Polynomial Regression Models

To describe a nonlinear relationship (such as a curvilinear relationship) between the predictors and the response, you use a polynomial regression model. A polynomial regression model is a special type of multiple linear regression model that includes higher-order terms, such as powers of variables (also referred to as polynomial terms) and cross-product (or interaction) terms. Polynomial regression models fall into the category of general linear models because they are linear in the parameters. Let's look at some examples of polynomial regression models. As shown in the first example, we can model the expected value of Y as a second-degree polynomial yielding a quadratic polynomial model of the type $Y_j = \beta_0 + \beta_1 X_j + \beta_2 X_j^2 + \varepsilon_j$.

In the second example, modeling a third-degree polynomial produces a cubic polynomial model. The third example contains a term that has an interaction between the variables X_1 and X_2. This polynomial model is of the type $Y_j = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + \beta_3 X_{1j} X_{2j} + \varepsilon_j$