# COMP9417: Homework Set #1

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## Question 1

### a)

We know from the normal equations for a the gradient of a minimised linear regression is:

$$\hat{\beta}_1 = \frac{\bar{XY} - \bar{X}\bar{Y}}{(\bar{X^2}) - (\bar{X})^2}$$

Which can expand into:

$$\hat{\beta}_1 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2}$$

So now substituting in the transformation, we get:

$$\hat{\beta}_1 = \frac{\frac{1}{n}\sum_{i=1}^{n}(\tilde{X}_i - \bar{X})(Y_i - \bar{Y})}{\frac{1}{n}\sum_{i=1}^{n}(\tilde{X}_i - \bar{X})^2} \tag{1}$$

$$\hat{\beta}_1 = \frac{\frac{1}{n}\sum_{i=1}^{n}(c(X_i + d) - \bar{X})(Y_i - \bar{Y})}{\frac{1}{n}\sum_{i=1}^{n}(c(X_i + d) - \bar{X})^2} \tag{2}$$

$$\ldots \tag{3}$$

### b)

# Question 2

See Github repository here for all of the python code used in this question.

## a)