Formulas and Theorems from Algebra *(continued)*

Discriminant of a general second-degree equation (p. 653)	Any conic can be described by a general second-degree equation in x and y: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. The expression $B^2 - 4AC$ is the discriminant of the conic equation and can be used to identify it. **Discriminant** — **Type of Conic** $B^2 - 4AC < 0$, $B = 0$, and $A = C$ — Circle $B^2 - 4AC < 0$, and either $B \neq 0$ or $A \neq C$ — Ellipse $B^2 - 4AC = 0$ — Parabola $B^2 - 4AC > 0$ — Hyperbola If $B = 0$, each axis of the conic is horizontal or vertical.

Formulas from Combinatorics

Fundamental counting principle (p. 682)	If one event can occur in m ways and another event can occur in n ways, then the number of ways that both events can occur is $m \cdot n$.
Permutations of *n* objects taken *r* at a time (p. 685)	The number of permutations of r objects taken from a group of n distinct objects is denoted by ${}_nP_r$ and is given by: $${}_nP_r = \frac{n!}{(n-r)!}$$
Permutations with repetition (p. 685)	The number of distinguishable permutations of n objects where one object is repeated s_1 times, another is repeated s_2 times, and so on is: $$\frac{n!}{s_1! \cdot s_2! \cdot \ldots \cdot s_k!}$$
Combinations of *n* objects taken *r* at a time (p. 690)	The number of combinations of r objects taken from a group of n distinct objects is denoted by ${}_nC_r$ and is given by: $${}_nC_r = \frac{n!}{(n-r)! \cdot r!}$$
Pascal's triangle (p. 692)	If you arrange the values of ${}_nC_r$ in a triangular pattern in which each row corresponds to a value of n, you get what is called Pascal's triangle. ${}_0C_0$ — 1 ${}_1C_0 \quad {}_1C_1$ — 1 1 ${}_2C_0 \quad {}_2C_1 \quad {}_2C_2$ — 1 2 1 ${}_3C_0 \quad {}_3C_1 \quad {}_3C_2 \quad {}_3C_3$ — 1 3 3 1 ${}_4C_0 \quad {}_4C_1 \quad {}_4C_2 \quad {}_4C_3 \quad {}_4C_4$ — 1 4 6 4 1 The first and last numbers in each row are 1. Every number other than 1 is the sum of the closest two numbers in the row directly above it.
Binomial theorem (p. 693)	The binomial expansion of $(a + b)^n$ for any positive integer n is: $$(a+b)^n = {}_nC_0a^nb^0 + {}_nC_1a^{n-1}b^1 + {}_nC_2a^{n-2}b^2 + \cdots + {}_nC_na^0b^n = \sum_{r=0}^{n} {}_nC_r a^{n-r}b^r$$

TABLES