

Math 29: Homework 1

Due Wednesday, April 5

In this homework, do not invoke Church's thesis. That is, your descriptions of recursive functions should clearly be of recursive functions. It is not enough to simply describe an "algorithm" informally then say "therefore it is recursive". (We will allow this for the most part in subsequent work.)

Please review the rules regarding homework on the course website.

All exercises refer to our textbook.

1. (a preliminary) Let $f(x)$ and $g(x)$ be differentiable functions. Give differentiable functions $h(x)$ and $k(x)$ such that:
 - (a) $h(x) = 0$ if and only if one (or both) of $f(x)$ or $g(x)$ is 0.
 - (b) $k(x) = 0$ if and only if both $f(x)$ and $g(x)$ are 0.
2. (exponentiation is recursive) Exercise 2.1.5
3. (sg and $\overline{\text{sg}}$ are recursive) Exercise 2.1.9
4. Give an expression for $\min(m, n)$ that shows the function is primitive recursive.
5. (finite sets are recursive) Exercise 2.2.11
6. (a proof about recursive relations) Exercise 2.2.13
7. (constant functions, sg and $\overline{\text{sg}}$ are URM-computable) Exercise 2.3.4
8. (reading a flowchart) Exercise 2.3.6
9. (two more arithmetical URM-computable functions) Exercise 2.3.7