

Math 115

Review Sheet for the Final Exam

The final exam will be cumulative, so any of the topics we have discussed during the term could appear on it. However, there will be some emphasis on the material covered since the last uniform exam. The derivatives of inverse trigonometric functions and inverse hyperbolic functions will not be tested on the final.

In addition to the other suggestions for studying for the tests mentioned at the Math 115 website, you should also read the “key concept” pages at the beginning of each chapter. If any of the concepts are a bit hazy to you, then you should restudy the sections that contain that material.

Be sure that the RSUMS program is in your calculator when you bring it to the final, and that you know how to use it.

General Topics and Skills

- You should understand the Rule of Four and know how to apply it to communicate your mathematical thoughts algebraically, graphically, numerically, and in good English written in complete sentences.
- You should understand what a function is, and know how to work with functions algebraically, graphically, and numerically. You should be able to describe the meaning of a function in English, and work with a function that is described to you in English. You should know the various families of functions covered in this course, as well as their uses.
- You should understand the concept of a rate of change, and know the difference between average and instantaneous rates of change. You should be able to compute rates of change of functions described by formulas, graphs, or tables. You should know how to represent rates of change graphically as the slopes of tangent lines.
- You should be familiar with derivatives, and understand that they measure instantaneous rates of change. You should understand the information contained in the signs of the first and second derivatives. You should be able to compute derivatives given by formulas, and estimate derivatives from graphs and tables. You should also be able to explain the practical meaning and applications of derivatives.
- You should understand left-hand and right-hand sums, and be able to represent them graphically, compute them from a table, and use your calculator to compute them when given a formula. You should know their uses and practical applications, and when they over- or underestimate a quantity.
- You should understand the information that the signs of the first and second derivatives give you.
- You should understand the concept of an integral and how it arises as a limit of Riemann sums. You should know what integrals can be used to represent or compute, and you should be able to explain the practical meaning of an integral.
- You should understand and be able to explain the Fundamental Theorem of Calculus and how it relates the two key concepts in calculus, integrals and derivatives.

- You should understand the difference between an approximate answer and an exact answer, and know which methods give which.

Specific Topics and Skills by Section

In addition to the topics and skills that were covered by the first two exams, you should have also mastered the following topics and skills for the final exam.

- 3.1 You should understand how to use left- and right-hand sums to determine distance traveled, given information about an object's speed. You should understand and be able to explain when such sums are over- or underestimates and how accurate they are. You should know how to represent distance traveled as an area on a velocity graph.
- 3.2 You should understand the concept of a definite integral. You should know how to estimate a definite integral of a function that is defined by a table, graph, or formula, and for formulas be able to compute left- and right-hand sums with a calculator program. You need to be able to know how accurate estimates of integrals with left- and right-hand sums are, and be able to explain why.
- 3.3 You should understand when integrals are positive or negative, and how they are related to areas and average values. You should be able to use integrals to compute the areas of various regions, such as the area between the graphs of two functions, and you should be able to use integrals to compute average values. You should understand what units (for example, feet or gallons) a solution computed with a definite integral should have.
- 3.4 You should understand and be able to explain how the Fundamental Theorem of Calculus relates integrals and derivatives, and what the theorem says in practical terms. You should understand that the definite integral of a rate of change represents a "total change." You should understand the properties of sums and constant multiples of integrals. You should understand and be able to apply the results about comparisons of integrals.
- 5.3 You should be familiar with the terms *global maximum* and *global minimum*. You should know that the global maxima and minima of continuous functions defined on a closed interval occur either at critical points or at endpoints. In many cases, you should be able to find the global maxima and minima, if any, of a function defined on an open interval.
- 5.4 You should understand how ideas from calculus can be applied to economics. You should be familiar with, be able to compute, and be able to explain the following concepts from economics: revenue, cost, profit, marginal revenue, marginal cost, marginal profit, and average cost.
- 5.5 You should be able to solve optimization problems. In particular, you should be able to find equations that model real-world situations, and then know how to use calculus or your calculator (depending on the situation and the instructions for the exercise) to find an optimal solution.
- 5.6 You should be familiar with the identities and derivative formulas for the hyperbolic sine, hyperbolic cosine, and hyperbolic tangent functions.