Attention! Please, note that this is the closed book test. You are not allowed to use graphing calculator. Simple calculators are allowed. Please, show all important steps in you solution but do not make your solution excessively long.

1. Find the domain of the following functions
   a) (4pt)
   \[ f(x) = \frac{1}{x}. \]

   b) (4pt)
   \[ f(x) = \frac{1}{\sqrt{1 - x}}. \]

   c) (7pt)
   \[ f(x) = \frac{1}{\sqrt{1 - x^2}}. \]
2. (20pt) Prove by $\varepsilon-\delta$ argument that

$$\lim_{x \to 1} (x^2 + 4x) = 5.$$
3. Evaluate the following limits
   a) (5pt) \[ \lim_{x \to \pi} \cos(x)x \]
   
   b) (5pt) \[ \lim_{x \to 0} \cot(x)x \]
   
   c) (5pt) \[ \lim_{x \to 0} \left( \frac{1}{\sin x} - \frac{1}{\tan x} \right) \]
4. The piece-wise function is given

\[ f(x) = \begin{cases} 
  x^2 - 2, & x < -1 \\
  x, & -1 < x < 0 \\
  \sin(1/x), & 0 < x < 1/\pi 
\end{cases} \]

a) (7pt) List all points where the function is discontinuous (not continuous)

b) (7pt) Is it possible define a value of \( f(x) \) at \( x = 1 \) in such a way to make it continuous on the interval \((-2, 0)\). Explain your answer.

b) (6pt) Is it possible define a value of \( f(x) \) at \( x = 1 \) and at \( x = 0 \) in such a way to make it continuous on the interval \((-2, 1/\pi)\). Explain your answer.
5. Find limits at infinity or indicate why the limit does not exist.

a) (5pt)
\[ \lim_{x \to \infty} \frac{\sqrt{x^2 - 2x - 1} - 1}{x} \]

b) (10pt)
\[ \lim_{x \to -\infty} (\sqrt{x^2 - 2x - 1} - \sqrt{x^2 - 7x + 3}) \]
6. Find infinite limits
   a) (5pt) \[
   \lim_{x \to 0^+} \frac{1}{\sin(x)}
   \]

   b) (5pt) \[
   \lim_{x \to (\pi/2)^+} \frac{1}{\cos(x)}
   \]

   c) (5pt) \[
   \lim_{x \to \infty} \frac{1}{\sin(1/x)}
   \]