Proof by Induction

Mathematics

The five parts of a complete induction, and where marks are lost.

To prove P(n) for every integer n from n_0 upward.

1. **State P(n) precisely**
   Write the proposition as a function of n before anything else.

2. **Prove the base case**
   Verify P(n_0) directly. Usually n_0 is 0 or 1, and it must be checked.

3. **State the hypothesis**
   Assume P(k) holds for one arbitrary fixed k at least n_0.

4. **Prove the inductive step**
   Show P(k) ⇒ P(k + 1), using the hypothesis somewhere explicit.

5. **Conclude**
   By induction P(n) holds for every n at least n_0. Write that line.

Strong induction assumes P(n_0) through P(k) rather than P(k) alone. Reach for it when P(k + 1) depends on more than one earlier case.