1. Prove the following using induction. For all $n \geq 0$,

$$1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + \cdots + n(n+1)(n+2) = \frac{n(n+1)(n+2)(n+3)}{4}$$

2. Prove the following using induction. For all positive integers $n$,

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \cdots + \frac{1}{n(n+1)} = 1 - \frac{1}{n+1}$$

3. Prove that for all integers $n$, if $n - 3$ is divisible by 4 then $n^2 - 1$ is divisible by 8.