Practice test 1

Time: 50 minutes

1. Solve the following equation:

$$5 \cdot X \equiv 17(mod101)$$

2. Prove the following theorem:

$$\sum_{k=1}^{2n} (-1)^{k+1} k^4 = -n(2n+1)(4n^2 + 2n - 1).$$

3. Write in the form x + iy (where x and y are real numbers) the four roots of degree 4 of

$$2 - i\sqrt{12}$$
.

4. Solve the following system of matrix equations:

$$\begin{cases} \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} X + \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix} Y = \begin{bmatrix} 2 & 8 \\ 0 & 5 \end{bmatrix} \\ \begin{bmatrix} 3 & -1 \\ -1 & 1 \end{bmatrix} X + \begin{bmatrix} 2 & 1 \\ -1 & -1 \end{bmatrix} Y = \begin{bmatrix} 4 & 9 \\ -1 & -4 \end{bmatrix}$$

5. Let R and S be two equivalence relations on a set A. Is $R \cap S$ an equivalence relation? Is it a function? If so, is it one-to-one? Onto?