Prove: $\forall x \in S,\ P \Rightarrow Q$.

- Direct: Assume P, show Q ☐
- Contrapositive: Assume $\sim Q$, show $\sim P$. ☐
- Contradiction: Assume $P \wedge \sim Q$, show (given) falsehood
- Induction: Show base: Q for smallest n in P ☐
  - Assume: Q for $n = k$ ☐
  - Show: Q for $n = k+1$ ☐

Translate Fact about division $\rightsquigarrow$ Algebraic Equation

Fact about division	Algebraic Equation	
z even	$z = 2k$	☐
z odd	$z = 2m+1$	☐
$a \mid b$	$b = ap$	☐
$z \bmod a = b$	$z = aq + b$	☐
$a \equiv b \pmod{c}$	$a - b = cq$	☐

→ Example:

$$(z^2+1) \equiv 17 \pmod{12} \rightsquigarrow z^2+1-17 = 12m$$

Encrypt
- Find sequence a_n
  - for A–Z letters, add a_n to standard number then mod 26, find new letter ☐
  - for binary, add a_n to bit, then mod 2. ☐

Decrypt
  - for A–Z, subtract a_n from std. number, mod 26 ☐
  - for binary, add a_n to bit, mod 2. (OR subtract)

Sets Given $\mathcal{U}$, A, B
- Find: $\bar{A}$, $A-B$, $A \cup B$, $A \cap B$, $\mathcal{P}(A)$, $A \times B$, $A \subseteq B$? ☐

→ Example:

Find $\overline{\bar{A} \cup (\overline{B-A})}$ using DeMorgans

- Find $|A|$, $|A \cup B|$, $|A-B|$, $|\mathcal{P}(A)|$, $|A \times B|$ ☐

→ Example:

Find $|\mathcal{P}(A \cup B) \times (A-B)|$

Counting
- Pizza orders, PIN numbers, DNA: Mult. Add. Subtract
  - $_nP_k$, $|A \cup B| = |A| + |B| - |A \cap B|$ ☐
  - $|\text{legal}| = |\mathcal{U}| - |A| - |B| + |A \cap B|$ ☐