

Parts per Thousand (ppt) Guide

For the values x_1 , x_2 and x_3 :

- Take the **average** of the values

$$\text{average} = \frac{\text{sum}}{\# \text{ of values}} = \frac{x_1 + x_2 + x_3}{3}$$

- Find the **deviation** of each value relative to the average

$$\begin{aligned} \text{deviation}_1 &= \text{absolute value (average} - x_1) = | \text{average} - x_1 | \\ \text{deviation}_2 &= | \text{average} - x_2 | \\ \text{deviation}_3 &= | \text{average} - x_3 | \end{aligned}$$

- Find the **average deviation** of the deviations

$$\text{average deviation} = \frac{\text{sum of deviations}}{\# \text{ of values}} = \frac{\text{deviation}_1 + \text{deviation}_2 + \text{deviation}_3}{3}$$

- Calculate the **parts per thousand (ppt)** for the values

$$\text{ppt} = \frac{\text{average deviation}}{\text{average}} * 1000$$

Example: Calculate the parts per thousand for the values 35.72, 35.92 and 36.02.

- Average = $\frac{35.72 + 35.92 + 36.02}{3} = \mathbf{35.89}$
- Deviation₁ = $| 35.89 - 35.72 | = 0.17$
- Deviation₂ = $| 35.89 - 35.92 | = 0.03$
- Deviation₃ = $| 35.89 - 36.02 | = 0.13$
- average deviation = $\frac{0.17 + 0.03 + 0.13}{3} = \mathbf{0.11}$
- parts per thousand = $\frac{0.11}{35.89} * 1000 = \mathbf{3.1}$

