1. Linear Growth, Recursion and Slope

2. You should be familiar with rates of change. In this lesson, we will describe the connection between repeated addition and the slope of a line.

3. *(Animation) Many disciplines have quantities that change over time in a fixed way. One common type of change is to have the quantity increase by a constant amount in each time interval. For example, the population of a suburb may be increasing by* 4000 *residents every ten years.*

4. We call this linear growth. The graph of the population as a function of time is a line. We will talk more about equations of lines at the end of this video.

5. (a) One way to represent the pattern of growth is with a recursive definition, we specify a starting condition, and a recursion that tells us how to find future members of the sequence based on earlier members of the sequence. In this example, we begin with the 1970 population of $18,000$. Typically, the variable represents the quantity being measured. In this case, we use P for population. When we graph this function, the population will be measured on the vertical axis. In many fields, this quantity will be called the dependent variable. Dependent since the population DEPENDS on time. The subscript tells us where we are in the sequence. In this example, we are measuring the population at various times, so the subscript is representing the year. P_{1970} is the population in 1970. The subscript variable, in this case t for time, is called the independent variable, and will be measured on the horizontal axis in the graph. We need one equation which specifies the starting condition, in this case, the population in 1970, and a second equation that tells us how to calculate the population after 1970. On the left hand side, the subscript is $t + 10$, and on the right hand side, the subscript is t. This equation tells us how to use the population at certain time, t, to calculate the population 10 years later, at time $t + 10$
   (b) For example, inserting $t = 1970$, we can calculate the 1980 population by adding 4000 to the 1970 population.
   (c) We can then use the 1980 population to find the 1990 population
   (d) And continue to find the 2000 population,
   (e) And the 2010 population.

6. When we plot this data, the graph is a straight line.

7. As we move to the right by 10 years, we move up 4000 in population

8. This rate of change is called the slope of the line. It is calculated by finding the difference in the y-coordinates (the population values) and dividing by the difference in the x-coordinates (the time values).