

## Math 361: Real Analysis 2

### Assignment # 1

Note in this homework set I might say give **a** definition of a concept instead of “the”. The reason for this is that concepts can often be defined in several equivalent ways. So your Real Analysis I classes may have given different definitions. As we go on and the definitions are from this class I will say “the” definition since I will want you to give the one we gave in class.

1. Give a definition of a set  $U \subseteq \mathbb{R}$  being a **closed** set.
2. Let  $X, Y$  be sets with  $A \subseteq X$ , and  $f : X \rightarrow Y$  a function. Define the set  $f(A)$ .
3. Let  $X, Y$  be sets with  $A, B \subseteq X$ , and  $f : X \rightarrow Y$  a function. Show that if  $A \subseteq B$  then  $f(A) \subseteq f(B)$ .
4. Let  $X \subseteq \mathbb{R}$  and  $f : X \rightarrow \mathbb{R}$ . Give a definition of  $f$  being continuous.
5. We say that  $I \subseteq \mathbb{R}$  is an interval if for all  $a, b \in I$  with  $a < b$ ,  $[a, b] \subseteq I$ . Suppose that  $X \subseteq \mathbb{R}$ ,  $f : X \rightarrow \mathbb{R}$  is continuous, and  $I \subseteq X$  is an interval. Show  $f(I)$  is an interval. (Hint: Use one of the big Theorems in Real I. Unless I say prove from the definition or you are doing a piece of the proof of the theorem you can always use the theorems from class. That is why we prove them!)