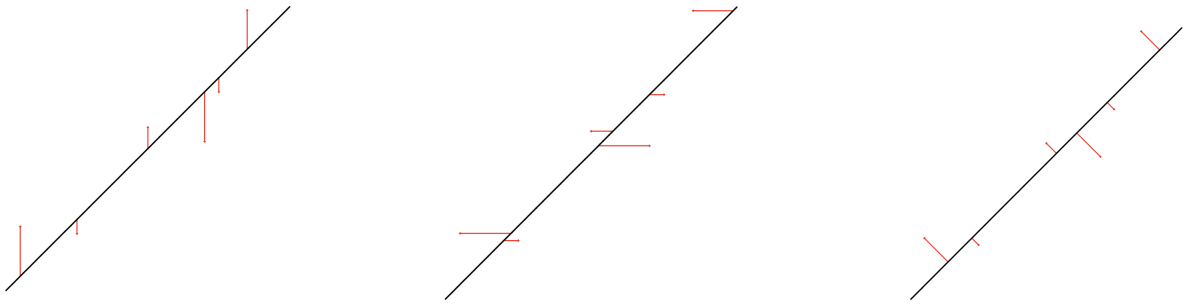
MAT 331, Spring 2026
Project 1: Least-Squares Fitting

Due March 4

In this project, you are to fit a line to some data in three different ways. First, by using the "usual" least squares method, which minimizes the sums of the squares of the *vertical* distances between the data and the line. Then, find the line given by assuming that the x variable may contain the errors and the y-values are exact (and hence minimize the sums of squares of the *horizontal* distances). Finally, assume that both x- and y-values are approximate, and find the line that minimizes the sum of the squares of the *absolute* distances from the points to the line. See the three figures below.



In the third case (minimizing the absolute Euclidean distance), the equations you need to solve to find the minimum will be nonlinear, and you will discover that there are two critical points. Only one is the minimum; **what line does the other critical point correspond to? Why must it be there?** (You may also get a line with a huge slope and intercept—this is due to rounding errors and may be thought of as a critical point "at infinity"). You might find it helpful to use `plot3d` to draw a picture of the surface that you are finding the minimum of.

You should, of course, also **plot the 3 lines you find along with the data points on the same graph**, including appropriate labeling.

Your project should be written as a paper which explains clearly each step you take and why.

There is a file containing a Maple command to assign the data points to a list called `data` at

`https://www.math.stonybrook.edu/~mmovshev/mat331-spr2026/students_files/NETID.txt`

In order to help you confirm your work, there is also a data file called `testcase.txt` which should yield (rounded to 4 places):

$$\text{Vertical: } y = -0.3009x + 4.7784,$$
$$\text{Horizontal: } y = -0.4541x + 4.9633,$$
$$\text{Euclidean: } y = -0.3142x + 4.7944.$$