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## Exponential distribution

Notation:

$$X \sim \text{Ex}(\alpha) \quad \text{with} \quad \alpha \in \mathbb{R}^{>0}$$

The exponential distribution is a continuous distribution with a distribution parameter  $\alpha$ . Expected value and variance are given by:

$$\text{E}(X) = \frac{1}{\alpha} \quad \text{and} \quad \text{Var}(X) = \frac{1}{\alpha^2}$$

### Density function

The density function is given by:

$$f(x) = \begin{cases} \alpha \exp(-\alpha x) & \text{for } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

### Cumulative distribution function

The cumulative distribution function (cdf) is given by:

$$F(x) = P(X \leq x) = \int_{-\infty}^x f(t) dt$$

The value of the cumulative distribution function is the probability that the random variable  $X$  is less than or equal to  $x$ .

### Quantile function

The quantile function returns the value  $x_p$  under which is  $p\%$  of the probability mass. Formally, the quantile function is the inverse function of the distribution function:

$$x_p = F^{-1}(p) = F^{-1}[P(X \leq x_p)]$$

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## Excel commands

### Density function and distribution function of the exponential distribution

- `=EXPON.VERT( $x$ ;  $\alpha$ ; kumuliert)`
  - $x$  := Value  $x$  where appropriate function value should be returned
  - $\alpha$  := Distribution parameter (in Excel:  $\alpha = \lambda$ )
  - kumuliert = 1 := Value of the distribution function (probability)
  - kumuliert = 0 := Value of the density function (no probability!)