MATH 242
REVIEW GUIDE
SECTIONS 1.1-1.8

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Instructions: The following is an outline of the major topics and skills from Chapter 1 that will covered on the exam. It is meant to be an overview and is not comprehensive. Material that is not explicitly listed on this guide is eligible for inclusion on the exam.

1.1 Four Ways to Represent a Function
- a) Four Ways:
  - (i) Verbally (description in words)
  - (ii) Numerically (table of values)
  - (iii) Visually (using a graph)
  - (iv) Algebraically (with a formula)
- b) Vertical Line Test to determine if something is a function
- c) Symmetry: Odd and Even Functions
- d) Determine if a function is Increasing or Decreasing on parts of its domain

1.2 Catalog of Essential Functions
- a) Be familiar with the basic properties (domain, range, etc) of the following types of functions:
  - (i) Polynomial functions
  - (ii) Rational functions
  - (iii) Algebraic functions (these are the ones that are hard to classify)
  - (iv) Trigonometric functions

1.3 New Functions from Old Functions
- a) Review the transformation rules covered in this section
  - (i) Vertical and Horizontal shifts
  - (ii) Vertical and Horizontal stretching/shrinking
  - (iii) Reflections about the x- and y-axes
- b) Be able to make quick and fairly accurate sketches of the functions from Section 1.2

1.4 Tangent and Velocity Problems
- a) Use a table of values to estimate the slope of the tangent line to a curve at a point
- b) Use a formula to estimate the slope of the tangent line to a curve at a point

1.5 Limit of a Function
- a) Be familiar with limit notation
- b) Determine the limit of a function defined by a graph
- c) Be able to determine one-sided limits
- d) Be able to determine two-sided limits (one-sided limits must exist and agree)

1.6 Calculating Limits Using Limit Laws
- a) Compute limits using the limit laws found on page 62 of the textbook
- b) Find the limit of a function, justifying each step with one of those laws
- c) Understand the Direct Substitution Property to compute limits for Polynomial and Rational Functions

1.7 The Precise Definition of a Limit
   a) Prove that $\lim_{x \to a} f(x) = L$ using the ϵ-δ definition of a limit

11.8 Power Series
   a) A function is continuous at a point a if $\lim_{x \to a} f(x) = f(a)$
   b) Use this property to evaluate limits of continuous functions
   c) Use the Intermediate Value Theorem to show that a function has a root in an interval (a, b)

Here are some examples of problems to expect to be on the exam. These aren't all of the possible problems, but some definite things you should be prepared for.

1. True or false questions from the chapter 1 review in the textbook. For these questions, you will be asked to determine if each is true or false and to given an explanation if true and a reason why or counter example if false.
2. Be prepared to answer questions about a function defined by a graph, such as identifying its value at a particular point, its domain, range, where it is increasing or decreasing and if it is continuous
3. Evaluate the limits of a function defined by a graph
4. Find the following limits:
   a) $\lim_{x \to 0} \cos(x + \sin(x))$
   b) $\lim_{h \to 0} \dfrac{(h-1)^3 + 1}{h}$
   c) $\lim_{t \to 2} \dfrac{t^2 - 4}{t^3 - 8}$
   d) $\lim_{s \to 4^+} \dfrac{4 - s}{|4 - s|}$
5. Use the precise (ϵ-δ) definition of a limit to prove that
$$\lim_{x \to 2} (14 - 5x) = 4$$
6. Use the Intermediate Value Theorem to prove that there is a root of the equation $x^5 - x^3 + 3x - 5 = 0$ in the interval $(1, 2)$.

Good Luck!