Lab Objectives: To understand the definition, graph and applications of the absolute value function

Description of Lab:

The formal definition of absolute value is given as

\[ |x| = \begin{cases} 
  x & x \geq 0 \\
  -x & x < 0 
\end{cases} \]

Part A: Understanding the definition
1. Rewrite the definition for \(|a|\).
2. Find the absolute value of the following numbers: 3, 0, 1 – 5, and 5 – 29.
3. Rewrite the definition for |x – 3|
4. Evaluate |x – 3| for x = 13 and for x = 2
5. Using your own words, describe how this definition is different than 'taking away the minus sign'

Part B: Graphing absolute value
6. Graph the lines \(y = x\) and \(y = -x\) on separate plots with the same scale. Be sure to label your graphs
7. On a different plot than number 6 do the following: Restrict the domain of \(y = x\) to include positive values only \((x \geq 0)\) and restrict the domain of \(y = -x\) to include negative values only \((x < 0)\).
8. Explain how this picture (from number 7) represents the graph of \(|x|\)

Part C: Applications
9. Absolute value is used to describe distance between two points on a number line. For example, the distance between \(a\) and \(b\) can be found as \(|a – b|\).
   a) How is this true?
   b) What are our conditions on \(a\) and \(b\)? Can they be integer, whole, fractions, negative, positive?
   c) Why do we use absolute value (why it is not just \(a – b\))?
   d) Give 3 examples of distance between points, and show it is true by the model of a number line
10. Absolute value is also used when taking \(\sqrt{x^2}\)
   a) Show that \(\sqrt{x^2} = |x|\) for \(x = 0, 2,\) and \(-2\)
   b) Explain why it is not sufficient to say that \(\sqrt{x^2} = x\)

Requirements:
1. Cover page with: title of lab, date and names of each group member
2. Answer each question (1 – 10) in order and in entirety