Homework for Packet #30

1. Use mathematical induction to prove that for every natural number n,
$$3 + 5 + 7 + \cdots + (2n + 1) = n(n + 2)$$

Q: Your sock drawer contains ten pairs of white socks and ten pairs of black socks. If you're only allowed to take one sock from the drawer at a time and you can't see what color sock you're taking until you've taken it, how many socks do you have to take before you're guaranteed to have at least one matching pair?

2. Use mathematical induction to prove that for every natural number n,
$1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$

3. Use mathematical induction to prove that for every natural number n,
   $1 + 4 + 7 + \cdots + (3n - 2) = \frac{n(3n-1)}{2}$

4. Use mathematical induction to prove that for every natural number n,

   $1 + 3 + 3^2 + \cdots + 3^{n-1} = \frac{3^n - 1}{2}$

5. Use mathematical induction to prove that for every natural number n,
$$\frac{1}{1\cdot 3}+\frac{1}{3\cdot 5}+\frac{1}{5\cdot 7}+\cdots+\frac{1}{(2n-1)(2n+1)}=\frac{n}{2n+1}$$

Optional exercises from the Sullivan book if you'd like more practice:
12.4 (p.830) #1-11 odd