Module I, Course Activity 4: Linear and Exponential Characteristics
Synthesis Questions

Name: ____

Purpose: To synthesize what you have learned about linear and exponential growth and decay patterns by applying them to recursive functions.

Procedure: Work on the following questions outside of class. You may consult with one or two other students. Each student should hand in their own copy of these synthesis questions.

1. For each of the following recursive functions, determine if they are linear, exponential or neither.
    a. $P(n+1) = P(n) - 2.1$, for all nonnegative integers n where $P(0) = 10$

    b. $P(n+1) = 2.7P(n) - 12$, for all nonnegative integers n where $P(0) = 10$

    c. $P(n+1) = P(n) - 0.76P(n)$, for all nonnegative integers n where $P(0) = 10$

    d. $P(n) = 1.7P(n)$, for all nonnegative integers n where $P(0) = 10$

    e. $P(n+1) = P(n) + 2.6$, for all nonnegative integers n where $P(0) = 10$

2. Would the answer to any of your questions above have changed if $P(0) = 5$ instead? What if $P(0) = 20$? Do we actually need to know $P(0)$ to answer Q1? Explain your reasoning.

3. For each of the recursive functions that you determined were linear from Q1 above, write a function of the form $y = mx + b$ that describes the same type of growth/decay. (This is called an explicit function.) Why is this function not exactly the same as the recursive function?

4. For each of the recursive functions that you determined were exponential from Q1 above, write a function of the form $y = a(b)^x$ that describes the same type of growth/decay. (This is called an explicit function.) Why is this function not exactly the same as the recursive function?

It is important to note that recursive functions cannot always be written in explicit form! In fact one of the very things we value about recursive functions is that they can describe very simply situations that would be quite complicated in direct form. To think more about this, consider the recursive function $P(n+2) = P(n+1) + P(n)$. Consider the difficulty of writing this function in explicit form?