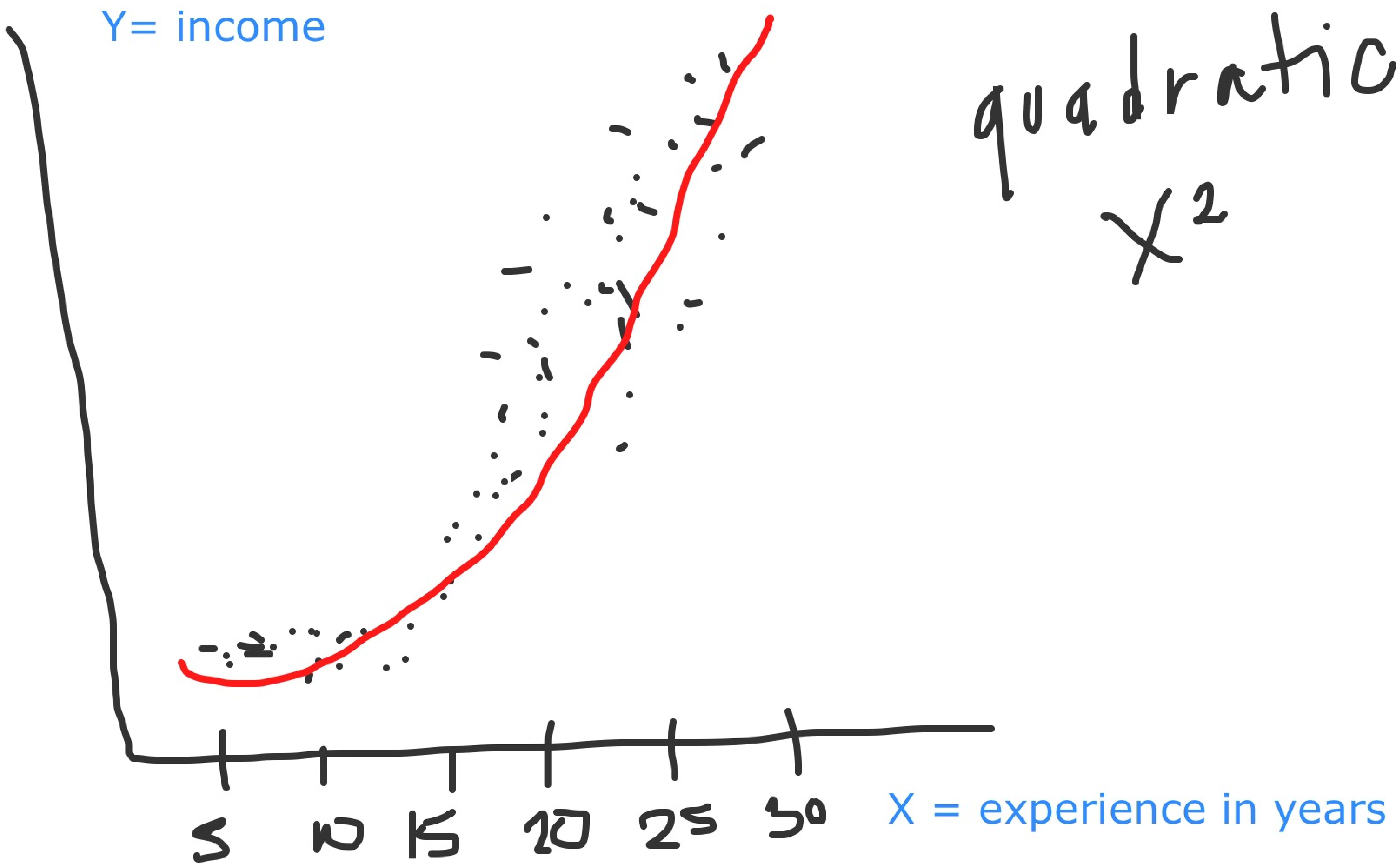
Non linear relationships between x and y



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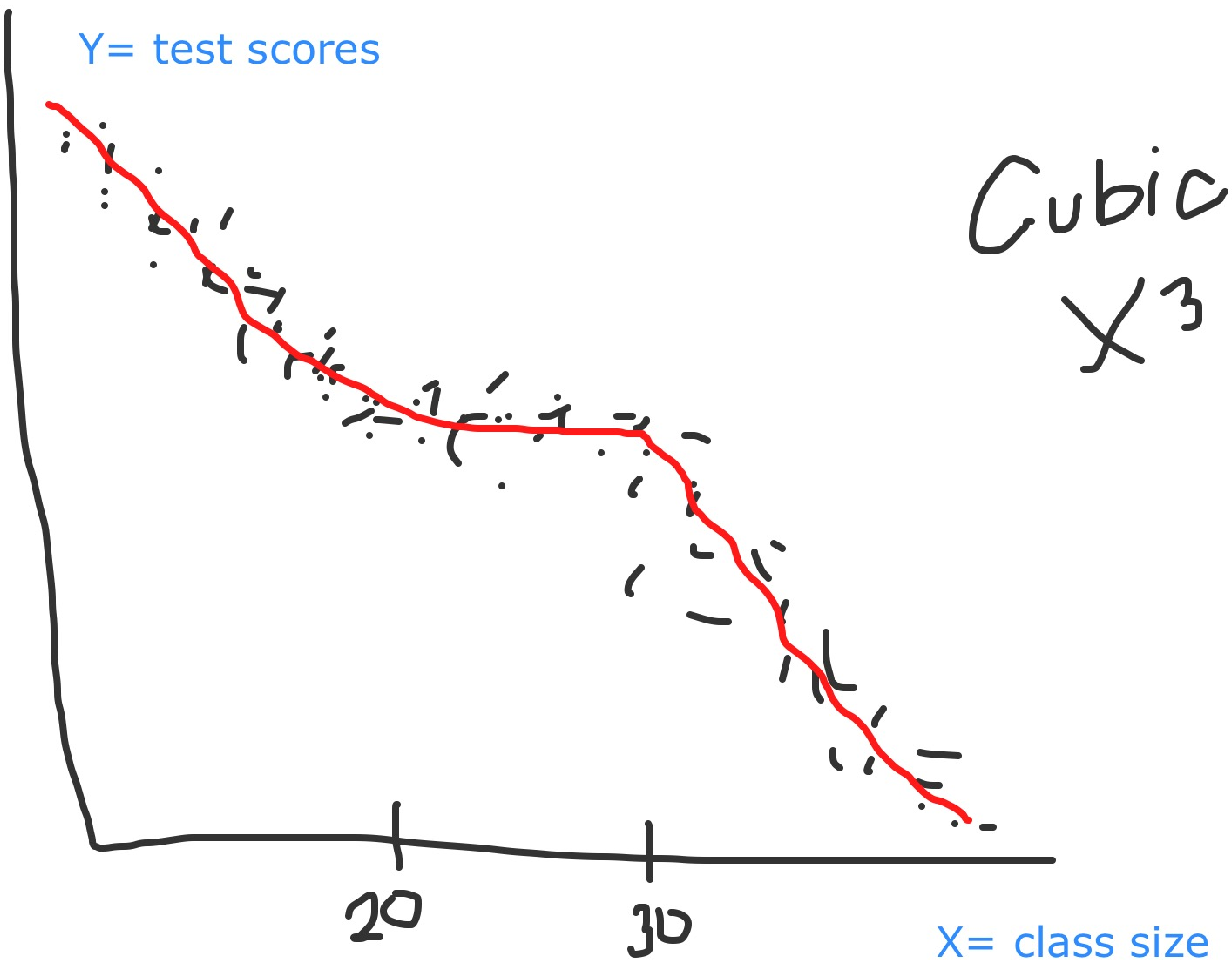
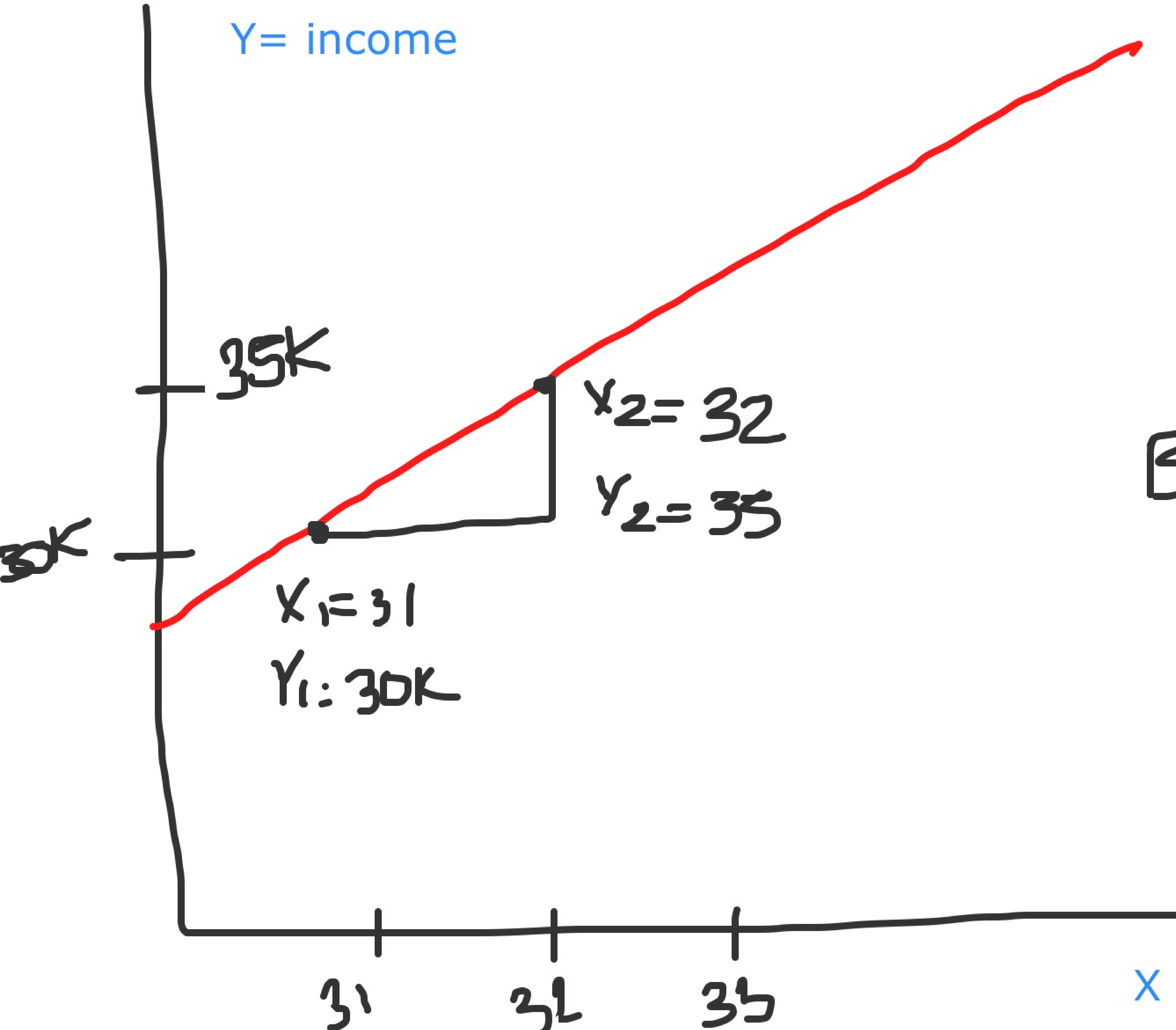


Slope Measures Relationship Between X and Y



X = hours worked

$$B = \frac{\Delta Y}{\Delta X} = \frac{Rise}{Run}$$

$$B = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{35-30}{32-31} = \frac{5}{1}$$

$$B = \$5,000$$

Population regression Line for prediction

$$Y_i = B_\emptyset + B_1 X_i$$

$B_\emptyset = \$5000$

$B_1 = \$2000$

$$E(Y|X=20) = Y_i = B_\emptyset + B_1 X_i$$

$$Y_i = 5000 + 2000 * 20$$

$$Y_i = 5000 + 40{,}000$$

$$Y_i = 45{,}000$$

$$\boxed{E(Y|X=20) = \$45{,}000}$$

$$Y_i = B_\emptyset + B_1 x_i$$

$B_\emptyset = \$5000$

$B_1 = \$2000$

$$E(Y \mid X=45) = Y_i = B_\emptyset + B_1 x_i$$

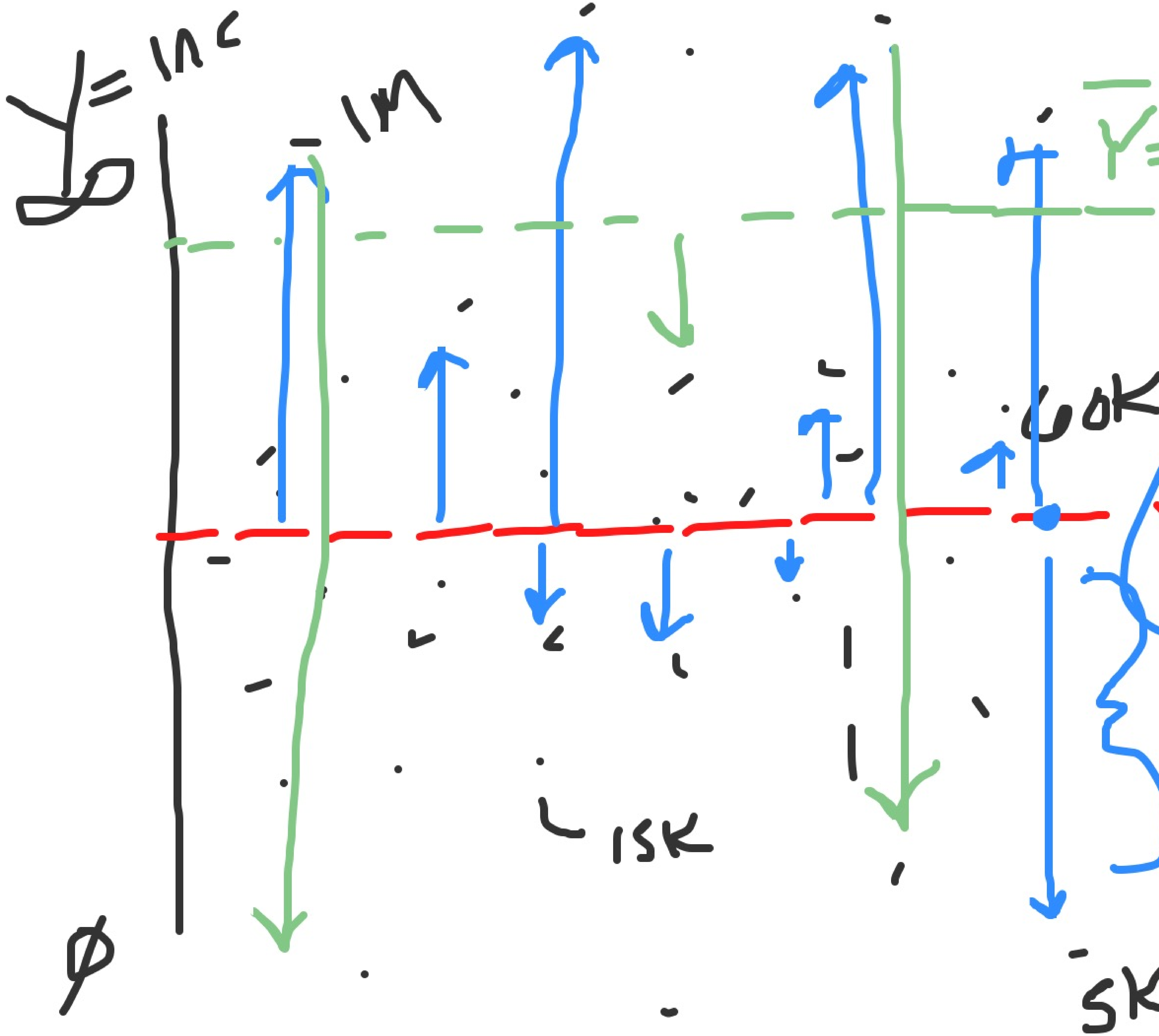
$$Y_i = 5000 + 2000 * 45$$

$$Y_i = 5000 + 90.000$$

$$Y_i = 95{,}000$$

$$E(Y \mid X=45) = 95{,}000$$

Estimate of the population mean



Y = income

$\bar{Y}$ = \$55K

$\bar{Y}$ = \$55K

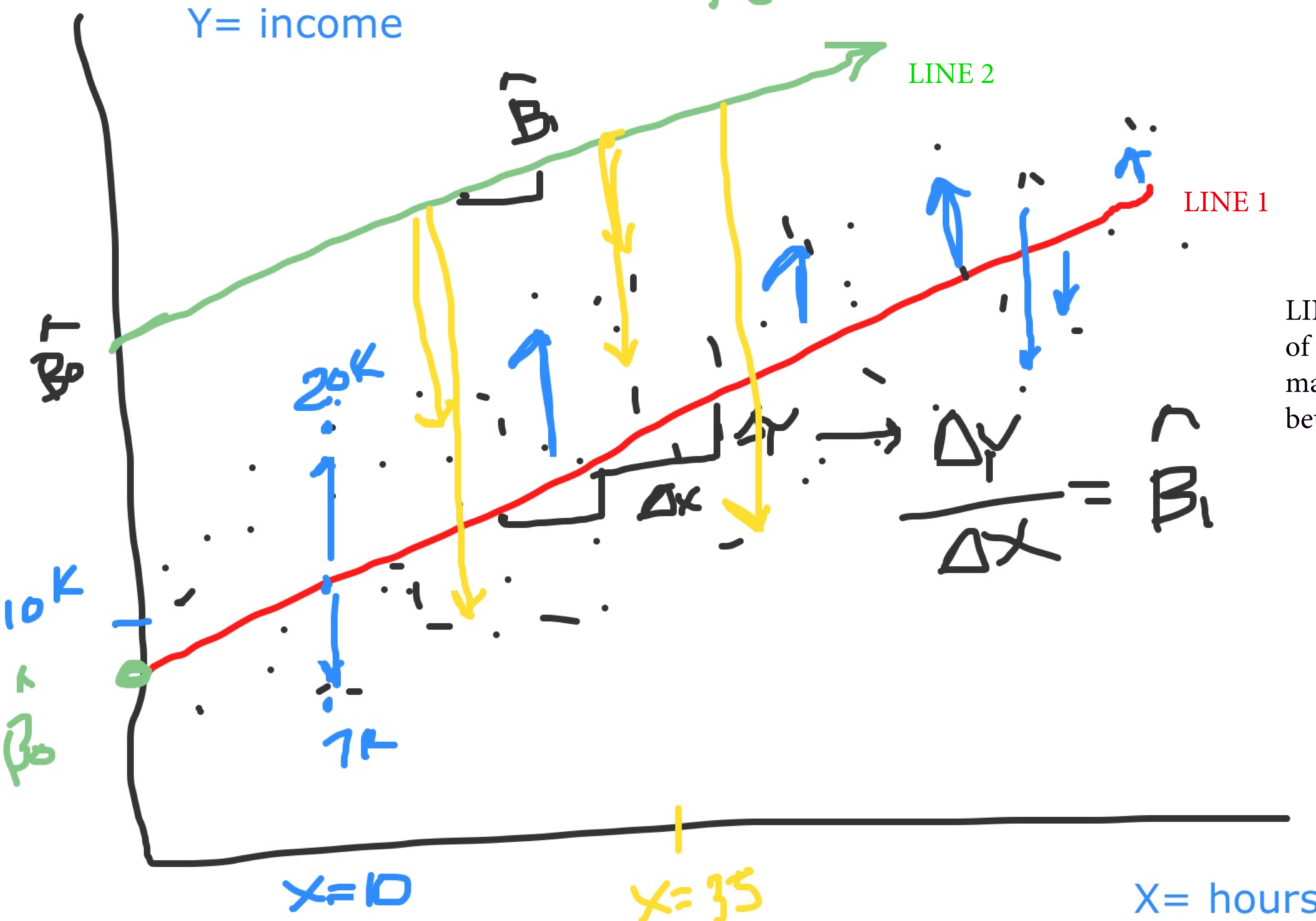
residual / error

Sum of Square Errors

$$\sum_{i=1}^{n}(Y_i-\bar{Y})^2$$

OLS Prediction Line

$$\hat{Y}_i = \hat{B}_\emptyset + \hat{B}_1 x_i$$



LINE 1 Minimizes the sum of square errors, which makes it the best line for our beta estimators

Population Regression Model

$$Y_i = B_0 + B_1 X_i + u_i$$

Y= annual income; X= hours worked per week

OLS Prediction Line without estimates

$$\hat{Y}_i = \hat{B}_0 + \hat{B}_1 X_i$$

$\hat{B}_0 =$ Sample population intercept; the average value of Y when X=0

$\hat{B}_1 =$ Sample regression coefficient; the average effect on Y for a one unit increase in X

OLS prediction line with estimates

$$\hat{Y}_i = 6961 + 455 X_i$$

$\hat{B}_0 = \$6961$

$\hat{B}_1 = \$455$

$\hat{B}_0 = \$6961 =$ Average income for someone that works zero hours in$6,961

$\hat{B}_1 = \$455 =$ On average, a one hour increase in ours worked per week is associated with a $455 increase in annual income

Predict Y using OLS prediction line

$$\hat{Y}_i = \$6961 + \$455 x_i$$

$$E(Y \mid X = 60) = \$6961 + \$455 * 60$$

$$= \$6961 + \$27{,}300$$

$$= \$34{,}261$$

$$E(Y \mid X = 60) = \$34{,}261$$