1. Find multiplicative modular inverse

$$2^{-1} \text{ in } \mathbb{Z}_7 \qquad 4^{-1} \text{ in } \mathbb{Z}_{11}$$
$$9^{-1} \text{ in } \mathbb{Z}_{26} \qquad 2^{-1} \text{ in } \mathbb{Z}_6$$

2. Find additive inverse

$$-3 \text{ in } \mathbb{Z}_5 \qquad -4 \text{ in } \mathbb{Z}_{10}$$

3. How many invertible elements?

$$\mathbb{Z}_6 \qquad \mathbb{Z}_6^\times \qquad \mathbb{Z}_{11}^\times$$

4. Which elements have multiplicative inverses in $\mathbb{Z}_8$ and $\mathbb{Z}_{20}$?

5. Write out addition and multiplication tables in $\mathbb{Z}_5$ and $\mathbb{Z}_8$.

6. Solve the following linear equations

$$x+3 \equiv 2 \pmod 5 \qquad 5+6 \equiv x \pmod{11} \qquad 5x+2 \equiv 3 \pmod 7$$
$$4x+3 \equiv 11 \pmod{12} \qquad x-4 \equiv 7 \pmod{12} \qquad 4x \equiv 2 \pmod{19}$$
$$4x+3 \equiv 5 \pmod{13} \qquad 2x+1 \equiv 9x-4 \pmod{23} \qquad 5x-1 \equiv 3x+1 \pmod{26}$$

7. Solve the systems of linear equations

$$\begin{cases} a+b \equiv 17 \pmod{26} \\ 2a+b \equiv 0 \pmod{26} \end{cases} \qquad \begin{cases} a+b \equiv 17 \pmod{26} \\ 4a+b \equiv 1 \pmod{26} \end{cases}$$

$$\begin{cases} a+b \equiv 17 \pmod{26} \\ 3a+b \equiv 0 \pmod{26} \end{cases} \qquad \begin{cases} 5a+b \equiv 21 \pmod{26} \\ 16a+b \equiv 10 \pmod{26} \end{cases}$$

$$\begin{cases} 8a+b \equiv 8 \pmod{26} \\ 5a+b \equiv 13 \pmod{26} \end{cases}$$

8. Solve for x

$$(a) \quad \begin{cases} x \equiv 1 \pmod 3 \\ x \equiv 2 \pmod 4 \end{cases} \qquad (b) \quad \begin{cases} x \equiv 0 \pmod 4 \\ x \equiv 3 \pmod 7 \end{cases}$$

$$(c) \quad \begin{cases} x \equiv 10 \pmod{12} \\ x \equiv 3 \pmod 5 \end{cases} \qquad (d) \quad \begin{cases} x \equiv 3 \pmod 5 \\ x \equiv 5 \pmod 6 \end{cases}$$

9. Solve for x

$$(a) \quad \begin{cases} x \equiv 0 \pmod 2 \\ x \equiv 2 \pmod 3 \\ x \equiv 3 \pmod 5 \end{cases} \qquad (b) \quad \begin{cases} x \equiv 1 \pmod 2 \\ x \equiv 2 \pmod 3 \\ x \equiv 3 \pmod 5 \\ x \equiv 5 \pmod 7 \end{cases}$$