
Calculus 1 Problem Descriptions

Module L: How can approximations lead to exact answers? The idea of limits.

- L1: Difference Quotient.** Compute a difference quotient for a given function and describe the meaning of a difference quotient.
- L2: Approaching a point.** Fill in a table of values to guess the value of a limit at a point or the instantaneous rate of change at a point.
- L3: Definitions and Meaning.** Describe what the limit notation represents and the ways a limit may not exist. Can also include the definition of continuity at a point and the types of discontinuities.
- L4: Graphical limits.** Determine limits of a function and where it is continuous or differentiable given its graph.
- L5: Examples.** Sketch an example graph that has given limit values or continuity restrictions.

Module D: How do we calculate instantaneous rate of change?

- D1: Definition and Meaning.** Write the formula definition of derivative, describe what the derivative represents and the ways a derivative may not exist.
- D2: Prove a Derivative by Definition.** Compute a derivative using the formula definition of derivative.
- D3: Graphical Derivatives.** Read information from a graph of a given function or derivative function. May include values of the derivative, inflection points, increasing/decreasing, extreme points, and critical numbers.
- D4: Sketching the Derivative Graph.** Sketch a graph of the derivative function given the graph of the original function.
- D5: Derivatives of Elementary Functions.** Compute derivatives of elementary functions. May include power, sum and constant multiple rules. Use the derivative to determine intervals of increasing/decreasing or concave up/concave down.
- D6: Chain Rule.** Compute derivatives of a composition of functions using the chain rule.
- D7: Product/Quotient Rules.** Compute derivatives of a product and quotient of functions using the product and quotient rules.
- D8: Derivative Rules.** Compute the derivative of a given function using multiple derivative rules.
- D9: Interpreting Derivatives.** Use given values of the first and second derivatives at a point to determine critical numbers, increasing/decreasing, concave up and concave down.

Module S: What are some important applications of derivatives?

- S1: Modeling.** Sketch a graph that models a given situation. Describe where the model is increasing and decreasing, concave up and concave down.
- S2: Tangent Lines.** Find an equation of the tangent line to a differentiable function at a point and use the line to estimate a nearby function value.
- S3: Optimization with One Variable.** Apply the techniques of optimization to solve a word problem involving one independent variable.
- S4: Optimization in Economics.** Apply the techniques of optimization to solve a word problem involving functions for demand, price per unit, cost, revenue, or profit.
- S5: Optimization with Two Variables.** Apply the techniques of optimization to solve a word problem involving two independent variables and a constraint equation.
- S6: Related Rates.** Solve a word problem involving related rates.

S7: L'Hopital's Rule Identify limits in indeterminate form and apply L'Hopital's rule correctly.

Module C: How do we compute area? The meaning of area.

C1: Antiderivatives. Write the antiderivative of given functions.

C2: Areas under Graphs. Interpret areas under a graph and calculate the exact area using geometry.

C3: Fundamental Theorem of Calculus. Use the fundamental theorem of calculus to compute definite integrals.