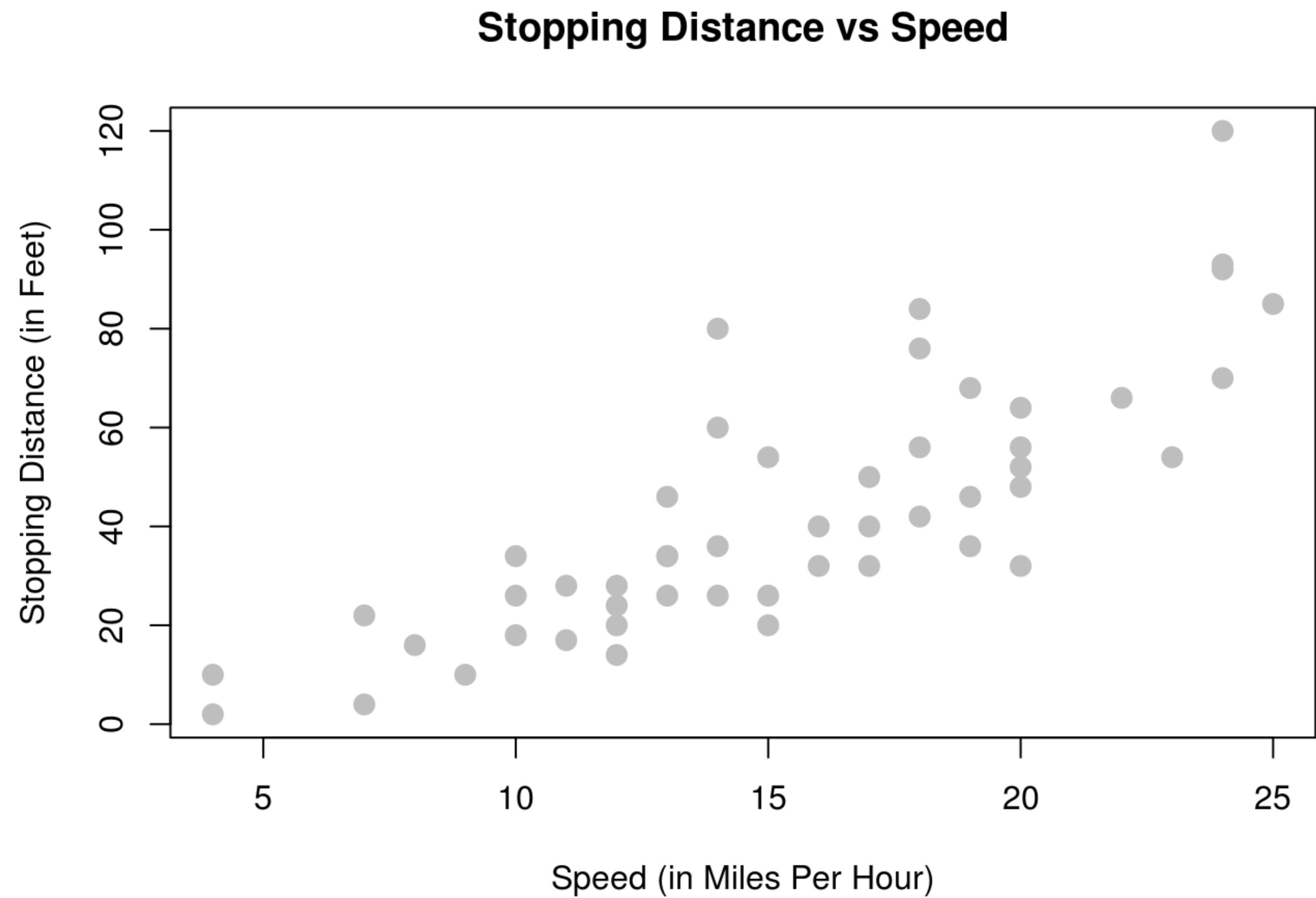


Simple Linear Regression

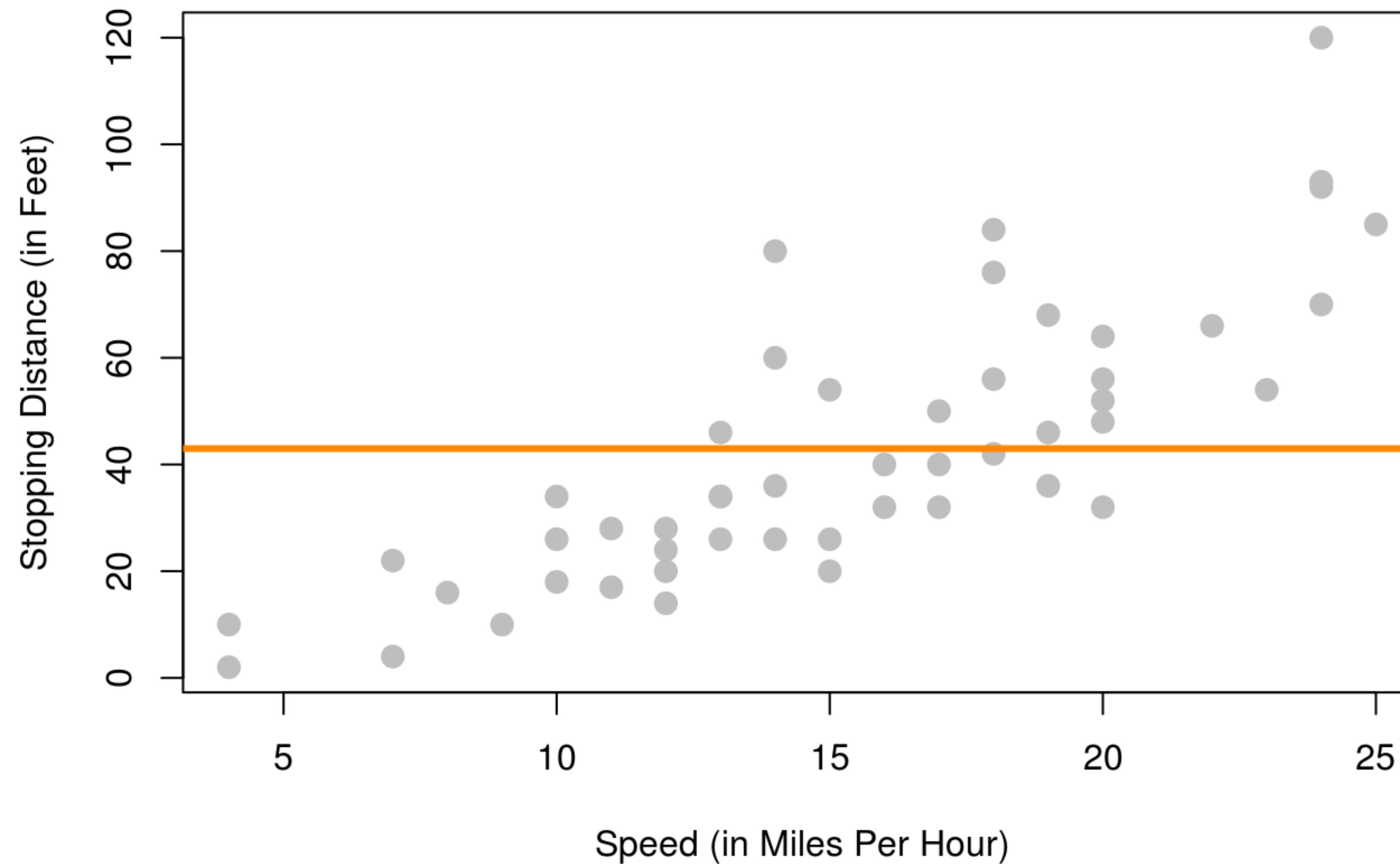
STAT 3202 | OSU | Autumn 2018
Dalpiaz

These aren't really "slides," instead just some visual aids
for lecture today....

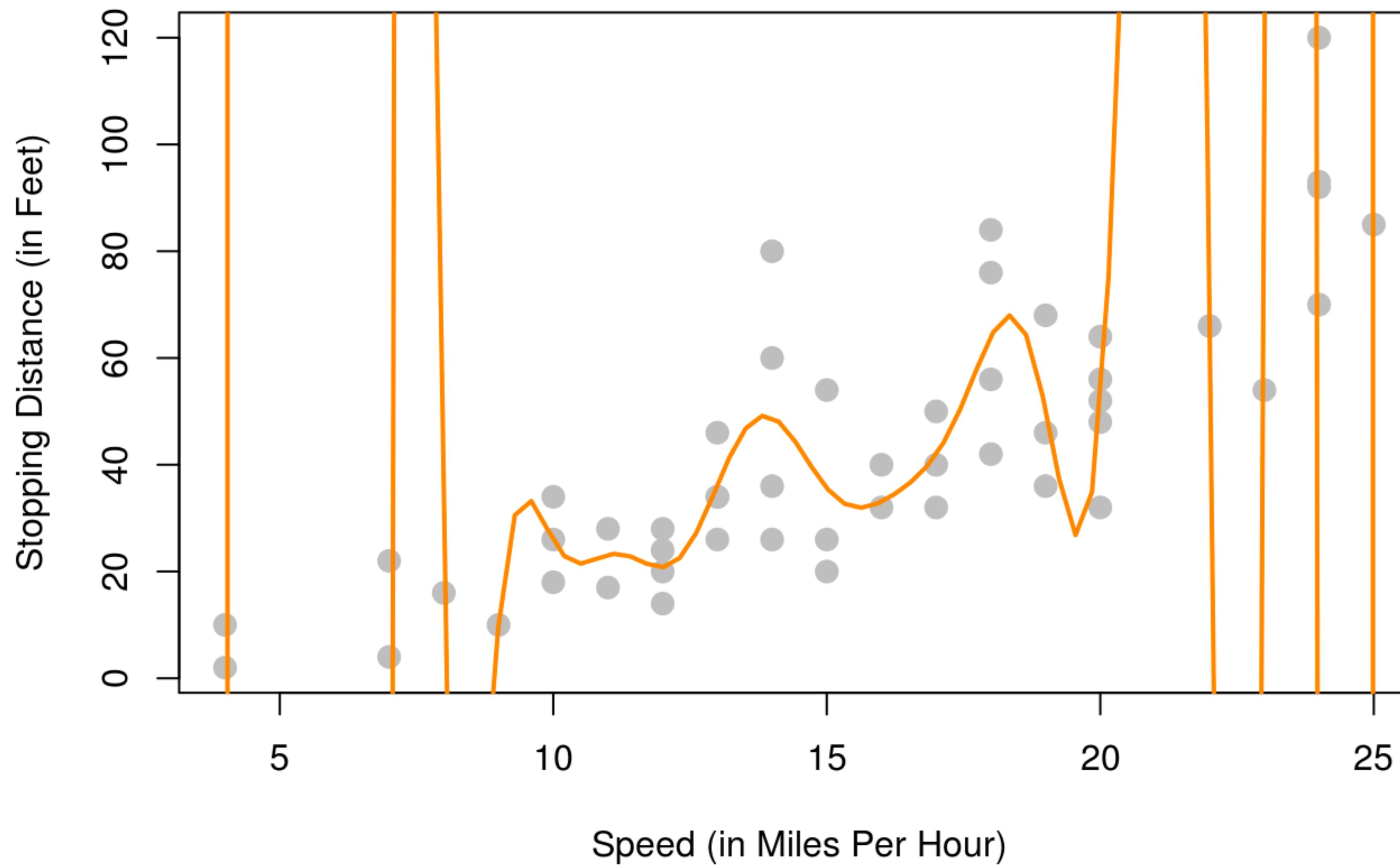
Speed	Distance
4	2
4	10
7	4
7	22
8	16
...	...
25	85



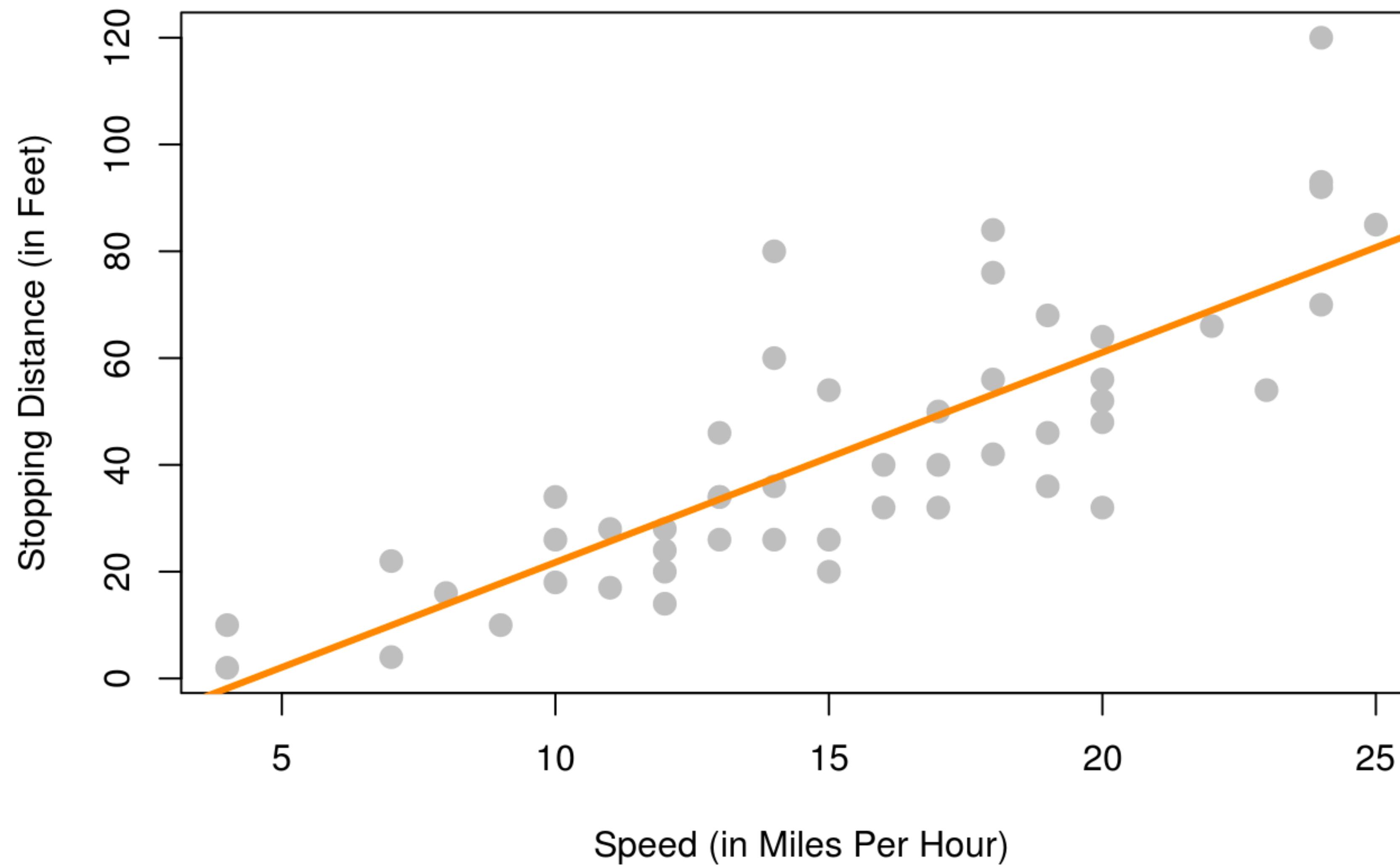
Stopping Distance vs Speed



Stopping Distance vs Speed



Stopping Distance vs Speed



y

$$E(Y) = \beta_1 x + \beta_0$$

 \vdash

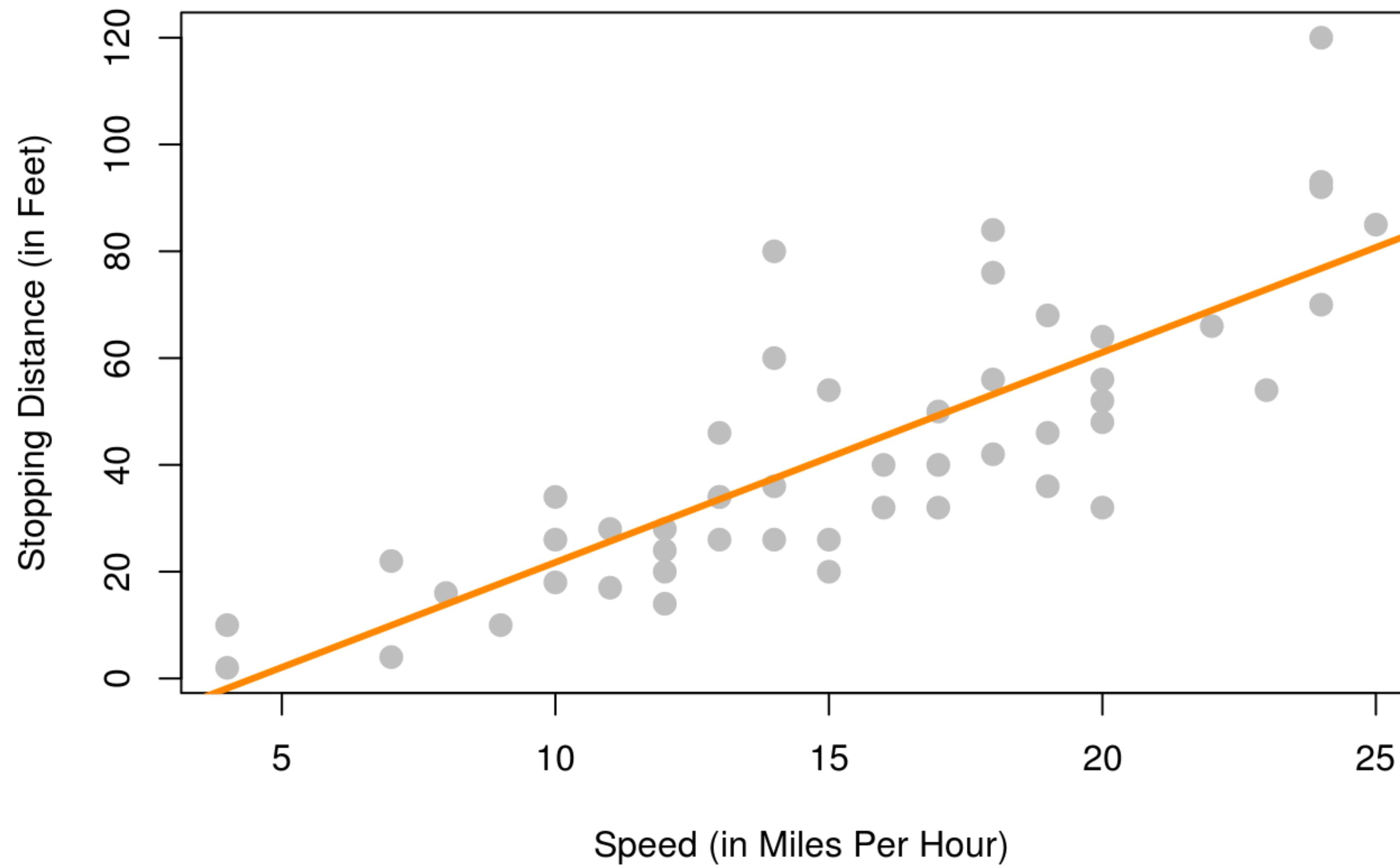
$$N(\beta_1 x_3 + \beta_0, \sigma^2)$$

$$N(\beta_1 x_2 + \beta_0, \sigma^2)$$

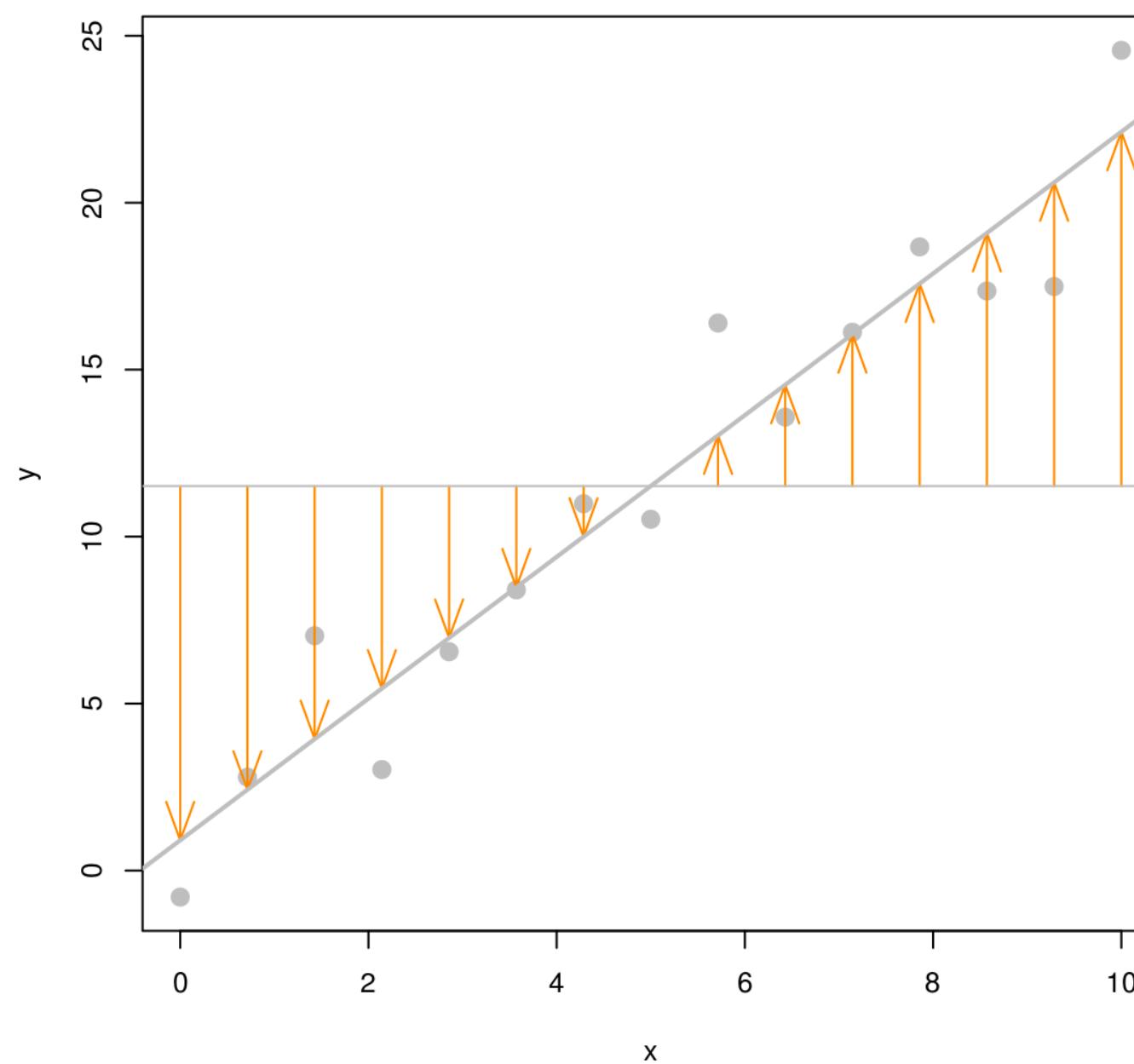
$$N(\beta_1 x_1 + \beta_0, \sigma^2)$$

 0 x_1 x_2 x_3 x

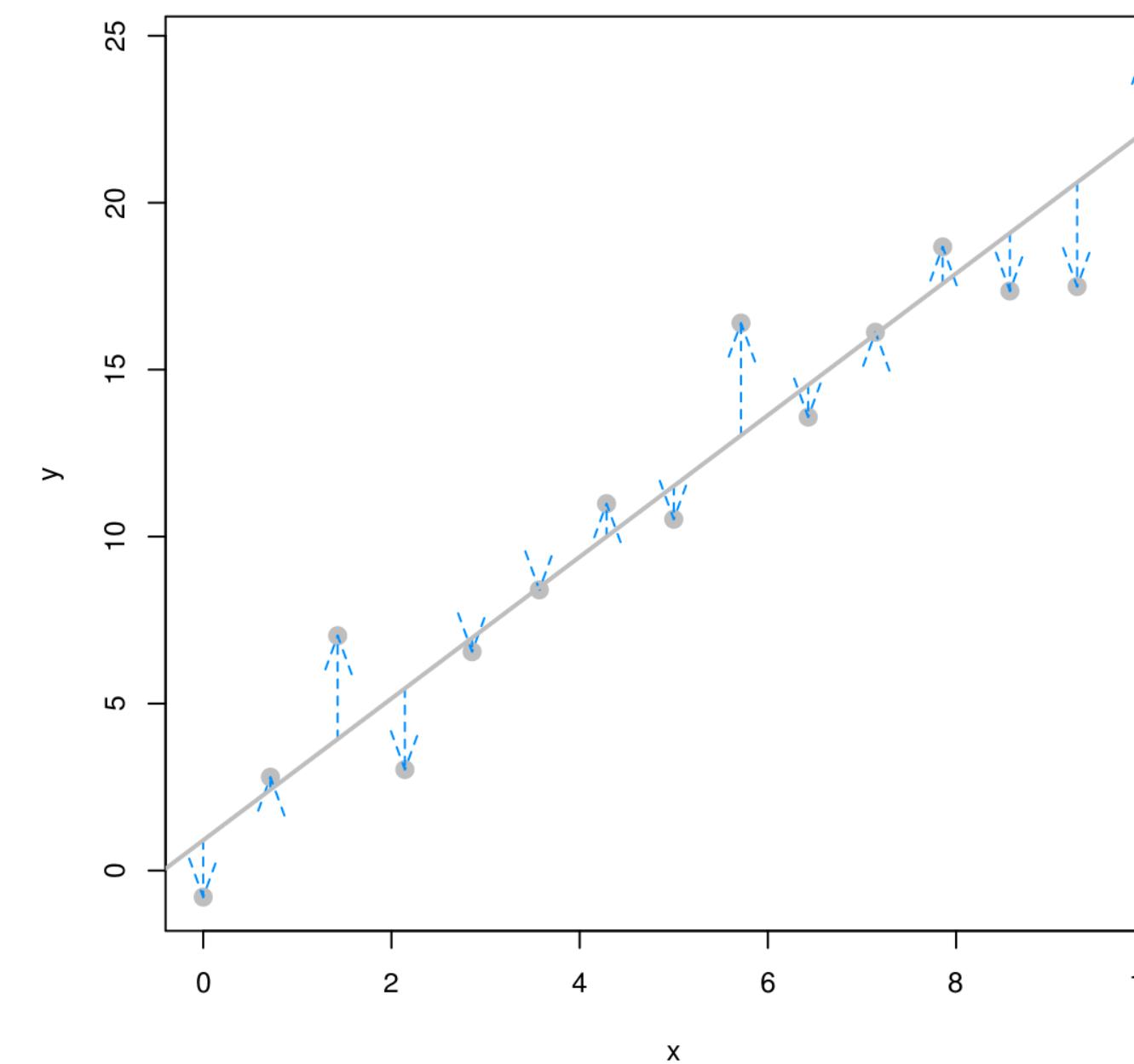
Stopping Distance vs Speed



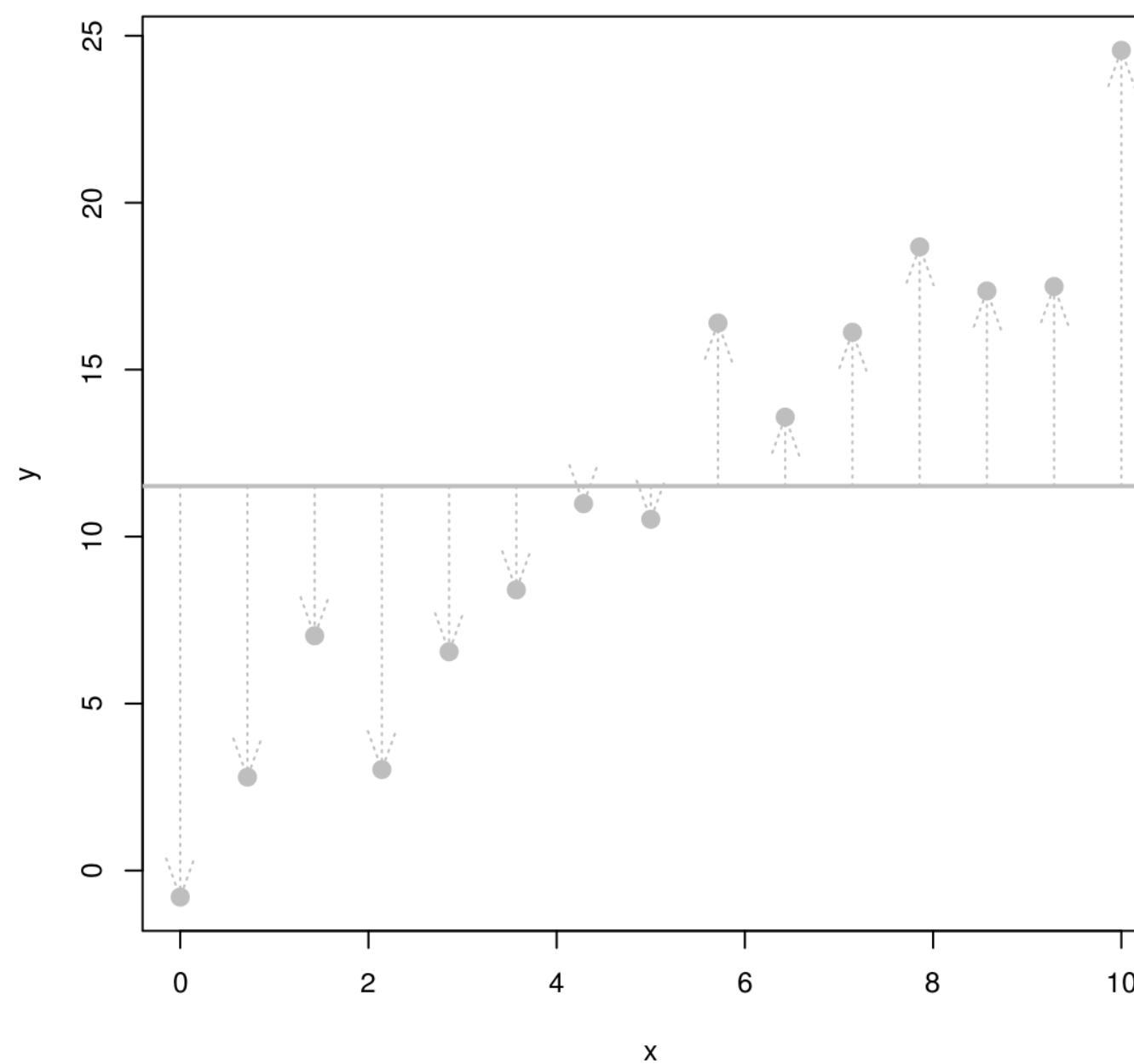
SSReg (Sum of Squares Regression)



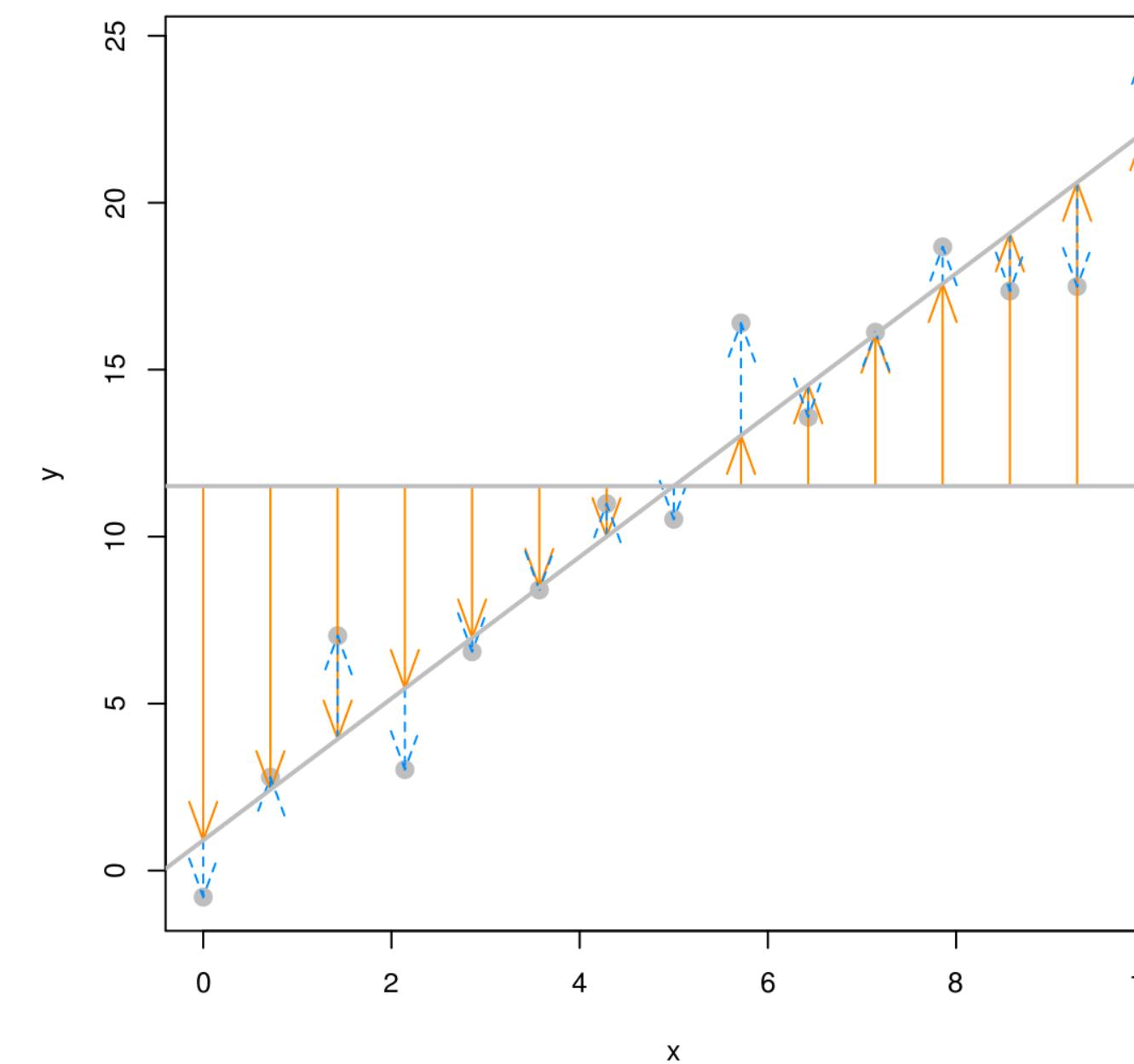
SSE (Sum of Squares Error)



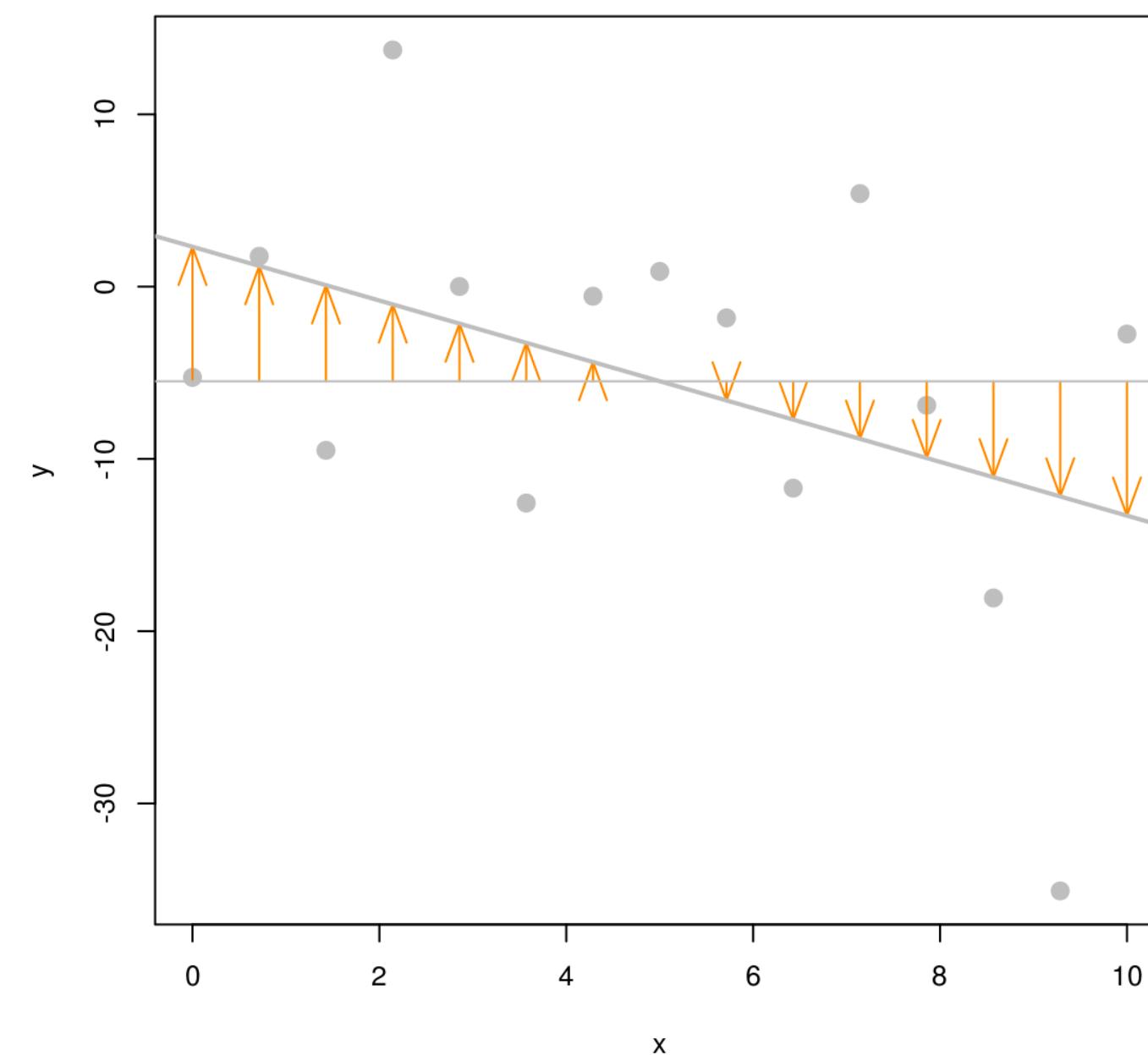
SST (Sum of Squares Total)



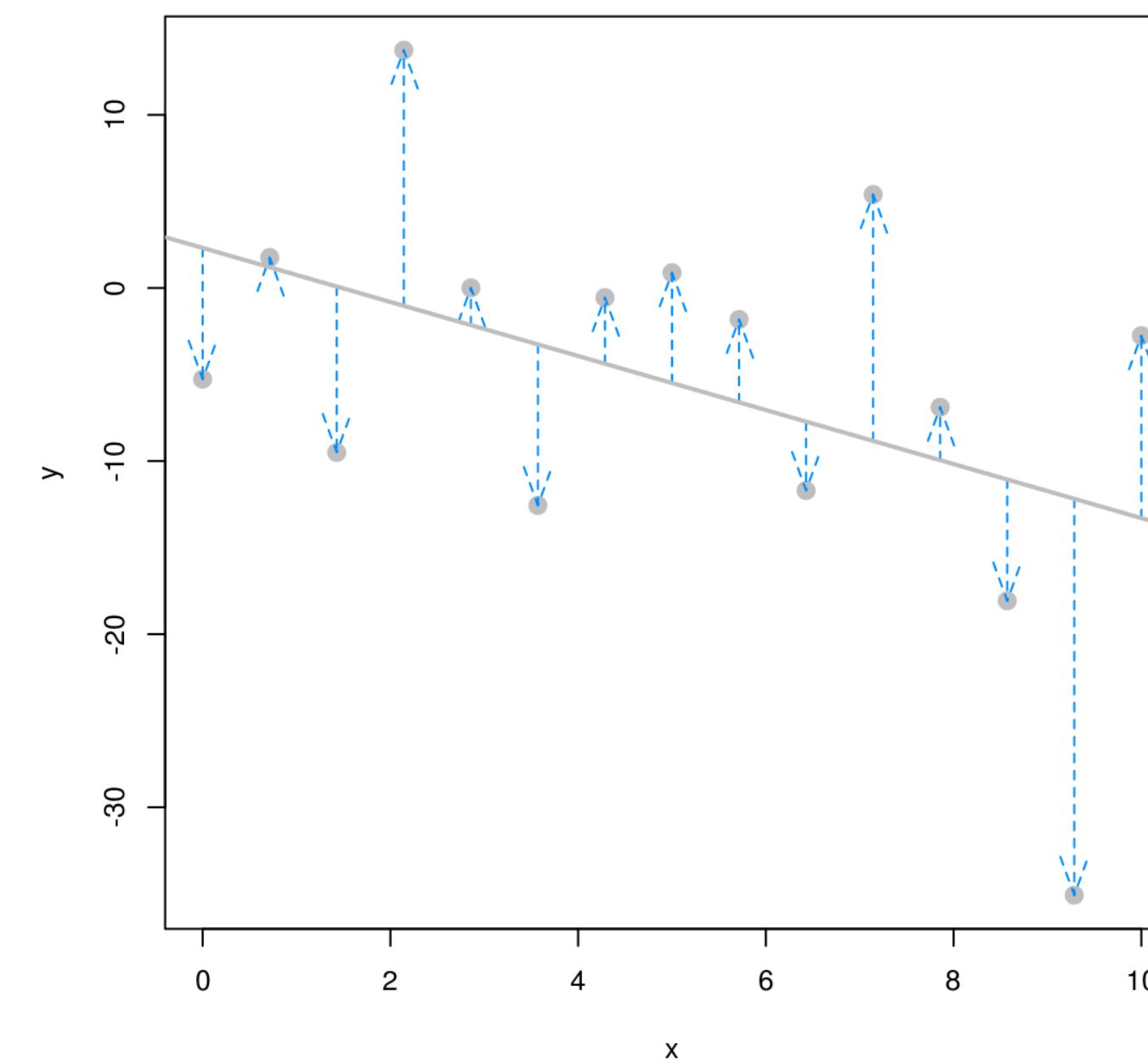
SST (Sum of Squares Total)



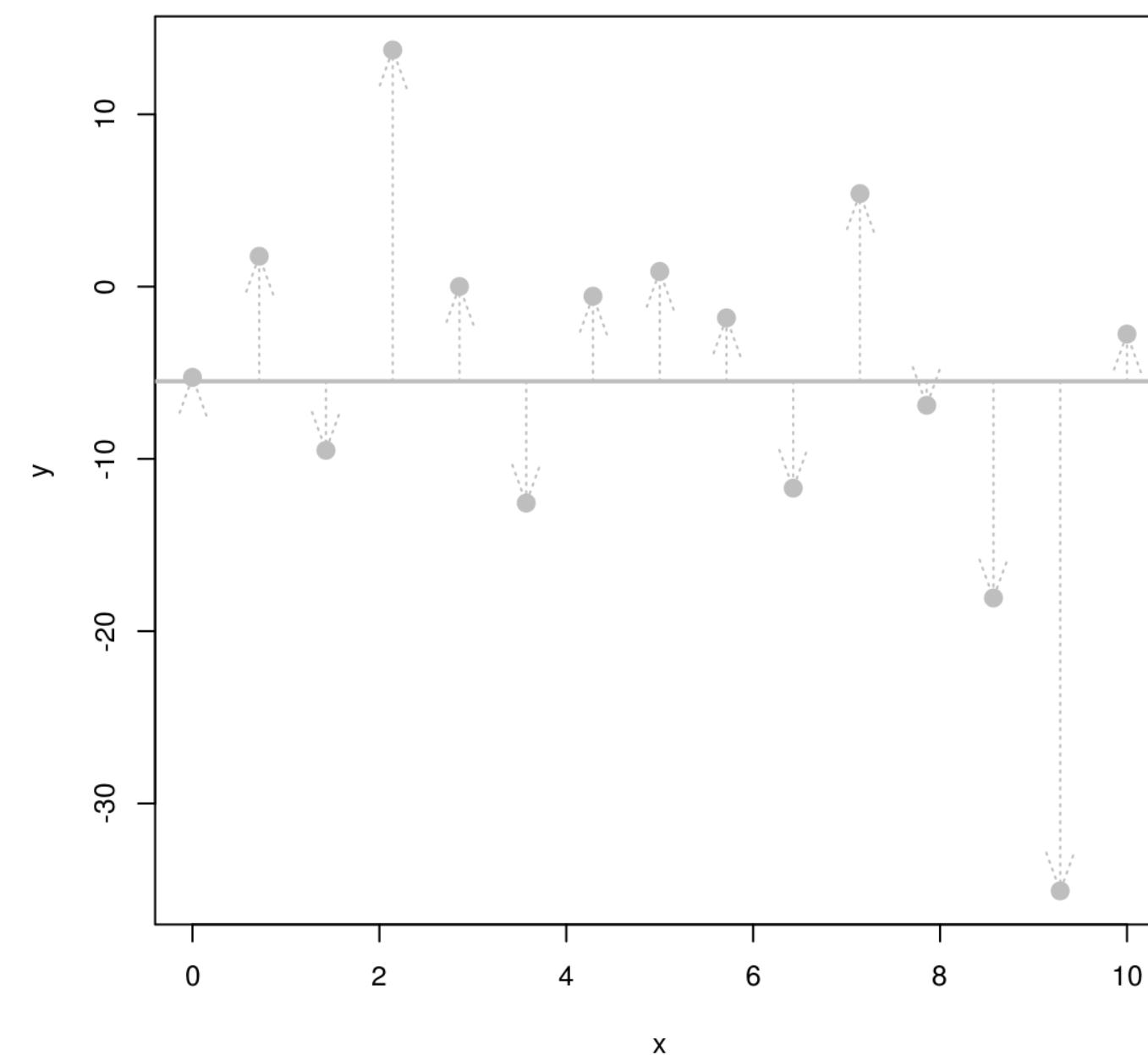
SSReg (Sum of Squares Regression)



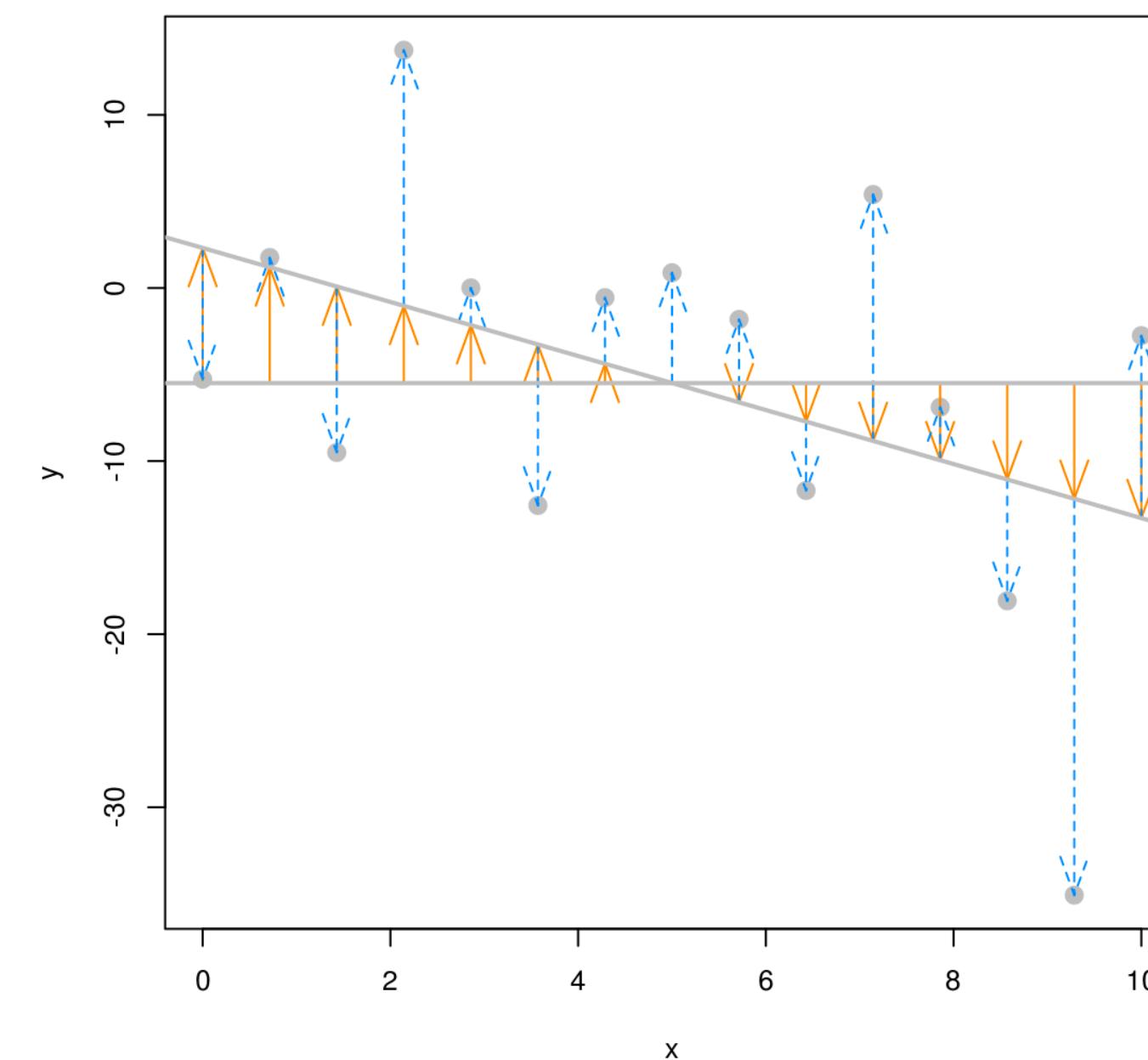
SSE (Sum of Squares Error)



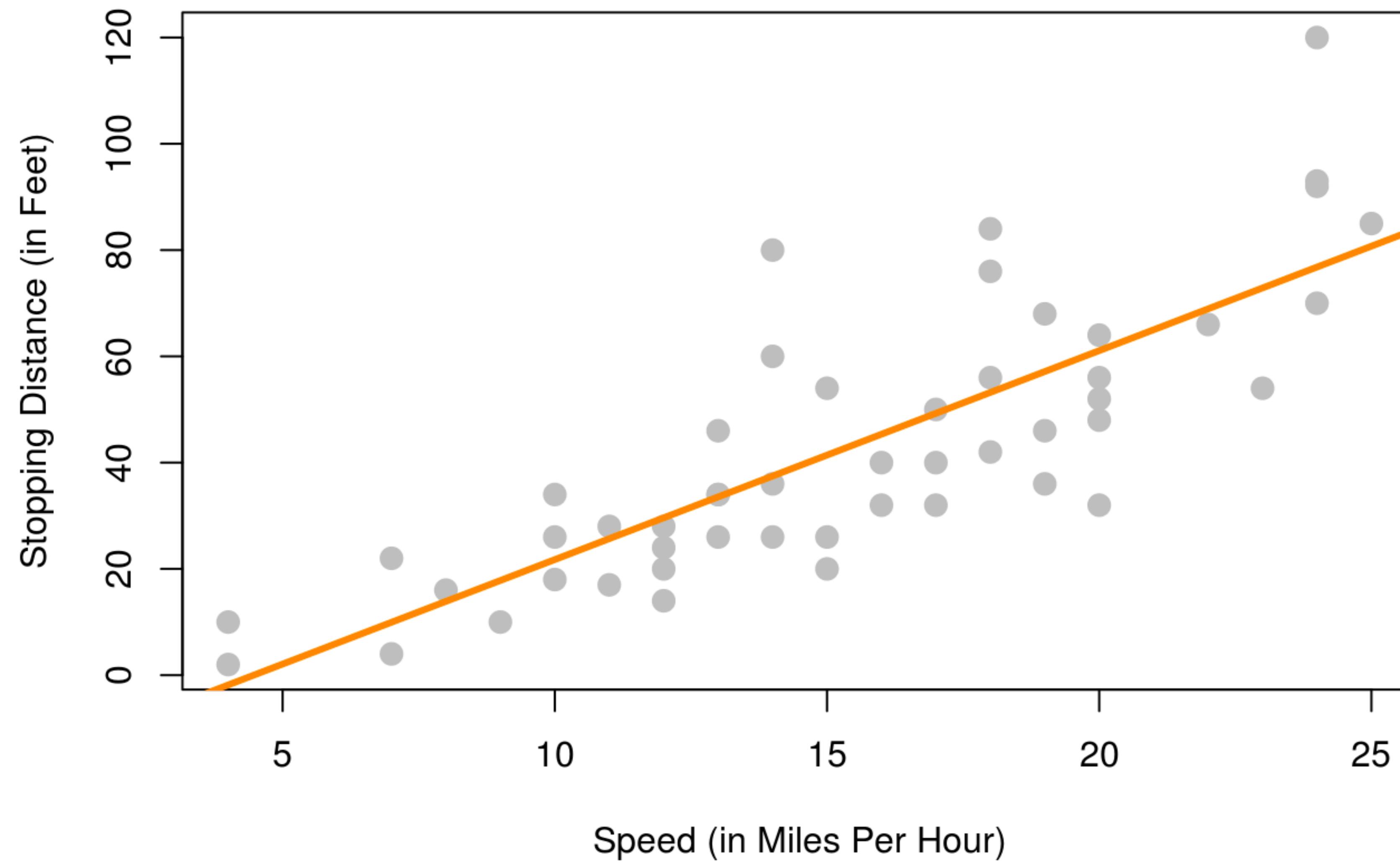
SST (Sum of Squares Total)



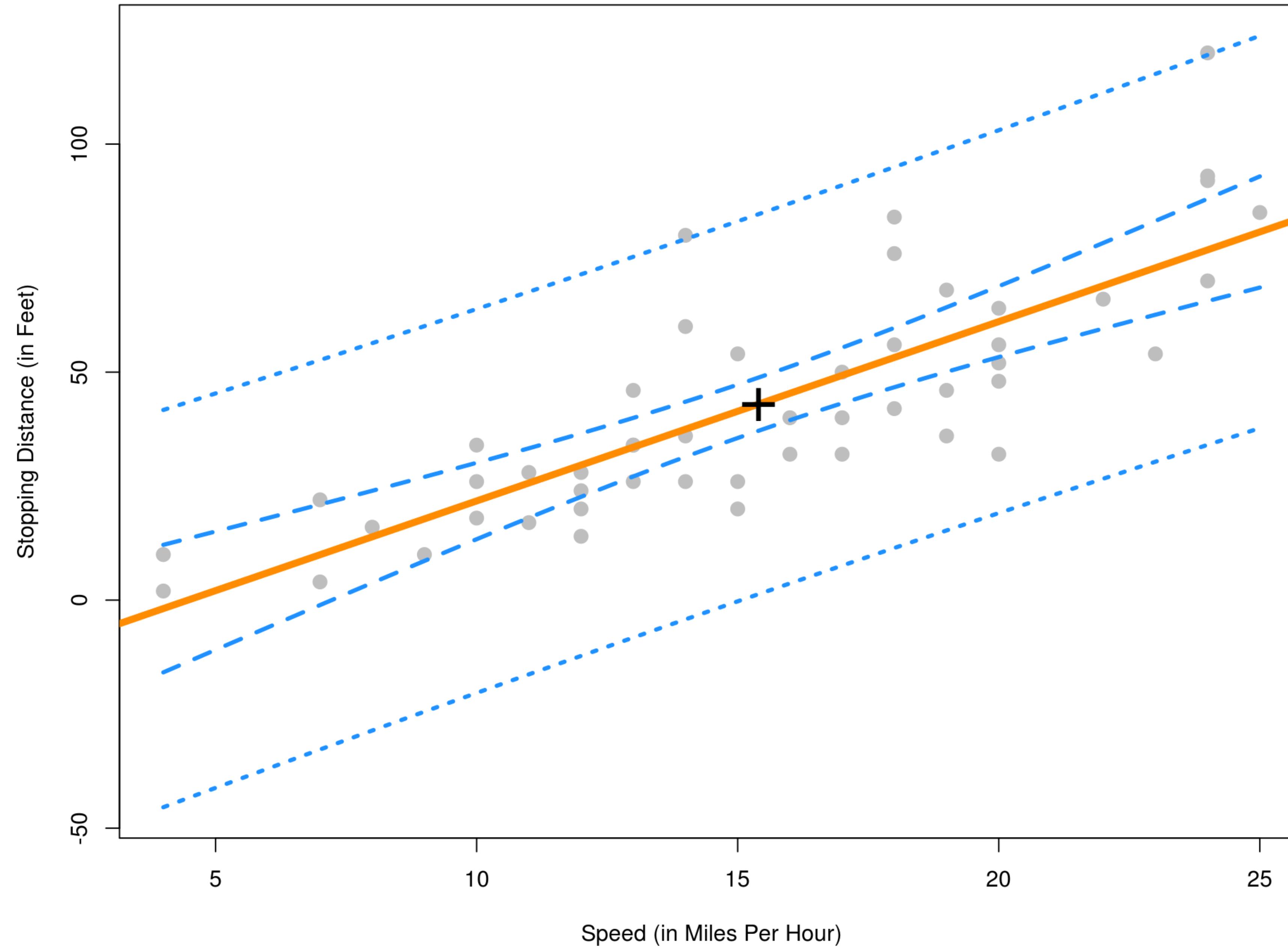
SST (Sum of Squares Total)



Stopping Distance vs Speed



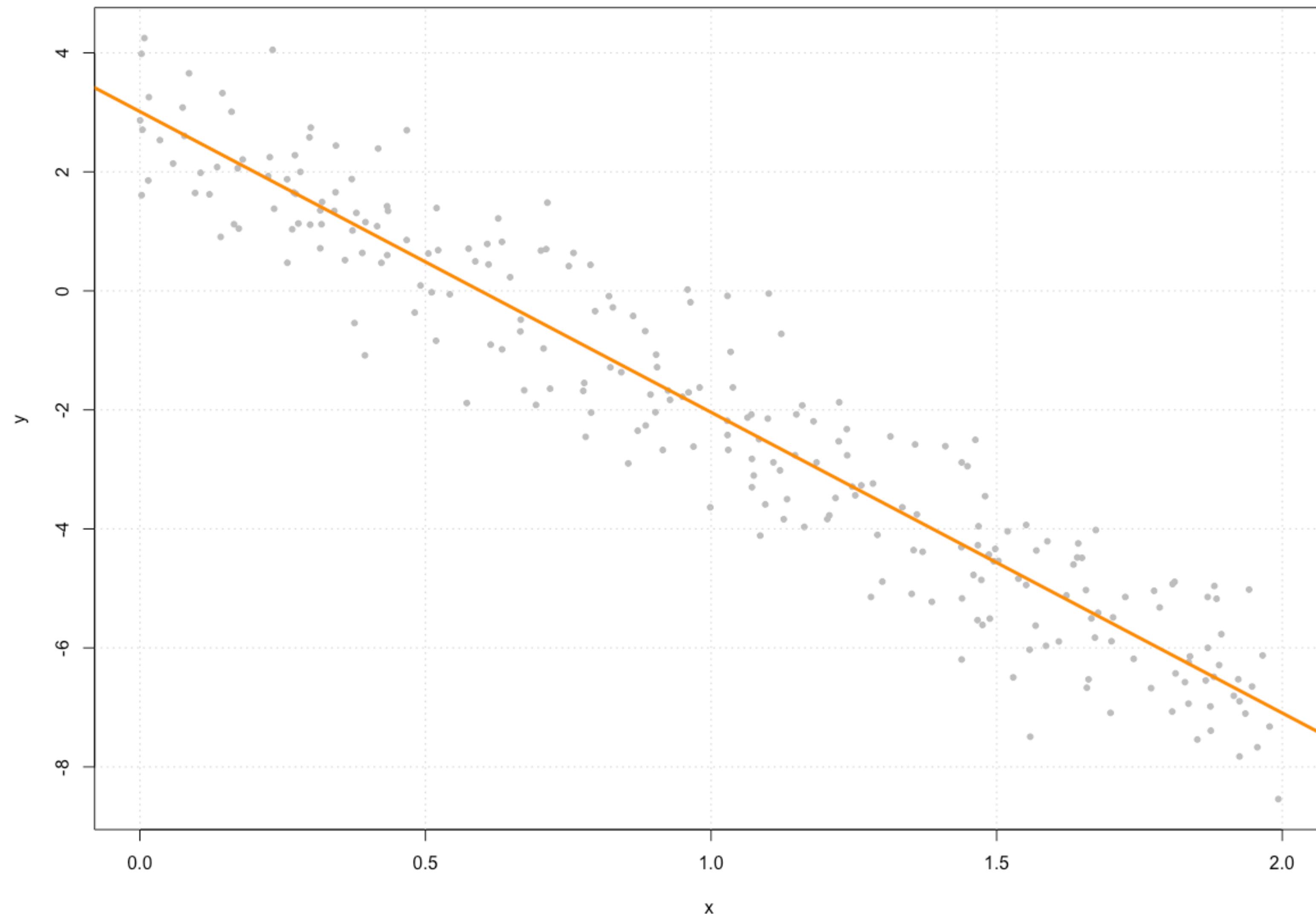
Stopping Distance vs Speed



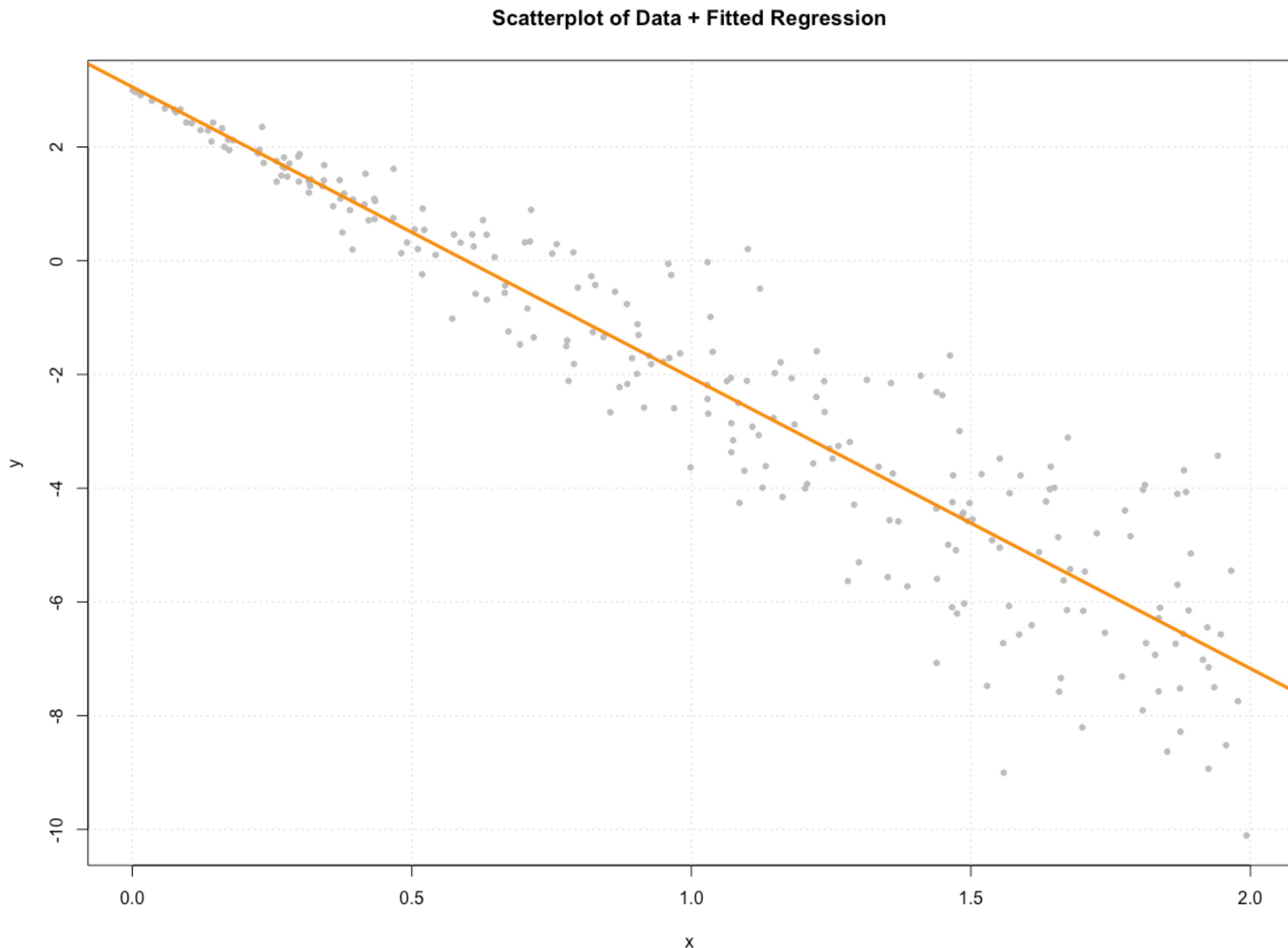
Assumptions and Diagnostics

Scatterplot of Data + Fitted Regression

Data and Model #1

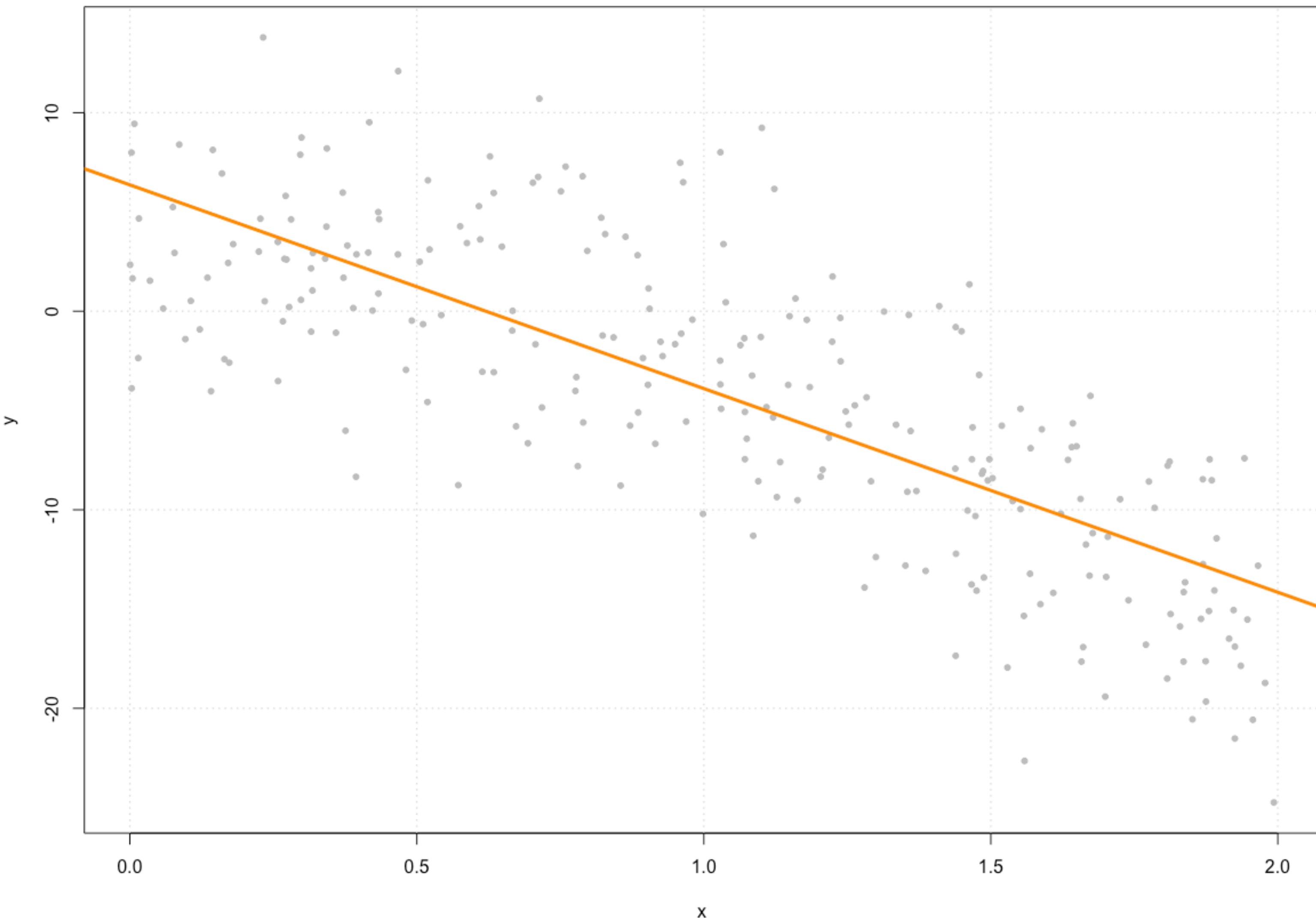


Data and Model #2



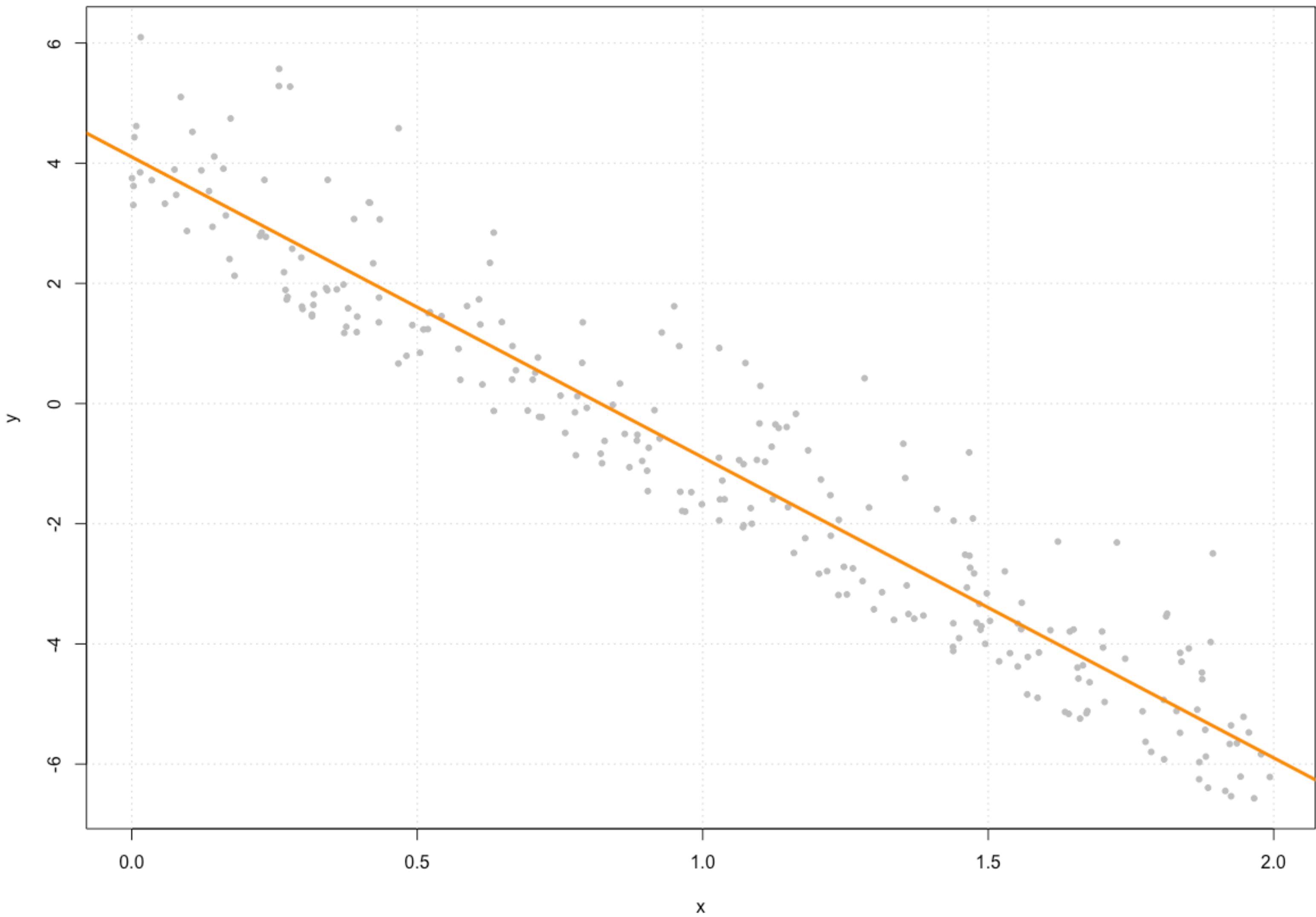
Data and Model #3

Scatterplot of Data + Fitted Regression



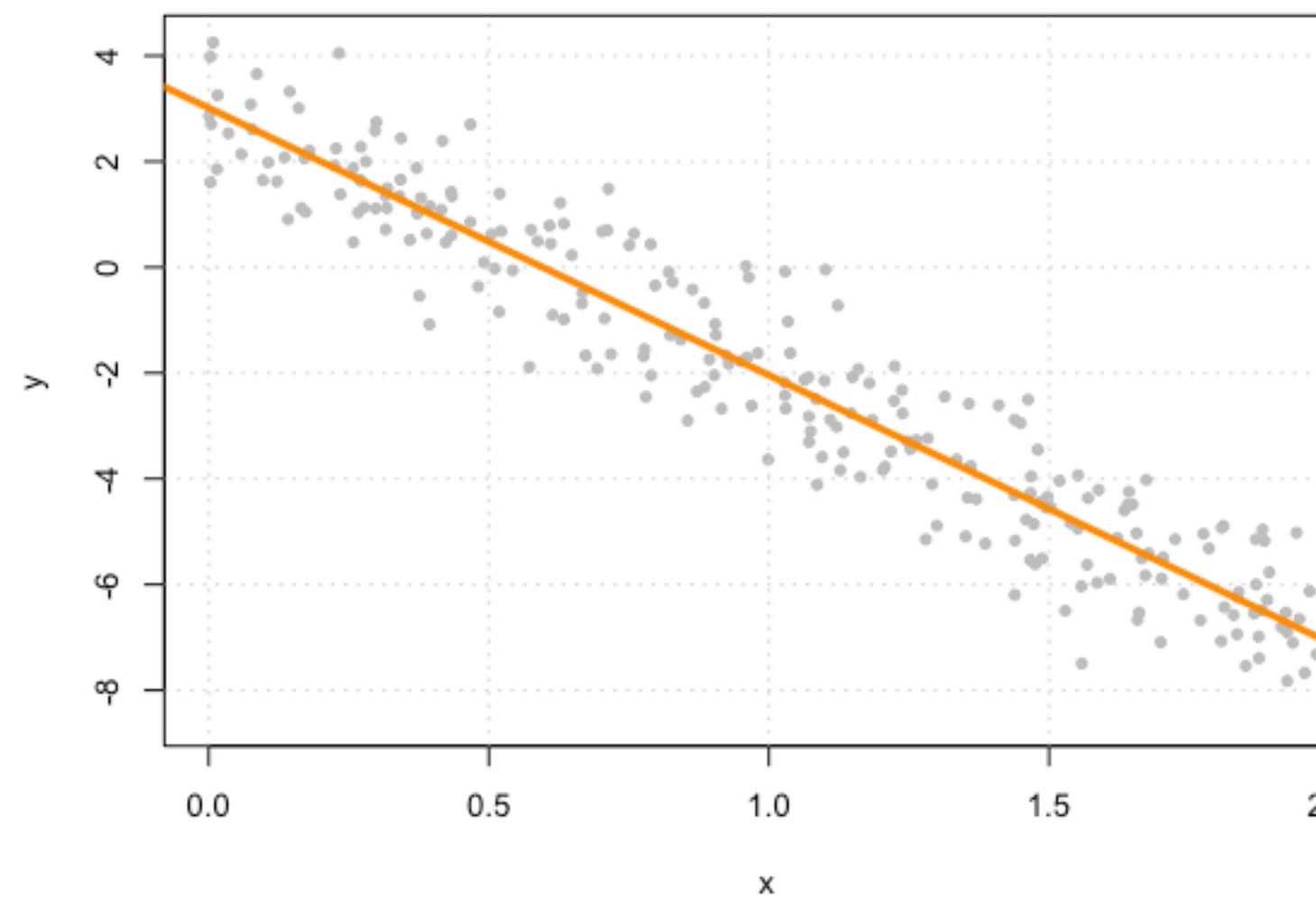
Data and Model #4

Scatterplot of Data + Fitted Regression

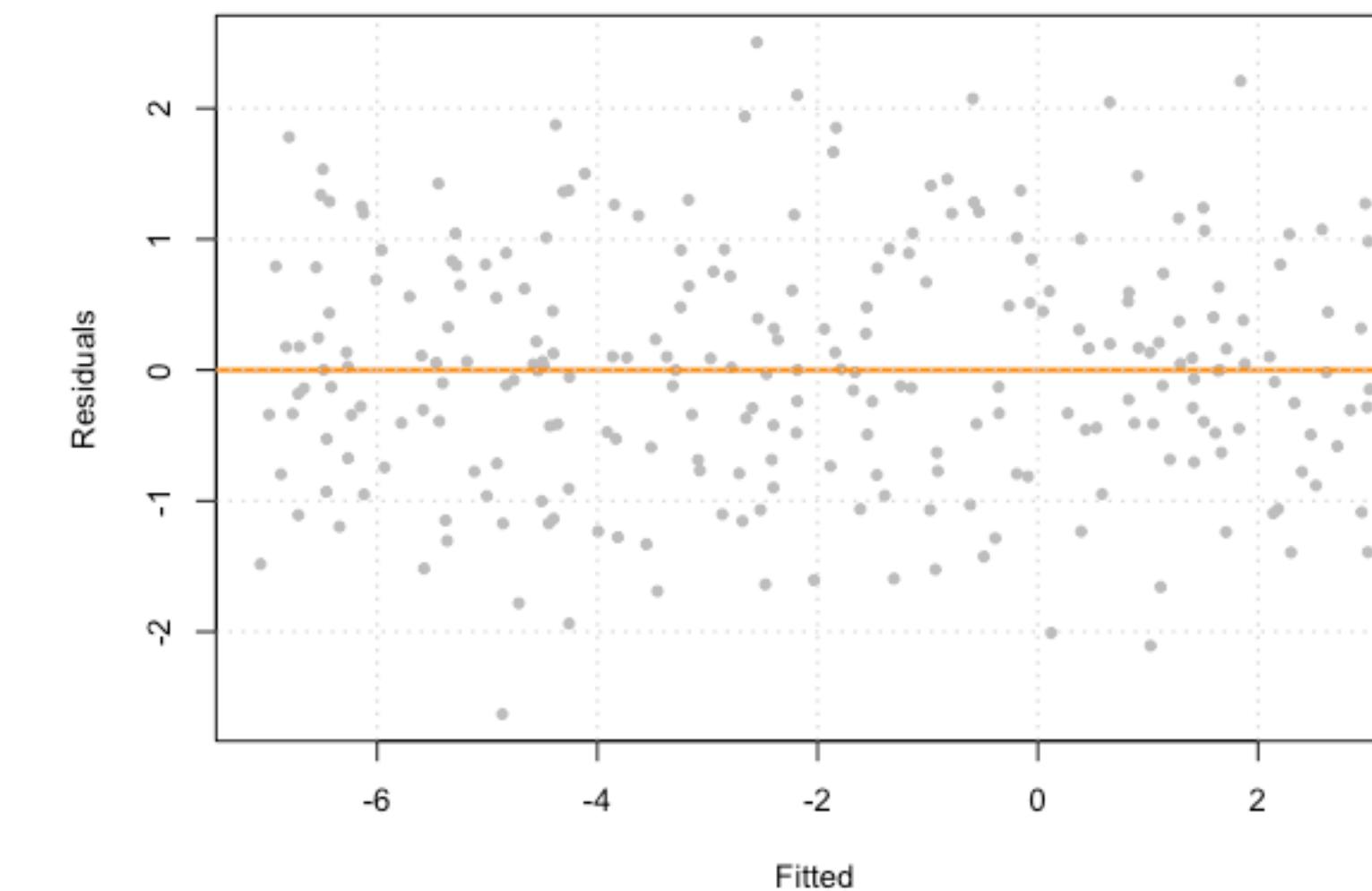


Model 1: $Y = 3 - 5x + \epsilon$, $\epsilon \sim N(0, 1)$

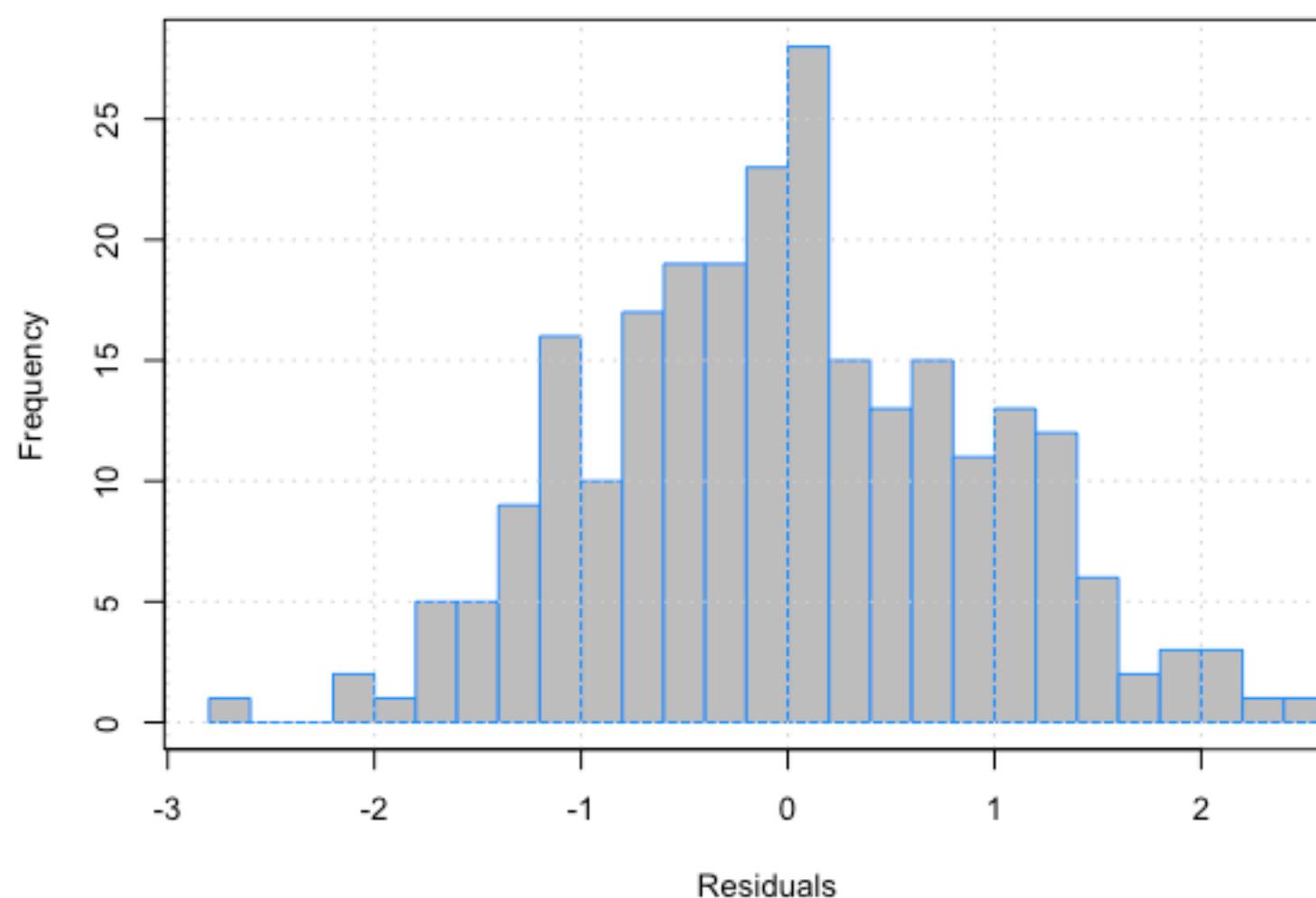
Scatterplot of Data + Fitted Regression



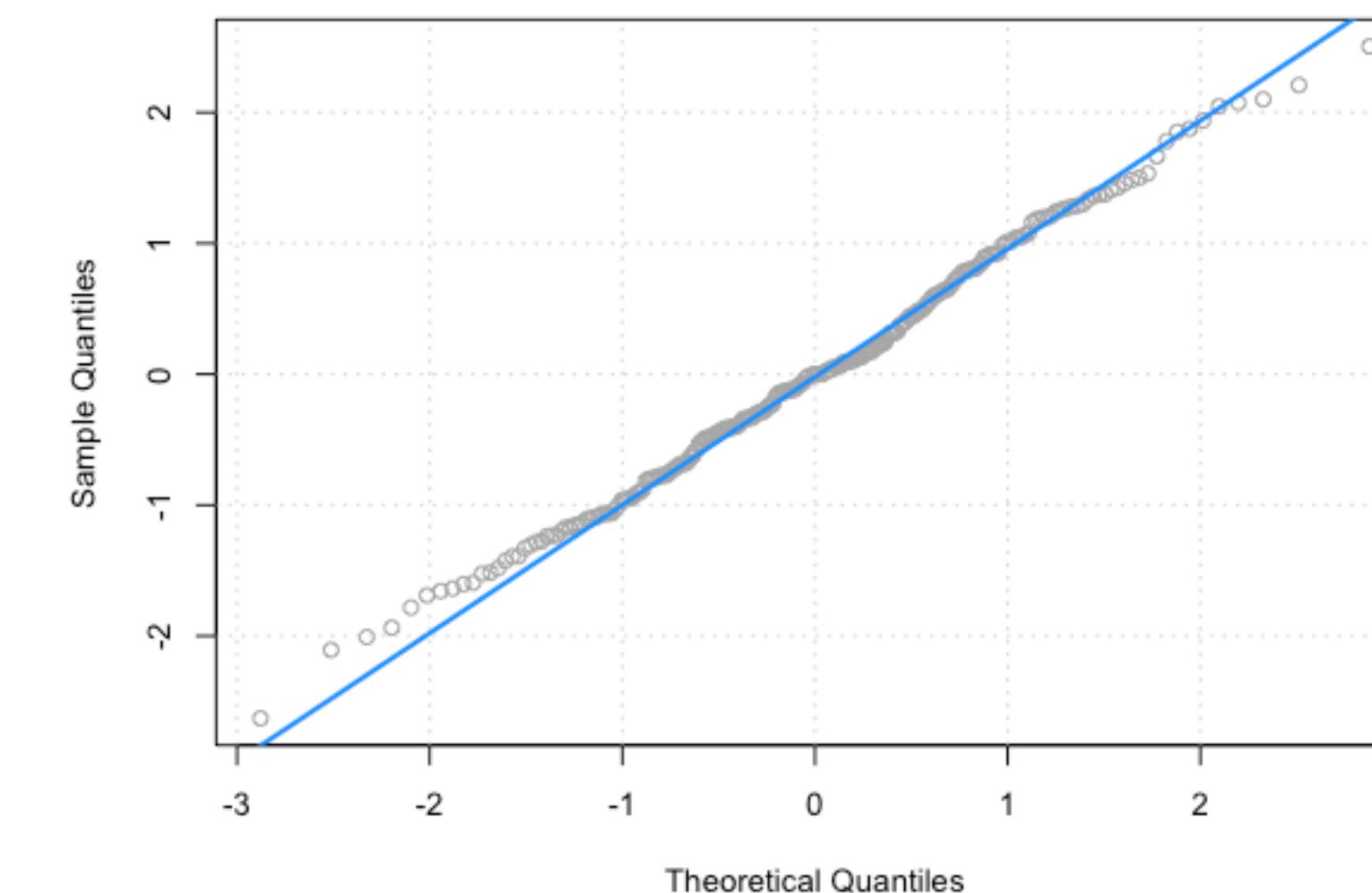
Fitted versus Residuals Plot



Histogram of Residuals

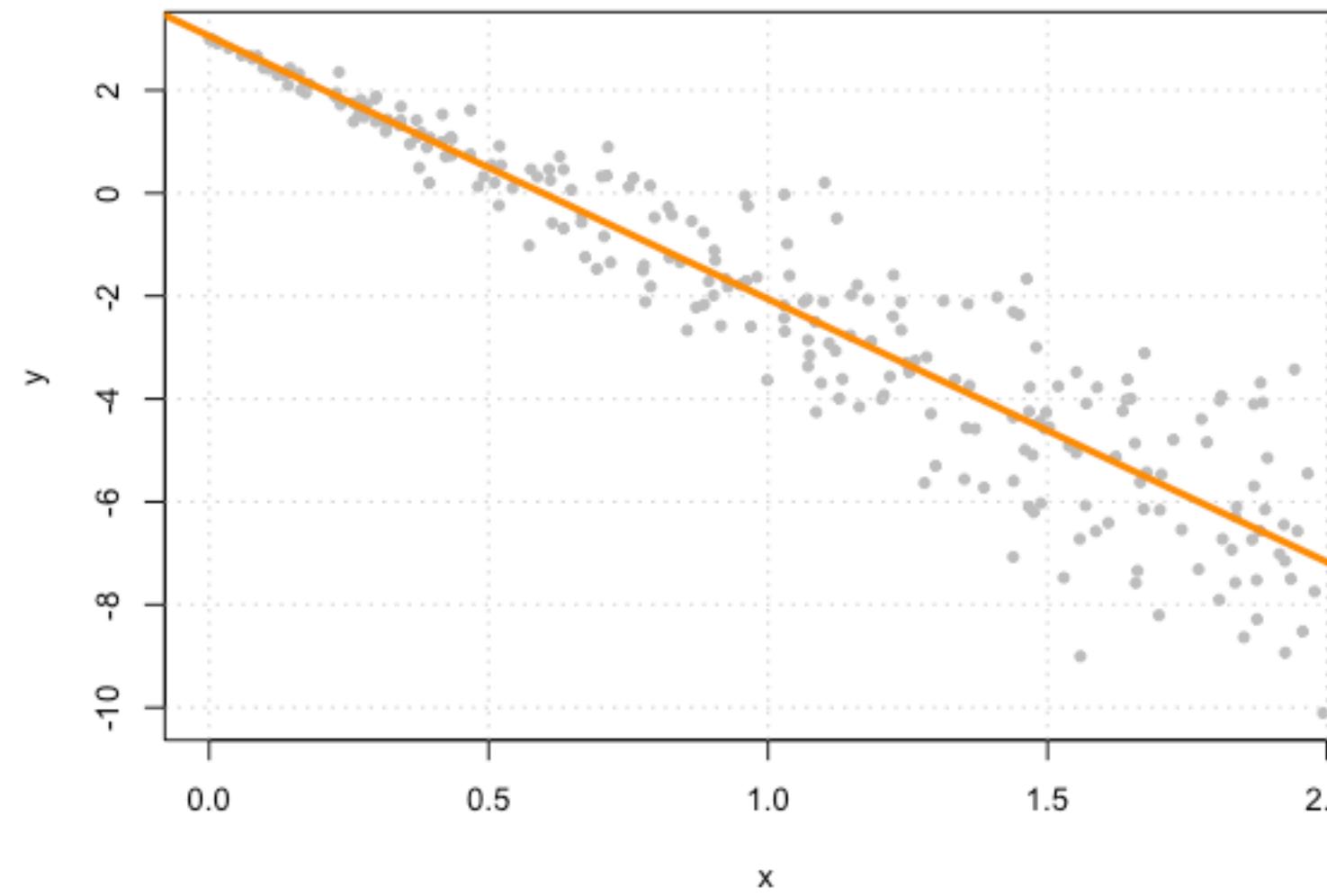


Residuals, Normal Q-Q Plot

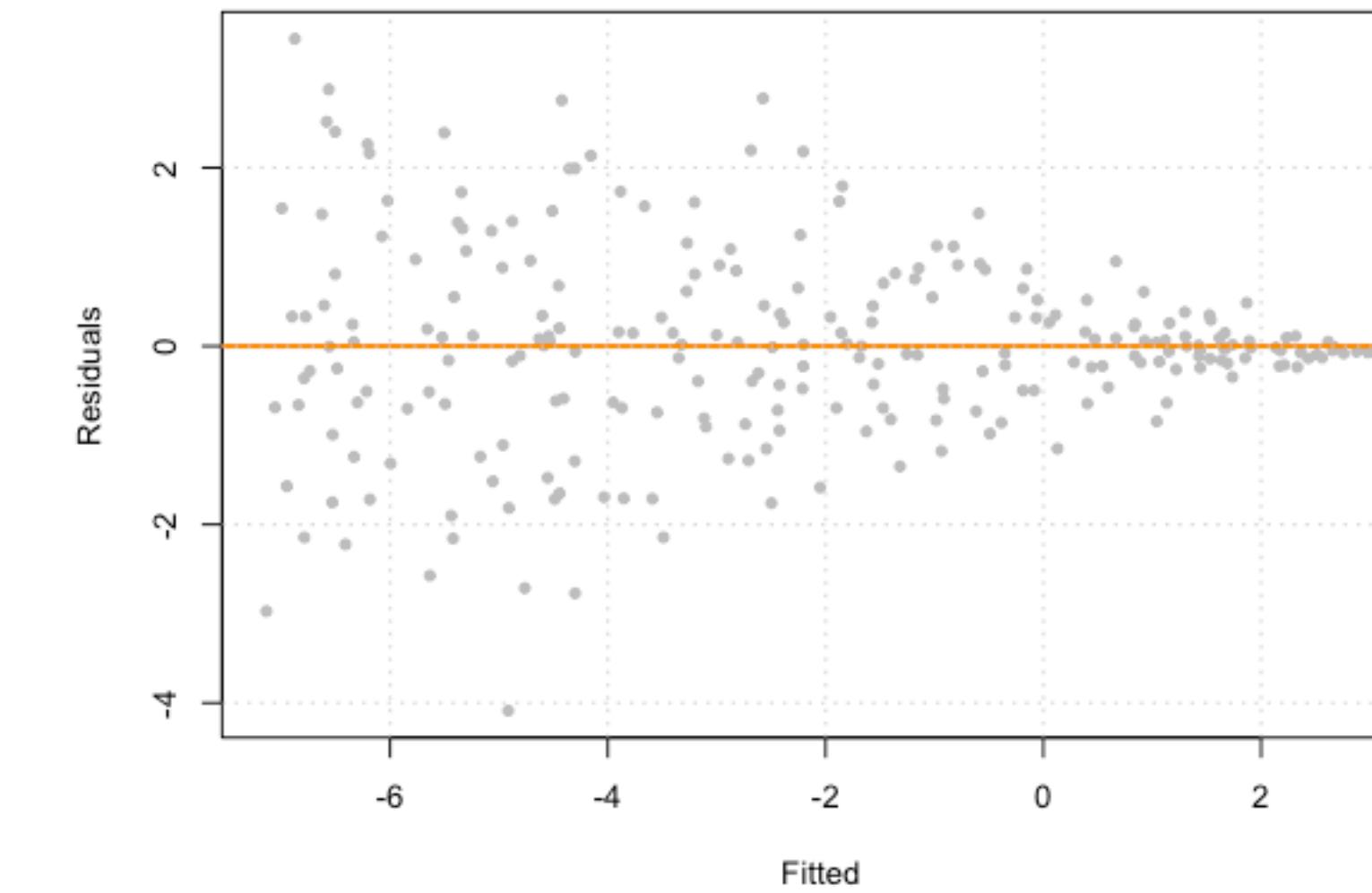


Model 2: $Y = 3 - 5x + \epsilon, \quad \epsilon \sim N(0, x^2)$

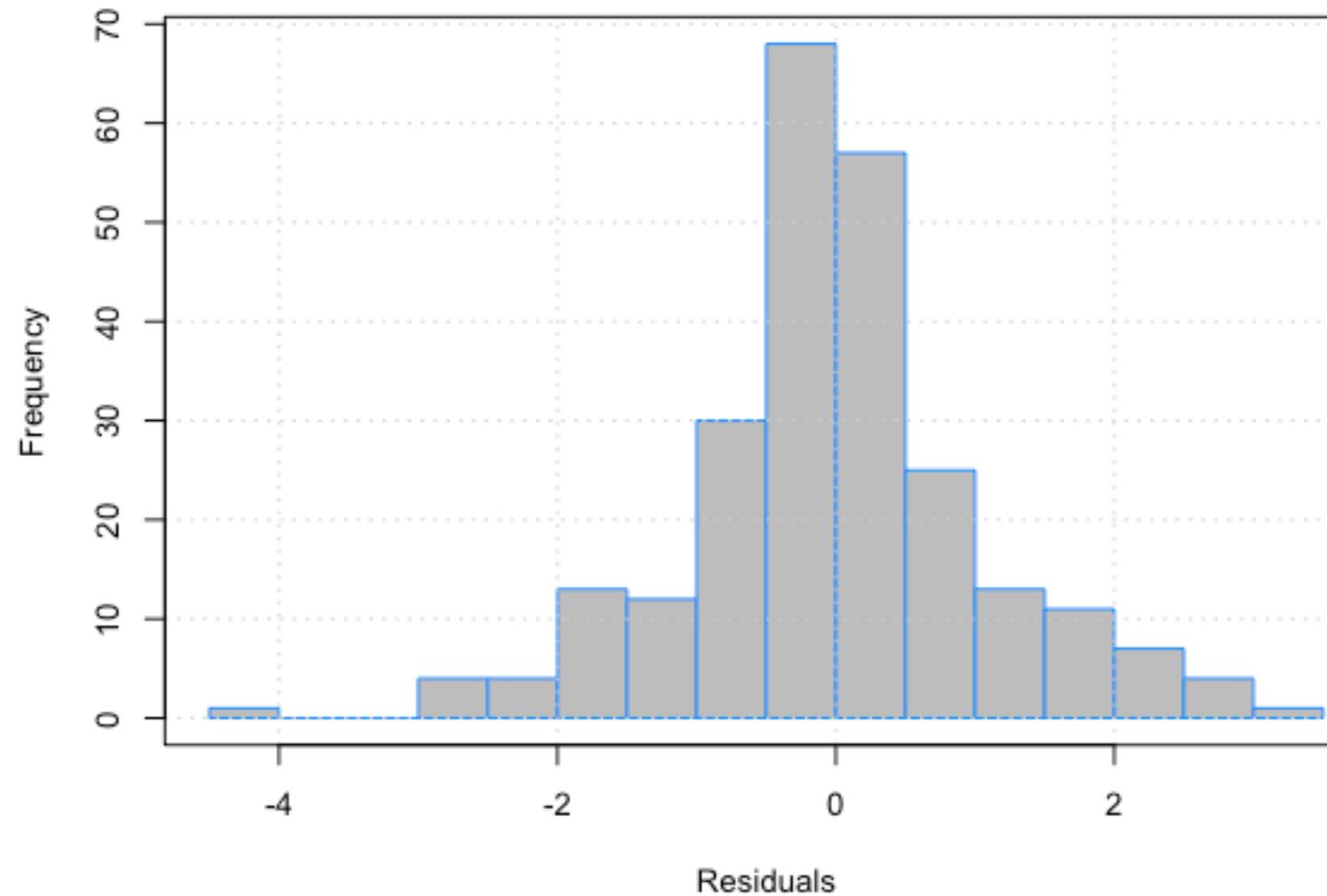
Scatterplot of Data + Fitted Regression



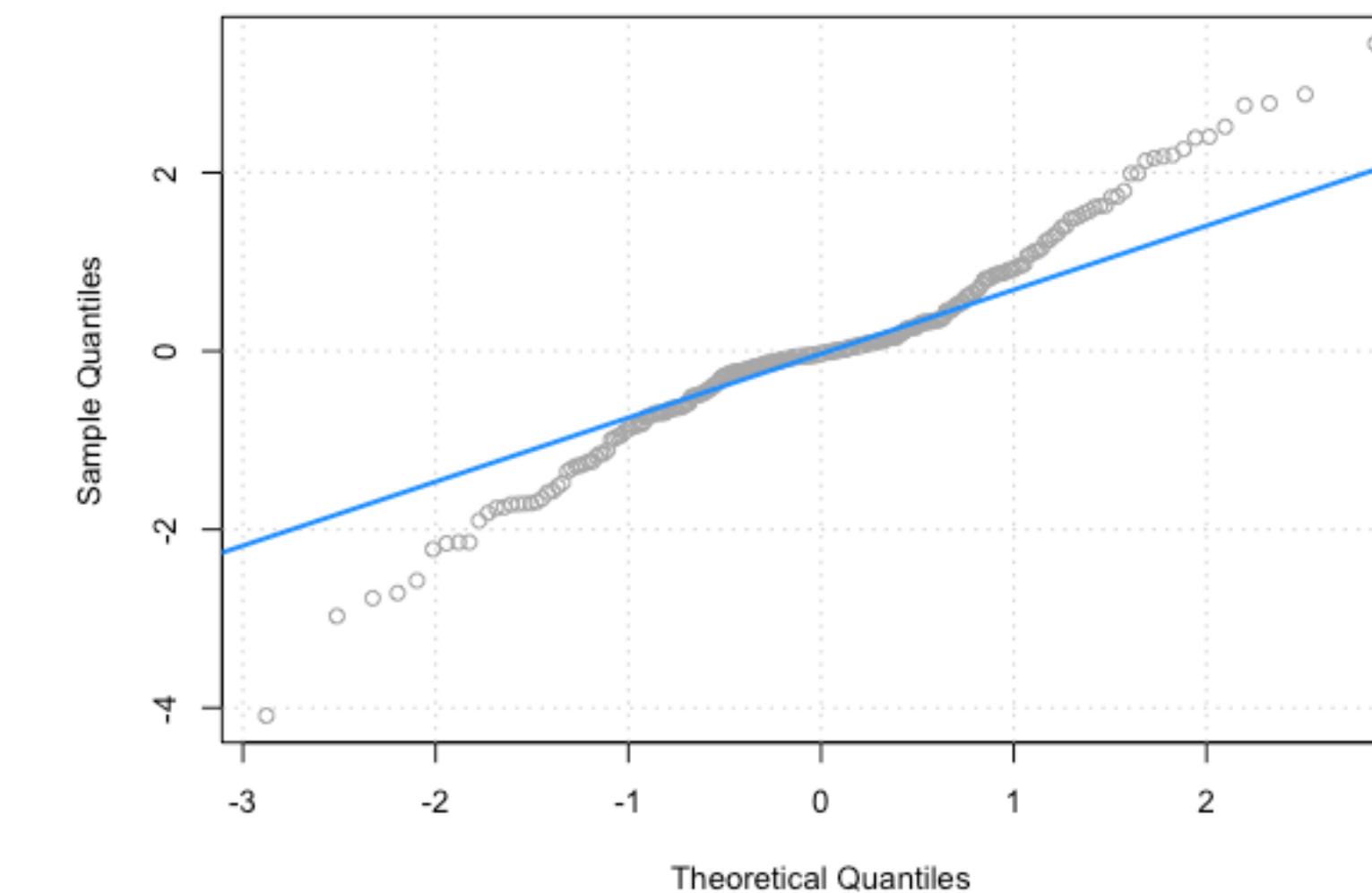
Fitted versus Residuals Plot



Histogram of Residuals

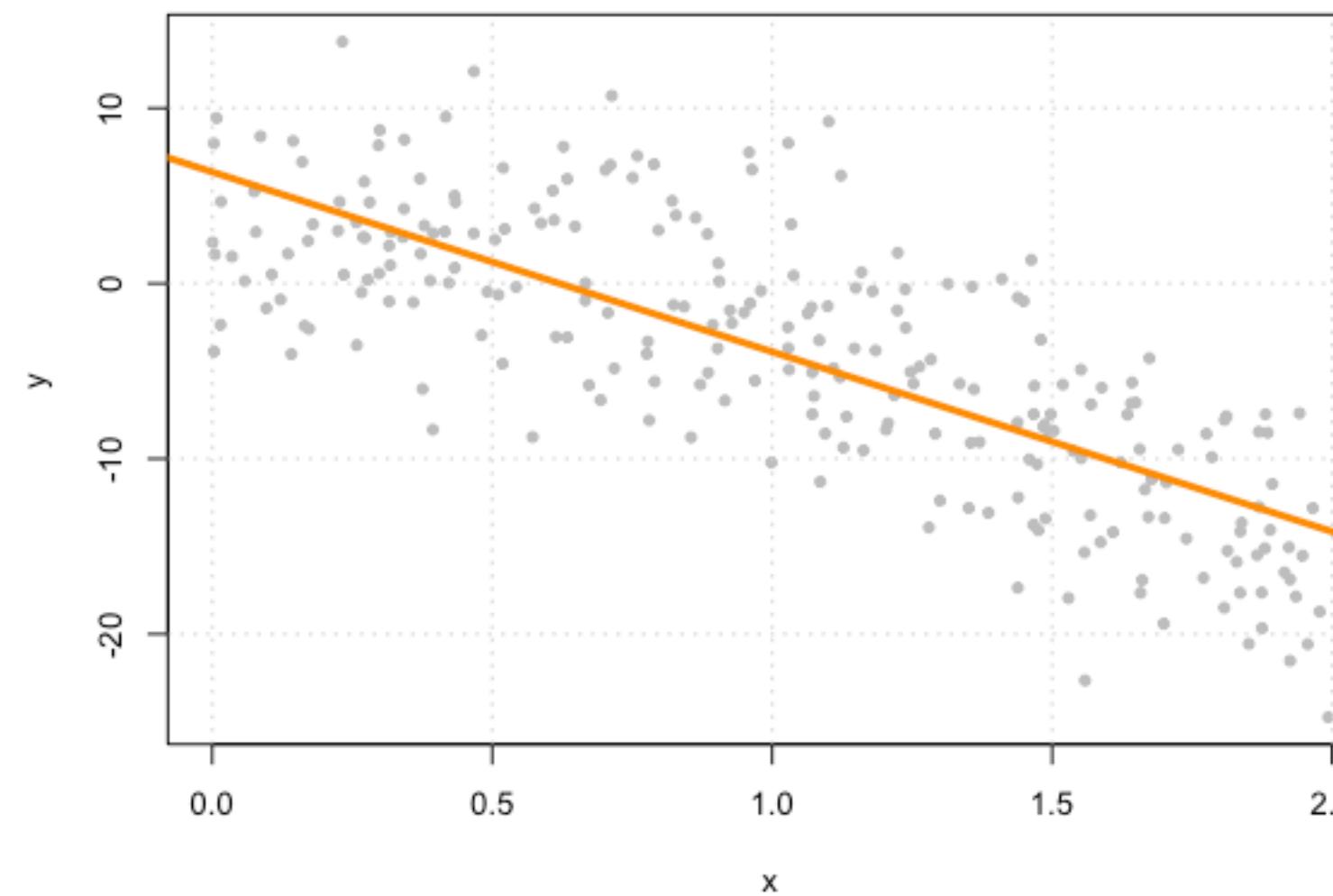


Residuals, Normal Q-Q Plot

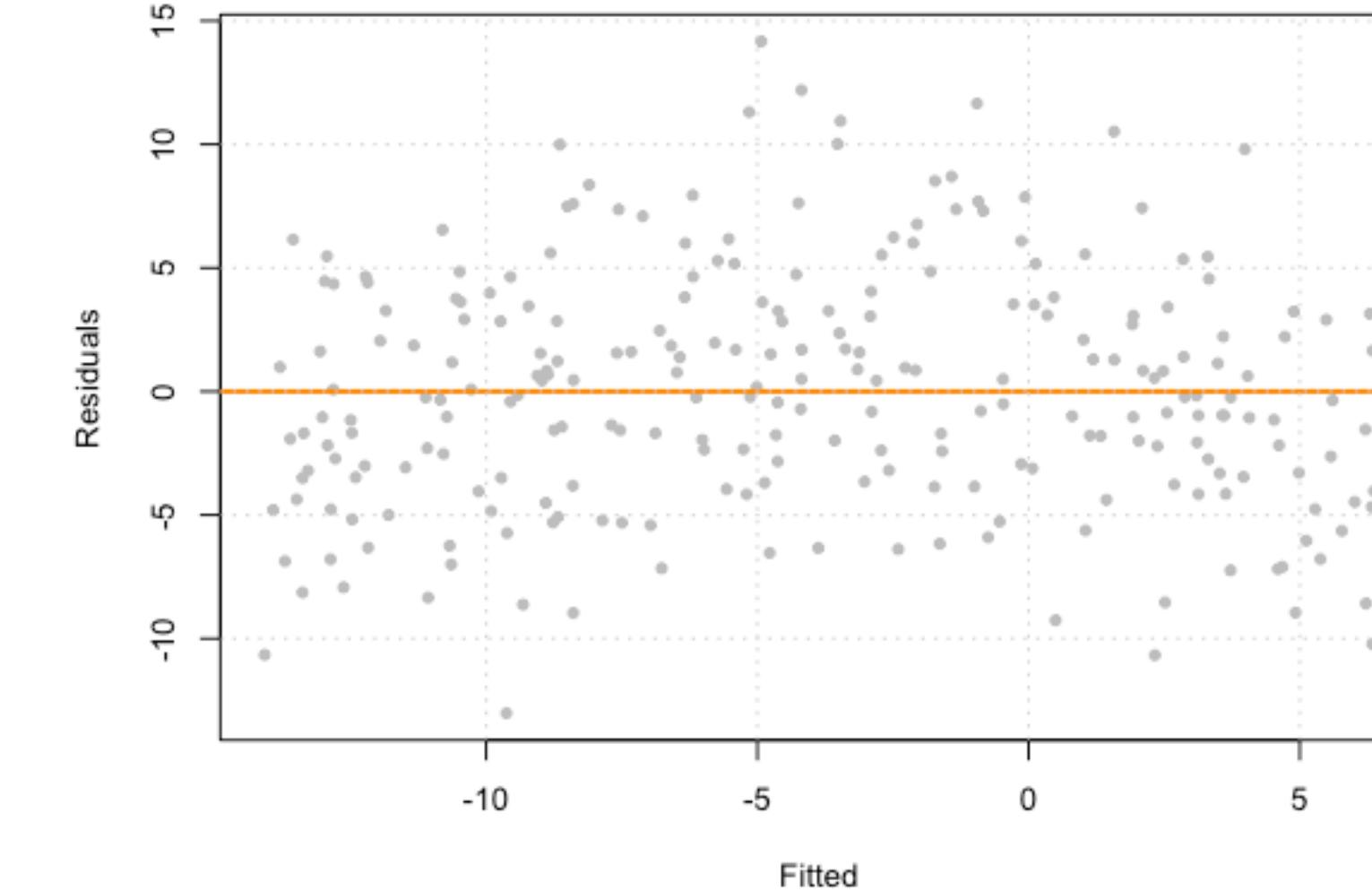


Model 1: $Y = 3 - 5x^2 + \epsilon$, $\epsilon \sim N(0, 5)$

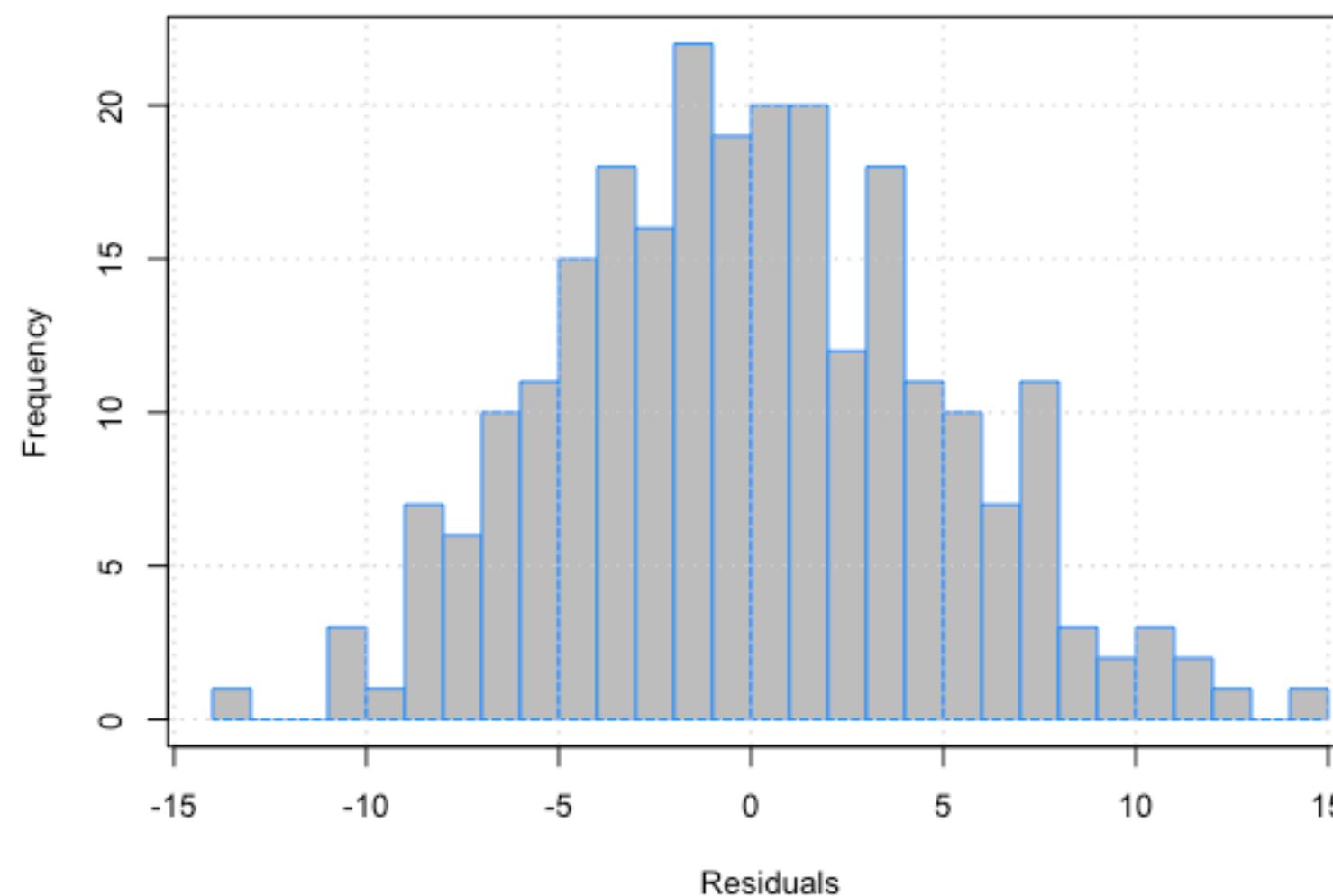
Scatterplot of Data + Fitted Regression



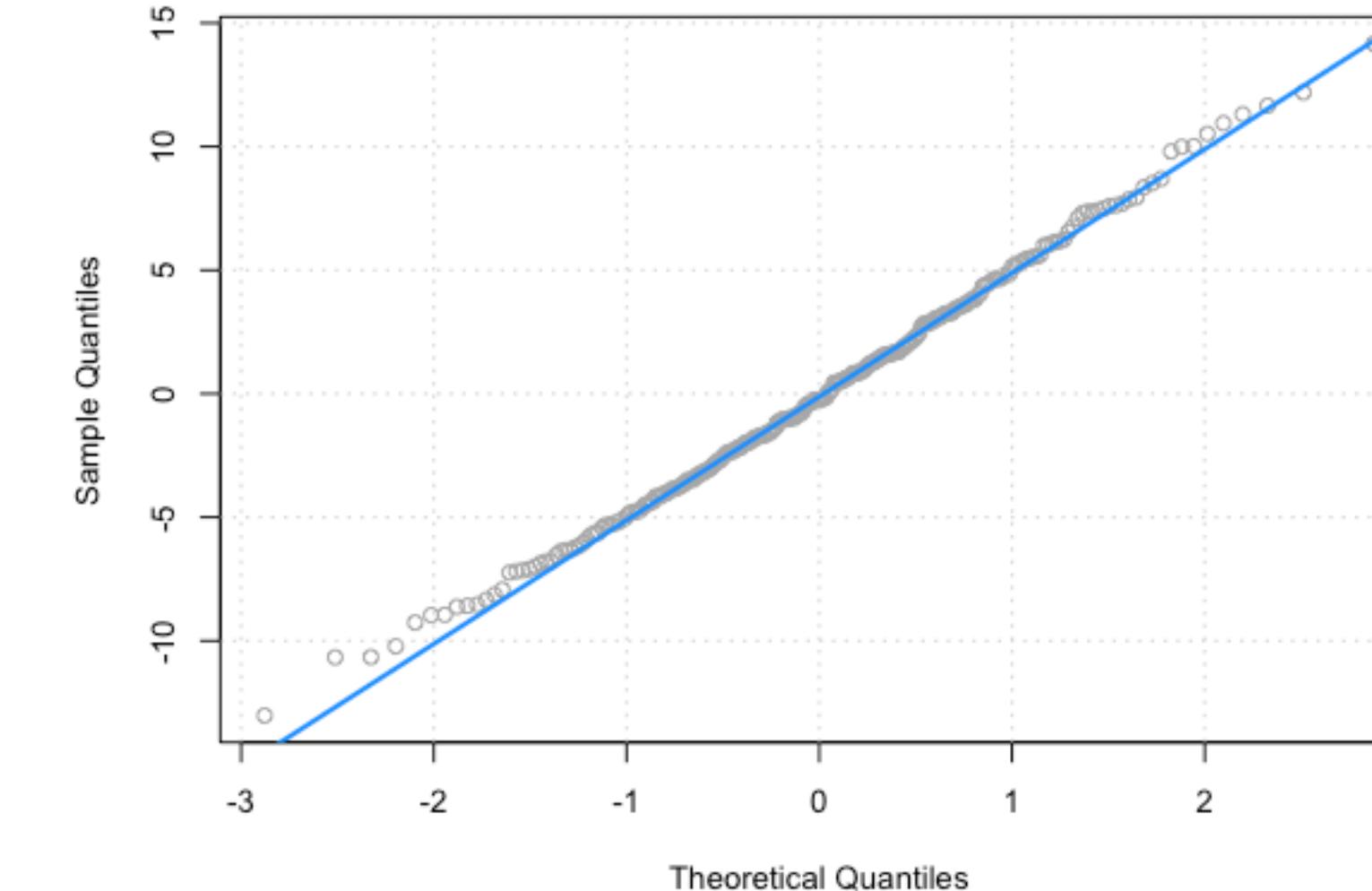
Fitted versus Residuals Plot



Histogram of Residuals

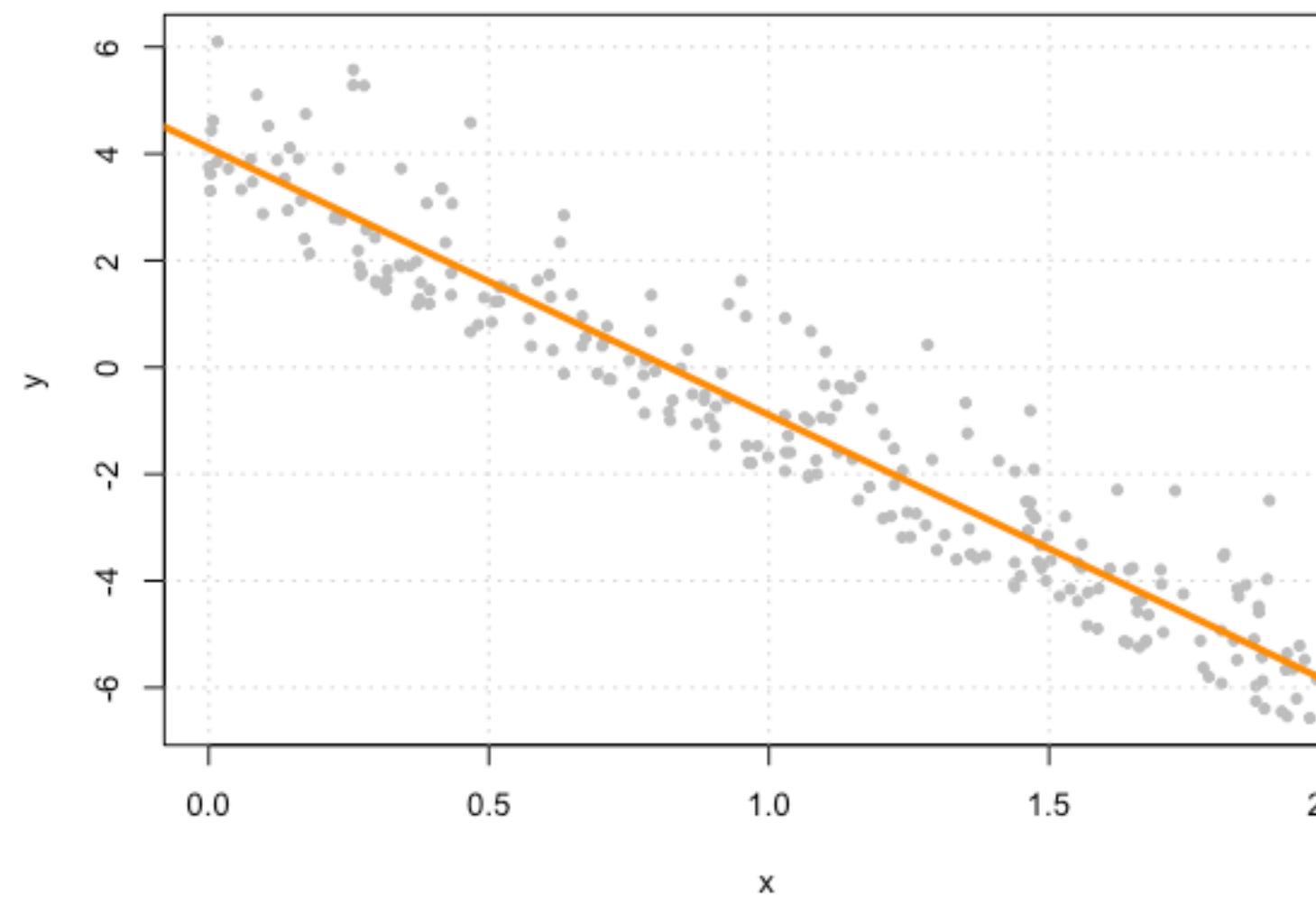


Residuals, Normal Q-Q Plot

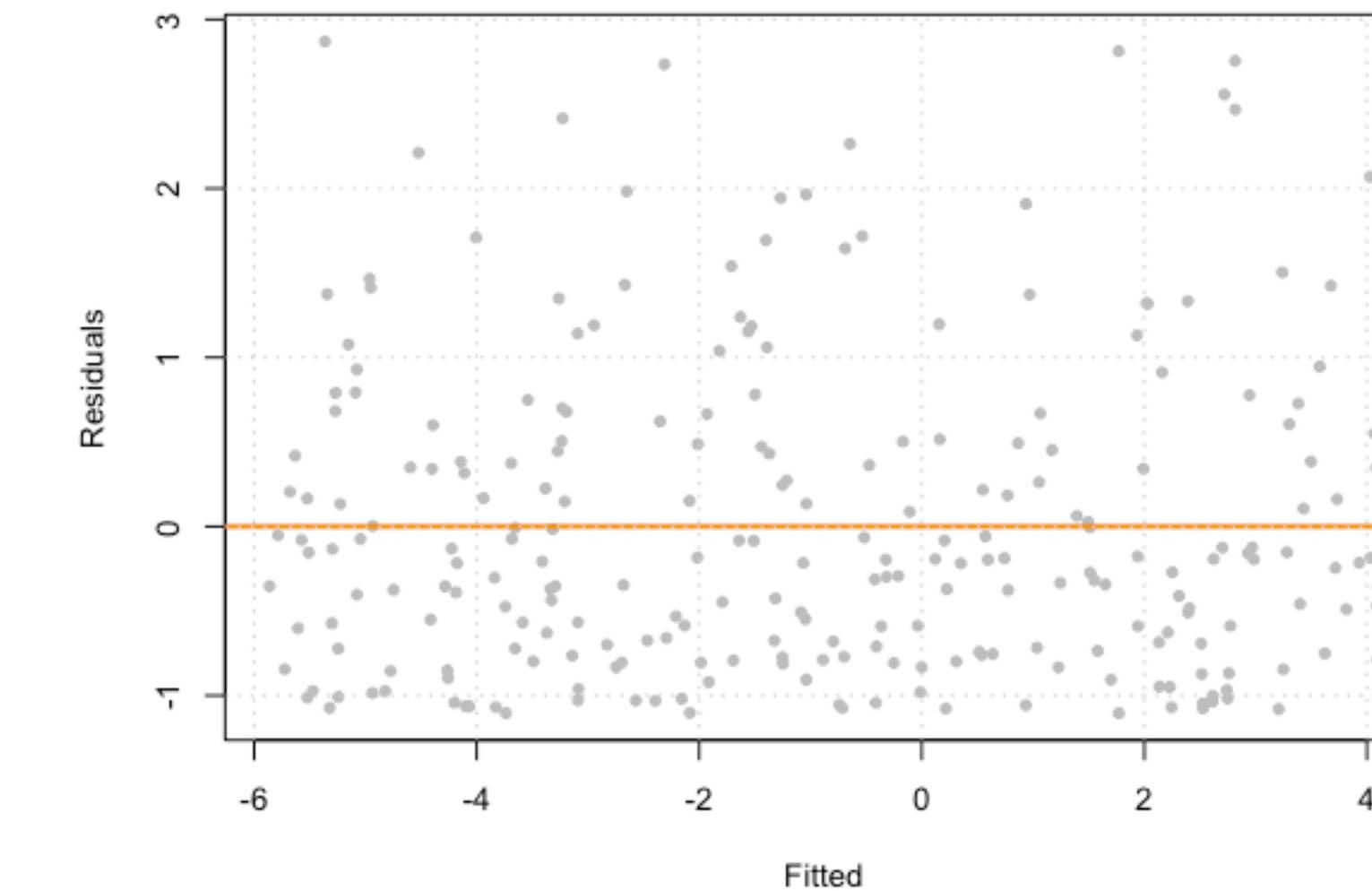


Model 4: $Y = 3 - 5x + \epsilon$, $\epsilon \sim Exp(1)$

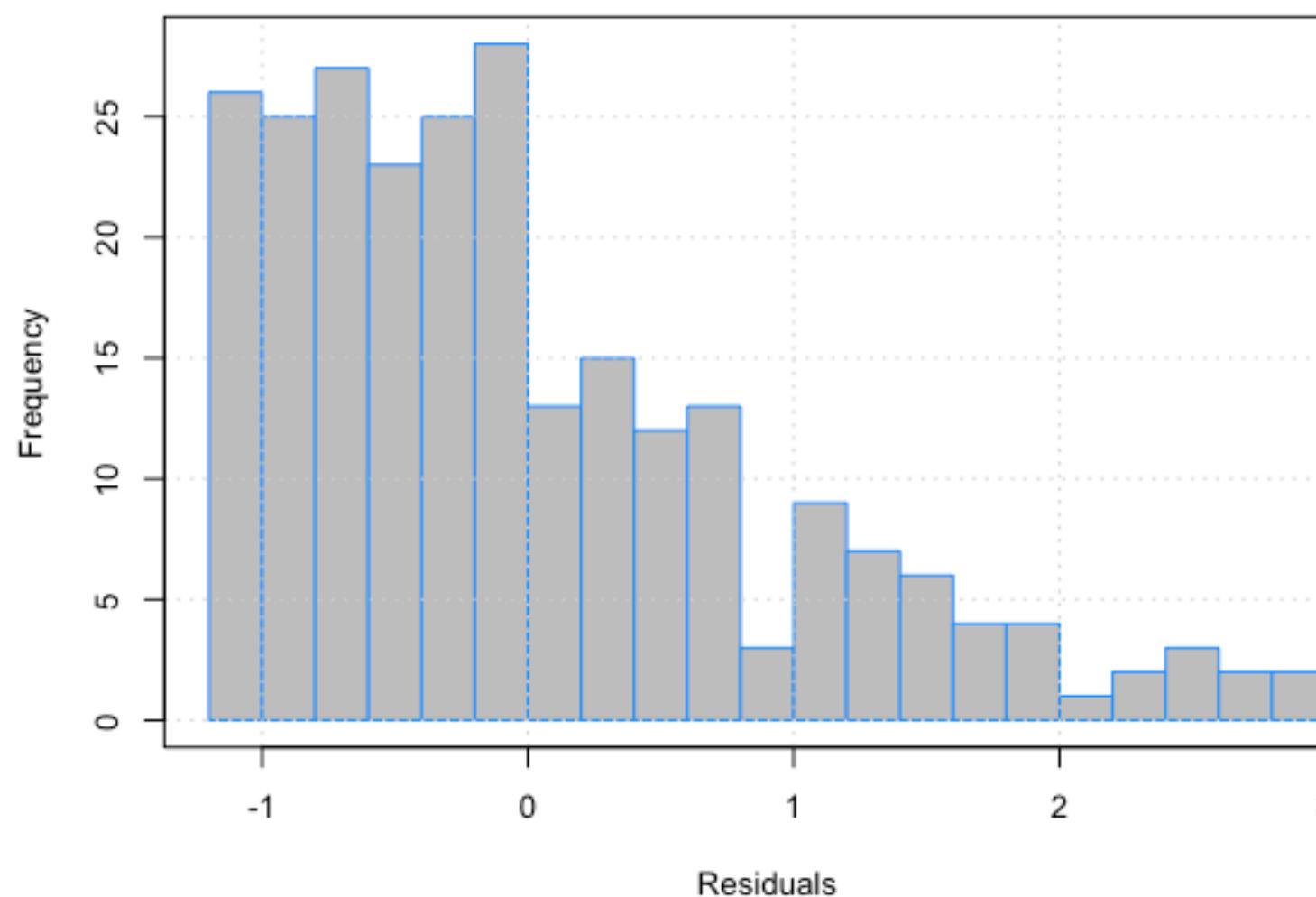
Scatterplot of Data + Fitted Regression



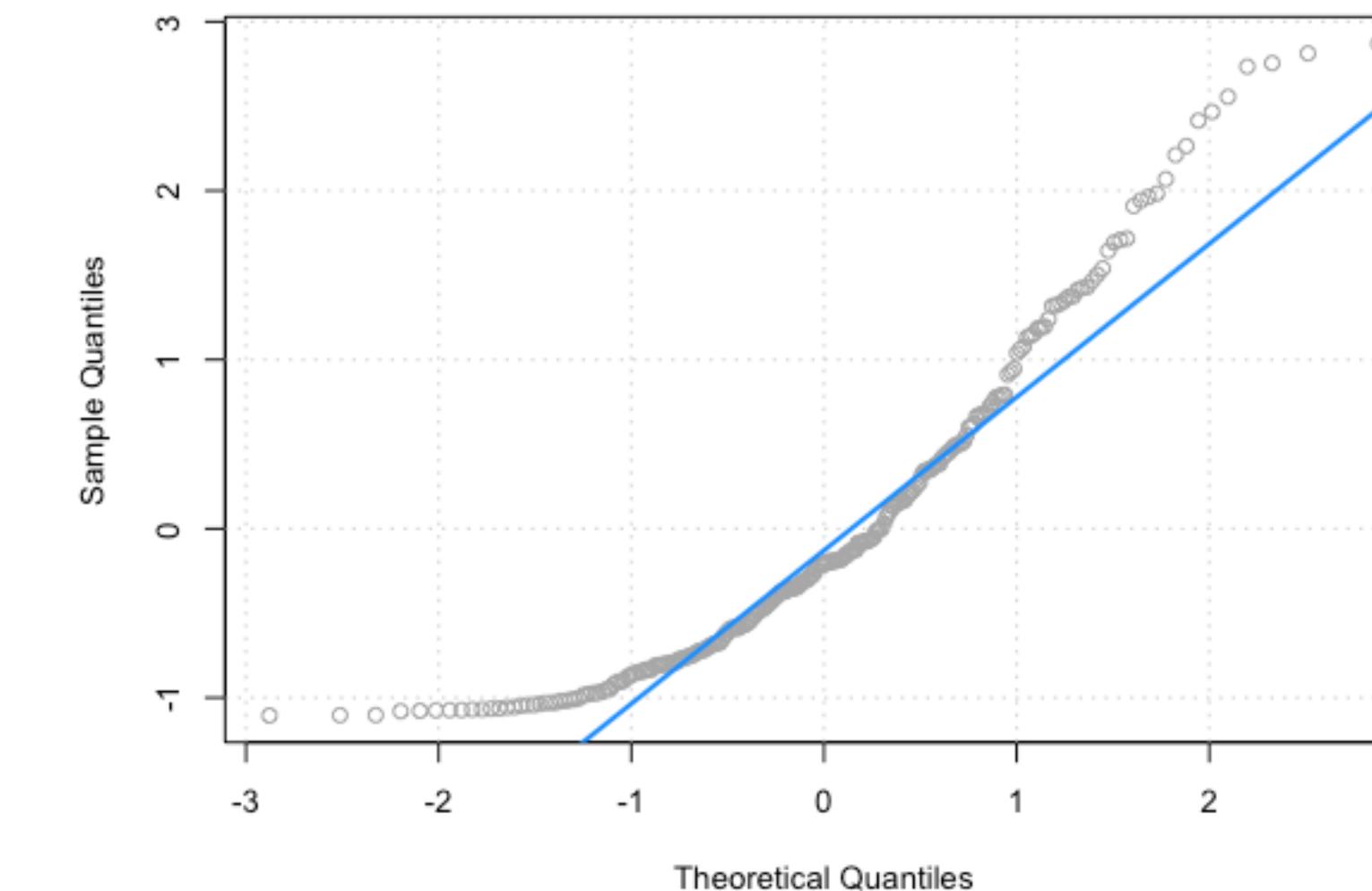
Fitted versus Residuals Plot



Histogram of Residuals



Residuals, Normal Q-Q Plot



Multiple Linear Regression

$$Y_i = \beta_0 + \beta_1x_{i1} + \beta_2x_{i2} + \cdots + \beta_{p-1}x_{i(p-1)} + \epsilon_i, \qquad \epsilon_i \sim N(0,\sigma^2)$$

$$Y\mid X=x\sim N(\beta_0+\beta_1x_1+\beta_2x_2+\cdots+\beta_{p-1}x_{(p-1)},\,\sigma^2)$$



That's all Folks!