2.2 Absolute Value Functions

- **The Absolute Value** of a real number \( x \) is given by

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

- **Properties of Absolute Values:** Let \( a, b \) and \( x \) be real numbers and let \( n \) be an integer. Then

  - \( |ab| = |a| \cdot |b| \)
  - \( |a^n| = |a|^n \) whenever \( a^n \) is defined
  - \( \frac{|a|}{|b|}, \) provided \( b \neq 0 \)

- **Equality Properties** Suppose \( x, y \) and \( c \) are real numbers.

  - \( |x| = 0 \) if and only if \( x = 0 \).
  - For \( c > 0 \), \( |x| = c \) if and only if \( x = c \) or \( x = -c \).
  - For \( c < 0 \), \( |x| = c \) has no solution.
  - \( |x| = |y| \) if and only if \( x = y \) or \( x = -y \)

1. Solve the following equalities:
   
   (a) \(|x^2 - 1| = 3\)
   (b) \(8 + |7x - 3| = 4\)
   (c) \(x + |7x - 3| = 4\)
   (d) \(|4x - 1| = |3 - 2x|\)
   (e) *(Optional)* \(|2x| + 1 = x^2\)

2. Graph the following functions (using whichever is appropriate: Transformations from 1.7 or by correctly writing them as piecewise functions and graphing that way)

   (a) \(y = |2x - 3|\)
   (b) \(y = 2x + |x - 2|\)
   (c) *(optional)* \(y = |x - 4| + |x|\)