Formula Sheet

$$Y_i = \beta_0 + \beta_1 X_i + u_i$$

$$\text{elasticity} = \frac{\%\Delta Y}{\%\Delta X} = \frac{\Delta Y / Y}{\Delta X / X} = \underbrace{\frac{\Delta Y}{\Delta X}}_{\text{Slope}} \frac{X}{Y}$$

$$\hat{\beta}_1 = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sum (X_i - \bar{X})^2} = \beta_1 + \frac{\sum u_i (X_i - \bar{X})}{\left(\sum (X_i - \bar{X})^2\right)} \text{ i.e. } SST_X$$

$$\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}$$

$$SST = \sum (Y_i - \bar{Y})^2 \qquad SSE = \sum (\hat{Y}_i - \bar{Y})^2 \qquad SSR = \sum (Y_i - \hat{Y}_i)^2$$

$$R^2 = \frac{SSE}{SST}$$

$$r_{x,y} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2} \sqrt{\sum (Y_i - \bar{Y})^2}}.$$

$$Var(\hat{\beta}_1) = \frac{\sigma^2}{\sum (X_i - \bar{X})^2}$$

$$Var(\hat{\beta}_0) = \frac{\sigma^2 \sum X_i^2}{n \sum (X_i - \bar{X})^2}$$

$$\hat{\sigma}^2 = \frac{SSR}{n-k-1}, \text{ where k is the number of regressors.}$$

Simple : $\frac{SSR}{n-2}$

$$\widehat{Var(\hat{\beta}_1)} = \frac{\hat{\sigma}^2}{\sum (X_i - \bar{X})^2}$$

$$se(\hat{\beta}_1) = \frac{\hat{\sigma}}{\sqrt{\sum (X_i - \bar{X})^2}}$$