

tec 0. We distinguish between the “sample” population (or distribution) and the “parent” population (or distribution). Useful quantities like the mean and the standard deviation of the sample population always have an uncertainty since knowledge about them is finite, derived from a finite number of experimental measurements, and therefore never fully exact. The parent population can be considered infinite since it is the population nature uses to describe a physical process. When we perform an experiment, we sample the parent population. The mean and standard deviation of the parent population can be considered exact since “nature knows the truth.” In general, when we perform repeated measurements, our sample mean and standard deviation approach the true mean and standard deviation of the parent population. Taylor sometimes refers to the parent distribution as the “limiting” distribution of a set of measurements.

Show that, in general, for a *parent* distribution with mean μ and variance σ^2 ,

$$\sigma_x^2 = \overline{x^2} - \mu^2$$

where x is the quantity (e.g., voltage, mass, length) described by the parent distribution. Hint: keep in mind the precise meaning of the mean and variance of a parent distribution.