

Homework Number Four

1. Suppose it is 5 o'clock. What is the time on a twelve hour clock, 110 hours later? How about on a 24 hour clock? Use modular arithmetic ideas and notation to solve this problem.
2. It is Tuesday. What day of the week is it 89 days later? (Do a calculation using $m = 7$).
3. The ancient Egyptians had a calendar in which a year is always 365 days long. Suppose that it is the 18th day of the year, and then 7439 days pass. What day of the year is it (formulate this problem as a calculation modulo 365)?
4. Suppose that $x + 15 = 4 \pmod{22}$. Solve this by adding the appropriate quantity to both sides.
5. Perform the divisions by hand to determine the multiplicative inverse of 11 modulo 23. (This is an easy example!)
6. Perform the divisions by hand to determine the multiplicative inverse of 7 modulo 17. (You can and should check your answer using Euclid, but please exhibit your by-hand calculations).
7. Use the fact from the previous exercise to solve $7x = 11 \pmod{17}$.
8. Find a multiplicative inverse for 8 modulo 17 (use any method you wish, including division by hand, squinting, or Euclid). Use that solution to solve $8x = 11 \pmod{17}$.
9. Use Euclid to find the multiplicative inverse of 26 modulo 113. Use that to solve the congruence $26x + 80 = 6 \pmod{113}$.
10. A patient is taking drugs on a 12 day cycle. Suppose that it is Tuesday. How many complete drug cycles would pass before it is Friday? Formulate this problem in the language of modular arithmetic, modulo 7.