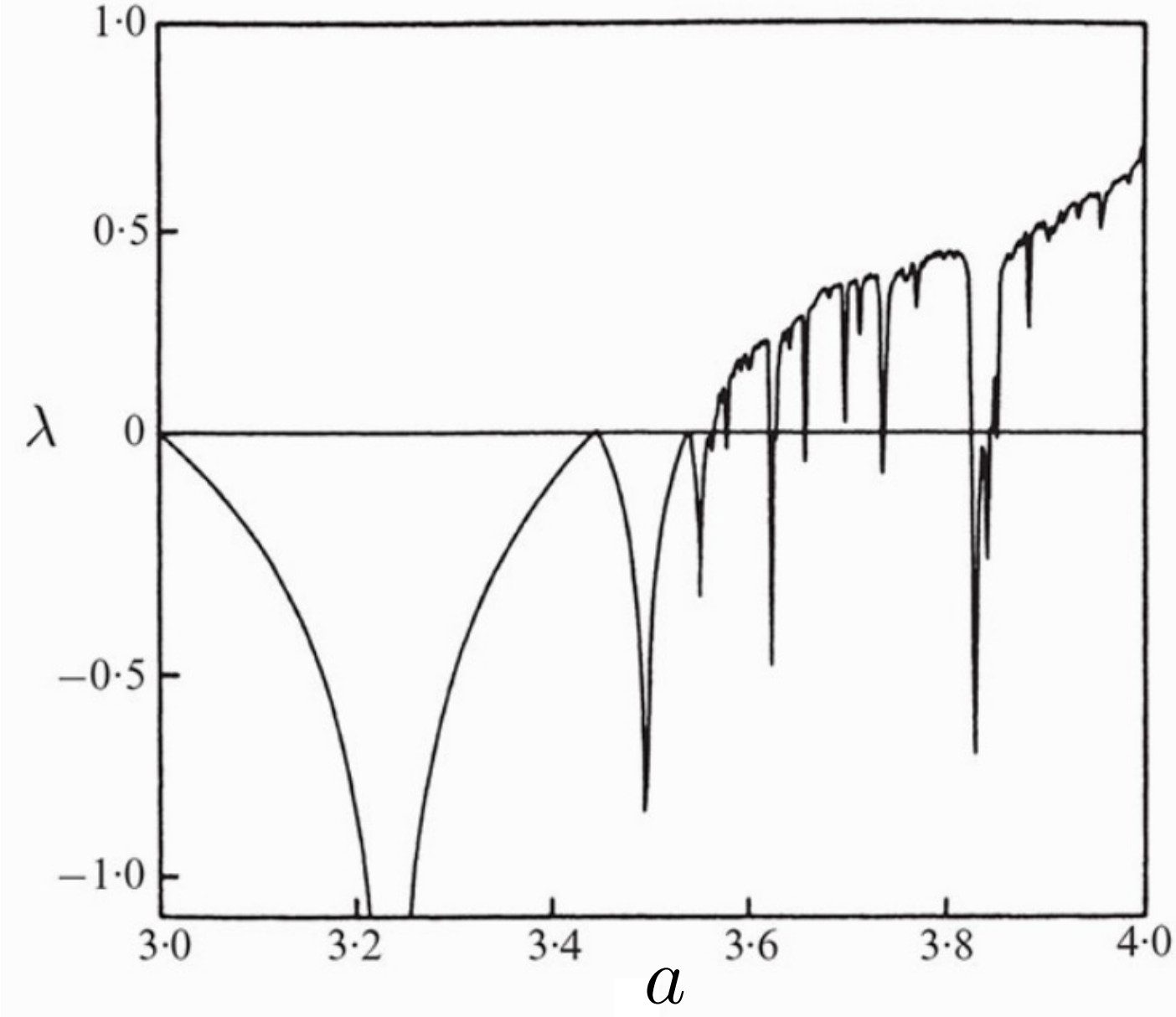
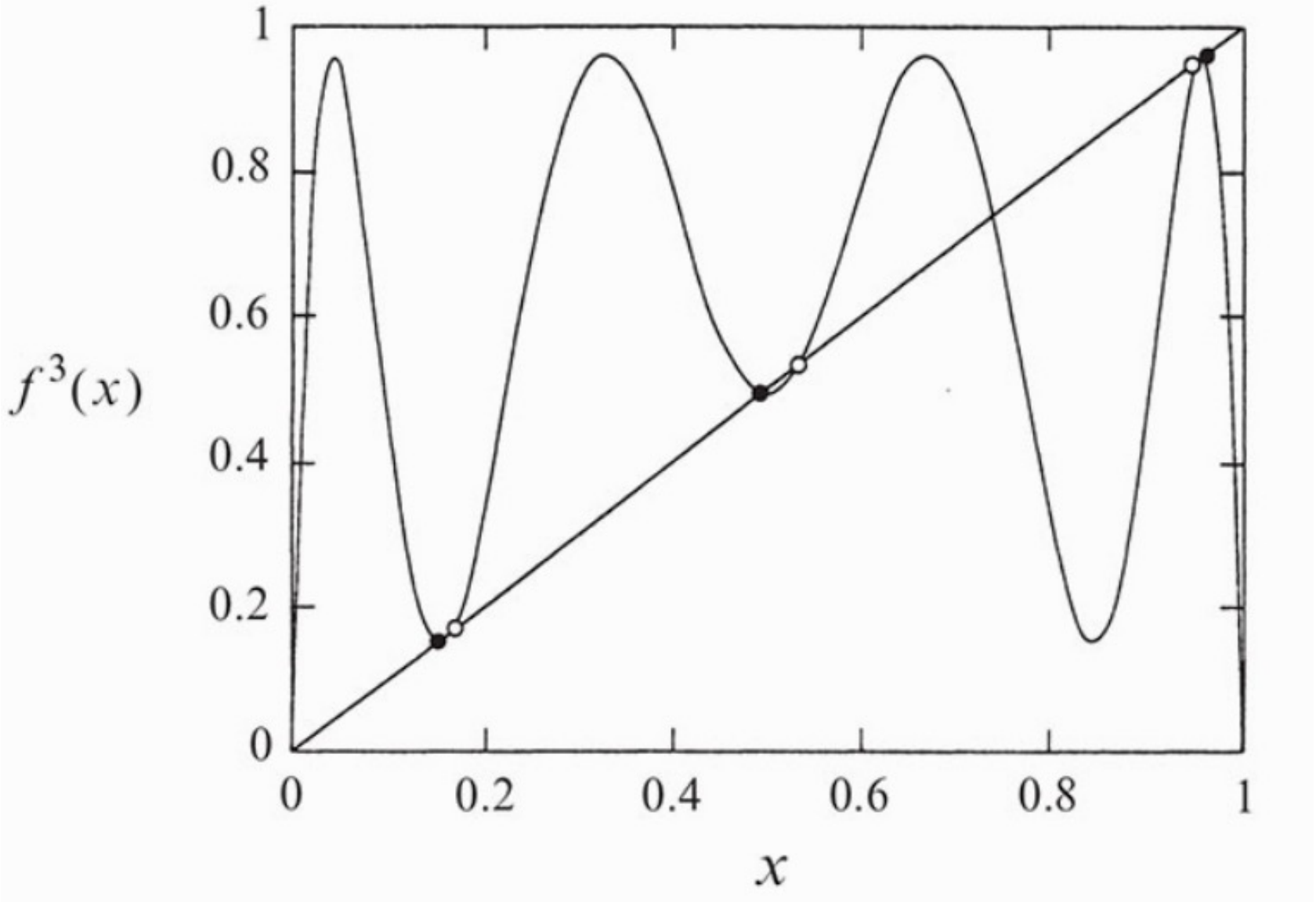
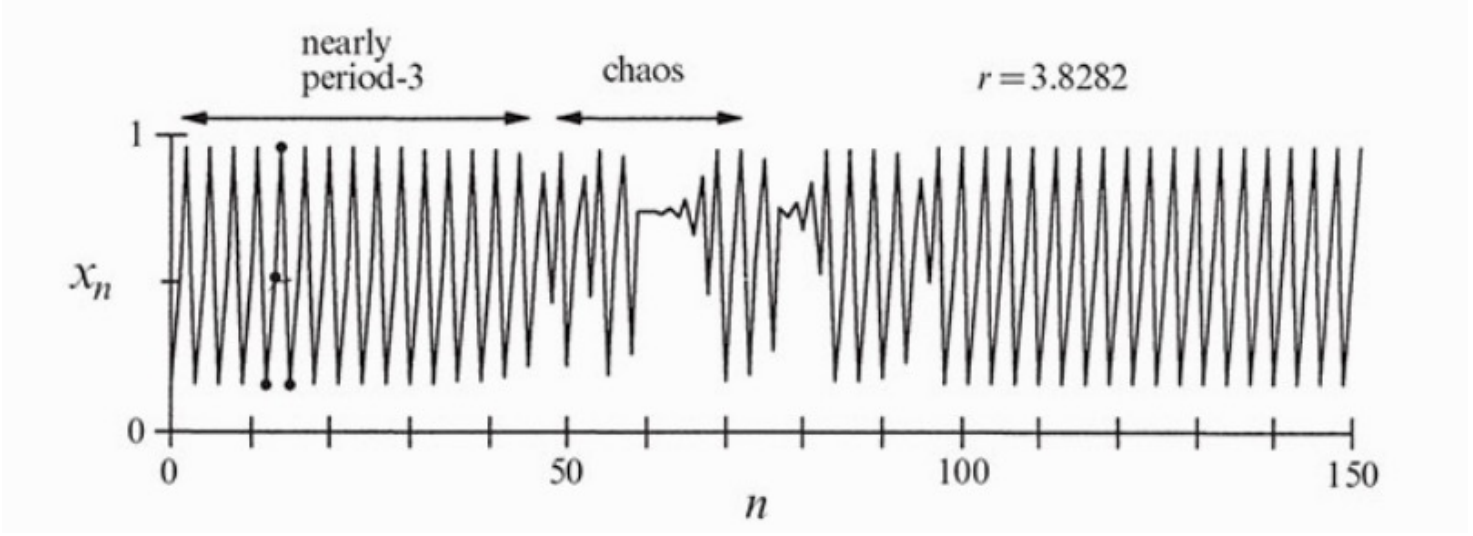

1
0.8
0.6
0.4
0.2
0
x
0
1
2
3
4
a

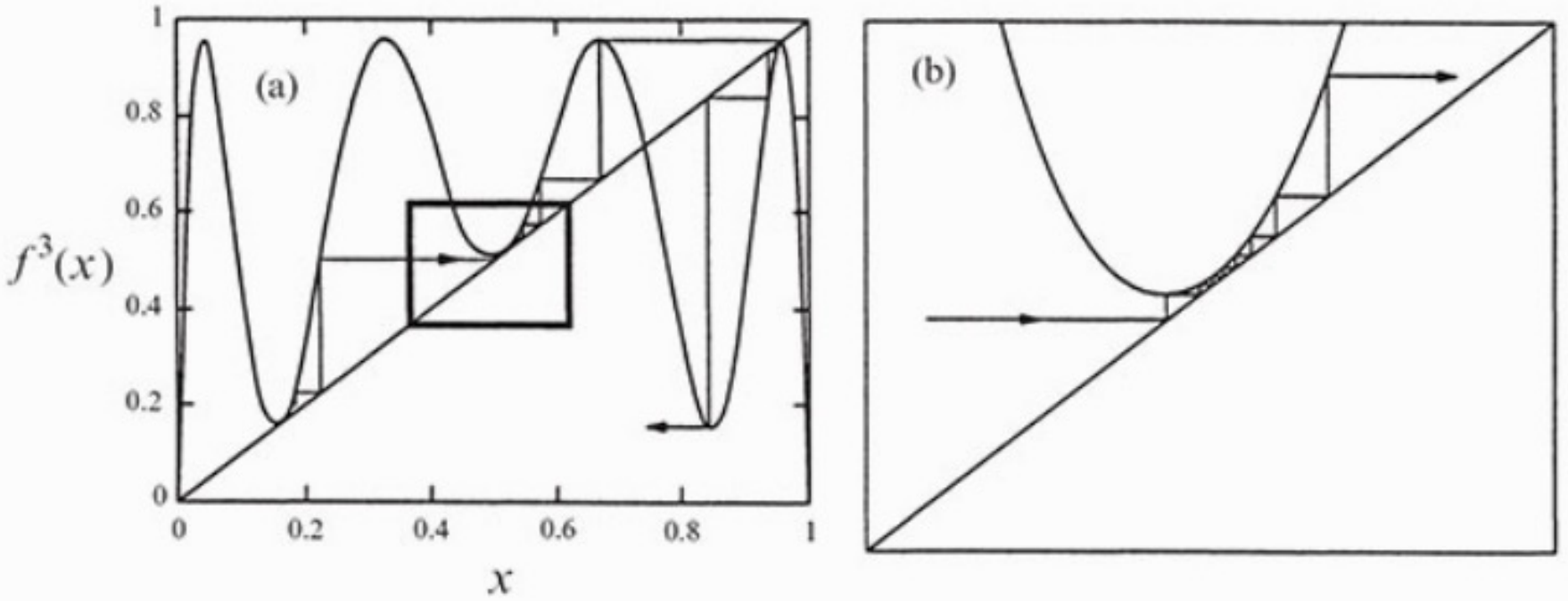

1
0.8
0.6
0.4
0.2
0
x
0
1
0.8
0.6
0.4
0.2
0
x
3.4
3.5
3.6
3.7
3.8
a
0.6
0.5
0.4
0.3
0.2
0.1
x
3.83
3.84
3.85
a
0.6
0.5
0.4
0.3
0.2
0.1
x
3.846
3.848
3.85
3.852
3.854
3.856
a


1·0
0·5
λ
0
−0·5
−1·0
3·0
3·2
3·4
3·6
3·8
4·0
a

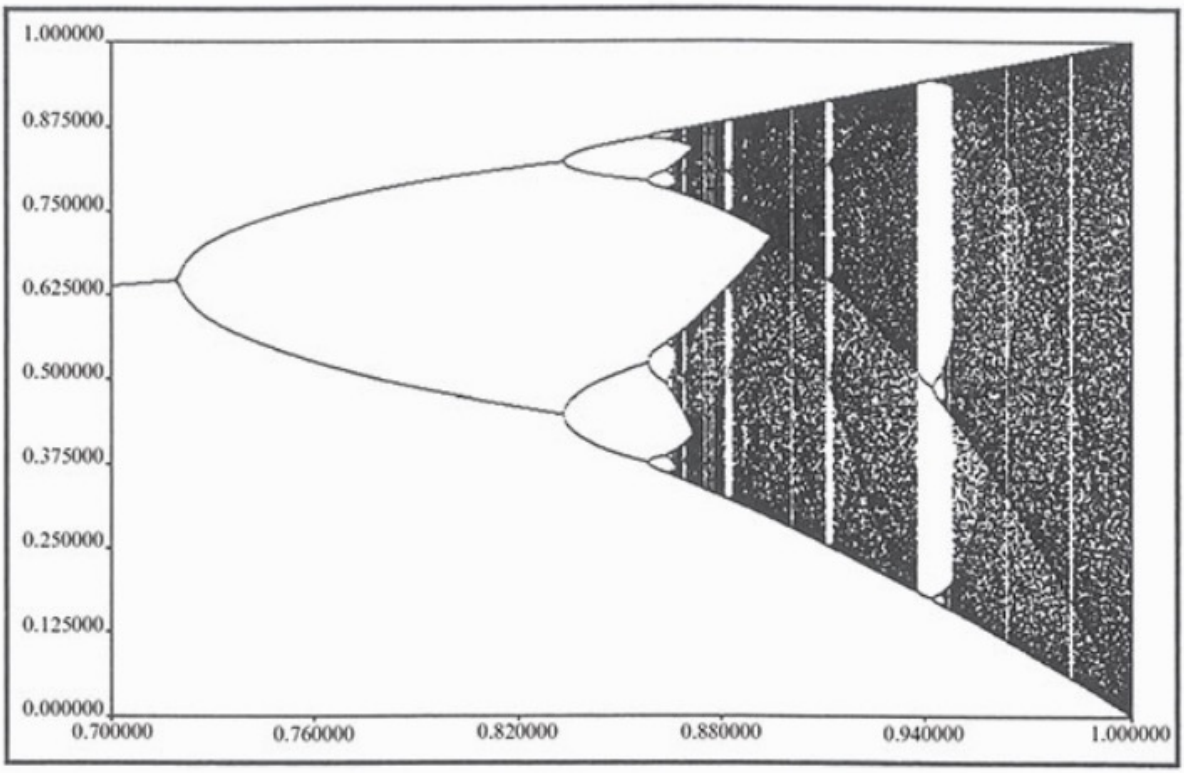


$a = 3.835$

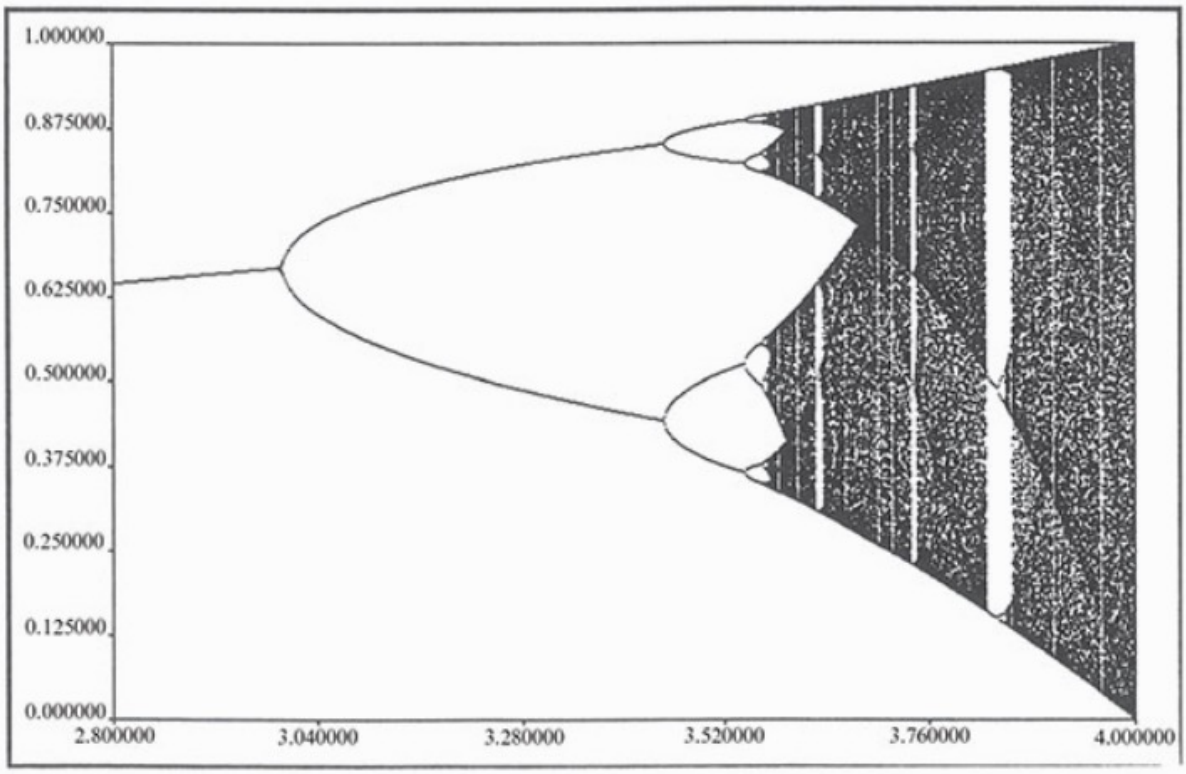

nearly
period-3
chaos
r = 3.8282
1
0
x_n
0
50
100
150
n

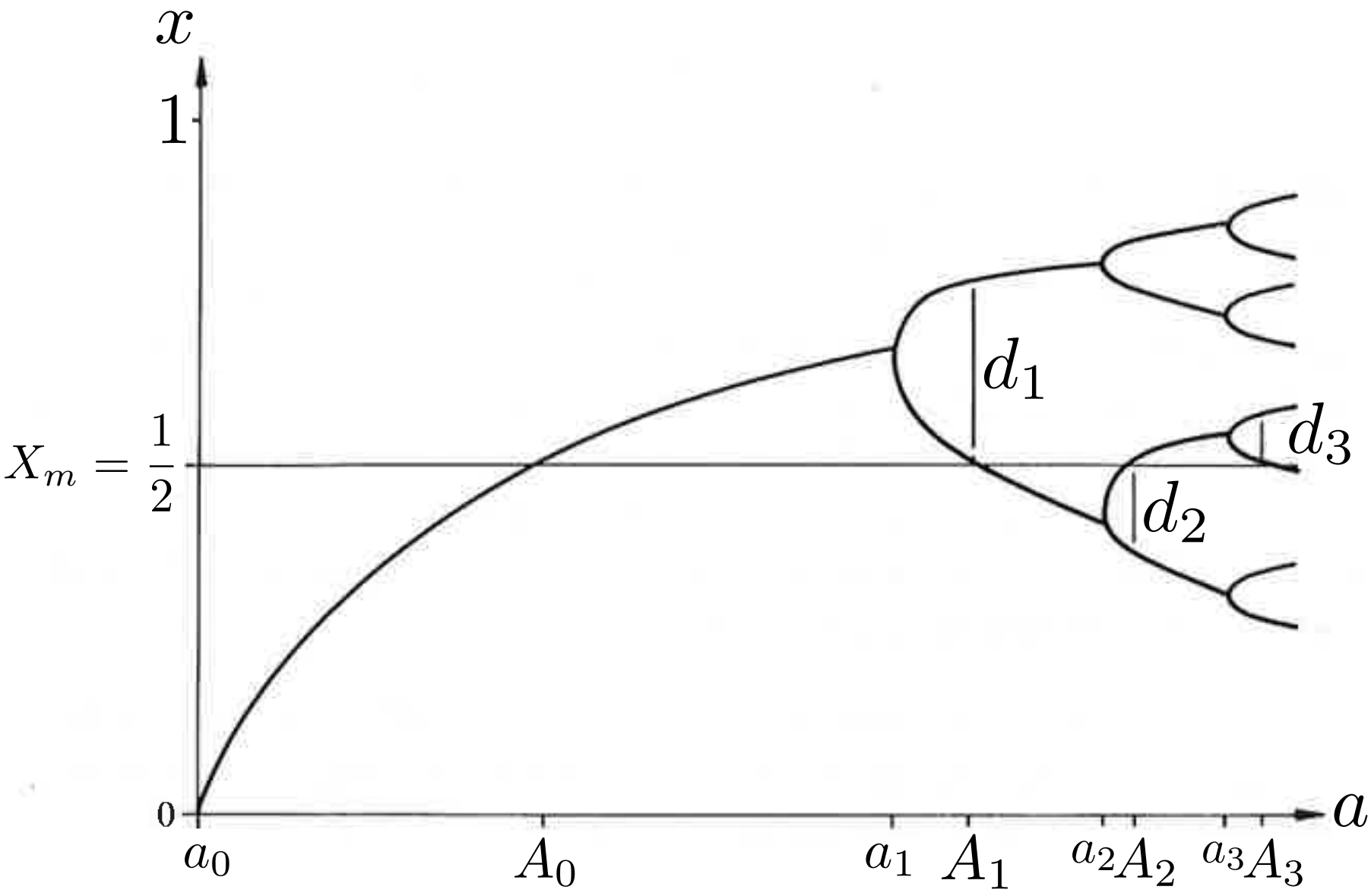

(a)
(b)
$f^3(x)$
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
x

$$x_{n+1} = a \sin(\pi x_n)$$



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




x
1
$X_m = \frac{1}{2}$
0
d_1
d_2
d_3
a
a_0
A_0
a_1
A_1
$a_2 A_2$
$a_3 A_3$