

Important Theory of Errors Formulas PDF



Formulas Examples with Units

List of 21 Important Theory of Errors Formulas

1) Mean Error given Specified Error of Single Measurement Formula

Formula

$$E_m = \frac{E_s}{\sqrt{n_{\text{obs}}}}$$

Example

$$0.125 = \frac{0.25}{\sqrt{4}}$$

Evaluate Formula 

2) Mean Error given Sum of Errors Formula

Formula

$$E_m = \frac{\Sigma E}{n_{\text{obs}}}$$

Example

$$0.6 = \frac{2.40}{4}$$

Evaluate Formula 

3) Most Probable Error given Standard Deviation Formula

Formula

$$\text{MPE} = 0.6745 \cdot \sigma$$

Example

$$0.8971 = 0.6745 \cdot 1.33$$

Evaluate Formula 

4) Most Probable Value given Residual Error Formula

Formula

$$\text{MPV} = x - r$$

Example

$$79 = 159 - 80$$

Evaluate Formula 

5) Most Probable Value with Different Weightage Formula

Formula

$$\text{MPV} = \text{add} \frac{w_i \cdot x_i}{a} \text{dd} (w_i)$$

Example

$$78 = \text{add} \frac{10 \cdot 78}{a} \text{dd} (10)$$

Evaluate Formula 

6) Most Probable Value with Same Weightage for Observations Formula

Formula

$$\text{MPV} = \frac{\Sigma x_i}{n_{\text{obs}}}$$

Example

$$200 = \frac{800}{4}$$

Evaluate Formula 



7) Observed Value given Relative Error Formula ↻

Formula

$$x = \frac{\varepsilon_x}{R_x}$$

Example

$$160 = \frac{320}{2}$$

Evaluate Formula ↻

8) Observed Value given Residual Error Formula ↻

Formula

$$x = r + MPV$$

Example

$$159 = 80 + 79$$

Evaluate Formula ↻

9) Observed Value given True Error Formula ↻

Formula

$$x = X - \varepsilon_x$$

Example

$$160 = 480 - 320$$

Evaluate Formula ↻

10) Probable Error of Mean Formula ↻

Formula

$$PE_m = \frac{PE_s}{n_{obs}^{0.5}}$$

Example

$$0.005 = \frac{0.01}{4^{0.5}}$$

Evaluate Formula ↻

11) Relative Error Formula ↻

Formula

$$R_x = \frac{\varepsilon_x}{x}$$

Example

$$2.0126 = \frac{320}{159}$$

Evaluate Formula ↻

12) Residual Error Formula ↻

Formula

$$r = x - MPV$$

Example

$$80 = 159 - 79$$

Evaluate Formula ↻

13) Residual Variation given Most Probable Value Formula ↻

Formula

$$V = m - MPV$$

Example

$$20.9 = 99.9 - 79$$

Evaluate Formula ↻

14) Standard Deviation of Weighted Observations Formula ↻

Formula

$$\sigma_w = \sqrt{\frac{\Sigma WV^2}{n_{obs} - 1}}$$

Example

$$22.3607 = \sqrt{\frac{1500}{4 - 1}}$$

Evaluate Formula ↻



15) Standard Deviation used for Survey Errors Formula

Formula

$$\sigma = \sqrt{\frac{\Sigma V^2}{n_{\text{obs}} - 1}}$$

Example

$$40.8248 = \sqrt{\frac{5000}{4 - 1}}$$

Evaluate Formula 

16) Standard Error of Function where variables are Subjected to Addition Formula

Formula

$$e_A = \sqrt{e_x^2 + e_y^2 + e_z^2}$$

Example

$$200.4221 = \sqrt{120^2 + 115^2 + 112^2}$$

Evaluate Formula 

17) Standard Error of Mean of Weighted Observations Formula

Formula

$$\sigma_{nw} = \frac{\sigma_w}{\sqrt{\Sigma W}}$$

Example

$$100.1388 = \frac{950}{\sqrt{90}}$$

Evaluate Formula 

18) True Error Formula

Formula

$$\epsilon_x = X - x$$

Example

$$321 = 480 - 159$$

Evaluate Formula 

19) True Error given Relative Error Formula

Formula

$$\epsilon_x = R_x \cdot x$$

Example

$$318 = 2 \cdot 159$$

Evaluate Formula 

20) True Value given True Error Formula

Formula

$$X = \epsilon_x + x$$

Example

$$479 = 320 + 159$$

Evaluate Formula 

21) Variance of Observations Formula

Formula

$$\sigma^2 = \frac{\Sigma V^2}{n_{\text{obs}} - 1}$$

Example

$$1666.6667 = \frac{5000}{4 - 1}$$

Evaluate Formula 



Variables used in list of Theory of Errors Formulas above

- e_A Standard Error in Function
- E_m Error of Mean
- E_s Specified Error of a Single Measurement
- e_x Standard Error in x coordinate
- e_y Standard Error in y coordinate
- e_z Standard Error in z coordinate
- m Measured Value
- MPE Most Probable Error
- MPV Most Probable Value
- n_{obs} Number of Observations
- PE_m Probable Mean of Error
- PE_s Probable Error in Single Measurement
- r Residual Error
- R_x Relative Error
- ΣV^2 Sum of Square of Residual Variation
- ΣW Sum of Weightage
- ΣWV^2 Sum of Weighted Residual Variation
- Σx_i Sum of Observed Values
- V Residual Variation
- w_i Weightage
- x Observed Value
- X True Value
- x_i Measured Quantity
- ϵ_x True Error
- σ Standard Deviation
- σ_{nw} Standard Error of Mean
- σ_w Weighted Standard Deviation
- σ^2 Variance
- ΣE Sum of Errors of Observations

Constants, Functions, Measurements used in list of Theory of Errors Formulas above

- **Functions:** **add**, `add(a1, ..., an)`
Add function that involves adding two or more numbers together to get their sum.
- **Functions:** **sqrt**, `sqrt(Number)`
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.



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