**Prerequisite:** Algebra

**Text:** Calculus (Early Transcendentals), Eighth Edition, by James Stewart, Cengage, ISBN 978-1-285-74155-0.

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| HOURS  | TOPICS | SECTION  | HOMEWORK |
| **2-2**  | Real Numbers, Sets, Inequalities, Absolute Value  | Appendix A  | 1-29\*, 47-55\* |
| **1-3**  | Coordinate Geometry and Lines  | Appendix B  | 1-9\*, 21-27\*, 43-51\* |
| **1-4**  | Trigonometry  | Appendix D  | 1-15\* |
| **1-5**  | Four Ways to Represent a Function  | 1.1  | 3-9\*, 27-35\* |
| **1-6**  | Essential Elementary FunctionsNew Functions from Old  | 1.21.3  | 1,21-5\*, 9-21, 33-41\* |
| **1-7** | Exponentials | 1.4 | 1,2,17-21 |
| **1-8**  | Inverse Functions and Logarithms  | 1.5  | 21-26,39-46,61-62 |
| **1-9**  | Limit Concept; Limit Calculation Laws  | 2.1-2.3  | 2.3: 1-31\* |
| **1-10**  | Continuity  | 2.5  | None |
| **1-11**  | Limits at Infinity; Horizontal Asymptotes  | 2.6  | 15-29\* |
| **1-12**  | Derivatives and Rates of Change  | 2.7  | None |
| **1-13**  | Derivatives as Functions  | 2.8  | 21-29\* |
| **1-14**  | Derivatives of Polynomials and Exponential Functions  | 3.1  | 3-41\* |
| **1-15**  | Product and Quotient Rules  | 3.2  | 3-35\* |
| **1-16**  | Derivatives of Trigonometric Functions  | 3.3  | 1-21\*,27,29 |
| **2-18**  | The Chain Rule  | 3.4  | 7-45\* |
| **1-19**  | Implicit Differentiation  | 3.5  | 5-15\*,25,27 |
| **1-20**  | Logarithmic Differentiation  | 3.6  | 3-25\*,45-49\* |
| **2-22**  | Related Rates  | 3.9  | 1-19\* |
| **2-24**  | Linear Approximations; Differentials; Error Estimation  | 3.10  | 1-4,15-18,23-26\* |
| **0-24**  | Derivatives of Hyperbolic Functions  | 3.11  | None |
| **1-25**  | Maximum and Minimum Values | 4.1 | 29-43\*,51-59\* |
| **1-26** | Optimization Problems  | 4.7  | 1,3,9,11,12,15,21,23 |
| **1-27** | Mean Value Theorem | 4.2 | 5-13 |
| **1-28**  | Indeterminate Forms and L'Hospital's Rule  | 4.4  | 9-27\* |
| **1-29**  | Anti-derivatives  | 4.9  | 1-17\*,27-33\* |
| **1-30**  | Areas and Distances  | 5.1  | None |
| **1-31**  | The Definite Integral  | 5.2  | None |
| **1-32** | The Fundamental Theorem of Calculus  | 5.3  | 9-35\* |
| **1-33**  | Indefinite Integrals and Net Change Theorem  | 5.4  | 5-15\*,27-35\* |
| **2-35**  | The Substitution Rule (Change of Variable)  | 5.5  | 7-33\*,59-65\* |
| **2-37**  | Integration by Parts  | 7.1  | 1-17\* |
| **1-38**  | How Derivatives Affect Graph Shapes  | 4.3  | 9-21\* |
| **1-39**  | Newton's Method  | 4.8  | None |
| **6-45** | Reviews, Exams, Holidays |  |  |

\* Do odd numbered problems in this range.

## Course Objectives

Upon completion of this course, the student should have the following skills.

### Functions and limits

* Use real numbers, inequalities involving real numbers and their absolute values, the trigonometric functions, and the radian measure of angles.
* Be able to move back and forth between the descriptions of a function by an equation, a table, a graph, and by words.
* Be able to use exponential functions, sketch their graphs, and define the number e.
* Define what it means for a function to be one-to-one and determine whether a function has an inverse or not and sketch its inverse if it does.
* Be able to use logarithmic functions, sketch their graphs, and define the relationship between the natural exponential and natural logarithmic functions.
* State in words what it means for a function to have a limit, be able to calculate limits, and be able to find the vertical and horizontal asymptotes of a function.
* State in words what it means for a function to be continuous and be able to find limits for continuous functions.

### Derivatives

* Relate the notions of tangent to a curve, velocity, and rate of change, and illustrate them in a sketch.
* State the definition of derivative as the limit of a difference quotient and explain how the derivative itself can be regarded as a function.
* Be able to find derivatives of polynomials and exponential functions.
* State the product and quotient rules for differentiation and be able to use them to differentiate functions.
* Know the derivatives of sine and cosine and be able to use the quotient rule to determine the derivatives of the remaining four trigonometric functions.
* State the chain rule and use it to differentiate functions obtained by composition.
* Use the differentiation rules to differentiate implicitly, and to find higher order derivatives.
* Be able to differentiate logarithmic functions, and functions involving them.
* Define the hyperbolic functions and be able to differentiate them.

### Applications of Differentiation

* Be able to solve related rates problems. Understand them as an application of the chain rule.
* Understand the connection between the derivative, the tangent line to the graph of a function, the linearization of a function, and the differential of a function.
* Use the differential (or linearization) to solve “small change” and applied approximation problems.
* Be able to state the Mean Value Theorem and give some of its consequences.
* Describe how the signs of the first and second derivatives of a function affect the shape of its graph.
* Define and recognize the various forms of indeterminate forms, and use L’Hospital’s Rule to determine their limits.
* Be able to set up and solve optimization problems using calculus methods.
* Be able to describe Newton’s method geometrically, and to use it to iteratively approximate the zeros of functions.
* Define what the antiderivative of a function is and be able to find it for reasonable functions.

### Integral Calculus

* Describe the connection between the problems of finding areas and distances travelled, and how both problems lead to the same limit.
* Know and be able to work with the properties of definite integrals.
* State the Fundamental Theorem of Calculus in words, describe how it connects integral and differential calculus, and how it helps in finding antiderivatives and in evaluating definite integrals.
* Define the indefinite integral of a function and state its relation to the antiderivative.
* Be able to use the Substitution Rule to evaluate definite and indefinite integrals.
* Be able to use integration by parts to evaluate appropriate integrals.