

DIFFERENCE EQUATIONS AND GRAPHS OUTLINE

MA 131-006

The main question: What happens to a bank account over a long period of time?
How can we use that information to make good decisions?

- Introduction to difference equations
 - Reminder: a sequence is a function
 - Remind: a recursions (eg: Fibonacci sequence) is a way to describe the terms in a sequence in which we use previous terms to compute the current term
 - A difference equation is an example of a recursion
 - Review Example 1 quickly
 - Give them Example 2
 - A difference equation is an equation of the form $y_n = ay_{n-1} + b$, where a and b are numbers.
 - Fill in: a and b are equal to... in this example
- Time periods
 - In these examples the interest is **compounded interest** (meaning that you earn interest on your interest—good deal!)
 - The period in which the interest is compounded may be shorter than a year (that's **annual interest**)
 - EG:
 - * Quarterly
 - * semiannual
 - * monthly
 - When we write a difference equation, we need to use the interest per period
 - monthly interest example: What's a ? What's b ?
- Explicit solution (use Fibonacci sequence again)
 - In previous example, give the explicit solution
 - Use your answer to find y_{20}
 - What happens when $a = 1$??
 - * Simple interest
 - * Example 4 (simple interest example)
 - Example 7 (population growth)
 - * Just guess: What does the graph look like?
- Graphing difference equations
 - Vertical direction
 - long term behavior
 - Key vocabulary:
 - * **Monotonic**
 - * **Unbounded**
 - * **oscillating**

* ***constant***

- Main theorem: The graph for a difference equation is either: monotonic, oscillating, or constant.
 - * Is this really dumb? Is it true for *every function*?
- What happens when $a > 0$ or $a < 0$ (we'll assume $a \neq 0$)?
- What happens when $|a| < 1$? What happens when $|a| > 1$?
- Examples 1-5 from 10.3

DEPARTMENT OF MATHEMATICS, NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC, USA