Objective: To practice using Wilson's Theorem and Fermat's Little Theorem and to preview the concepts of quadratic residues.

1. What is the remainder when 18! is divided by 437?

2. What is the remainder when 5^{100} is divided by 7?

3. Find the least positive residue of $3^{999,999,999}$ modulo 7.

4. Use Fermat's Little Theorem to solve $7x \equiv 12 \mod 17$

5. **Def:** If $m > 0$, we say that a is a <u>quadratic residue of m</u> if $(a, m) = 1$ and the congruence $x^2 \equiv a$ mod m has a solution.

    (a) Find all quadratic residues of 7. Pick your favorite quadratic residue a which is not a perfect square (in $\mathbb{Z}$) and find all solutions to $x^2 \equiv a$ mod 7

    (b) Find all quadratic residues of 24. Pick your favorite quadratic residue a which is not a perfect square (in $\mathbb{Z}$) and find all solutions to $x^2 \equiv a$ mod 24