

Introduction to Complexity (2017)

3.8 Take Unit 3 Test » Unit 3 Test

Instructions 1

You may use any course materials, websites, Netlogo models, calculators, etc. for this test. Just don't ask another person for the answers or share your answers with other people.

Question 2

Suppose that level 0 of the Koch curve starts with a line segment of **length 10 centimeters**. What is the length of the curve at level 4 (in centimeters)?

- A. 10^4
 - B. $10 \times (4 / 3)$
 - C. $10^4 \times (4 / 3)$
 - D. $10 \times (4 / 3)^4$
 - E. $(4 / 3)^{10}$
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Question 3

Suppose that level 0 of the Cantor set starts with a line segment of **length 10 centimeters**. What is the length of the figure at level 8 (in centimeters)?

- A. $10 \times (3 / 2)^8$
 - B. $(3 / 2)^{10}$
 - C. $(2 / 3) \times 10^8$
 - D. $(2 / 3)^{10} \times 8$
 - E. $(2 / 3)^8 \times 10$
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Question 4

Consider the fractal defined in the picture below. At each level, the square is replaced by four squares, each of which has side equal to $1/3$ the length of the side at the previous level. What is the fractal (Hausdorff) dimension of this fractal?



- A. $\log 3 / \log 4$
- B. $\log (3/4)$
- C. $\log 4 / \log 3$
- D. $\log (4 / 3)^3$
- E. $\log 3^2 / \log 4^2$

Question 5

The Sierpinski "carpet" fractal is defined as follows:

Start with a black square, with side length L . At each succeeding level, replace each black square with 8 black squares, arrayed as shown below, each with side length $1/3$ of the side length at the previous level.



How many black squares are there at level 10?

- A. 8^{10}
 - B. 80
 - C. 128
 - D. 800
 - E. None of the above
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Question 6

What is the fractal (Hausdorff) dimension of the Sierpinski carpet fractal from Question 4 ?

- A. $\log 4 / \log 3$
 - B. $\log 9 / \log 3$
 - C. $\log 8 / \log 3$
 - D. $\log 64 / \log 8$
 - E. $\log 64 / \log 3$
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Question 7

Which of the following variants of the Koch curve has higher fractal (Hausdorff) dimension than the original Koch curve?

- A. A version where each line segment at level T is replaced by four line segments, each $1/4$ the size of the line segment at level T .
 - B. A version where each line segment at level T is replaced by four line segments, each $1/5$ the size of the line segment at level T .
 - C. A version where each line segment at level T is replaced by five line segments, each $1/3$ the size of the line segment at level T .
 - D. A version where each line segment at level T is replaced by 3 line segments, each $1/3$ the size of the line segment at level T , with no space between them.
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Question 8

Suppose you are calculating the box-counting dimension of a given figure. You find that the boxes obey the following relationship:

$$\log [\textit{number of boxes}] = 1.78 \log [1 / \textit{box-size}].$$

What is the box-counting dimension of this fractal?

- A. $\log 1.78$
- B. 1.78
- C. $1.78 \times \log [\textit{number of boxes}] / \log [1 / \textit{box-size}]$
- D. $1 / \log (1.78)$

Question 9

Who invented the term "fractal"?

- A. Helge von Koch
- B. Benoit Mandelbrot
- C. Waclaw Sierpinski
- D. Georg Cantor
- E. Al Gore