$$(\exists n \in N)[2 + 2^2 + 2^3 + ... + 2^n = 2^{n+1} - 2]$$

Proof: By induction.
$n = 1$:

$$\begin{aligned} 2 &= 2^{1+1} - 2 \\ 2 &= 2^2 - 2 \\ 2 &= 2 \end{aligned}$$

Assume $n = k$ holds:

$$2 + 2^2 + 2^3 + ... + 2^k = 2^{k+1} - 2$$

Show that $n = k + 1$ holds

$$2 + 2^2 + 2^3 + ... + 2^k + 2^{k+1} = 2^{(k+1)+1} - 2 \qquad \text{(By induction)}$$

$$\begin{aligned} 2 + 2^2 + 2^3 + ... + 2^k + 2^{k+1} &= 2^{k+1} - 2 + 2^{k+1} \\ &= 2 * 2^k - 2 + 2 * 2^k \\ &= 4 * 2^k - 2 \\ &= 2^2 * 2^k - 2 \\ &= 2^{k+2} - 2 \end{aligned}$$

Therefore by induction the equation holds for all n.
QED.