Topic A

Linear and Exponential Sequences

F-IF.A.1, F-IF.A.2, F-IF.A.3, F-IF.B.6, F-BF.A.1a, F-LE.A.1, F-LE.A.2, F-LE.A.3

Focus Standards:

F-IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If \( f \) is a function and \( x \) is an element of its domain, then \( f(x) \) denotes the output of \( f \) corresponding to the input \( x \). The graph of \( f \) is the graph of the equation \( y = f(x) \).

F-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by \( f(0) = f(1) = 1, f(n + 1) = f(n) + f(n - 1) \) for \( n \geq 1 \).

F-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

F-BF.A.1 Write a function that describes a relationship between two quantities.*

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.*

a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*

F-LE.A.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.*
In Lesson 1 of Topic A, students challenge the idea that patterns can be defined by merely seeing the first few numbers of the pattern. They learn that a sequence is an ordered list of elements and that it is sometimes intuitive to number the elements in a sequence beginning with 0 rather than 1. In Lessons 2 and 3, students learn to define sequences explicitly and recursively and begin their study of arithmetic and geometric sequences that continues through Lessons 4–7 as students explore applications of geometric sequences. In the final lesson, students compare arithmetic and geometric sequences as they compare growth rates.

Throughout this topic, students use the notation of functions without naming it as such—they come to understand \( f(n) \) as a “formula for the \( n \)th term of a sequence,” expanding to use other letters such as \( A(n) \) for Akelia’s sequence and \( B(n) \) for Ben’s sequence. Their use of this same notation for functions is developed in Topic B.