1. **Increasing and Decreasing Functions:** Now that we know what a function is and what a graph is, we’d like to be able to describe them. Look at this graph.

   ![Graph](image)

   If you were describing this to your friend over the phone, what might you say? You might say something like:

   It goes down from \( x = -\infty \) to \( x = -3 \), then up from \( x = -3 \) to \( x = -1 \), then down from \( x = -1 \) to \( x = 3 \), then up from \( x = 3 \) to \( x = 5 \).

   But rather than saying “going up” we’ll say *increasing* and rather than saying “going down” we’ll say *decreasing*. Also rather than saying “from \( x = a \) to \( x = b \)” we’ll say “on the interval \([a, b]\)” except when one of them is \( \pm \infty \) in which case we use a parenthesis.

   Example: In the above graph, \( f(x) \) is increasing on \([-3, -1] \cup [3, 5]\) and decreasing on \((-\infty, -3] \cup [-1, 3]\).

2. **Average Rate of Change of a Function:** Suppose I tell you that \( d(t) = t^2 - t + 3 \) is the distance I’ve travelled after \( t \) hours. Does this tell you speed? No, it doesn’t. Can it tell you anything about speed? For example, \( d(0) = 3 \) and \( d(10) = 93 \), so can I conclude anything? Yes, between \( t = 0 \) and \( t = 10 \) I travelled 90 miles, so I averaged 9 miles per hour. What we’ve found here is the average value of the function.

   Given a function \( f(x) \), the average value of \( f(x) \) between \( x = a \) and \( x = b \) is \( \frac{f(b) - f(a)}{b - a} \).

   Example: Find the average value of the function \( f(x) = \frac{1}{x} \) between \( x = 1 \) and \( x = 3 \).

   Example: Find the average value of the function \( g(x) = \frac{x + 3}{2} \) between \( x = 5 \) and \( x = 5 + h \). Simplify your answer.