Disproof and counterexamples

1. Suppose $A \neq \emptyset$. Prove that $A \times B \subseteq A \times C$ if and only if $B \subseteq C$. What if A is empty?
2. Prove that there is no $x \in \mathbb{Z}$ such that $3x \equiv 8 \pmod{6}$.

Euclid's algorithm and congruence equations

1. Solve $7x \equiv 3 \pmod{41}$.
2. Solve $6x \equiv 2 \pmod{24}$.