

# OLS – Hypothesis Testing

Two major reasons to derive the variance of  $b_1$  (and  $b_0$ ):

- Determine the statistical properties of OLS
- Hypothesis testing

Thirdly, by looking at the formula for  $\text{Var}(b_1)$  we'll be able to see that:

- A larger sample is better
- More variation in  $X$  is better
- Less variation in  $\epsilon$  is better

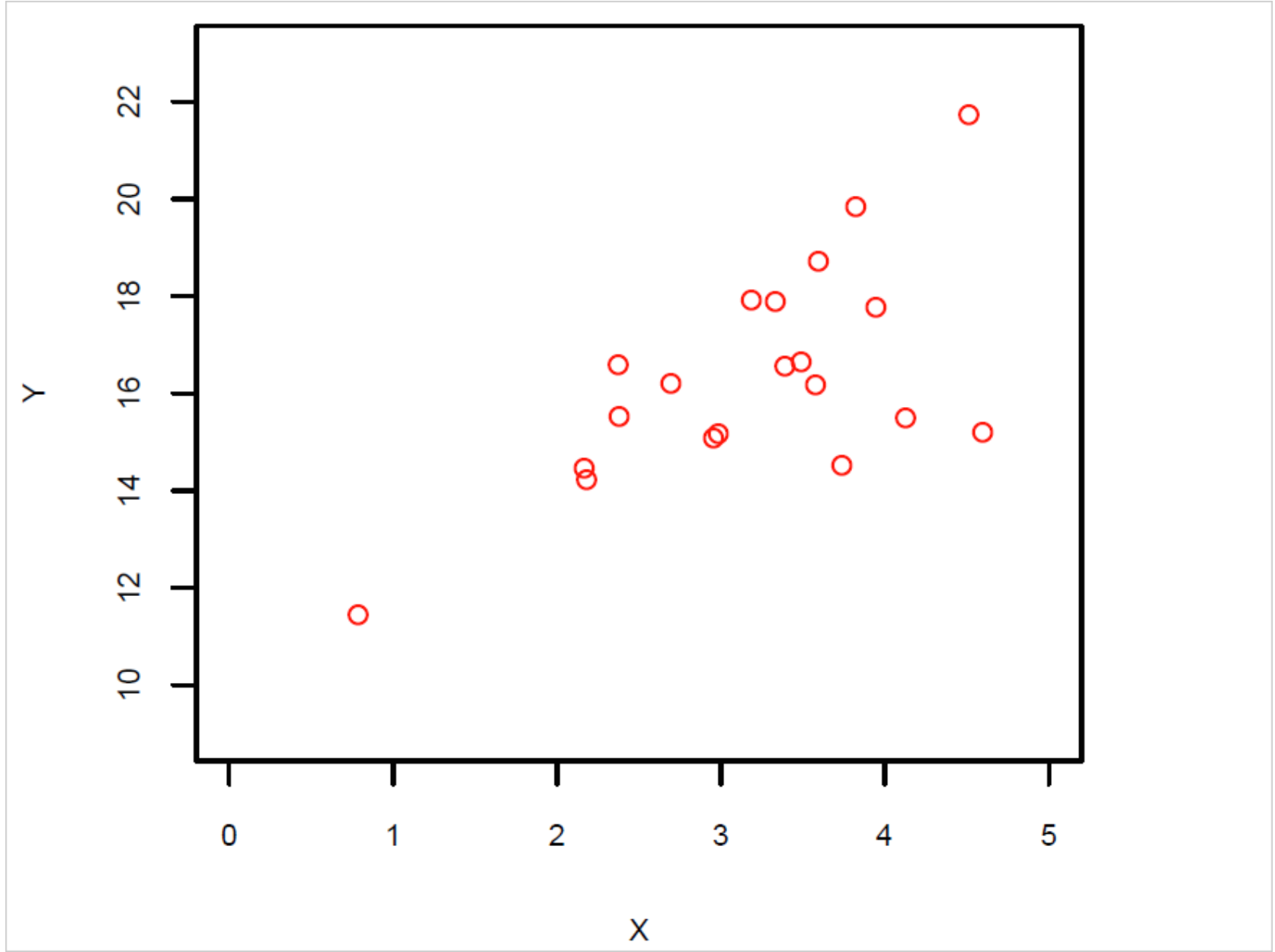
How would you derive the expected value and variance of  $b_1$ ?

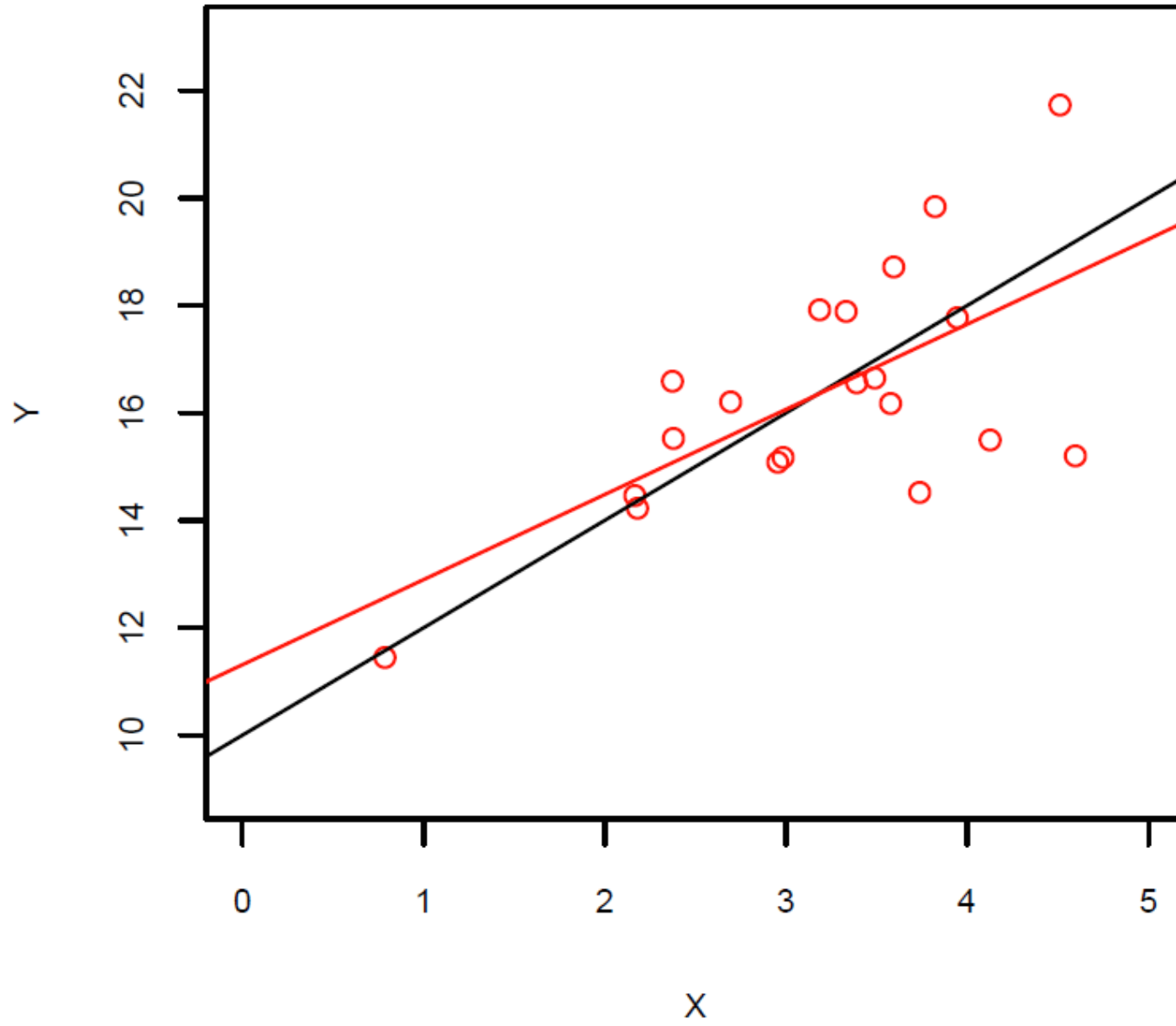
$$\text{Var} [b_1] = \frac{\sigma_\epsilon^2}{\sum X_i^2 - \frac{(\sum X_i)^2}{n}}$$

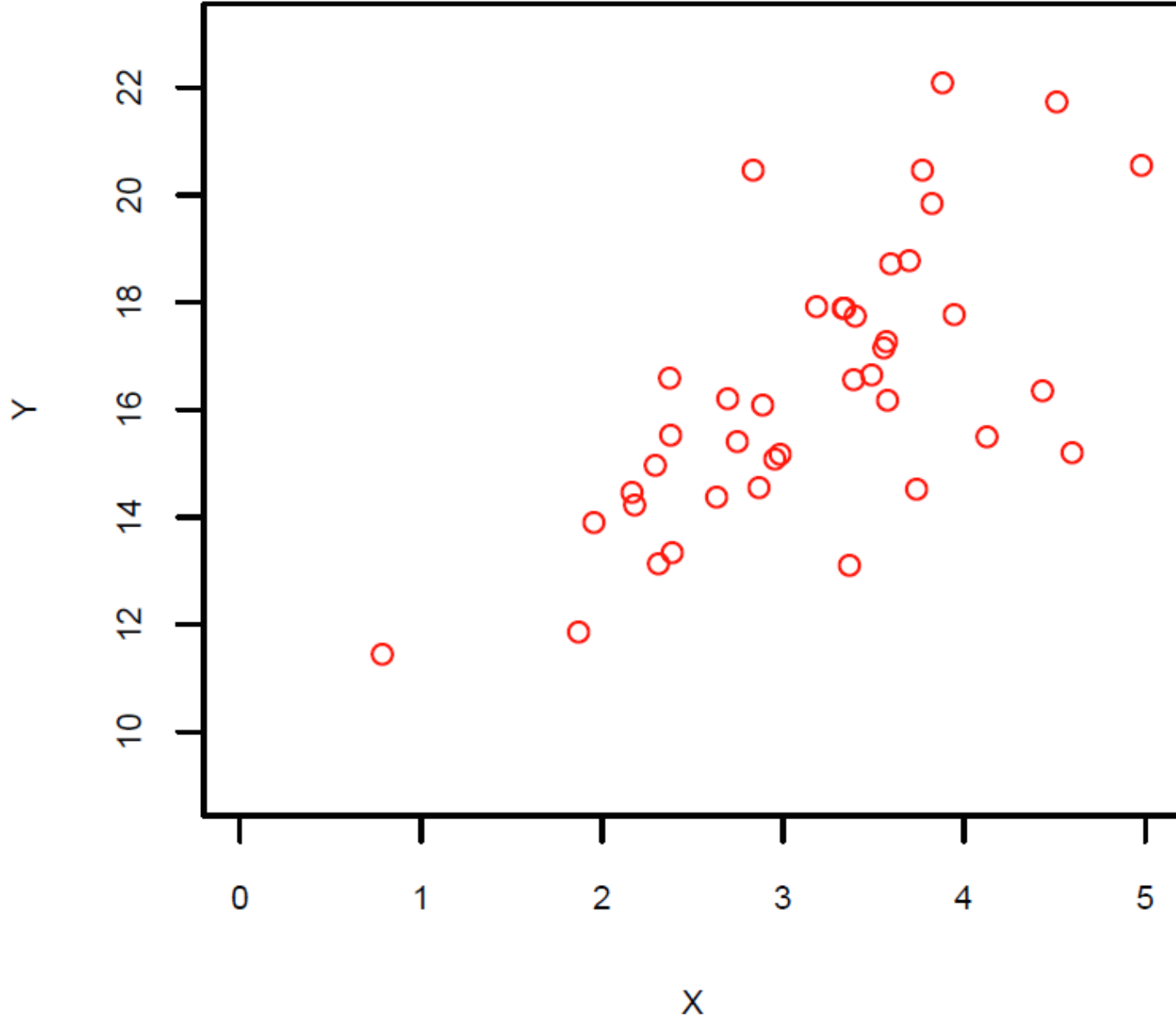
Pretend that you know that the population model is:

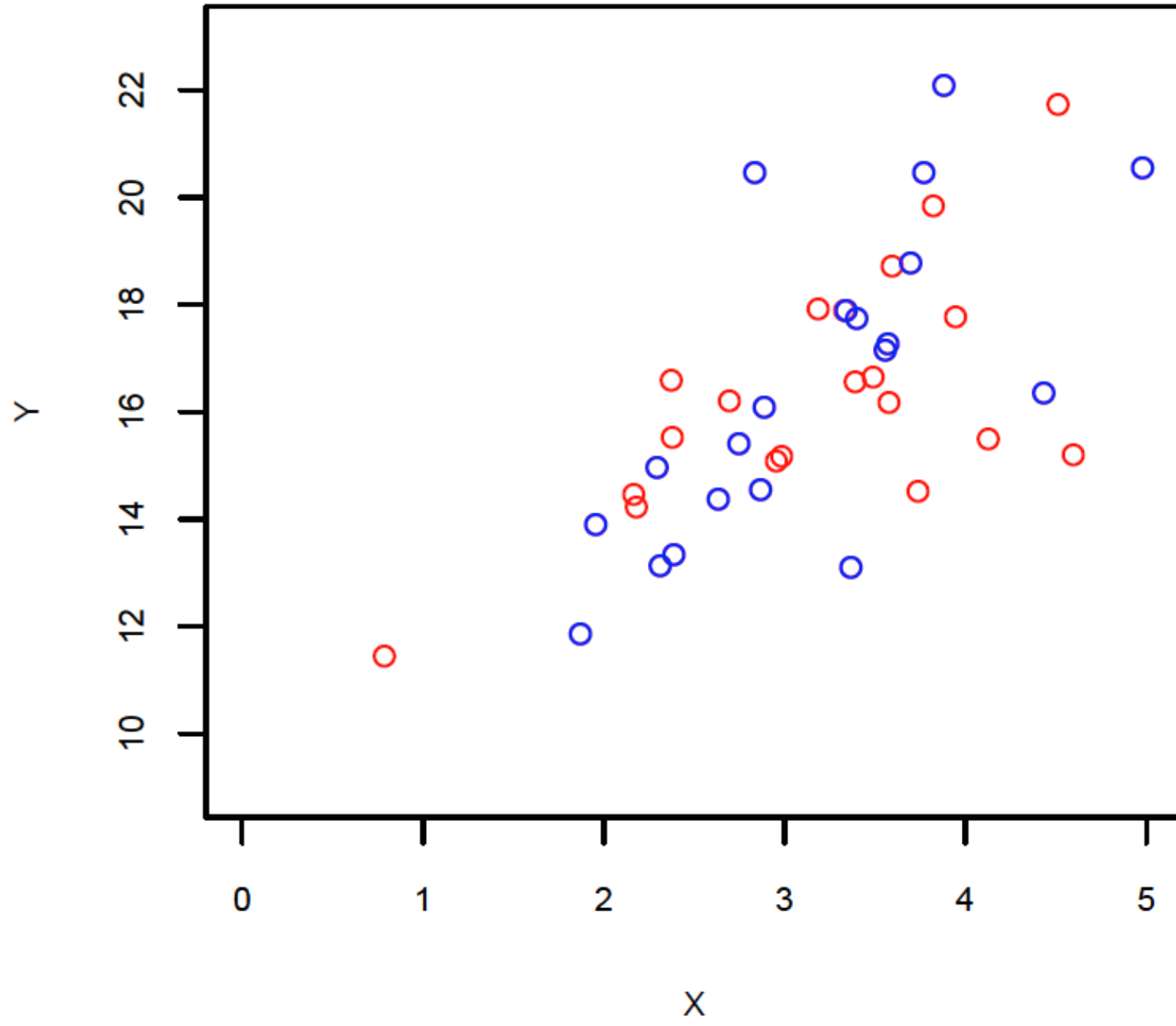
$$Y_i = 10 + 2X_i + \epsilon$$

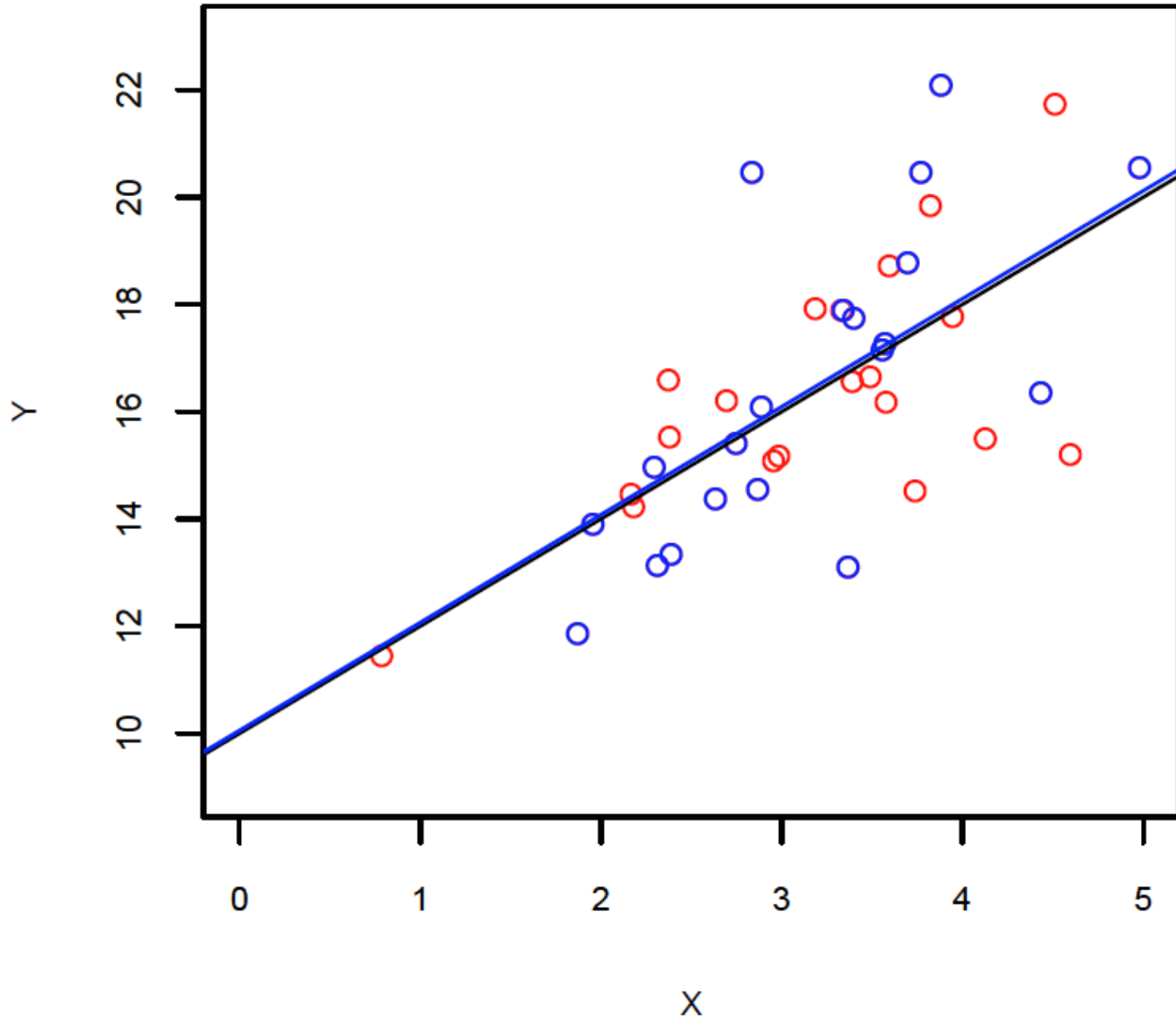
Let's see if it's easier to pick the regression line when  $n$  increases.





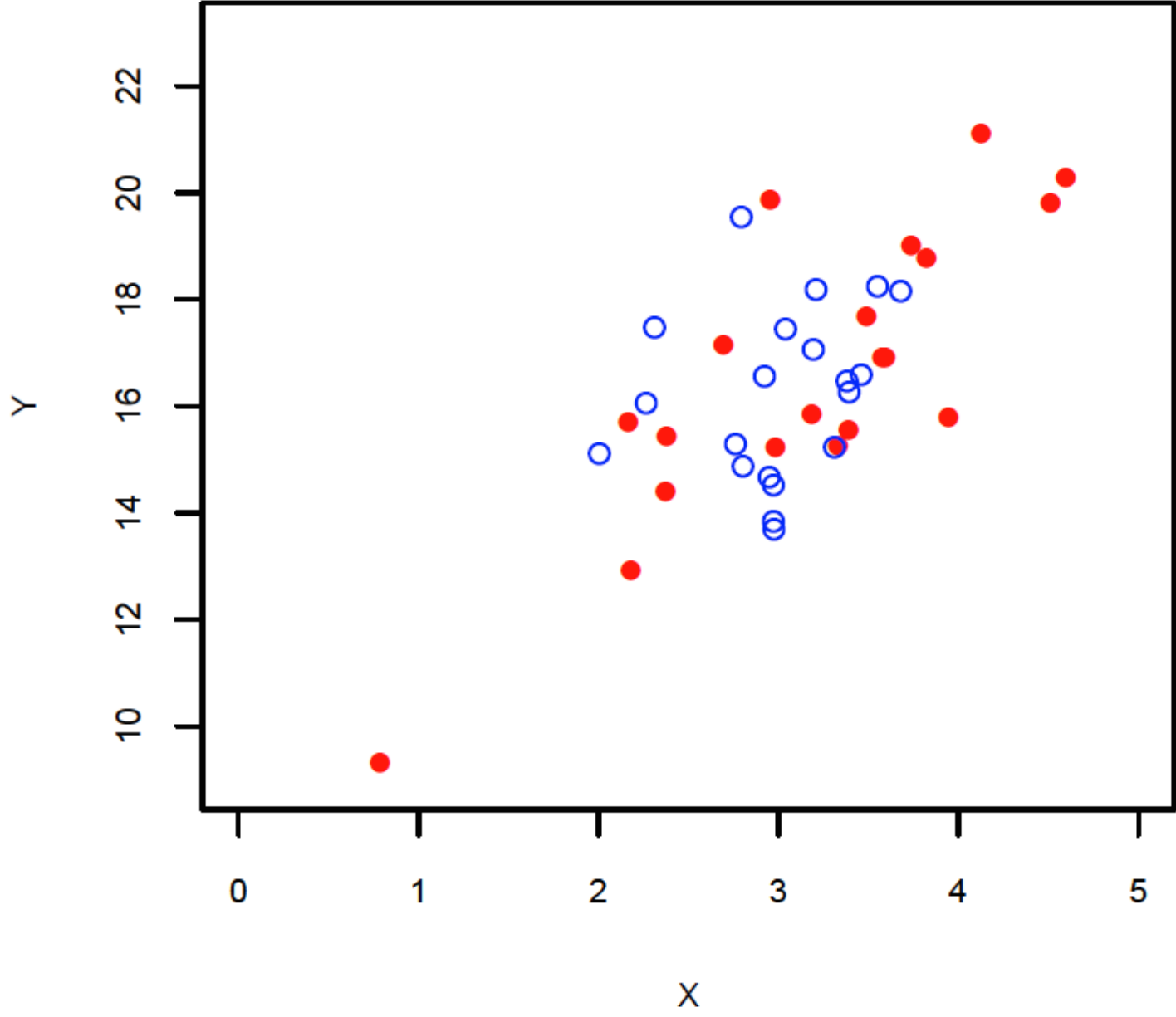


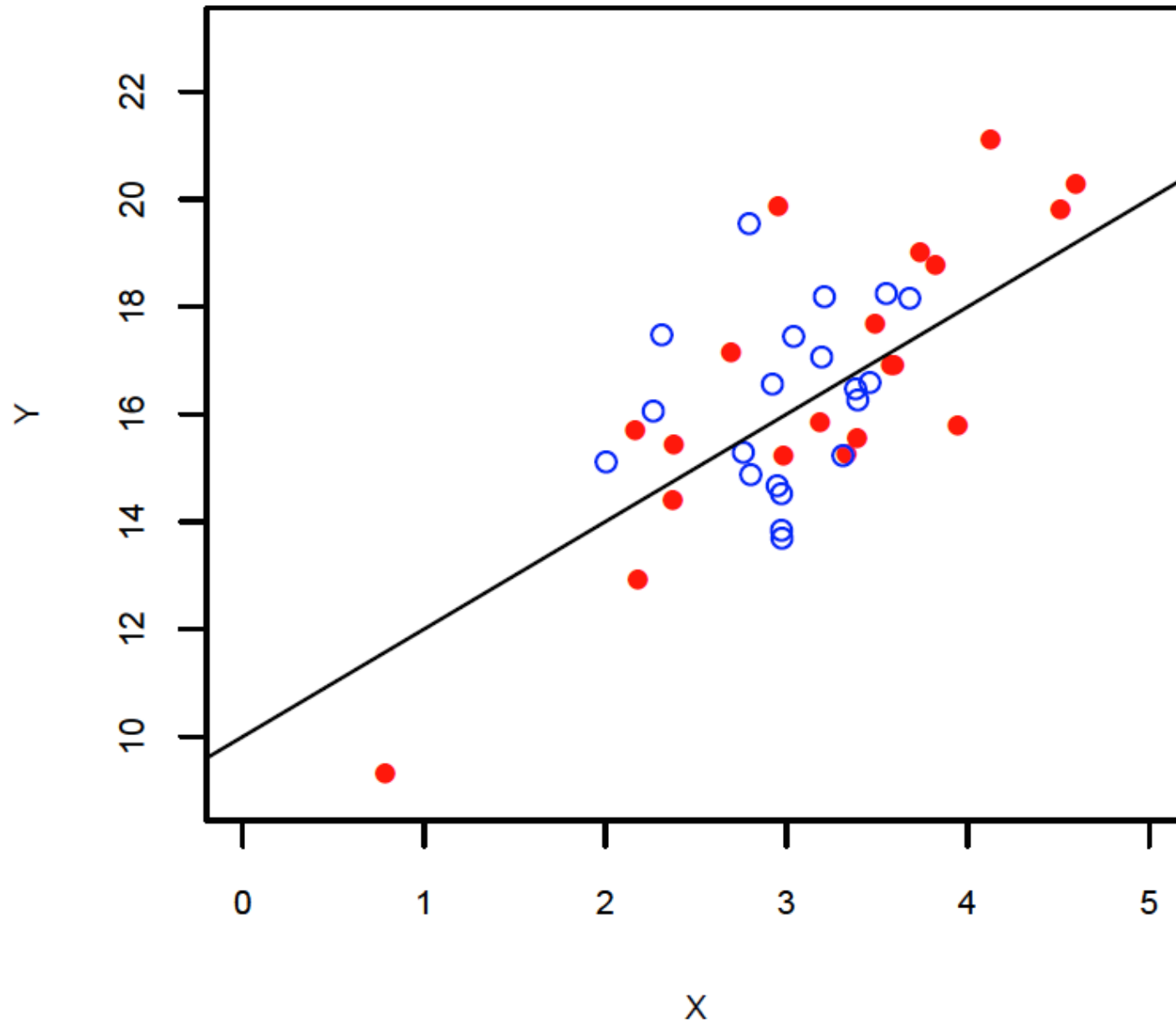


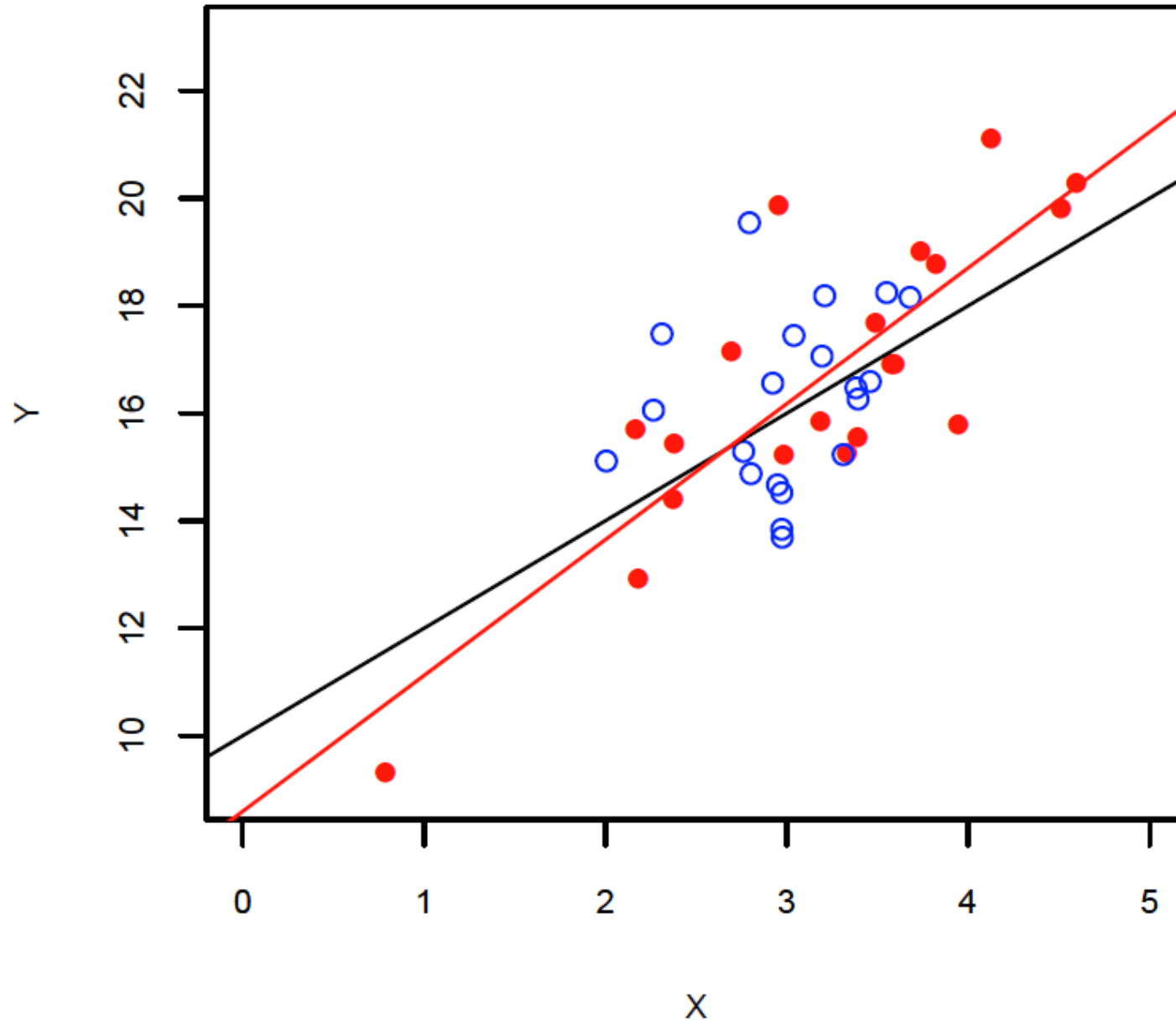


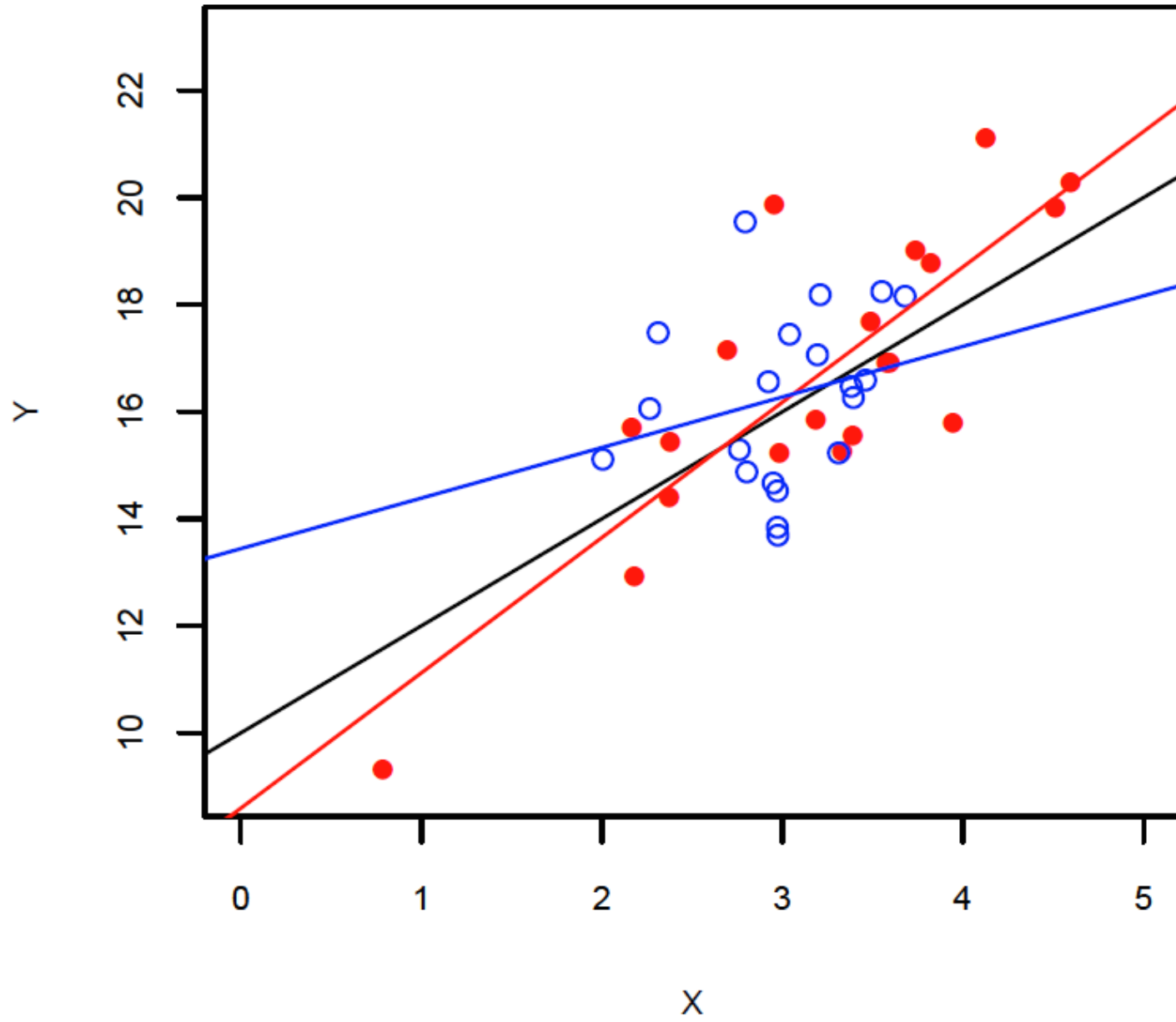
Now let's see what happens when the variance of  $X$  changes.











Now let's see what a change in the variance of  $\epsilon$  does.

