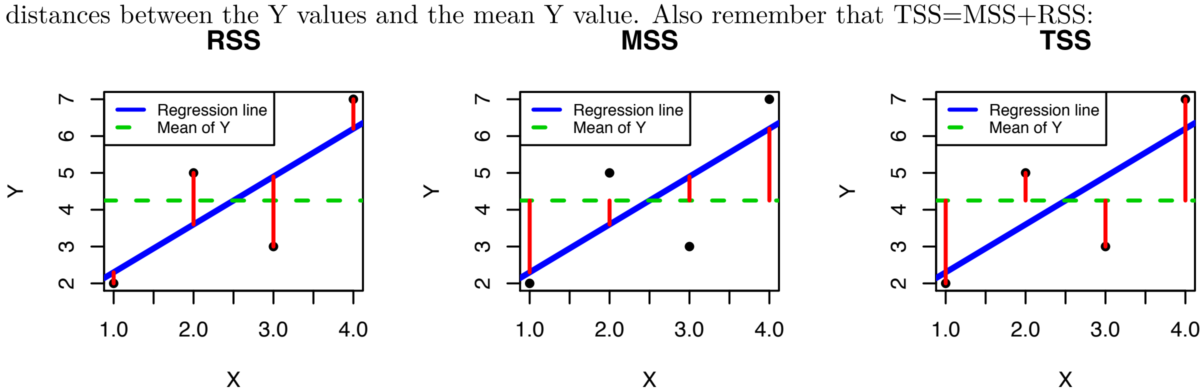
Notes: MSS, RSS, TSS and Degrees Freedom

Remember that the residual sum of squares (RSS) is the sum of the squared distances between the predicted Y values and the regression line, the model sum of squares (MSS) is the sum of squared distances between the predicted Y values and the mean Y value, and the total sum of squares (TSS) is the sum of squared distances between the Y values and the mean Y value. Also remember that TSS=MSS+RSS:



The degrees of freedom for the MSS (i.e., model degrees of freedom) is equal to the number of predictors in the model (note: NOT the number of parameters; the model Y~X has one predictor, X, and two parameters, β_0 and β_1). The degrees freedom of the RSS (i.e., residual degrees of freedom) is equal to $n - 1 - p$ where n is the number of observations (in the dataset that was used to fit the model) and p is the same. The degrees freedom of the TSS is equal to the sum of the degrees freedom of the MSS plus the degrees freedom of the RSS (i.e., $df(TSS) = df(MSS) + df(RSS) = p + n - 1 - p = n - 1$). So to summarize:

	DF
MSS	p
RSS	n-1-p
TSS	n-1

For the data that I used to create the three plots above, there are 4 observations and I am fitting the model Y~X, so there is one predictor. Thus, $n = 4$ and $p = 1$. So the model degrees of freedom is 1 and the residual degrees of freedom is $4 - 1 - 1 = 2$. The reported model degrees of freedom is highlighted in yellow below and the reported residual degrees of freedom is highlighted in green.

```
##
## Call:
## lm(formula = Y ~ X)
##
## Residuals:
##    1    2    3    4
## -0.3  1.4 -1.9  0.8
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.0000     2.1737   0.460    0.691
## X             1.3000     0.7937   1.638    0.243
##
## Residual standard error: 1.775 on 2 degrees of freedom
## Multiple R-squared:  0.5729, Adjusted R-squared:  0.3593
## F-statistic: 2.683 on 1 and 2 DF,  p-value: 0.2431
```