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Article Abstract: A new mathematical model is presented for the box-office dynamics of a motion picture released in North America. Though previous work on this problem has usually involved probabilistic methods, the new model for describing cumulative box-office gross uses a continuous-time, differential-equation approach. This model, which consists of a system of three nonlinear, coupled, ordinary differential equations, incorporates the effects of marketing and advertising expenses, audience reaction, critical reviews, and previous box-office behavior, among other factors. Analytical asymptotic results are presented for various parameter regimes. In the general case, the model must be solved numerically. Numerical simulations are tested against actual revenue data from several recent movies to analyse the model's accuracy. An algorithm for practical usage of the model is presented.