

MA 113 CALCULUS I, SPRING 2014
WRITTEN ASSIGNMENT #2
Due 31 January 2014 at the beginning of lecture.

Instructions: The purpose of this assignment is to develop your ability to formulate and communicate mathematical arguments. Your complete assignment should have your name and section number on each page, be stapled, and be neat and legible. *Unreadable work will receive no credit.*

You should provide well-written, complete answers to each of the questions. We will look for correct mathematical arguments, careful explanations, and correct use of English. Your solution should be formulated in complete sentences. As appropriate, you may want to include diagrams or equations written out on a separate line. Your textbook provides examples of how we communicate mathematics.

Students are encouraged to use word-processing software to produce high quality solutions. However, you may find that it is simpler to add graphs and equations using pen or pencil.

1. (5 points) Magic dust is an unusual substance in that its mass increases over time. If we begin with one kilogram of magic dust at time $t = 0$, the mass after t hours is $M(t) = e^t$.
 - (a) Find the average rate of change of magic dust on the time intervals $[0, 0.1]$, $[-0.02, 0]$ and $[0, 0.0005]$. Use this information to guess the instantaneous rate of change at time $t = 0$.
 - (b) What are the units for the rate of change you found in part a)?
 - (c) Consider a line with equation $y = ct + d$. Find c and d so that the line passes through the point $(0, M(0))$ and the slope of the line is the instantaneous rate of change you found in part a). Graph this line and the function $M(t)$ on the same axes. What is the relation between the graph of $M(t)$ and the line?
2. (5 points) Consider the function $f(x) = \sin(\pi/x)$.
 - (a) Compute the values of $f(0.1)$, $f(-0.02)$, $f(0.005)$ and $f(-0.00025)$.
 - (b) Do you think the limit $\lim_{x \rightarrow 0} \sin(\pi/x)$ exists? If the limit exists, guess the value of the limit.
 - (c) Sketch the graph of f . Does this graph support your answer to part b)?