

Quantitative Reasoning 28: The Magic of Numbers

Homework 21

Assigned on April 6

Due at 5:00 p.m. April 8

Please submit problem sets to the boxes outside the Math Department's main office, on the third floor of the Science Center (Room 325).

Reading:

Gross-Harris, Chapter 19

Problems:

Please explain your reasoning and show your work.

1. The goal of this problem is to find the 11th root of 5 (mod 29).
 - (a) Find a number k such that $11k \equiv 1 \pmod{28}$. (Caution: for this part, we are working (mod 28)).
 - (b) Compute $5^k \pmod{29}$. Why is this number the 11th root of 5 (mod 29)?
 - (c) Check that your answer to part (b) is correct by raising it to the 11th power and seeing if you get 5.
2. The method we discussed in today's lecture and reviewed in the previous problem (and which is discussed in Chapter 19 of the book) for computing roots (mod p) can be applied to only 2 of the following 4 problems. Say which 2 can be solved by this method, and solve them. Also, explain why our method fails in the other 2 cases.
 - (a) The 5th root of 3 (mod 23);
 - (b) The 5th root of 7 (mod 31);
 - (c) The 5th root of 6 (mod 33);
 - (d) The 5th root of 4 (mod 37).
3. What is the 15th root of 2 (mod 29)?