

STAT 345
IMPORTANT FORMULAS/CALCULUS REVIEW

TAYLOR SERIES EXPANSION OF e^a

$$(1) \quad e^a = \sum_{k=0}^{\infty} \frac{a^k}{k!}$$

BINOMIAL THEOREM

The *Binomial Coefficient* is a formula which gives "the number of ways to choose k unordered items from a set containing n items".

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

Some facts.

$$\binom{n}{0} = 1 \qquad \binom{n}{1} = n \qquad \binom{n}{k} = \binom{n}{n-k}$$

Binomial Theorem:

$$(2) \quad \sum_{k=0}^n \binom{n}{k} a^k b^{n-k} = (a+b)^n$$

GEOMETRIC SERIES

$$(3) \quad \sum_{k=1}^n p^k = \frac{p - p^{n+1}}{1 - p}, \text{ for } p \neq 1$$

If $|p| < 1$, then we also have

$$(4) \quad \sum_{k=1}^{\infty} p^k = \frac{p}{1 - p}$$

NATURAL NUMBERS

The sum of the first n positive integers,

$$(5) \quad \sum_{k=1}^N k = \frac{N(N+1)}{2}$$

The sum of the first n positive *squares*,

$$(6) \quad \sum_{k=1}^N k^2 = \frac{N(N+1)(2N+1)}{6}$$