

# Proof by induction

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Suppose we want to show that some statement  $p$  is true for all non-negative integers  $0, 1, 2, \dots$

Let  $p(n)$  be a proposition involving  $n \in \mathbb{Z}$  for  $n \geq 0$ . (Note, importantly, that  $p(n)$  is *not* a function.)

To prove a statement of the form  $\forall n (p(n))$ :

1. First prove  $p(0)$  (base case).
2. Then prove  $\forall n (p(n-1) \implies p(n))$  (inductive step).

Form of final proof:

Base case: [Proof of  $p(0)$  goes here]

Inductive step: [Proof of  $\forall n (p(n-1) \implies p(n))$  goes here]