Instructions: The purpose of this assignment is to develop your ability to formulate and communicate mathematical arguments.

Please write a short essay in response to each of the following questions, following the standard rules for grammar and editing. You should provide well-written, complete answers to each of the questions. It is strongly recommended that you use word processing software (such as Microsoft Word or Libre Office) for this assignment, with hand-drawn graphs and pictures.

When using mathematical symbols in your essay, either use them as part of complete sentences or display them separately from your paragraphs. Your textbook is a good model for this type of writing.

Your complete assignment should:

• have your name and section number on each page,
• be stapled, and
• be neat and legible.

Unreadable work will receive no credit.

Question A: Let function $f$ be defined by

$$f(x) = \begin{cases} 
x + 3 & \text{for } x \leq -1, \\
x^2 & \text{for } -1 < x \leq 1, \\
-x^2 + 2x + 2 & \text{for } x > 1.
\end{cases}$$

i) Compute the right- and left-hand limits at $x = -1$ and at $x = 1$; ii) determine whether $f$ is left-continuous, right-continuous or continuous at $x = -1$ and at $x = 1$; iii) sketch the graph of $f$.

Question B: Let $m$ and $n$ be two positive integers. Evaluate the following limit (algebraically)

$$\lim_{x \to 1} \frac{x^m - 1}{x^n - 1}.$$

Question C: Let $f(x) = x^2 - 2x$. Determine a domain on which $f^{-1}$ exists and find a formula for $f^{-1}$ for this domain of $f$. 