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Sequences and Limits Quiz Answer Key PDF

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Which sequences are examples of geometric sequences?

A. a_n = 2^n ✓

B. a_n = 3n + 1

C. a_n = 5 * 3^n ✓

D. a_n = n^2

Which methods can be used to find the limit of a sequence?

A. Direct substitution ✓

B. L'Hôpital's Rule ✓

C. Graphical analysis

D. Squeeze Theorem ✓

Explain how you would determine if a sequence is arithmetic or geometric, providing examples for each.

A sequence is arithmetic if the difference between consecutive terms is constant, such as 2, 4, 6, 8 (difference of 2). A sequence is geometric if the ratio of consecutive terms is constant, such as 3, 6, 12, 24 (ratio of 2).

Explain the difference between a convergent and a divergent sequence.

A convergent sequence is one where the terms approach a specific value (limit) as the sequence progresses, whereas a divergent sequence does not approach any limit and can either grow indefinitely or fluctuate without settling.

What is the limit of the sequence a_n = n^2 as n to infinity?

A. 0

B. 1

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C. Infinity ✓

D. Does not exist

Provide an example of a sequence that converges to a limit and explain why it converges.

The sequence a_n = 1/n converges to 0 as n approaches infinity.

How can the Squeeze Theorem be used to determine the limit of a sequence? Provide an example.

To use the Squeeze Theorem, identify two sequences that bound the sequence of interest from above and below, both converging to the same limit. For example, consider the sequence a_n = n/(n+1). We can squeeze it between 0 and 1, since 0 < n/(n+1) < 1 for all n, and both bounds converge to 1 as n approaches infinity. Thus, by the Squeeze Theorem, the limit of a_n as n approaches infinity is 1.

What is the first term of the Fibonacci sequence?

A. 0 ✓

B. 1

C. 2

D. 3

Which term represents the general term of a sequence?

A. a_0

B. a_n ✓

C. a_1

D. a_{n+1}

Which sequence converges to a limit?

A. a_n = n

B. a_n = (-1)^n

C. a_n = 1/n ✓

D. a_n = n^2

What is the limit of the sequence a_n = 1/n as n to infinity?

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A. 0 ✓

B. 1

C. Infinity

D. Does not exist

Describe the epsilon-delta definition of a limit and its significance in calculus.

The epsilon-delta definition of a limit states that a function f(x) approaches a limit L as x approaches a point c if, for every positive number ε (epsilon), there exists a positive number δ (delta) such that whenever $0 < |x - c| < δ$, it follows that $|f(x) - L| < ε$. This definition is significant because it provides a rigorous framework for understanding limits, which are fundamental to calculus.

What are possible values for the limit of a convergent sequence?

A. 0 ✓

B. 1 ✓

C. Any real number ✓

D. Infinity

Which of the following is an example of a recursive sequence?

A. $a_n = 2n + 1$

B. $a_n = 3^n$

C. $a_n = a_{n-1} + a_{n-2}$ ✓

D. $a_n = n^2$

Discuss the importance of sequences and limits in real-world applications.

The importance of sequences and limits in real-world applications lies in their ability to describe and predict behavior in systems that change over time, such as population growth, financial markets, and the convergence of algorithms in computing.

Which of the following sequences have a limit of zero?

A. $a_n = 1/n$ ✓

B. $a_n = 1/n^2$ ✓

C. $a_n = n$

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D. a_n = 1/sqrt{n} ✓

What is the common difference in the arithmetic sequence 5, 10, 15, 20, ...?

A. 2

B. 3

C. 5 ✓

D. 10

Which of the following sequences is geometric?

A. 1, 2, 3, 4, ...

B. 2, 4, 8, 16, ... ✓

C. 5, 10, 15, 20, ...

D. 1, 3, 5, 7, ...

Which of the following are characteristics of an arithmetic sequence?

A. Constant difference between terms ✓

B. Constant ratio between terms

C. Linear growth ✓

D. Exponential growth

Which sequences are divergent?

A. a_n = n ✓

B. a_n = 1/n

C. a_n = (-1)^n ✓

D. a_n = n^2 ✓

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