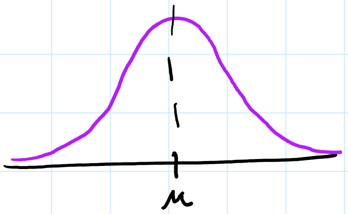
THE NORMAL DISTRIBUTION

- Describes the distributions of many physical quantities (e.g. lengths, weights, measurements).



- Arises from the Central Limit Theorem.

- pdf of $X \sim N(\mu, \sigma)$: $f(x; \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$

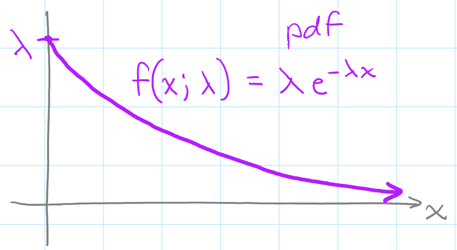
- cdf of $X \sim N(0,1)$: $\Phi(x) = \int_{-\infty}^{x} \frac{1}{\sqrt{2\pi}} e^{-y^2/2}\, dy$

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

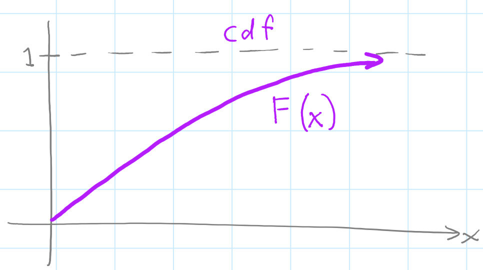
EXPONENTIAL DISTRIBUTION

The times between events in a Poisson process are exponentially distributed.

- pdf: $f(x; \lambda) = \begin{cases} \lambda e^{-\lambda x} & x > 0 \\ 0 & \text{otherwise.} \end{cases}$



- cdf: $F(x) = \begin{cases} 1 - e^{-\lambda x} & \text{for } x > 0 \\ 0 & \text{otherwise.} \end{cases}$



- mean $E(X) = \frac{1}{\lambda}$

- variance: $Var(X) = \frac{1}{\lambda^2}$