Math 10A
Worksheet, Discussion #25; Friday, 7/20/2018
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1 Recurrence Relations

1.1 Concepts

1. A **homogeneous** recurrence relation does not include any extra constants (e.g. $a_n = a_{n-1} + a_{n-2}$) and a **nonhomogeneous** recurrence relation contains one (e.g. $a_n = a_{n-1} + 4$). The **order** of a recurrence relation is the "farthest" back the relation goes. For instance, the order of $a_n = a_{n-1} + a_{n-3}$ is 3 because we need the term 3 terms back (a_{n-3}). A **linear** recurrence relation has all the a_i terms being linear and a recurrence relation with **constant coefficients** is one where the coefficients in front of the a_i are all constants.

1.2 Problems

2. For the following recurrence relations, find their order and label them as homogeneous, linear, and/or with constant coefficients.

   (a) $a_n = a_{n-1} + na_{n-1}^2$

   (b) $a_n = n^2 a_{n-1} - a_{n-2}$

   (c) $a_n = 4a_{n-1} - 2a_{n-4} + 3$

   (d) $a_n = a_{n-1}^2 - n^2$

   (e) $a_n = a_{n-2}$

   (f) $a_n = a_{n-1} - a_{n-2}$

3. Find constants A, B such that $a_n = An + B$ is a solution to the recurrence relation $a_n = 2a_{n-1} - 3a_{n-2} + 2n$.

4. Verify that $a_n = n + 1$ is a solution to $a_n = 3a_{n-1} - 3a_{n-2} + a_{n-3}$.

5. Find constants A, B such that $a_n = An + B$ is a solution to the recurrence relation $a_n = a_{n-1} + a_{n-3} + n + 3$.

6. Verify that $a_n = 1 - n$ is a solution to $a_n = 2a_{n-1} - a_{n-2}$.