

Playsheet 4

Modular Arithmetic

MATH 130-02
Tuesday, January 27, 2009

Directions: Groups should consist of three or four people. Work together on each problem; do not delegate different problems to different people. Submit one **neatly written** write-up per group. Remember to use complete sentences as appropriate and explain your reasoning. That is, **show your work!**

1. You have a four-speed fan that is currently off. If you pull the chain 1371 times, what will the speed be? (0 is off, 1 is high, 2 is medium, and 3 is low.)
2. Compute $68 \cdot 43 \pmod{5}$ by
 - (a) multiplying first and then reducing
 - (b) reducing first and then multiplying (and reducing again if necessary)
3. Compute $7^{12} \pmod{17}$ by computing $((7^2)^2)^3$ and reducing after each step.
4. Do you remember “place values” from elementary school? For example, 234 means 2 hundreds and 3 tens and 4 ones. In symbols, it is $234 = 2 \cdot 10^2 + 3 \cdot 10 + 4$. This is called “expanded notation.”
 - (a) Write 56237 in expanded notation.
 - (b) How could you reduce $56327 \pmod{9}$ in a simple way using expanded notation?
 - (c) Based on your work in (a), devise a simple test for determining whether a number is divisible by 9.
 - (d) Now devise a test for divisibility by 3.

(OVER)

5. Determine whether an error has been made in entering the ISBN 0-534-37371-8.

6. What is the check digit for the UPC 0 21130 52009?