

Expected Value and Variance of a Continuous RV

If X has a probability distribution given by the function f , then $P(a < X < b) =$ area under the graph of f between $x=a$ and $x=b$.

Imagine a particular x on the horizontal axis and a very thin histogram bar, of width dx at that position. The probability that X is between $x-dx/2$ and $x+dx/2$ is the area $f(x)dx$ of that histogram bar. Hence the expected value and variance of X are:

$$\mu = E(X) = \int_{-\infty}^{\infty} xf(x)dx$$

$$\sigma^2 = V(X) = \int_{-\infty}^{\infty} (x - \mu)^2 f(x)dx$$