The Ninth Grade Math Competition Class
Base Numbers 1
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1. What is the largest base 10 number that can be expressed as a three-digit base 5 number?

2. How many natural numbers require 3 digits when written in base 12, but require 4 digits when written in base 9?

3. Given $9^6 = 531441$, how would you represent 531440 in base 9?

4. How many integers from 1 to 1992 inclusive have a base-three representation that does not contain the digit 2?

5. When written in base 3, a positive integer has two terminal zeros. When written in base 4 or base 5, this same integer has one terminal zero. In how many other positive integral bases greater than 1 must the representation of this integer have at least one terminal zero?

6. Find the 100th smallest positive integer that can be written using only the digits 1, 3, and 5 in base 7.

7. A number N has three digits when expressed in base 7. When N is expressed in base 9, the digits are reversed. Find the middle digit in either representation of N.