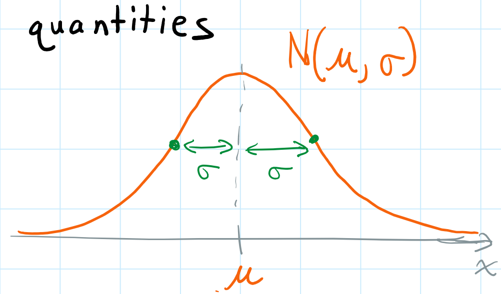
THE NORMAL DISTRIBUTION



basic bell-shaped curve:

$$e^{-x^2}$$

- Describes the distributions of many physical quantities (e.g. lengths, weights, measurements).
- Arises from the Central Limit Theorem.
- pdf of $X \sim N(\mu, \sigma)$: $f(x; \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$
- cdf of $X \sim N(0,1)$: $\Phi(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{-y^2/2}\, dy$

  standard normal $\mu = 0$, $\sigma = 1$
- mgf of $X \sim N(0,1)$: $M_X(t) = e^{\mu t + \frac{\sigma^2 t^2}{2}}$

R: $\text{pnorm}(x, \mu, \sigma)$ computes $P(X \leq x)$ with $X \sim N(\mu, \sigma)$

$\text{qnorm}(p, \mu, \sigma)$ computes x such that $P(X \leq x) = p$

Mathematica: CDF[NormalDistribution[μ, σ], x]

InverseCDF[NormalDistribution[μ, σ], p]