The Central Limit Theorem.

From a population of quantities, x, with mean μ & std. dev. σ, consider the sampling distribution of all sample means from samples of this population with size n.

The mean of the sampling distribution is $\mu_{\bar{x}}$ & the standard error (deviation) is $\sigma_{\bar{x}}$. The following can be proven:

1. The sample means ($\bar{x}$) are approximately normal if $n > 30$ or you're sampling from a normal population.
2. $\mu_{\bar{x}} = \mu$.
3. $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ ← standard error in $\bar{x}$ values

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Margin of Error in $\bar{x}$ estimate $\quad E = z_{\alpha/2} \cdot (\text{standard error})$

$$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}.$$

Confidence interval: estimate $- E <$ unknown parameter $<$ estimate $+ E$

$$\bar{x} - E < \mu < \bar{x} + E.$$