1) Let \( f(x) = \begin{cases} 
  x - 1 & x < 2 \\
  a & x = 2 \\
  ax^2 + b & x > 2 
\end{cases} \)
For which \( a \) and \( b \) is \( f \) continuous at 2?

2) Suppose that \( f \) is continuous on \([0,1]\) and \( f(0) = f(1) \). Show that there is \( c \in [0,1/2] \) such that \( f(c) = f(c + 1/2) \).

3) Show that \( \sin(x) = x - 1 \) has a solution. You don’t have to find it; just demonstrate that a solution exists.

4) In each of the two parts below you are given a function \( f \) defined for all \( x \neq 0 \). You must decide if there is another function, \( F \), defined for all \( x \) such that (i) \( F \) is continuous (on all of the real line) and (ii) \( F(x) = f(x) \) for all \( x \neq 0 \).

   i) \( f(x) = \frac{\sin x}{x} \);

   ii) \( f(x) = \frac{|x|}{x} \).