Last name _______________________

First name _______________________

LARSON—MATH 350—CLASSROOM WORKSHEET 08
Binomial Coeficients

Review

- What is a *permutation* (or *ordered set*)?
- We proved: the number of permutations of an n-element set is $n!$
- We proved: the number of ordered k-subsets of an n-set is $\frac{n!}{(n-k)!}$.
- What is a *combination*?
- (**Notation**) What is $\binom{n}{k}$?
- **Theorem** $\binom{n}{k} = \frac{n!}{k!(n-k)!}$?

We conjectured:

$$\binom{n}{0} + \binom{n}{1} + \ldots + \binom{n}{n-1} + \binom{n}{n} = 2^n.$$

1. Check the conjecture for $n = 4$.

2. Can you see a *reason* for *why* the conjecture is true when $n = 4$?

3. Can you *extend* this reason to the general claim?

4. Use small concrete numbers to check the claim that $\binom{n}{k} = \binom{n}{n-k}$ (for $0 \leq k \leq n$).

5. Can you see a *reason* for *why* the statement is true in general (can you give an argument)?

6. Use small concrete numbers to check the claim that $\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k}$ (for $0 \leq k < n$).

7. Can you see a *reason* for *why* the statement is true in general (can you give an argument)?

Mathematical Induction (Chp. 2)

8. Find $1 + 3$.

9. Find $1 + 3 + 5$.

10. Find $1 + 3 + 5 + 7$.

11. Find $1 + 3 + 5 + 7 + 9$.

12. Conjecture a formula for the sum of the first n odd integers.