

Math 115 Review Sheet for Exam I

All of the material covered in Chapter 1 and Appendix A of the text is fair game for the exam, whether or not it happens to be mentioned in this review sheet. However, this sheet does cover the main topics and skills tested by the exam, so be sure you understand and can do everything mentioned here.

General Topics and Skills

- Be aware of the Rule of Four: You should be able to communicate your mathematical thoughts
 1. numerically, for example by using tables;
 2. graphically;
 3. algebraically, by using formulas; and
 4. in everyday English using complete sentences.

Given mathematical information expressed in any one of these four ways, you should be able to re-express it in any of the others.

- You should understand what a function is and how one is used.
- You should know the basic building block functions: linear, exponential, polynomial, rational, logarithmic, and trigonometric. You need to know what types of real-world problems these different types of functions are used to model.

Specific Topics and Skills by Section

- 1.1 You should understand the concept of a function. You should know the meaning of the terms *domain* and *range* and know how to find domains and ranges. You should know what the phrases *is proportional to* and *is inversely proportional to* mean, and how they translate into formulas and graphs.
- 1.2 You should know how to check to see if a function is linear if it is given in any of the Rule of Four forms, and you should be able to find and work with equations for lines.
- 1.3 You should know how to check if a function is exponential if it is given in any of the Rule of Four forms. You should be able to find formulas for exponential functions if you know two points on the graph, or if you know one point on the graph and you know the growth or decay rate. You should know the difference between exponential growth and decay, and you should know how to recognize the difference by looking at a formula, graph, or table. You should know what is meant by concavity.
- 1.4 You should know what power functions are and how they differ from exponential functions. You should know which functions grow faster than other functions in the long run. With the help of your calculator, you should be able to draw a complete graph of a function, knowing the essential features of such a

graph without the aid of your calculator so that you are not misled by using too small or too large a viewing window.

- 1.5 You should understand what it means for a function to be invertible, and how to check a function to see if it has this property. You should be able to find function inverses algebraically, numerically, and graphically. You should be able to describe the practical meaning of the inverse of a function in plain English, and be able to apply this meaning to real-world problems.
 - 1.6 You should be able to manipulate logarithms algebraically, knowing the laws of logarithms so thoroughly that you will not make any of the common mistakes (such as believing incorrectly, for example, that $\log(15 + x) = \log 15 + \log x$).
 - 1.7 You should know how to work with the number e and with natural logarithms. You should be able to convert exponential equations from a^t to e^{kt} form and *vice versa*. You should know the difference between continuous (that is, e^{kt}) and annual (that is, $(1 + r)^t$) growth rates, and how to convert between them.
 - 1.8 You should understand how to take the sum and difference of two functions algebraically, graphically, and numerically. You should be comfortable working with shifts and stretches algebraically, graphically, and numerically. You should understand what is meant by the composition of two functions, and how to find such a composition algebraically, graphically, and numerically. You should know what odd and even functions are.
 - 1.9 You should know what is meant by a periodic function and a trigonometric function. You should understand how trigonometric functions are used to model some periodic natural phenomena. You should know the meaning of amplitude and period and how to find these quantities. You should be able to find formulas for trigonometric functions from graphs, descriptions, and tables. This test will not require you to be familiar with inverse trigonometric functions, but you will be expected to know about them later in the term.
 - 1.10 You should know what a polynomial is. You should know how to find possible equations for polynomials if you know the roots and the behavior as $x \rightarrow \pm\infty$. You should know how the degree and leading coefficient affect the behavior as $x \rightarrow \pm\infty$, and you should know how many direction changes the graph of a polynomial can have. You should know what a rational function is, how to find horizontal and vertical asymptotes, and how to graph a rational function with help from your calculator and without being misled by some limitations calculators have when graphing rational functions.
 - 1.11 You should know how to tell by looking at a graph whether a function is continuous. You should be able to give examples of functions that are not continuous.
- App. A You should be able to use your calculator to find numerical approximations to roots of equations to any desired degree of accuracy.