Informally, a graph is a collection of vertices, some pairs of which are joined by edges. An independent set in a graph is a collection of vertices no two of which are joined by an edge. If \( G \) is a graph and \( k > 0 \) is an integer, then I denote by "\( f_k(G) \)" the number of \( k \)-vertex independent sets in \( G \). The independence polynomial of \( G \) is \( f_G(x) = \sum f_k(G)x^k \), where \( f_G(x) \) is the generating function for the numbers \( \{f_k(G)\} \). Most of the previous results are inequalities and asymptotic estimates, but exact formulas have been found for only a few classes of graphs such as paths, cycles, and \( 2 \times n \) lattices. I have studied the independence polynomial for some classes of graphs and found exact formulas in several cases. Among my results are closed formulas for \( 2 \times n \) lattices, Möbius ladders, and combs. For each of these classes of graphs, I generate a combinatorial identity. I have also considered "matching polynomials," that is, independence polynomials of line graphs, and derived a closed expression for the matching polynomials of some generalized combs. I last have investigated "independence equivalence," the phenomenon of non-isomorphic graphs having identical polynomials finding several infinite classes of such pairs of graphs. (Received September 21, 2010)