In the present thesis we study methods of financial derivatives valuation. We use stochastic calculus theory to build up the pricing model and to proceed on sufficiently general level which enables us to apply the model to different types of derivatives. After deriving explicit formulae for European-style options and forwards we show how to deal with American-style options pricing as well as pricing of the most widely used exotic options. We also study the sensitivity of portfolio to change of different factors and introduce hedging methods using financial derivatives. The theory is followed by an implementation of some assertions in computational algebra system and ilustrated by numerical examples.