Math 4 Honors Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lesson 5-5: *Combinations, The Binomial Thm. & Pascal’s ∆* Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Learning Goal:**

* *I can apply connections among combinations, Pascal’s triangle, and expansions of binomial expressions of the form (a + b)n.*

1 a.  = \_\_\_\_\_  = \_\_\_\_\_\_\_\_  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Show work Show work

 b. The expansions begin and end with a coefficient of \_\_\_\_\_\_\_\_\_. The sum of the coefficients is \_\_\_\_\_.

 The number of coefficients is equal to \_\_\_\_\_\_ more than the degree (largest power) of the expansion.

 c. The coefficients for a given power *n* are the values of *C*(*n*, *k*).

2a.  = \_\_\_\_\_ Row 0 **(*n* = 0)**

  = \_\_\_\_\_ \_\_\_\_\_ Row 1

  = \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Row 2

**Pascal’s**

**Triangle**

  = \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Row 3

  = \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Row 4

  = \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Row 5

  = \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Row 6

 b. Any number on a row is the sum of the *two* numbers directly \_\_\_\_\_\_\_\_\_\_\_ it in the previous row.

 This excludes the first row and the ends of the rows.

 c.  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (use the pattern)

3. Be sure to read the information between questions 2 and 3. Just read through this problem to make sure

 you’ve seen the pattern for Pascal’s Triangle. You’ve done the work already!

4 a. *C*(4, 2) = \_\_\_\_ This number is in row \_\_\_\_\_, entry \_\_\_\_\_. So, the coefficient of the *a*2*b*2 term is

 \_\_\_\_\_\_\_\_\_\_, or simplified to \_\_\_\_\_\_.

 b. *C*(6, 4) = \_\_\_\_ This number is in row \_\_\_\_\_, entry \_\_\_\_\_. So, the coefficient of the *a*2*b*4 term is

 \_\_\_\_\_\_\_\_\_\_, or simplified to \_\_\_\_\_\_.

 c. *C*(*n*, *k*) is in row \_\_\_\_\_\_, entry \_\_\_\_\_ of Pascal’s triangle. The coefficient of the *an−kbk* term in

 (*a + b*)*n* is also entry *k* in row *n* of Pascal’s triangle.

5 a. The coefficient of the *a*29*b*71 term in  is \_\_\_\_\_\_\_\_\_\_\_\_\_.

 b. 

 c. The coefficient of the *a*3*b*5 term in  is \_\_\_\_\_\_\_\_\_\_\_, or simplified to \_\_\_\_\_\_\_.

 d. The coefficient of the *an−kbk* term in  is \_\_\_\_\_\_\_\_\_\_\_. OVER 🡪

**Binomial Theorem**: For any positive integer *n*,



6 a. 

 = \_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ = 

 b. Coefficient of *a*3*b*5 term in  = *C*(\_\_\_\_\_, \_\_\_\_\_) = \_\_\_\_\_\_\_

 c and d. Skip these for now.

 e. *a* = \_\_\_\_\_\_ and *b* = \_\_\_\_\_\_ Be careful on this one. Put *a* and *b* in parentheses when simplifying.

 Expand below.  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Show all work.

7. Complete these conjectures.

* *C*(*n*, *k*) = *C*(*n*, \_\_\_\_\_\_\_) *C*(*n*, *k*) = *C*(*n* − 1, *k* − 1) + *C*(\_\_\_\_\_\_, *k*)
* *C*(*n*, 0) + *C*(*n*, 1) +…*C*(*n*, *n*) = \_\_\_\_\_

8. Just complete the following using properties of the binomial theorem.

 *C*(9, 2) *= C*(9, \_\_\_\_) *C*(15, 12) = *C*(15, \_\_\_\_) *C*(26, 8) = *C*(\_\_\_\_, 18)

 These work because choosing *k* objects to take from *n* objects is the same as choosing ***n − k*** *not* to take.

**Check Your Understanding**  ***SHOW WORK* for each method!** 

a. By hand (multiply factors) Pascal’s Triangle Binomial Theorem

b. Combinations Pascal’s Triangle Binomial Theorem

 *Use a different combination*

 *than you used already.*

**PRACTICE**: Expand  using *either* Pascal’s Triangle or Binomial Theorem.

**Lesson 5-5 Homework**

**Expand each of the following using Pascal’s Triangle.**

1.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Expand each of the following using the Binomial Theorem.**

5.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 OVER 🡪

7.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Find the coefficient of the  term in . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. Find the coefficient of the  term in . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. Find the coefficient of the  term in . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. Find the coefficient of the  term in . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. Write the 5th term in the expansion of . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Preview:**

14.