1. For the following problems, write formulas when giving your examples. (If you are having trouble finding a formula, try to at least sketch a graph.)

   (a) (2 points) Give an example of a function that is not one-to-one.

   (b) (2 points) Give an example of two functions \( f(x) \) and \( g(x) \) with the following three properties:

   - (i) \( \lim_{x \to \infty} f(x) = +\infty \)
   - (ii) \( \lim_{x \to \infty} g(x) = +\infty \)
   - (iii) \( \lim_{x \to \infty} \frac{f(x)}{g(x)} = 2 \)

   (c) (2 points) Give an example of a function \( f(x) \) such that both \( \lim_{x \to \infty} f(x) = +\infty \) and \( \lim_{x \to -\infty} f(x) = +\infty \).

2. (4 points) Find the values of \( c \) (if any) for which the following function is continuous.

\[
f(x) = \begin{cases} 
x^2 & |x| \leq 1 \\
cx & |x| > 1 
\end{cases}
\]

3. (4 points) Let \( f(x) \) be the function defined by:

\[
f(x) = 2 - x^2
\]

Find a number \( \delta \) so that the following statement is true:

\[
|x| < \delta \quad \text{implies} \quad |f(x) - 2| < \frac{1}{100}
\]

4. (3 points each) Calculate the following limits:

   (i) \( \lim_{x \to 1} \frac{x^3 - 1}{x^2 - 1} \)

   (ii) \( \lim_{x \to +\infty} \frac{1 - x^3}{x^2 + 1} \)

5. (5 points) If \( f(x) \) is a function, the derivative of \( f \) at a point \( a \) is defined as:

\[
f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}
\]

Use the definition to calculate \( f'(1) \) where \( f(x) = x^2 \). (I don’t want you to use any differentiation rules even if you happen to know them already.)