

# Introduction to Dynamical Systems and Chaos (2021)

## 8.7 Test » Unit 8 Test

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### Instructions 1

You may use any course materials, videos, websites, calculators, etc. for this test. Just don't ask another person for the answers or answers with other people. Please do not post questions about the test on the forum. If you have questions, please send them via email to [chaos@complexityexplorer.org](mailto:chaos@complexityexplorer.org). Thanks.

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### Question 2

For the Hénon map with  $a=0.88$  and  $b = 0.4$ , what do you observe is the long-term behavior of most orbits?

- The orbits approach a fixed point.
  - The orbits approach a cycle of period two.
  - The orbits approach a cycle of period four.
  - The orbits are pulled in to a strange attractor.
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### Question 3

For the Hénon map with  $a=1.2$  and  $b = 0.2$ , what do you observe is the long-term behavior of most orbits?

- The orbits approach a fixed point.
  - The orbits approach a cycle of period two.
  - The orbits approach a cycle of period four.
  - The orbits are pulled in to a strange attractor.
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### Question 4

If an orbit is pulled to a strange attractor, which of the following statements is **not** true?

- The orbit is aperiodic
  - The orbit will eventually reach a fixed point.
  - The system has sensitive dependence on initial conditions.
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### Question 5

Why are stretching and folding key geometric ingredients for chaos?

- Folding ensures that the dynamical system is deterministic and stretching makes orbits aperiodic.
  - Folding keeps orbits bounded and stretching leads to sensitive dependence on initial conditions.
  - Folding makes systems unpredictable and stretching makes a strange attractor.
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### Question 6

Consider the Lorenz equations with the following parameter values:  $\sigma = 20, \rho = 50, \beta = 2.667$ . What is the best description of the long-term behavior of the orbits? Answer this question using the program at: <http://highfellow.github.io/lorenz-attractor/attractor.html>

- The orbits are pulled toward a fixed point.
- The orbits are pulled to a periodic cycle
- The orbits are pulled to a strange attractor.

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**Question 7**

Consider the Lorenz equations with the following parameter values:  $\sigma = 20, \rho = 50, \beta = 2.667$ . Does the dynamical system have sensitive dependence on initial conditions? Answer this question using the program at: <http://highfellow.github.io/lorenz-attractor/attractor.h>

- Yes
  - No
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**Question 8**

Consider the Lorenz equations with the following parameter values:  $\sigma = 10, \rho = 25, \beta = 5$ . What is the best description of the long-term behavior of the orbits? Answer this question using the program at: <http://highfellow.github.io/lorenz-attractor/attractor.html>

- The orbits are pulled to a fixed point.
  - The orbits are pulled to a periodic cycle.
  - The orbits are pulled toward a strange attractor.
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**Question 9**

Consider the Lorenz equations with the following parameter values:  $\sigma = 10, \rho = 25, \beta = 5$ . Does this dynamical system have sensitive dependence on initial conditions? Answer this question using the program at: <http://highfellow.github.io/lorenz-attractor/attractor.h>

- Yes
- No