Question 7

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proposition:for any natural number n, $2 + 2^2 + 2^3 + ... + 2^n = 2^{n+1} - 2$

proof: prove by induction.

1. initial step: for $n = 1$ $2 = 2^2 - 2$ is valid
2. assume the proposition is true for n. $2 + 2^2 + 2^3 + ... + 2^n = 2^{n+1} - 2$
3. for $n + 1$ we have $2 + 2^2 + 2^3 + ... + 2^n + 2^{n+1} = 2^{n+1} + 2^{n+1} - 2 = 2^{(n+1)+1} - 2$.

The identity is true for n + 1

4. therefore by induction, we proved $2 + 2^2 + 2^3 + ... + 2^n = 2^{n+1} - 2$

conclusion: By induction, we proved $2 + 2^2 + 2^3 + ... + 2^n = 2^{n+1} - 2$