1. Show that for any $k > 2$, 2^{3k-1} divides $(2^k+1)(2^k+3)...(2^{k+1}-1) - (2^k-1)(2^k-3)...(2^k-2^k+1)$ but 2^{3k} does not

2. Let $p > 2$ be a prime number and $\frac{m}{n}$ is the irreducible fraction $\frac{m}{n} = 1+\frac{1}{2}+\frac{1}{3}+...+\frac{1}{p-1}$. Show that p divides m.