

# Math 112, sections 001-006

## Winter Semester 2019

### MWF 10:00-10:50 AM, JKB 3108

**Instructor Information:** Paul Jenkins, 282 TMCB, 801-422-5868, [jenkins@math.byu.edu](mailto:jenkins@math.byu.edu)  
**Office Hours:** 3:00-3:50 MWF, 282 TMCB

#### **TA Information:**

Sections 1-3: Joshua Linnell, 388 TMCB, 801-422-1205, [josh\\_linnell@mathematics.byu.edu](mailto:josh_linnell@mathematics.byu.edu)

Section 1 8-8:50 TTh, Section 2 9-9:50 TTh, Section 3 10-10:50 TTh, 104 TMCB

Office hours: 1:00-2:30 TTh, 388 TMCB

Sections 4-6: Michael Carroll, 163A TMCB, 801-422-8039, [m.a.carroll@mathematics.byu.edu](mailto:m.a.carroll@mathematics.byu.edu)

Section 4 12-12:50 TTh, Section 5 1-1:50 TTh, Section 6 2-2:50 TTh, 104 TMCB

Office hours: 1:00-1:50 MWF, 163A TMCB

#### **Texts & Materials**

Information about purchasing the electronic textbook and the online homework program, WebAssign, is available at BYU's myBookList at <https://booklist.byu.edu/>. DO NOT PURCHASE these materials through another source; if you do so you may end up paying for the materials twice. The textbook for this course is an integrated e-textbook; there is no physical book to purchase. The retail price for the course material has been negotiated by the department and is priced well below the national retail price.

You should be able to access the digital textbook directly through a link found in WebAssign, the online homework system (see the section Homework Assignments). Please note that there is NO physical book to purchase. You may purchase a physical version of the book if you want to, but you do not have to.

#### **Course Description**

Calculus is the foundation for most of the mathematics studied at the university level. The mastery of calculus requires well-developed skills, clear conceptual understanding, and the ability to model phenomena in a variety of settings. Math 112, Calculus 1, develops the concepts of limit, derivative, and integral, and is fundamental for many fields of mathematics, science, and engineering.

#### **GE Certification Area**

This course is designed to fulfill the **Quantitative Reasoning requirement** of the Aims of a BYU Education which refers to: "Quantitative Reasoning—numerical abilities that equip students with the capacity to understand and explain the world in quantitative terms; to interpret numerical data; and to evaluate arguments that rely on quantitative information and approaches" (Aims, "Intellectually Enlarging").

#### **Quantitative Reasoning Learning Outcomes**

1. The course should improve critical thinking and problem solving, especially as these apply to quantitative analysis.
2. The course should prepare students to identify and intelligently face problems they encounter later in life that require quantitative reasoning.

#### **Prerequisites**

Students are expected to know the material in Math 110 and 111 or the equivalent. This includes College Algebra and Trigonometry, but could also be satisfied with a good course in Precalculus. Students will also be required to take a pretest in order to exhibit competency in these areas.

#### **Diagnostic test in Webassign (required to move to chapter 2 homework)**

Successful completion of Math 112 requires a solid background in both College Algebra and Trigonometry. In Webassign you will find a **Math 112 Diagnostic Test** that you must complete during the time that the class is going through the Chapter 1 review material. You must pass this Diagnostic Test with an 80% or better in order to move past Chapter 1 and access the Chapter 2 homework. You can attempt the test as many times as you want. If you have difficulty with a certain part of the Diagnostic Test, you should carefully review the corresponding section in Chapter 1 (or the Trigonometry section in Appendix D).

If you cannot achieve a score of 80% or higher on the Diagnostic Test then you may not have the necessary skills to succeed in Calculus at this time. Talk to your instructor about making plans to better prepare yourself to take Calculus another semester. You can switch from 112 to either Math 110 or Math 111 by the 12<sup>th</sup> school day of the semester. Talk to your instructor about how to do so.

## Preparation time

The expectation for undergraduate courses is three hours of work per week per credit hour for the average student who is appropriately prepared; much more time may be required to achieve excellence. These three hours may include one hour in-class and two hours out-of-class per credit, which adds up to 12 hours per week for math 112. A minimal time commitment is likely to lead to an average grade; more time may be required to completely master the content.

## Homework Assignments

Assignments will be due Mondays, Wednesdays, and Fridays. The assignments can be found in the accompanying homework schedule spreadsheet. Late homework will not be accepted. The lowest three online and lowest three written homework scores will not be figured into your final grade, which is meant to accommodate for illness or other disruptions to your regular schedule that might prevent you from turning an assignment in on time. Each assignment consists of two parts: (1) online and (2) written, which will be turned in separately.

**Online homework** will be done through WebAssign which can be accessed by going to the WebAssign homepage (<https://www.webassign.net>) and then entering in your Class Key, which is "byu 6358 4478".

The online portion of the homework is typically due at 2 AM the class day after the section is covered, so material covered Monday will be due at 2 AM on Wednesday, material covered Wednesday will be due at 2 AM on Friday, and material covered Friday will be due at 2 AM on Monday.

**Written assignments** will generally be collected at the beginning of each lecture. Assignments are due the next class period after they are assigned. Homework that is not stapled, is excessively sloppy, or is written on paper torn from a spiral notebook may receive less than full credit. Solutions should be clearly labeled and in order. The style of your written solutions should be very much like that of a textbook example; they should contain enough explanation that one of your classmates would be able to easily understand what you have done. Generally, it is NOT adequate to merely write down a final answer.

You are strongly encouraged to study together and work together on homework assignments. However, you each must submit your own assignment. Everything you turn in should be in your own words, and you should thoroughly understand everything you write down or submit to the computer.

## Math 112 Learning Outcomes

### Differential and integral calculus

This course is designed for students majoring in the mathematical and physical sciences, engineering, or mathematics education and for students minoring in mathematics or mathematics education. Calculus is the foundation for most of the mathematics studied at the university level. The mastery of calculus requires well-developed skills, clear conceptual understanding, and the ability to model phenomena in a variety of settings. Calculus 1 develops the concepts of limit, derivative, and integral, and is fundamental for many fields of mathematics. This course contributes to all the expected learning outcomes of the Mathematics BS. For more detailed information, visit the Math 112 Wiki page.

**Limits.** Students will:

- Develop informal meanings for the limit concept.
- Compute limits (or determine non-existence) of functions described algebraically and graphically.

**Derivatives.** Students will:

- Know the limit definition of the derivative and interpret it as slope and rate of change.
- Use various differentiation rules to compute derivatives.

**Definite and Indefinite Integrals.** Students will:

- Know the limit-Riemann-sum definition of the integral and interpret it as area under a curve, accumulation, and net change.
- Use geometry, the fundamental theorem of calculus, and u-substitution to compute integrals.

**Applications.** Students will use derivatives and integrals to solve common real-world problems, including:

- Optimization, related rates, approximation, and curve sketching for derivatives.
- Net change and area problems for integrals.

## Grading Policies

Your final grade will be determined as follows:

Homework: 30% (15% online, 15% written)  
 Participation and in-class activities/quizzes: 5%  
 2 Midterm Exams: 40%  
 Final exam: 25%

## Common final exam

A common final exam is given to all students in all sections of Math 112. Please note that it WILL NOT BE at the regularly scheduled BYU final exam time for this class; instead, a single time will be scheduled for all 112 sections. The date and time of the final exam will be given later in the semester, once the University Registrar's office has scheduled it. Having a common final exam for all sections at the same time allows the Mathematics Department to assign grades fairly. The percentile ranking of each student relative to all students in all sections will be computed based on the final exam scores. Using this information the Calculus Committee will compute an average grade distribution for each section. It is department policy that the average grade for each section should match its average grade on the common final exam. No calculators, books, or notes will be permitted during the final exam.

## BYU Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

## Preventing Sexual Discrimination and Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU's policy against sexual harassment extends not only to employees of the university, but to students as well. If you encounter unlawful sexual harassment or gender-based discrimination, please talk to your professor, contact the Equal Employment Office at 422-5895 or 367-5689 (24 hours), or contact the Honor Code Office at 422-2847.

## Students with Disabilities

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by the UAC.

Lecture Date	Section(s)	Topic	Online hmwk*	Written Textbook hmwk**
<b>*Online homework due by 2 AM the next lecture day after it is covered in class</b>				
<b>**Written homework due at the beginning of the next class period after it is covered in class</b>				
Week 1	1.1-1.3	Functions	1.1-1.3	<u>1.1</u> : 3, 17, 21, 45, 55, 72; <u>1.2</u> : 3, 4; <u>1.3</u> : 2, 7, 14, 36
Jan 7-11	Appx D	Trigonometry	Appx D	24, 27, 37, 46, 53, 73, 79
	1.4	Exponential Functions	1.4	3, 4, 11, 12, 19, 21, 23, 24, 25
Week 2	1.5	Inverses and Logarithmic Functions	1.5	18, 48, 49, 71, 75
Jan 14-18	2.1-2.2	Tangents and velocity, limits	2.1-2.2	<u>2.1</u> : 2, 5; <u>2.2</u> : 6, 9, 16, 35, 38, 44a, 49, 54
	2.3p1	Calculating Limits	2.3a	10, 17, 20, 21, 25, 26, 32
Week 3	<b>HOLIDAY, NO CLASS ON MONDAY</b>			
Jan 22-25	2.3p2	Limits (+informal $\epsilon$ - $\delta$ )	2.3b	38, 39, 41, 44, 59, 60, 62
	2.5p1	Continuity	2.5a	4, 6, 8, 18, 21, 24
Week 4	2.5p2	Continuity (cont)	2.5b	27, 35, 42, 45, 55, 57
Jan 28-Feb1	2.6	Limits at Infinity and Asymptotes	2.6	5, 7, 10, 13, 24, 37, 49, 58
	2.7	Derivatives and Rate of Change	2.7	3ab, 7, 12, 17, 20, 21, 23, 24
Week 5	2.7-2.8	Derivatives, Derivative Function	2.7-2.8	<u>2.7</u> : 37, 53, 54; <u>2.8</u> : 3, 5, 6, 11
Feb 4-8	2.8	The Derivative as a Function	2.8	22, 27, 44, 51
	3.1	Deriv. of Polys and Exponentials	3.1	4, 11, 16, 23, 26, 59, 65, 78, 83
Week 6	3.2	The Product and Quotient Rules	3.2	2, 11, 23, 24, 32, 42, 49, 51, 61
Feb 11-15	<b>Wednesday: Review for exam 1, Sections 1.1-3.2</b>			
<b>Exam 1 (1.1-3.2): Feb 13-16, Late Day Feb 19. BYU Testing Center (hours vary by day)</b>				
	3.3	Derivatives of Trig. Functions	3.3	9, 10, 18, 20, 35, 42, 45, 51
Week 7	3.4	The Chain Rule	3.4	15, 19, 27, 37, 41, 47, 63, 65, 94
Feb 19-22	3.5	Implicit Differentiation	3.5	3, 15, 21, 25, 35, 53, 55, 63
(TUE=MON)	3.6	Derivatives of Log Functions	3.6	7, 16, 24, 27, 33, 40, 46, 47, 53
Week 8	3.7	Rates of Change in Sciences	3.7	1abcdg, 5, 23ab, 30
Feb25-Mar1	3.9	Related Rates	3.9	22, 28, 29, 39, 41
	4.1	Maximum and Minimum Values	4.1	3, 7, 9, 10, 11, 13, 35, 37, 57, 60, 76, 78
Week 9	4.2	The Mean Value Theorem	4.2	3, 15, 18, 19, 31, 37
Mar 4-8	4.3p1	Concavity and Inflection Points	4.3a	1, 6, 7, 68

	<b>4.3p2</b>	Graphing, 1st/2nd Derivative Tests	<b>4.3b</b>	21, 23, 27, 30, 36
Week 10	<b>4.4</b>	L'Hopital's Rule	<b>4.4</b>	4, 13, 19, 43, 46, 59
Mar 11-14	<b>4.5</b>	Curve Sketching	<b>4.5</b>	5, 9, 17, 34, 42
	<b>SPRING BREAK, NO CLASS ON FRIDAY</b>			
Week 11	<b>4.7p1</b>	Optimization Problems	<b>4.7a</b>	12, 13, 22, 44(in terms of $\mu$ ), 59
Mar 18-22	<b>4.7p2</b>	Optimization Problems, cont	<b>4.7b</b>	16, 17, 51, 81a
	<b>Friday: Review for exam 2, Sections 3.3-4.7</b>			
<b>Exam 2 (3.3-4.7): Mar 22-26, Late Day Mar 27. BYU Testing Center (hours vary by day)</b>				
Week 12	<b>4.8</b>	Newton's Method	<b>4.8</b>	1, 2, 3, 11, 13
Mar 25-29	<b>4.9</b>	Antiderivatives	<b>4.9</b>	12, 15, 17, 28, 34, 41, 51, 53, 55, 69, 71
	<b>5.1/5.2</b>	Intro to the Definite Integral	<b>5.1/5.2</b>	<b>5.1:</b> 1a, 14, 23, 25 <b>5.2:</b> 5ab, 17, 29, 73
Week 13	<b>Appx E</b>	Sigma Notation	<b>Appx E</b>	5, 10, 13, 20, 23, 30, 35, 41cd, 43
Apr 1-5	<b>5.2</b>	The Definite Integral	<b>5.2b</b>	33, 37, 43, 47, 49, 50, 51, 52, 69
	<b>5.3p1</b>	Fundamental Thm of Calculus	<b>5.3a</b>	1, 3, 9, 12, 15, 54, 55, 73
Week 14	<b>5.3p2</b>	Fundamental Thm of Calculus, cont	<b>5.3b</b>	22, 29, 31, 43, 66, 69, 74
Apr 8-12	<b>5.4</b>	Net change, Indefinite Integrals	<b>5.4</b>	6, 8, 16, 35, 45, 53, 54, 57, 58, 61
	<b>5.5</b>	The Substitution Rule	<b>5.5</b>	9, 15, 18, 25, 47, 59, 67, 70, 79
Week 15	<b>Review for Final Exam</b>			
Apr 15-17	<b>Review for Final Exam</b>			
<b>CUMULATIVE FINAL EXAM: DATE/TIME TBA</b>				