Discrete Math

Induction Practice Problems

Name: .....

Id: .....

1. Prove the following identity by induction on $n \geq 1$.

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

2. Prove the following identity by induction on $n \geq 2$.

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

3. Prove by induction that $n! > 2^n$ for all integers $n \geq 4$.

4. Prove by induction that $8^n - 1$ is divisible by 7 for all integers $n \geq 1$.

5. A ternary string of length n is a list of n digits in which each digit is either 0, or 1, or 2. Prove by induction that there are 3^n ternary strings of length n for all integers $n \geq 1$.