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# Errors, Sum of Squares, Degrees of Freedom and Hypothesis Testing Formulas

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# List of 19 Errors, Sum of Squares, Degrees of Freedom and Hypothesis Testing Formulas

## Errors, Sum of Squares, Degrees of Freedom and Hypothesis Testing

### Degrees of Freedom

#### 1) Degrees of Freedom in Chi-square Goodness of Fit Test

Open Calculator

fx $$\mathrm{DF} = \mathrm{N}_{\mathrm{Groups}} - 1$$

ex $$8 = 9 - 1$$

#### 2) Degrees of Freedom in Chi-square Independence Test

Open Calculator

fx $$\mathrm{DF} = (\mathrm{N}_{\mathrm{Rows}} - 1) \cdot (\mathrm{N}_{\mathrm{Columns}} - 1)$$

ex $$8 = (5 - 1) \cdot (3 - 1)$$

#### 3) Degrees of Freedom in F Test

Open Calculator

fx $$\mathrm{DF} = \mathrm{N} - 1$$

ex $$9 = 10 - 1$$

## 4) Degrees of Freedom in Independent Samples t Test

Open Calculator

fx $$\mathrm{DF} = \mathrm{N_X} + \mathrm{N_Y} - 2$$

ex $$8 = 6 + 4 - 2$$

## 5) Degrees of Freedom in One Sample t Test

Open Calculator

fx $$\mathrm{DF} = \mathrm{N} - 1$$

ex $$9 = 10 - 1$$

## 6) Degrees of Freedom in One-way ANOVA Test within Groups

Open Calculator

fx $$\mathrm{DF} = \mathrm{N_{Total}} - \mathrm{N_{Groups}}$$

ex $$8 = 17 - 9$$

## 7) Degrees of Freedom in Simple Linear Regression Test

Open Calculator

fx $$\mathrm{DF} = \mathrm{N} - 2$$

ex $$8 = 10 - 2$$

# Errors

## 8) Residual Standard Error of Data

Open Calculator

fx $$\mathrm{RSE_{Data}} = \sqrt{\frac{\mathrm{RSS_{(Error)}}}{\mathrm{N_{(Error)}} - 1}}$$

ex $$2.010076 = \sqrt{\frac{400}{100 - 1}}$$

## 9) Residual Standard Error of Data given Degrees of Freedom

Open Calculator

fx $$\mathrm{RSE_{Data}} = \sqrt{\frac{\mathrm{RSS_{(Error)}}}{\mathrm{DF_{(Error)}}}}$$

ex $$2.010076 = \sqrt{\frac{400}{99}}$$

## 10) Standard Error of Data

Open Calculator

fx $$\mathrm{SE_{Data}} = \frac{\sigma_{\mathrm{(Error)}}}{\sqrt{\mathrm{N_{(Error)}}}}$$

ex $$2.5 = \frac{25}{\sqrt{100}}$$

## 11) Standard Error of Data given Mean

Open Calculator

fx $$SE_{Data} = \sqrt{\left(\frac{\Sigma x^2}{N_{(Error)}^2}\right) - \left(\frac{\mu^2}{N_{(Error)}}\right)}$$

ex $$2.5 = \sqrt{\left(\frac{85000}{(100)^2}\right) - \left(\frac{(15)^2}{100}\right)}$$

## 12) Standard Error of Data given Variance

Open Calculator

fx $$SE_{Data} = \sqrt{\frac{\sigma^2 Error}{N_{(Error)}}}$$

ex $$2.5 = \sqrt{\frac{625}{100}}$$

## 13) Standard Error of Difference of Means

Open Calculator

fx $$SE_{\mu 1\text{-}\mu 2} = \sqrt{\left(\frac{\sigma_X^2}{N_{X(Error)}}\right) + \left(\frac{\sigma_Y^2}{N_{Y(Error)}}\right)}$$

ex $$1.549193 = \sqrt{\left(\frac{(4)^2}{20}\right) + \left(\frac{(8)^2}{40}\right)}$$

### 14) Standard Error of Proportion

Open Calculator

fx $$SEP = \sqrt{\frac{p \cdot (1 - p)}{N_{(Error)}}}$$

ex $$0.05 = \sqrt{\frac{0.5 \cdot (1 - 0.5)}{100}}$$

## Hypothesis Testing

### 15) One Sample t Statistic for Mean

Open Calculator

fx $$t = \frac{\bar{x} - \mu_{Population}}{SE}$$

ex $$2 = \frac{25 - 20}{2.5}$$

### 16) Standardized Test Statistic

Open Calculator

fx $$t_{Standardized} = \frac{S - P}{\sigma}$$

ex $$2.4 = \frac{160 - 40}{50}$$

# Sum of Squares

## 17) Residual Sum of Squares

Open Calculator

fx $$\mathrm{RSS} = \left(\mathrm{RSE}^2\right) \cdot \mathrm{DF}_{(\mathrm{SS})}$$

ex $$56 = \left((2)^2\right) \cdot 14$$

## 18) Residual Sum of Squares given Residual Standard Error

Open Calculator

fx $$\mathrm{RSS} = \left(\mathrm{RSE}^2\right) \cdot \left(\mathrm{N}_{(\mathrm{SS})} - 1\right)$$

ex $$56 = \left((2)^2\right) \cdot (15 - 1)$$

## 19) Sum of Squares

Open Calculator

fx $$\mathrm{SS} = \sigma^2 \cdot \mathrm{N}_{(\mathrm{SS})}$$

ex $$240 = 16 \cdot 15$$

# Variables Used

- **DF** Degrees of Freedom
- $\mathbf{DF_{(Error)}}$ Degrees of Freedom in Standard Error
- $\mathbf{DF_{(SS)}}$ Degrees of Freedom in Sum of Squares
- **N** Sample Size
- $\mathbf{N_{(Error)}}$ Sample Size in Standard Error
- $\mathbf{N_{(SS)}}$ Sample Size in Sum of Square
- $\mathbf{N_{Columns}}$ Number of Columns
- $\mathbf{N_{Groups}}$ Number of Groups
- $\mathbf{N_{Rows}}$ Number of Rows
- $\mathbf{N_{Total}}$ Total Sample Size
- $\mathbf{N_{X}}$ Size of Sample X
- $\mathbf{N_{X(Error)}}$ Size of Sample X in Standard Error
- $\mathbf{N_{Y}}$ Size of Sample Y
- $\mathbf{N_{Y(Error)}}$ Size of Sample Y in Standard Error
- **p** Sample Proportion
- **P** Parameter
- **RSE** Residual Standard Error
- $\mathbf{RSE_{Data}}$ Residual Standard Error of Data
- **RSS** Residual Sum of Squares
- $\mathbf{RSS_{(Error)}}$ Residual Sum of Squares in Standard Error
- **S** Statistic
- **SE** Standard Error

- $SE_{Data}$ Standard Error of Data
- $SE_{\mu 1-\mu 2}$ Standard Error of Difference of Means
- **SEP** Standard Error of Proportion
- **SS** Sum of Squares
- **t** t Statistic
- $t_{Standardized}$ Standardized Test Statistic
- $\bar{x}$ Sample Mean
- $\mu$ Mean of Data
- $\mu_{Population}$ Population Mean
- $\sigma$ Standard Deviation of Statistic
- $\sigma_{(Error)}$ Standard Deviation of Data
- $\sigma_X$ Standard Deviation of Sample X
- $\sigma_Y$ Standard Deviation of Sample Y
- $\sigma^2$ Variance of Data
- $\sigma^2 Error$ Variance of Data in Standard Error
- $\Sigma x^2$ Sum of Squares of Individual Values

# Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  *Square root function*

## Check other formula lists

- **Basic Formulas in Statistics**
- **Coefficients, Proportion and Regression Formulas**
- **Errors, Sum of Squares, Degrees of Freedom and Hypothesis Testing Formulas**
- **Frequency Formulas**
- **Maximum and Minimum Values of Data Formulas**
- **Measures of Central Tendency Formulas**
- **Measures of Dispersion Formulas**

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