Simple Example
For any integers a and b, if a and b are odd, then ab is also odd.

Proof:

Proof with divisibility
For any integers a, x, y, b, c, if $a \mid x$ and $a \mid y$, then $a \mid bx + cy$.
Proof:

Proof with Modulus

For any integers a, b, c, d, k with $k > 0$, if $a \equiv b \pmod{k}$ and $c \equiv d \pmod{k}$ then $(a + c) \equiv (b + d) \pmod{k}$.

Proof

Disproving Existential Statements
Claim to disprove: There exists a real $x, x^2 - 2x + 1 < 0$.

Proof

Disproving Universal Statements
Claim to disprove: For all real $x, (x+1)^2 > 0$.

Proof