16 limits and continuity homework answer key

1.6 Limits and Continuity: Homework Answer Key

1. Structure:

This document provides a comprehensive answer key for the homework assignment covering section 1.6, "Limits and Continuity," from a Calculus textbook (the specific textbook will be named in the publisher section). The structure follows the order of problems presented in the original assignment. Each problem is presented with its original statement, followed by a detailed step-by-step solution, including relevant theorems, definitions, and graphical illustrations where appropriate. Solutions are presented clearly and concisely, aiming for maximum readability and understanding. Where applicable, multiple approaches to solving a problem may be presented to showcase different problem-solving techniques and reinforce understanding of the concepts. The answer key also includes clarifying notes and explanations for common errors students may make. Finally, it concludes with a summary of key concepts revisited in the homework problems.

1. Description:

This answer key serves as a valuable resource for students to check their understanding of limits and continuity. It provides not just the final answers, but detailed explanations of the reasoning and calculations involved. This allows students to identify and correct their mistakes, reinforce their learning, and gain a deeper understanding of the underlying mathematical principles. The key is designed to be both self-explanatory and comprehensive, guiding students through the problem-solving process while promoting independent learning. The level of detail is tailored to suit students enrolled in a typical first-semester Calculus course.

1. Author:

[Insert Author Name and Credentials Here]. For example: Dr. Jane Doe, PhD, Associate Professor of Mathematics, University of Example.

1. Keywords:

Calculus, Limits, Continuity, Limit Laws, One-Sided Limits, Infinite Limits, Continuity Definitions, Removable Discontinuity, Jump Discontinuity, Infinite Discontinuity, Epsilon-Delta Definition, Homework Solutions, Answer Key, Mathematical Analysis.

1. Summary:

This 1000-word answer key meticulously covers the homework problems assigned for section 1.6, "Limits and Continuity," providing detailed solutions for each problem. The solutions demonstrate a thorough understanding of the core concepts, including evaluating limits using algebraic manipulation, applying limit laws, analyzing one-sided limits, identifying types of discontinuities, and understanding the epsilon-delta definition of a limit. The answer key emphasizes a step-by-step approach, providing clarity and aiding students in identifying and rectifying their own mistakes. It serves as a powerful tool for self-assessment and reinforcement of learning, facilitating a deeper comprehension of limits and continuity within the broader context of Calculus.

1. Publisher:

[Insert Publisher Name Here]. For example: Pearson Education, Inc. The answer key is specifically designed for the homework problems within the section 1.6 of the textbook: [Insert Textbook Title and Edition Here]. For example: Calculus: Early Transcendentals, 10th Edition, by James Stewart.

1. Editor:

[Insert Editor Name and Credentials Here (Optional)]. For example: Dr. John Smith, PhD, Mathematics Editor, Pearson Education, Inc.

1. Example Problem and Solution (Illustrative - Replace with actual problems from the homework):

Problem: Evaluate the limit: lim $(x \to 2)$ $(x^2 - 4) / (x - 2)$

Solution:

We can attempt to directly substitute $x = 2$ into the expression, but this results in an indeterminate form 0/0. Therefore, we need to manipulate the expression algebraically. We can factor the numerator:

$x^2 - 4 = (x - 2)(x + 2)$

Substituting this back into the limit expression, we get:

$\lim_{x \to 2} [(x - 2)(x + 2)] / (x - 2)$

We can cancel the (x - 2) terms, provided $x \neq 2$ (which is true as we are considering the limit as x approaches 2, not x equals 2):

$\lim_{x \to 2} (x + 2)$

Now we can directly substitute x = 2:

$(2 + 2) = 4$

Therefore, the limit is 4.

Graphical Illustration: A graph of the function $f(x) = (x^2 - 4)/(x - 2)$ would show a removable discontinuity at x = 2, with the function approaching a value of 4 as x approaches 2 from both the left and the right. (Include a simple sketch here if possible)

(Note: The remaining 900+ words would be filled with similar detailed solutions for the remaining problems in the homework assignment. Each problem would require its own dedicated solution, including explanations, relevant theorems, and potentially graphical representations as needed.)

1. Conclusion:

This answer key serves as a comprehensive guide for students tackling the challenging concepts of limits and continuity. By providing detailed solutions and explanations, it fosters a deeper understanding of the underlying principles and equips students with the skills to successfully navigate more complex problems in calculus. Regular review of these solutions, coupled with practice problems, will solidify their grasp of these foundational calculus concepts.

Decoding the Mysteries: 1.6 Limits and Continuity Homework Answer Key – A Comprehensive Guide

Meta Description: Struggling with your 1.6 Limits and Continuity homework? This comprehensive guide provides detailed explanations, solved problems, and crucial tips to master this challenging calculus topic. Get the answers and understand the concepts!

Keywords: 1.6 limits and continuity, limits and continuity homework, calculus limits and continuity, limits and continuity problems, limit definition, continuity definition, epsilon delta definition, removable discontinuity, jump discontinuity, infinite discontinuity, limits and continuity answer key, calculus homework help, 1.6 limits and continuity solutions, solving limits problems, understanding continuity

Introduction: Navigating the Realm of Limits and Continuity

Calculus, a cornerstone of higher mathematics, often presents students with significant hurdles. Among these, the concepts of limits and continuity can be particularly challenging. Section 1.6 (or a similarly numbered section depending on your textbook) frequently focuses on these crucial topics, introducing definitions, theorems, and problem-solving techniques that require a strong grasp of foundational algebraic and analytical skills. This guide serves as a comprehensive resource to help you understand and solve problems related to 1.6 Limits and Continuity, providing a detailed explanation of key concepts and offering solutions to common homework problems. Remember, merely obtaining the "answer key" isn't sufficient; understanding the why behind each step is crucial for true mastery.

Understanding the Fundamentals: Limits

Before diving into specific homework problems, let's solidify our understanding of the core concept of a limit. Informally, the limit of a function f(x) as x approaches a value 'c' (written as lim (x→c) f(x)) represents the value that f(x) approaches as x gets arbitrarily close to 'c', regardless of whether f(c) is defined.

Key Aspects of Limits:

One-sided limits: Limits can be approached from the left (lim ($x \to c^-$) f(x)) or the right (lim ($x \to c^+$) f(x)). For a limit to exist, both one-sided limits must exist and be equal.
Infinite limits: A limit can be infinite (lim (x→c) f(x) = ∞ or lim (x→c) f(x) = -∞), indicating that the function's value grows without bound as x approaches 'c'.
Limit Laws: These are algebraic rules that allow us to manipulate limits of sums, differences, products, quotients, and compositions of functions. Understanding and applying these laws is paramount for problem-solving.
Epsilon-Delta Definition: This rigorous definition formalizes the intuitive notion of a limit, providing a precise mathematical framework. While challenging, understanding this definition is crucial for a deep understanding of limits.

Understanding the Fundamentals: Continuity

Continuity, closely tied to limits, describes the "smoothness" of a function. A function f(x) is continuous at a point 'c' if three conditions are met:

1. f(c) is defined: The function has a value at 'c'.
2. lim (x→c) f(x) exists: The limit of the function as x approaches 'c' exists.
3. lim (x→c) f(x) = f(c): The limit equals the function's value at 'c'.

If a function is not continuous at a point, it has a discontinuity at that point. Discontinuities are categorized into three main types:

Removable discontinuity: This occurs when the limit exists but is not equal to the function's value at the point (or the function is undefined at the point). Often, these can be "removed" by redefining the function at that point.
Jump discontinuity: This occurs when the one-sided limits exist but are not equal. The function "jumps" at this point.
Infinite discontinuity: This occurs when the limit is infinite (either $+\infty$ or $-\infty$). The function approaches infinity or negative infinity at this point.

Solved Problems: Examples from 1.6 Limits and Continuity Homework

Let's tackle some typical problems you might encounter in your 1.6 homework. Remember, these examples are meant to illustrate the application of the concepts, not to provide a complete answer key for every possible problem in your assignment. Always refer to your textbook and lecture notes for further clarification.

Problem 1: Evaluate lim $(x \to 2)$ $(x^2 - 4) / (x - 2)$.

Solution: We can factor the numerator: $(x^2 - 4) = (x - 2)(x + 2)$. This allows us to simplify the expression to $(x + 2)$. Therefore, lim $(x \to 2)$ $(x + 2) = 4$. This illustrates the importance of algebraic manipulation in evaluating limits.

Problem 2: Determine if the function $f(x) = \{ x^2 \text{ if } x \leq 1, 2x \text{ if } x > 1 \}$ is continuous at $x = 1$.

Solution: We need to check the three conditions for continuity. $f(1) = 1^2$. The left-hand limit is lim $(x \to 1^-)$ $x^2 = 1$, and the right-hand limit is lim $(x \to 1^+)$ $2x = 2$. Since the left and right limits are not equal, the limit does not exist, and the function is discontinuous at $x = 1$ (specifically, a jump discontinuity).

Problem 3: Find the value of 'k' that makes the function $f(x) = \{ (x^2 - 9) / (x - 3) \text{ if } x \neq 3, k \text{ if } x = 3 \}$ continuous at $x = 3$.

Solution: For the function to be continuous at $x = 3$, we need lim $(x \to 3)$ $f(x) = f(3) = k$. Simplifying $(x^2 - 9) / (x - 3)$ to $(x + 3)$, we find the limit as x approaches 3 is 6. Therefore, k must equal 6 for continuity.

Problem 4 (Epsilon-Delta): Prove lim $(x \to 2)$ $(3x - 1) = 5$ using the epsilon-delta definition.

Solution: This requires demonstrating that for any $\varepsilon > 0$, there exists a $\delta > 0$ such that if $0 < |x - 2| < \delta$, then $|(3x - 1) - 5| < \varepsilon$. Through algebraic manipulation of $|(3x - 1) - 5|$, we can find a suitable δ in terms of ε, completing the proof. This is a more advanced concept requiring a thorough understanding of the epsilon-delta definition.

Conclusion: Mastering Limits and Continuity

Understanding limits and continuity is fundamental to your success in calculus. While the initial learning curve can be steep, consistent practice and a focus on understanding the underlying concepts are key to mastery. Remember to consult your textbook, lecture notes, and seek help from your instructor or peers when facing difficulties. This guide offers a starting point; continued study and problem-solving will solidify your understanding and prepare you for more advanced calculus topics. Don't just aim for the "answer key"— strive for a comprehensive understanding of the "why" behind each solution. This approach will lead to a much stronger foundation in calculus and beyond.

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