

The **Curve Fitting** simulation allows students to explore how the number of data points and uncertainty around them can affect chi squared and r squared.

The screenshot shows the PhET Curve Fitting simulation interface. It includes a central graph with data points and a fitted curve, a 'Deviations' panel on the left showing  $\chi^2 = 8.25$  and  $r^2 = 0.83$ , and a control panel on the right. Callout boxes provide the following information:

- DETERMINE** how well a curve fits the data points (pointing to the Deviations panel).
- DRAG** points to create a data set (pointing to the bowl of orange spheres).
- FIT** different curves to the data set (pointing to the curve type selection options: Linear, Quadratic, Cubic).
- CUSTOMIZE** the curve using adjustable fit, or view the best fit and drag points to see the curve update (pointing to the adjustable fit controls for  $y = bx^2 + cx + d$ ).

## Important Notes

- $\Delta_y$  and  $\sigma$  represent the same idea, but conventions for graphical display and equations are not the same. The term "error bar" is commonly used to refer to the uncertainty of a data point on a graph. Technically, the half-length of the error bar is equal to one standard deviation. The symbol  $\sigma_i$  is conventionally used to refer to the uncertainty of data point  $(x_i, y_i)$  in equations.
- Students may have experience with correlation coefficient,  $r^2$ , from using graphing calculators and Excel (or another spreadsheet program). They may not observe the residuals if their data points all are on the curve. Make sure that as they explore the sim that they use many points and with some deviation.

## Suggestions for Use

- This sim could be used as an exploration into statistics without students trying to learn how  $\chi^2$  is calculated. For an example, see: [Curve Fitting Activity](#).

## Sample Challenge Prompts

- Build a data set and decide which curve fits your data the best. How do you know?
- What effect does changing the error bars have on  $\chi^2$  and  $r^2$ ?

See all published activities for Curve Fitting [here](#).

For more tips on using PhET sims with your students, see [Tips for Using PhET](#).