

Standard Deviation

Concepts

1. The **variance** of a random variable is defined as $E[(X - \mu)^2]$ and there is a shortcut formula that we can use to define it as $E[X^2] - \mu^2$. For continuous random variables, we replace summation with

$$\sigma^2 = E[X^2] - \mu^2 = \int_{-\infty}^{\infty} x^2 f(x) dx - \mu^2.$$

Example

2. Let $f(x) = e \cdot e^x$ for $x \leq -1$ and 0 otherwise. Find the standard deviation of this distribution.

Problems

3. True False The standard deviation always exists.
4. True False Sometimes, we take the standard deviation to be the negative square root of the variance.
5. True False The variance is always nonnegative.
6. True False If the mean doesn't exist, then the standard deviation doesn't exist.
7. True False If the mean exists, then the standard deviation exists.
8. Let $f(x)$ be $2/3x$ from $1 \leq x \leq 2$ and 0 everywhere else. Find the standard deviation of this distribution.
9. Let $f(x)$ be $-4/x^5$ for $x \leq -1$ and 0 everywhere else. Find the standard deviation of this distribution.
10. Let $f(x)$ be the uniform distribution on $0 \leq x \leq 10$ and 0 everywhere else. Find the standard deviation of this distribution.