The Gaussian density function is

$$f_x(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}.$$

$\mu, \sigma$ parameters.

The corresponding distribution is called the Gaussian distribution.

A r.v is called Gaussian if its pdf is Gaussian.

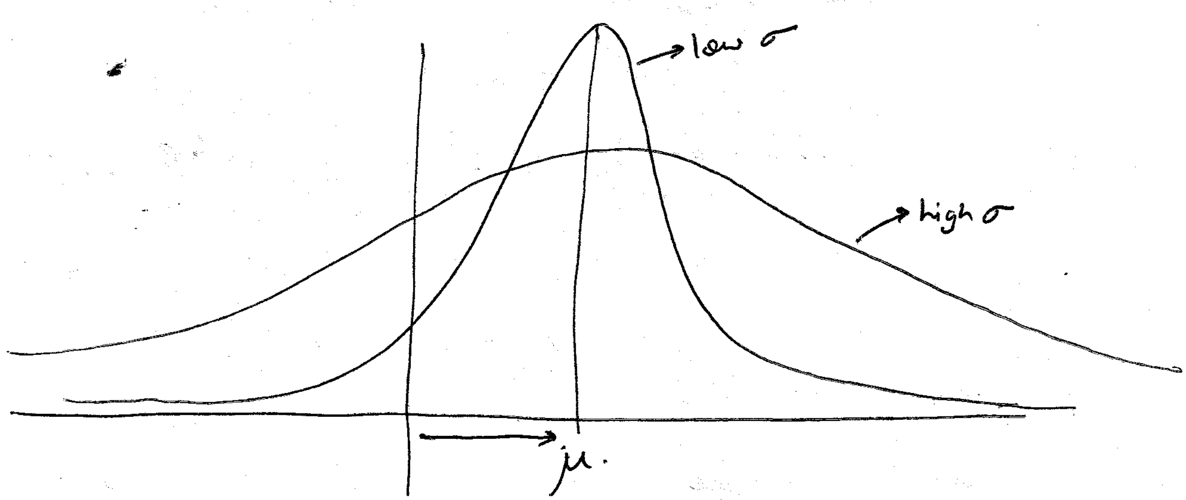
If $x$ is a Gaussian, then $E(x) = \mu$, $\sigma_x = \sigma$.

This is written as $x \sim N(\mu, \sigma)$.

If $x \sim N(\mu, \sigma)$, then the r.v. $y = \frac{x-\mu}{\sigma}$ is Gaussian with mean 0 & variance 1. That is,

$$y \sim N(0,1).$$

$N(0,1)$ is called the unit normal distribution. Available in tables.



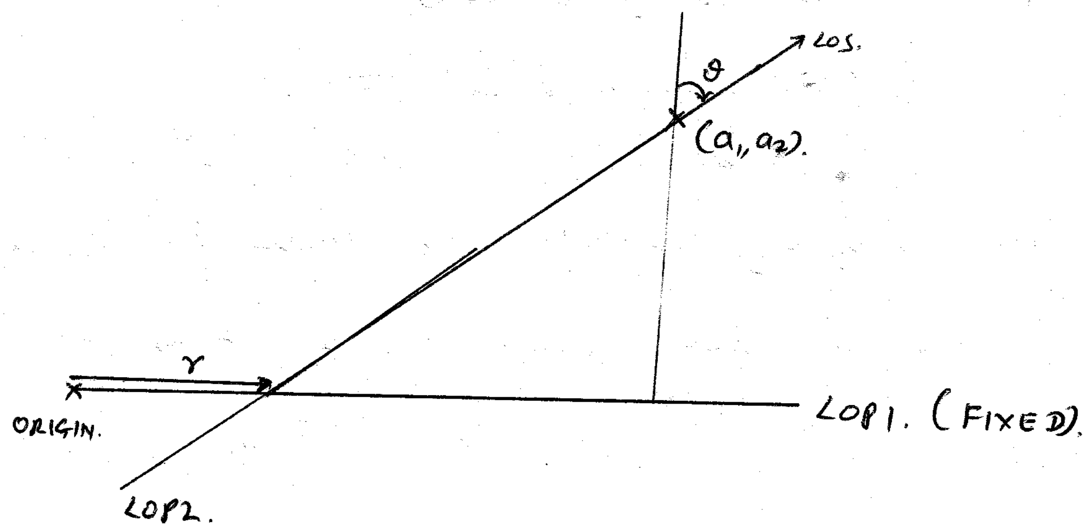

Ex. If $x$ is the measurement error, then $\mu \sim$ accuracy/bias

$\sigma$ – precision.

Same fixed probability of finding the error between $\mu-\sigma$ & $\mu+\sigma$.

$1\sigma$ - 68.26%, $2\sigma$ - 95.44%, $3\sigma$ - 99.74%

Ex. Position fixing using bearing measurement.




The bearing measurement $\theta_0$ fixes the position along LOP1 as $r_0 = a_1 - a_2 \tan\theta_0$.

The bearing measurement has a small error $\delta\theta$. which gives rise to an ~~error~~ navigation

$$\delta r = -a_2 \sec^2\theta_0 \, \delta\theta .$$

If $\cancel{\delta\theta \sim N(0, \sigma_\theta)}$ ~~the~~ the measurement error $\delta\theta$ has variance $\sigma_\theta^2$, then the variance of the navigation error $\delta r$ is $\sigma_r^2 = a_2^2 \sec^4\theta_0 \, \sigma_\theta^2$

Note: $\theta_0 \sim 90^\circ$ ~~is~~ yields a large variance.

Multiple random variables:

Two random variables $x_1$ & $x_2$, may be viewed as the elements of a single random vector. $x$ whose sample space is $\mathbb{R}^2$.