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Gaussian Distribution. In probability theory, a normal distribution or a Gaussian distribution is a type of continuous probability distribution for a real-valued random variable, such as age, height, marks, and so on. The general form of this distribution is given by

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \quad (1)$$

where μ is the mean or expectation of variable, σ^2 is the variation, and x is the random variable. When plotted, this looks like a symmetrical bell-shaped curve. For $\mu = 1$ and $\sigma^2 = \frac{1}{2}$, the distribution looks like this:

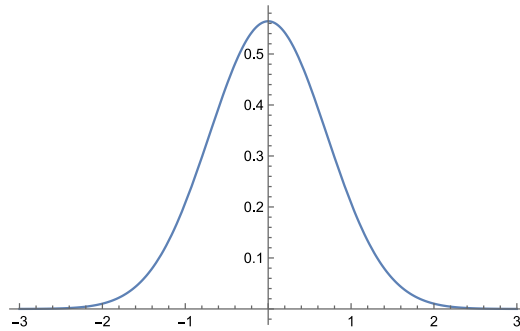


Figure 1. Gaussian Distribution for $\mu = 1$ and $\sigma^2 = \frac{1}{2}$.

Here, the peak occurs at mean (in this case, 0), whereas the standard deviation dictates the width of the curve. While the normal distribution equation (1) may appear complex at first glance, it elegantly describes some of the simplest and most common natural phenomena, such as the distribution of heights in a population or more complicated events such as measurement errors in scientific experiments.

Case Study. On campus, one of the most interesting applications of this equation is in modelling of the distribution of marks in a large class, where scores tend to cluster around the average with fewer students scoring extremely high or low. This average mostly happens to appear at 60% or around that. For example, figure 2 represents distribution of marks scored by students of Sri Guru Tegh Bahadur Khalsa College in internal assessments. The data was taken from college website.

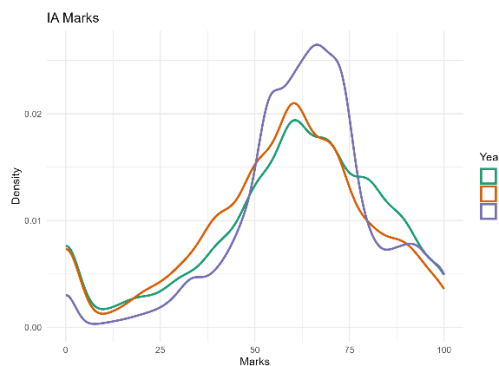


Figure 2. Distribution of internal assessment marks following the normal distribution.

A normal distribution can indeed be seen. In this case, we find that the average lies around 60 as expected, and marks corresponding to students of all three years follow a similar distribution.