Name_____Date_____Per_____

Algebra 2H Extra Notes: Binomial Theorem

The coefficients of the expansion of $(x + y)^n$ are the numbers in Pascal's triangle. The binomial coefficients are also combinations.

Pascal's Triangle	Combinations	Binomial Expansion
1	${}_0C_0$	$(x+y)^0 = 1$
1 1	${}_1C_0$ ${}_1C_1$	$(x+y)^1 = x+y$
1 2 1	${}_2C_0$ ${}_2C_1$ ${}_2C_2$	$(x+y)^2 = x^2+2xy+y^2$
1 3 3 1	${}_3C_0$ ${}_3C_1$ ${}_3C_2$ ${}_3C_3$	$(x+y)^3 = x^3+3x^2y+3xy^2+y^2$

- The number of terms in the expansion of $(x+y)^n$ is $n + 1$.
- The exponents of x decrease while the exponents of y increase.
- The sum of the exponents of the variables in any term is n.
- The Pascal numbers or combinations are the coefficients of each term.

The **Binomial Theorem** can be used to find a single term of a binomial expansion or instead of Pascal's Triangle to expand $(x+y)^n$.

Binomial Theorem
For any whole number n,

$$(x+y)^n = \sum_{r=0}^{n} {}_nC_r\, x^{n-r} y^r = {}_nC_0\, x^n y^0 + {}_nC_1 x^{n-1} y^1 + {}_nC_2\, x^{n-2} y^2 + \ldots + {}_nC_n\, x^0 y^n$$

Example 1. Find the term containing x^7 in $(2 - 3x)^{10}$.

Example 2. Find the middle term of $(2 - 3x)^{10}$.

CC Algebra 2H Problem Set: Binomial Theorem and review

Show all work on your own paper. Save this handout for reference.

Use the Binomial Theorem for #1-3.

1. Find the term containing x^4 in the expansion of $(x - 3)^7$.

2. Find the third term in the expansion $(3x + 2)^9$.

3. Find the middle term of $(x^2 + 4)^8$.

4. Use Pascal's Triangle or the Binomial Theorem to expand $(2x - 5)^5$.

Give the answers to #5-6 to the nearest thousandth.

5. Mrs. Bryant bought 4 boxes of Chocolate Krave cereal. One out of every 5 boxes has a coupon for a free box of Krave.
a. What is the probability that Mrs. Bryant got exactly 3 coupons?
b. What is the probability that Mrs. Bryant got at least 2 coupons?

6. In a manufacturing plant, there is a 2% chance that a stamp will be placed on a box upside down. If the plant shipped 30 boxes today, what is the probability that at least 2 of the boxes have an upside-down stamp?

7. Suppose that in 2004, 95% of the high school students in a city graduated. A follow-up study showed that at age 25, 81% of the high school graduates held full-time jobs while only 63% of those who did not graduate held full-time jobs. What is the probability that a randomly selected former student did not have a full-time job at age 25? Give the answer as a percent rounded to the nearest whole number.

8. Tomas is trying to decide on the best possible route to drive to work so that he is on time. Over a 40-day period, he randomly selects a route each day and keeps track of whether he is late. The table of joint and marginal relative frequencies for the results of his study are shown.

	Late	Not late	Total
Route A	0.1	0.25	0.35
Route B	0.075	0.175	0.25
Route C	0.1	0.3	0.4
Total	0.275	0.725	1

Use conditional probabilities to determine the best route for Tomas to drive so that he is on time for work.

Answers:
1. $-945x^4$ 2. $314{,}928x^7$ 3. $17{,}920x^8$ 4. $32x^5 - 400x^4 + 2000x^3 - 5000x^2 + 6250x - 3125$

5a. 0.026 5b. 0.181 6. 0.121 7. 20% 8. Tomas should choose Route C.