Understanding statistical error bars

- Why should we quote error bars on our measurements?

- What distinguishes a sample mean from a population mean?

- What integrals should be calculated to give the expectation and variance?

- State the central limit theorem and explain what each of the terms in this theorem represent.

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- How is the cumulative probability distribution function defined and how is the probability density function defined?

- What is the variance of the random variable $S = \frac{1}{N}\sum_{i=1}^{N} X_i$ if each of the X_is in this sum is a independent and identically distributed random variable taken from a distribution with variance σ?

- Explain in your own words why a sample mean gives an estimate of the true population mean.

- Give the expression that allows you to calculate an estimate of the true population from a sample taken from that population and explain how this result is derived.

Understanding statistical error bars

- We can calculate a weighted sample average as $\mu_S = \frac{1}{W}\sum_{i=1}^{N_S} w_i x_i$, where $W = \sum_{i=1}^{N_S} w_i$. In these expressions the x_is are the values of the quantities in our samples and the w_is are the sample weights. Show, using the maths from the video, that an appropriate estimator for the popupation variance for this weighted sample is $\sigma^2 = \frac{W}{W - \frac{W_2}{W}} \frac{1}{W} \sum_{i=1}^{N_S} w_i (x_i - \mu_S)^2$.