

Quantitative Reasoning 28: The Magic of Numbers

Homework 21

Assigned on Monday November 26th

Due at 12 noon Wednesday November 28th

Please submit problem sets at the end of the relevant lecture, or leave in the box labeled QR28 outside the Math Department's main office, on the third floor of the Science Center (Room 325).

Reading:

Gross-Harris, Chapter 18

Problems:

Please explain your reasoning and show your work.

1. Use your power table from arithmetic (mod 13) on HW 20 to compute the following.
 - (a) What is the 5th root of 4 (mod 13)?
 - (b) What is the 11th root of 9 (mod 13)?
2. 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.
3. The method we know 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.
 - (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).
4. What is the 15th root of 2 (mod 29)?