Question 3

$\alpha = 0 \quad \beta = \gamma$

$$RSS = \sum_{i=1}^{n} (Y_i - \gamma X_i)^2$$

derive OLS estimate for γ

Take derivative with respect to γ

$$\frac{dRSS}{d\gamma} = \sum_{i=1}^{n} 2(Y_i - \gamma X_i)(-1) = 0$$

$$= \sum_{i=1}^{n} (Y_i - \hat{\gamma} X_i)$$

$$= \sum Y_i - n\hat{\beta}_0(0) - \hat{\beta}_1 \sum x_i = 0$$

$$0 = -\sum Y_i + \hat{\gamma}_1 \sum X_i$$

$$\hat{\gamma}_0 = \overline{Y} - \hat{\gamma}_1 \overline{X}$$

γ_1 equals.

$$\frac{d\,RSS}{d\,\hat{\gamma}_1} = \sum_{i=1}^{n} 2(Y_i - \hat{\gamma}_1 X_i)(-X_i) = 0$$

$$= \sum_{i=1}^{n} (Y_i - \hat{\gamma}_1 X_1) X_i = 0$$

$$= \sum_{i=1}^{n} Y_i X_i - \hat{\gamma}_1 X_i^2 = 0$$

$$= \sum Y_i X_i - \hat{\gamma}_1 \sum X_i^2 = 0$$

$$= \frac{\sum Y_i X_i - \frac{1}{n} \sum \gamma_1 \sum X_i}{\sum X_i^2 - \frac{1}{n}(\sum X_i)^2} = \hat{\gamma}_1$$

Yes it sum to zero