ESP Math 182

Worksheet 14

Spring 2015

26 February 2015

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1. Recall the definition of a polynomial: "a function $f(x) = \sum_{i=0}^{n} a_i x^i$ where $n \in \mathbf{Z}_{\geqslant 0}$ and $a_i \in \mathbf{R}$." Using this definition, decide which of the following functions are polynomials.

   (a) $f(x) = 0$

   (b) $g(x) = 3x + \frac{5}{2}$

   (c) $h(y) = 55y^5 + \frac{\pi^3 y^4}{e^2} + 3y^3 + 22y^2 - 2015.2$

   (d) $i(z) = \frac{z^2}{5} + \frac{5}{z^2}$

   (e) $j(t) = \cos(4t^2)$

   (f) $k(q) = 99q^{99} + e^{99q}$

2. Find the first four terms in the following sequences, starting at $n = 1$.

   (a) $a_{n+1} = 2a_n + a_n^2$ where $a_1 = 2$

   (b) $b_n = 2 + (-n)^n$

   (c) $c_n = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$

3. Find a general formula for the nth term of the following sequences.

   (a) $\frac{2}{6}, \frac{3}{7}, \frac{4}{8}, \ldots$

   (b) $4, -3, \frac{9}{4}, -\frac{27}{16}, \ldots$

   (c) $1, \frac{-1}{4}, \frac{1}{27}, \frac{-1}{256}, \ldots$

   (d) $e, \frac{e}{\pi}, \frac{e^2}{\pi}, \frac{e^2}{\pi^2}, \frac{e^3}{\pi^2}, \ldots$

   Hint 1 for (d): Try finding a formula for the sequence $\{0, 1, 0, 1, 0, 1, \ldots\}$.

   Hint 2 for (d): Try first finding a formula for the sequence $\{-1, 1, -1, 1, -1, 1, \ldots\}$.