Example of Direct Proof

Theorem: Every odd integer is the difference of two perfect squares. (Put more formally $\forall$ odd integers x, $\exists y, z$ integers such that $x = y^2 - z^2$.)

Proof: Since x is odd, there is an integer L such that $x = 2L + 1$.
Note that $(L+1)^2 = L^2 + 2L + 1$
Hence $(L+1)^2 - L^2 = x$
Q.E.D.