



Intro to Calculus - Unit B - Limits and Continuity

Unit Focus

Students are introduced to the concept of a limit. Different representations will provide students with a deep understanding of limits. Simple computations of limits are introduced. Students will understand continuity of its' implications. Formative assessments for each section can be done as pairs. The teacher can decide whether assessments are given as open note or not.

For all written exercises, students must give a specific justification for any answer. Notation used must be correct. For example:

$$\lim_{x \rightarrow 3} \frac{x^2 - 4x + 3}{x - 3} = \lim_{x \rightarrow 3} \frac{(x-3)(x-1)}{x-3} = \lim_{x \rightarrow 3} (x-1) = 2 \quad \text{or} \quad \lim_{x \rightarrow 3} \left[\frac{x^2 - 4x + 3}{x - 3} = \frac{(x-3)(x-1)}{x-3} = x - 1 \right] = 2 \quad \text{not} \quad \lim_{x \rightarrow 3} \frac{x^2 - 4x + 3}{x - 3} = \frac{(x-3)(x-1)}{x-3} = x - 1 = 2$$

Prerequisite skills to review:

- toolkit graphs
- rational, absolute value functions
- radical functions
- domain restrictions
- factoring polynomials

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Common Core Mathematics: 9-12 • Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (CCSS.MATH.CONTENT.HSF.IF.B.6) • Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1) • Construct viable arguments and critique the reasoning of others. (CCSS.MATH.MP.3) • Model with mathematics. (CCSS.MATH.MP.4) • Attend to precision. (CCSS.MATH.MP.6) • Look for and make use of structure. (CCSS.MATH.MP.7)	<i>Students will be able to independently use their learning to...</i> T1 represent and interpret patterns in numbers, data and objects. T2 demonstrate fluency with math facts, computation and concepts.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Mathematicians flexibly use different tools, strategies, and operations to build conceptual knowledge or solve problems. U2 Mathematicians identify relevant tools, strategies, relationships, and/or information in order to draw conclusions. U3 Mathematicians represent and analyze mathematical situations and structures using algebraic symbols to communicate thinking.	<i>Students will keep considering...</i> Q1 How do I interpret this mathematical model? Q2 What math tools/models/ strategies can I use to solve the problem? Q3 How can understanding a pattern help me?

Stage 1: Desired Results - Key Understandings

Madison Public Schools Profile of a Graduate	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) - Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)	<i>Students will know...</i> K1 the addition, subtraction, multiplication, division and constant factor rules for limit computation K2 the three conditions to guarantee continuity K3 the relationship between the $\lim_{x \rightarrow \infty} f(x)$ and any horizontal asymptote on the graph of $y = f(x)$ K4 Vocabulary: one sided limit, undefined limit, continuity, discontinuity, open and closed intervals, delta, epsilon	<i>Students will be skilled at...</i> S1 determining a limit visually from a graph S2 determining whether a limit exists or not by graphing or by a table on a calculator S3 sketching a reasonable image of a graph given a point and limit information about the graph S4 computing limits using graphs, algebraic manipulation or direct substitution S5 computing limits at different points in the domain of a piecewise function S6 determining continuity and discontinuity and prove using definition S7 given a graph, determine intervals of continuity and/or point(s) of discontinuity S8 given an equation, finding any point(s) of discontinuity and tell whether they are removable or not S9 using intermediate value theorem to prove existence of zeros in a closed interval S10 determining limits involving infinity on rational and exponential functions S11 determining all asymptotes of rational functions S12 proving limits using the formal definition of a limit (in terms of delta and epsilon) (simple problems to stress concept over computation)