

**Problem 1** For this exercise, we will go back to the two data series

| Data Series | Observation 1 | Observation 2 | Observation 3 |
|-------------|---------------|---------------|---------------|
| X           | 15            | 15            | 30            |
| Y           | 10            | 25            | 4             |

In last worksheet, we found that the correlation between X and Y was  $-0.72$ , indicating a relatively strong (although only because we have a small number of observations) linear fit.

Q1.1) Running an OLS regression returns an estimated slope coefficient of  $-0.9$  and an estimated intercept of  $31$ . That means we have the equation

$$y_i = 31 - 0.9x_i + \epsilon_i$$

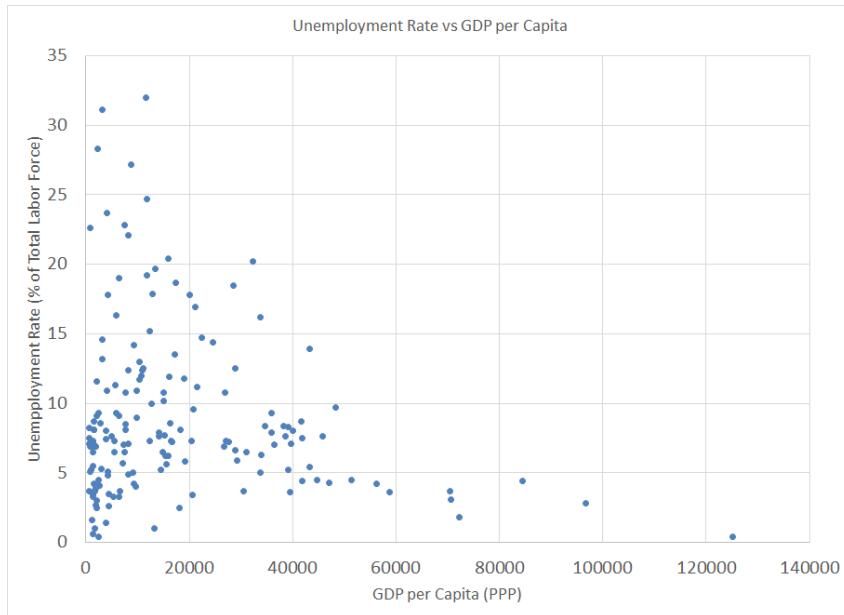
What is the predicted value of  $Y$  when  $X = 30$ ? What is the error for observation 3?

Q1.2) Suppose  $X$  was to decrease from  $15$  to  $5$ . How much would  $Y$  change, and in what direction?

Q1.3) The standard error for this  $\alpha$  estimate is  $18.37$  and the standard error for the  $\beta$  estimate is  $0.87$ . Calculate approximate 95% confidence intervals for each estimate by adding/subtracting twice the standard error from each point estimate.

Q1.4) Are our estimated coefficients statistically significant at a significance level of  $0.05$ ?

**Problem 2** Below is the Unemployment Rate vs GDP per Capita (PPP) in 2010 for all countries with data.



Last time we discovered the following correlations between GDP per Capita and the Unemployment Rate

Correlation for all Countries:  $-0.165$

Correlation for Rich Countries:  $0.228$

Correlation for Poor Countries:  $-0.447$

Cutoff between rich and poor was GDP per Capita of \$10k.

Q2.1) Fitting a regression line between GDP per Capita and Unemployment for rich countries we have the following best fit line:  $GDP = 38847 - 1731 \times Unemp$

What is the expected % change in GDP per Capita from decreasing Unemployment Rate from 10.5 to 10?

$$\% \text{ Change in GDP} \equiv 100 \times \left( \frac{GDP'}{GDP} - 1 \right)$$

Q2.2) We can also fit a regression line between GDP per Capita and Unemployment after taking logs:

$$\log GDP = 11.0861 - 0.4644 \times \log Unemp$$

The interpretation of the coefficient is how much a 1% increase in Unemployment increases GDP in %. A change from 10.5 to 10 is a 5% decrease (percentage, **not** percentage points). According to this regression, how much should the % change in GDP be?