# Unit 3: Limits and Continuity

Content Area: **Mathematics**
Course(s): **Pre-Calculus Honors**
Time Period: **March**
Length: **8 Weeks**
Status: **Published**

## Unit Overview

During this unit, students will…

- Determine limits using tables and graphs.
- Determine one and two-sided limits.
- Determine limits using algebraic properties.
- Use limits to determine continuity.

BLITZER- Chapter 11

## Transfer

Students will be able to independently use their learning to...

- Determine limits for a variety of functions.
- Recognize mastering of limits is the foundation of derivatives and calculus.

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For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

## Meaning

## Understandings

Students will understand that...

- Accuracy when graphing functions and making tables is important for evaluating limits and continuity.
- Limits can be found using a variety of methods.
- Limits as x goes to infinity and rules for horizontal asymptotes are directly related to the graph of functions.

- The understanding of limits are necessary to determine continuity of a function.

## Essential Questions

Students will keep considering...

- Why is a good fountation of limits essential to preparing me for calculus?
- How will the skills I have learned help me explain real-world occurances?
- How can sketching accurate graphs of functions be helpful in solving limits and checking for contunuity?

## Application of Knowledge and Skill

## Students will know...

Students will know...

- That limits are used to explain tangent and secant lines relationship.
- Limits exist even if a function is undefined at a specific point.
- Continuity refers to the graph of a function and the relationship between limits and ordered pairs.

## Students will be skilled at...

Students will be skilled at...

- Determining limits for a variety of functions.
- Using limit notation for one and two sided limits.
- Using graphs, tables and algebraic properties to evaluate limits.

## Academic Vocabulary

limit

one-sided limit

limit notation

infinity

substitution

factoring

rationalize the denominator and/or numerator

piecewise functions

continuity

discontinuous

continuous

defined point

undefined point

## Learning Goal 3.1

SWBAT determine limits using various methods based on their knowledge of its definition.

## Target 3.1.1 (Limit Definition)

SWBAT define and describe a limit by investigating the following:

- Determine limits using graphs and tables. **(DOK 2)**
- Determine the relationship between one and two-sided limits. **(DOK 2)**

**Section 11.1**

| | |
|---|---|
| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.K-12.3 | Construct viable arguments and critique the reasoning of others. |
| MA.F-IF.B.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. |
| MA.K-12.5 | Use appropriate tools strategically. |

| | |
|---|---|
| MA.F-IF.C.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. |
| MA.K-12.8 | Look for and express regularity in repeated reasoning. |

## Target 3.1.2 (Limits found algebraically)

SWBAT...

- Determine limits using limit properties. **(DOK 2)**
- Determine limits using algebraic properties including direct substitution, factoring methods, and rationalization. **(DOK 2)**

**Section 11.1-11.2**

| | |
|---|---|
| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.F-IF.A.1 | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$. The graph of $f$ is the graph of the equation $y = f(x)$. |
| MA.F-IF.A.2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. |
| MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. |
| MA.K-12.3 | Construct viable arguments and critique the reasoning of others. |
| MA.K-12.5 | Use appropriate tools strategically. |
| MA.F-IF.C.7d | Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. |
| MA.A-APR.D | Rewrite rational expressions |
| MA.A-REI.B.4b | Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$. |

## Learning Goal 3.2

SWBAT use the definition of a limit to determine the continuity of a function at a specified value.

## Target 3.2.1 Continuity of Functions

SWBAT

- Define continuity. **(DOK 1)**
- Determine a function's continuity at a specific value graphically and algebraically. **(DOK 2)**

## Section 11.3

| | |
|---|---|
| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.K-12.2 | Reason abstractly and quantitatively. |
| MA.F-IF.A.1 | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$. The graph of $f$ is the graph of the equation $y = f(x)$. |
| MA.F-IF.A.2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. |
| MA.K-12.3 | Construct viable arguments and critique the reasoning of others. |
| MA.F-IF.B.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. |
| MA.K-12.5 | Use appropriate tools strategically. |
| MA.K-12.6 | Attend to precision. |

## Formative Assessment and Performance Opportunities

- academic games
- Class discussions
- Classwork
- Do nows
- Exit tickets
- Homework
- Problem based learning
- student interviews
- Teacher observation
- whiteboard/communicator opportunities

## Summative Assessment

- Link It Exams
- Projects
- Quizzes
- student interviews
- Tests
- Unit Exam

## 21st Century Life and Careers

| | |
|---|---|
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP2.1 | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation. |
| CRP.K-12.CRP3 | Attend to personal health and financial well-being. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP10 | Plan education and career paths aligned to personal goals. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CRP.K-12.CRP12 | Work productively in teams while using cultural global competence. |
| CAEP.9.2.12.C | Career Preparation |
| CAEP.9.2.12.C.3 | Identify transferable career skills and design alternate career plans. |

## Technology

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|---|---|
| TECH.8.1.12.C | Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. |
| TECH.8.1.12.D | Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. |
| TECH.8.1.12.D.CS1 | Advocate and practice safe, legal, and responsible use of information and technology. |
| TECH.8.1.12.D.CS2 | Demonstrate personal responsibility for lifelong learning. |
| TECH.8.1.12.E | Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information. |
| TECH.8.1.12.E.1 | Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources. |
| TECH.8.1.12.E.CS1 | Plan strategies to guide inquiry. |
| TECH.8.1.12.E.CS4 | Process data and report results. |
| TECH.8.2.12.A.CS2 | The core concepts of technology. |

## Accommodations and Modifications

- 504 Accommodations
- centers/stations
- challenge questions
- IEP Modifications
- Individual vs. Large Group Wipeboard Q & A
- manipulatives (highlighting, underlining, starring critical information)
- projects

- Provide YouTube Videos (calc phobe tutorials)
- scaffolding questions
- small group instruction (opportunity to work with teacher 1-on-1)
- use of technology such as google classroom to provide answer keys

## Unit Resources

- Google Classroom
- Kuta software
- NCTM website
- online textbook materials
- Text
- You Tube & Internet Videos

## Interdisciplinary Connections

The concept and process of a limit explains the fluid motion behind watching a film or a movie. By making the value of what the limit is approaching smaller and smaller, it allows for individual slides or pictures to move faster and faster. Therefore, the human eye is unable to see the pauses between the slides and sees a movie as one fluid entity. (MA.9-12.F-IF.B.4)

| | |
|---|---|
| TECH.8.1.12.E | Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information. |
| TECH.8.1.12.E.CS3 | Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. |
| TECH.8.2.12.A | The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live. |