

Formulae Sheet

$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} \sqrt{n(\sum y^2) - (\sum y)^2}}$	$r^2 = \frac{\sum (\hat{y} - \bar{y})^2}{\sum (y - \bar{y})^2}$
$r = \frac{\sum Z_x Z_y}{n-1}$	Adjusted $R^2 = 1 - \frac{(n-1)}{[n-(k+1)]} (1 - R^2)$
$Z_x = \frac{x - \bar{x}}{s_x}$	$(X'X)b = X'y$
$Z_y = \frac{y - \bar{y}}{s_y}$	$X'X = \begin{bmatrix} 1 & \sum_{i=1}^n x_{1i} & \sum_{i=1}^n x_{2i} & \cdots & \sum_{i=1}^n x_{ki} \\ \sum_{i=1}^n x_{1i} & \sum_{i=1}^n x_{1i}^2 & \sum_{i=1}^n x_{1i} x_{2i} & \cdots & \sum_{i=1}^n x_{1i} x_{ki} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \sum_{i=1}^n x_{ki} & \sum_{i=1}^n x_{ki} x_{1i} & \sum_{i=1}^n x_{ki} x_{2i} & \cdots & \sum_{i=1}^n x_{ki}^2 \end{bmatrix}$
$s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$	$X'y = \begin{bmatrix} \sum_{i=1}^n y_i \\ \sum_{i=1}^n x_{1i} y_i \\ \vdots \\ \sum_{i=1}^n x_{ki} y_i \end{bmatrix}$
$s_x = \sqrt{\frac{1}{n(n-1)} \{n \sum_{i=1}^n x_{1i}^2 - (\sum_{i=1}^n x_{1i})^2\}}$	$b = (X'X)^{-1} X'y$
$s_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}}$	<p>If $n \leq 25$: Test statistic is x = the number of times the less frequent sign occurs.</p> <p>If $n > 25$: Test statistic is $Z = \frac{(x+0.5) - \frac{n}{2}}{\frac{\sqrt{n}}{2}}$</p> <p>1. If $n \leq 25$, critical x values are found in Table A-7. 2. If $n > 25$, critical z values are found in Table A-2.</p>
$s_y = \sqrt{\frac{1}{n(n-1)} \{n \sum_{i=1}^n y_{1i}^2 - (\sum_{i=1}^n y_{1i})^2\}}$	<p>If $n \leq 30$: Test statistic is x = the number of times the less frequent sign occurs.</p> <p>If $n > 30$, the test statistic is</p> $Z = \frac{T - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$ <p>1. If $n \leq 30$, the critical T value is found in Table A-8. 2. If $n > 30$, the critical z values are found in Table A-2.</p>
$t_{cal} = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$	$z = \frac{R - \mu_R}{\sigma_R}$ <p>Where</p> $\mu_R = \frac{n_1(n_1 + n_2 + 1)}{2} \quad \text{and} \quad \sigma_R = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$

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	Critical values can be found in Table A-2
$b_1 = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$	$H = \frac{12}{N(N+1)} \left(\frac{R_1^2}{n_1} + \frac{R_2^2}{n_2} + \dots + \frac{R_k^2}{n_k} \right) - 3(N+1)$ The test is <i>right-tailed</i> and critical values can be found from the chi-square distribution in Table A-4.
$b_1 = r \frac{s_y}{s_x}$	$r_s = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} \sqrt{n(\sum y^2) - (\sum y)^2}}$ $r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$ <ol style="list-style-type: none"> If $n \leq 30$, critical values are found in Table A-9. If $n > 30$, critical values of r_s are found using the formula: $r_s = \frac{\pm z}{\sqrt{n-1}}$ (critical values for $n > 30$)
$b_0 = \bar{y} - b_1 \bar{x}$	$z = \frac{G - \mu_G}{\frac{\sigma_G}{\sqrt{2n_1 n_2}}}$ $\mu_G = \frac{2n_1 n_2}{n_1 + n_2} + 1$ and $\sigma_G = \sqrt{\frac{(2n_1 n_2)(2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}}$ Critical values of z: Use Table A-2.
$b_0 = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$	
$\hat{y} = b_0 + b_1 x$	
$\hat{y} - E < y < \hat{y} + E$	
$E = t_{\alpha/2} s_e \sqrt{1 + \frac{1}{n} + \frac{n(x_0 - \bar{x})^2}{n(\sum x^2) - (\sum x)^2}}$	
$s_e = \sqrt{\frac{\sum (y - \hat{y})^2}{n-2}}$	
$s_e = \sqrt{\frac{\sum y^2 - b_0 \sum y - b_1 \sum xy}{n-2}}$	
$\sum (y - \bar{y})^2 = \sum (\hat{y} - \bar{y})^2 +$ $\sum (y - \hat{y})^2$	