Name: _____

Problem 1. State the binomial theorem for the expansion of $(x + y)^n$.
Solution:
$$(x + y)^n = \sum_{k=0}^{n} \binom{n}{k} x^k y^{n-k}$$

Problem 2. Suppose we have a probability distribution with sample space $S = \{a, b, c\}$. What are the relations that $p(a), p(b)$, and $p(c)$ must satisfy so that we have a valid probability distribution?
Solution: We must have $0 \le p(a) \le 1, 0 \le p(b) \le 1, 0 \le p(c) \le 1$, and $p(a) + p(b) + p(c) = 1$.

Problem 3. Give an arithmetical expression for the following. For this problem, expressions involving factorials like $5 \cdot 3!$ are fine, but expressions involving quantities like $\binom{4}{2}$ or $P(5,3)$ are not.

(No work needed)

(a) $\binom{8}{3}$

Solution: $\frac{8!}{3! \cdot 5!}$

(b) $P(8,3)$

Solution: $8 \cdot 7 \cdot 6$ (or $\frac{8!}{5!}$)

(c) The number of distinct permutations of the string AAAABBCCCD (different copies of the same letter are taken to be indistinguishable).

Solution: $\binom{10}{4,2,3,1} = \frac{10!}{4! \cdot 2! \cdot 3! \cdot 1!}$.