Proof: By Induction

For n = 1, left side is 2, and right side is 4 - 2 = 2, so the identity is valid for n = 1.

Assume the identity holds for n. Then:

Let left side be L(n).

$$\begin{aligned} L(n) &= 2 + 2^1 + \cdots + 2^{n+1} \\ &= 2^{n+1} - 2 + 2^{n+1} (\textit{By Induction hypothesis}) \\ &= 2^{n+2} - 2 \end{aligned}$$

which is the identity for n + 1. The proof is complete.