We use induction to prove the statement
Let P(n) denote the statement $2 + 2^2 + ... + 2^n = 2^{n+1} - 2$
Base case :- For n = 1
LHS = 2
RHS = $2^2 - 2 = 2$
LHS = RHS
Hence P(1) is True.
Induction Hypothesis :- Let the statement be true for k.$k \in \mathbb{N}$ $k > 1$
$\implies 2 + 2^2 + ... + 2^k = 2^{k+1} - 2$
for n=k+1 we have
LHS = $2 + 2^2 + ... + 2^k + 2^{k+1}$
$= 2^{k+1} - 2 + 2^{k+1}$ from induction hypothesis.
$= 2(2^{k+1}) - 2$
$= 2^{k+2} - 2$
LHS = RHS
Hence P(n) is true for n = k+1
Hence by induction P(n) is true $\forall n \in \mathbb{N}$