

Name: _____

Standard Deviation

Measures of central tendency (averages) are basically designed to tell you what to expect from data. For example, if you “average” (have a mean score of) a B on quizzes, then you can expect to get a B or something like it on the next quiz. But, how trustworthy is that “average”? A student can have a B average without ever getting a B. Averages are useful indicators, but they aren’t perfect. If you want to know the accuracy of the average, you have to determine something called **standard deviation**. Standard deviation shows how much the data generally varies from the mean. The smaller the standard deviation, the more trustworthy the mean is. Determining standard deviation, represented by the symbol σ , is not difficult to do...if you follow the steps.

- Step 1: Find the mean, represented by \bar{X}
- Step 2: Subtract the mean (\bar{X}) from each data point (X)
- Step 3: Square each of the values from step 2
- Step 4: Determine the sum (Σ) of all of the values from step 3
- Step 5: Divide the value from step 4 by the number of data points you started with (N)
- Step 6: Square root the value from step 5

EXAMPLE: Determine the standard deviation of the data to the nearest tenth. {11, 3, 2, 12}

| Data (X) | 11 | 3 | 2 | 12 |
|--|---|---------------|---------------|--------------|
| #1: Determine the mean. (\bar{X}) | $\bar{X} = \frac{11 + 3 + 2 + 12}{4} = \frac{28}{4} = 7$ | | | |
| #2: Subtract each. ($X - \bar{X}$) | $11 - 7 = 4$ | $3 - 7 = -4$ | $2 - 7 = -5$ | $12 - 7 = 5$ |
| #3: Square each. ($X - \bar{X}$) ² | $4^2 = 16$ | $(-4)^2 = 16$ | $(-5)^2 = 25$ | $5^2 = 25$ |
| #4: Add them up. $\Sigma(X - \bar{X})^2$ | $\Sigma(X - \bar{X})^2 = 16 + 16 + 25 + 25 = 82$ | | | |
| #5: Divide by the amount of data. $\frac{\Sigma(X - \bar{X})^2}{N}$ | $\frac{\Sigma(X - \bar{X})^2}{N} = \frac{82}{4} = 20.5$ | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}}$ | $\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}} = \sqrt{20.5} = \boxed{4.5}$ | | | |

EXAMPLE: Determine the standard deviation of the data to the nearest tenth. {-54, 20, 3, 0, -1}

| Data (X) | -54 | 20 | 3 | 0 | -1 |
|--|---|------------------|-----------------|----------------|-----------------|
| #1: Determine the mean. (\bar{X}) | $\bar{X} = \frac{-54 + 20 + 3 + 0 + -1}{5} = \frac{-30}{5} = -6$ | | | | |
| #2: Subtract each. ($X - \bar{X}$) | $-54 - (-6) = -48$ | $20 - (-6) = 26$ | $4 - (-6) = 10$ | $0 - (-6) = 6$ | $-1 - (-6) = 5$ |
| #3: Square each. ($X - \bar{X}$) ² | $(-48)^2 = 2304$ | $26^2 = 676$ | $10^2 = 100$ | $6^2 = 36$ | $5^2 = 25$ |
| #4: Add them up. $\Sigma(X - \bar{X})^2$ | $\Sigma(X - \bar{X})^2 = 2304 + 676 + 100 + 36 + 25 = 3141$ | | | | |
| #5: Divide by the amount of data. $\frac{\Sigma(X - \bar{X})^2}{N}$ | $\frac{\Sigma(X - \bar{X})^2}{N} = \frac{3141}{5} = 628.2$ | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}}$ | $\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{N}} = \sqrt{628.2} = \boxed{25.1}$ | | | | |

1. Determine the standard deviation of the data to the nearest tenth. {2, -4, 6, 7, 4}

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|--|--|--|--|--|--|
| Data (X) | | | | | |
| #1: Determine the mean. (\bar{X}) | | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | | |

2. Determine the standard deviation of the data to the nearest tenth. {10, 1, 5, 6, 8, 6}

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| Data (X) | | | | | |
| #1: Determine the mean. (\bar{X}) | | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | | |

3. Determine the standard deviation of the data to the nearest tenth. {0, -3, 5, 2}

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|--|--|--|--|--|
| Data (X) | | | | |
| #1: Determine the mean. (\bar{X}) | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | |

4. Determine the standard deviation of the data to the nearest tenth. {8, -10, 14}

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|--|--|--|--|--|
| Data (X) | | | | |
| #1: Determine the mean. (\bar{X}) | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | |

5. Determine the standard deviation of the data to the nearest tenth. {11, 6, 0, 3}

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|--|--|--|--|--|
| Data (X) | | | | |
| #1: Determine the mean. (\bar{X}) | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | |

6. Determine the standard deviation of the data to the nearest tenth. {-8, 5, -7, 3, -3}

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|--|--|--|--|--|--|
| Data (X) | | | | | |
| #1: Determine the mean. (\bar{X}) | | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | | |

7. Determine the standard deviation of the data to the nearest tenth. {-11, -9, -10, -12, -8}

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|--|--|--|--|--|--|
| Data (X) | | | | | |
| #1: Determine the mean. (\bar{X}) | | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | | |

8. Determine the standard deviation of the data to the nearest tenth. {9, 3, 3, 2, 5, -4}

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| Data (X) | | | | | |
| #1: Determine the mean. (\bar{X}) | | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | | |

9. Determine the standard deviation of the data to the nearest tenth. {9, 14, 8, 13}

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|--|--|--|--|--|
| Data (X) | | | | |
| #1: Determine the mean. (\bar{X}) | | | | |
| #2: Subtract each. ($X - \bar{X}$) | | | | |
| #3: Square each. ($X - \bar{X}$) ² | | | | |
| #4: Add them up. $\sum(X - \bar{X})^2$ | | | | |
| #5: Divide by the amount of data. $\frac{\sum(X - \bar{X})^2}{N}$ | | | | |
| #6: Square root it. $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$ | | | | |