



## Grade 11/12 Math Circles

October 25, 2023

### P-adic numbers, Part 1 - Problem Set

1. What's  $\dots 13131313_5 = ?$
2. Find the numbers  $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \frac{6}{7}$  as real numbers and as 10-adic numbers. What do you notice?
3. Using the following theorem: *A  $p$ -adic number has an eventually periodic  $p$ -adic expansion if and only if it is rational, i.e. can be written as a fraction.* Determine the periodic 5-adic expansion of  $\frac{4}{3}$ .
4. Show that a 2-adic integer that is a unit has a square root if and only if its last 3 digits are  $\dots 001$ .