Binomial Expansion: $\left(x+y\right)^{0}=1$

 $\left(x+y\right)^{1}=x+y$

 $\left(x+y\right)^{2}=x^{2}+2xy+y^{2}$

 $\left(x+y\right)^{3}=x^{3}+3x^{2}y+3xy^{2}+y^{3}$

 $\left(x+y\right)^{4}=x^{4}+4x^{3}y+6x^{2}y^{2}+4xy^{3}+y^{4}$

 $\left(x+y\right)^{5}=x^{5}+5x^{4}y+10x^{3}y^{2}+10x^{2}y^{3}+5xy^{4}+y^{5}$

Notice the patterns:

1. In each expansion there are $n+1$ terms.
2. In successive terms the powers of *x* decrease by 1 and the powers of *y* increase by 1.
3. The sum of the powers in always *n*.
4. The coefficients are symmetrical.

**The Binomial Theorem** – in the expansion of $\left(x+y\right)^{n}$

 $\left(x+y\right)^{n}=x^{n}+nx^{n-1}y+\cdots +$

 The coefficient of $x^{n-r}y^{r}$ is $$ we also use $\left(\begin{matrix}n\\r\end{matrix}\right)$ instead of $$

Ex. $$

Ex. $\left(\begin{matrix}11\\4\end{matrix}\right)$ = $$

$$ key on calculator

Ex. $$ $$ $$

**Pascal’s Triangle** 1

 1 1

 1 2 1

 1 3 3 1

 1 4 6 4 1

 1 5 10 10 5 1

 1 6 15 20 15 6 1

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**Binomial Expansion (using Pascal’s Triangle)**

Ex. Write the expression for $\left(x+2\right)^{4}$

Ex. Write the expansion for $\left(y-3\right)^{3}$

Ex. Write the expansion for $\left(2x-y\right)^{5}$

Ex. Write the expansion for $\left(3-x^{2}\right)^{3}$

Ex. Write the expansion for $\left(3x+\frac{1}{y}\right)^{4}$

**Finding the *k*th term in a Binomial Expansion**

 The *k*th term in the binomial expansion of $\left(x+y\right)^{n}$ is: $y^{y}$

Ex. Find the 6th term of $\left(a+2b\right)^{8}$

Ex. Find the 4th term of $\left(2x-y\right)^{11}$

Ex. Find the coefficient of the term $a^{4}b^{7}$ in the expansion of $\left(2a-3b\right)^{11}$

**Applications**

Ex. Expand $\left(2+i\right)^{5}$

Ex. The probability of a baseball player getting a hit is 1 out of 4 ($\frac{1}{4}$ or $0.250$).

 Find the probability that the player gets 6 hits in the next 10 at bats.

 $\left(\frac{3}{4}\right)^{4}$=

Ex. The probability of a girl baby is 50.9%. Find the probability that a family of 4 has exactly 3 girls.