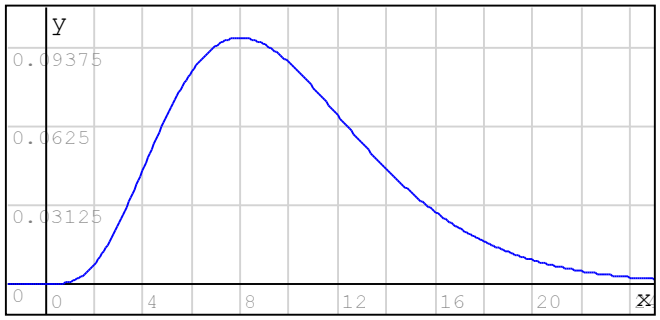
//Density function,chi-squareddistribution

$$f\chi 2(x,\nu) := (x \geq 0)\cdot \frac{1}{2^{\frac{\nu}{2}}\cdot \text{Gamma}\left(\frac{\nu}{2}\right)}\cdot x^{\frac{\nu}{2}-1}\cdot e^{-\frac{x}{2}}$$

// ν - degrees of freedom

$\nu := 10$



$f\chi 2(x,\nu)$

//Find the probability for a given χ and ν values that p=P(X<χ)
//cumulative probability - quantiles

$$F(\chi,\nu) := \int_0^{\chi} f\chi 2(x,\nu)\,dx$$

//Example

$x := 50 \quad \nu := 10 \quad p := F(x,\nu) \quad p = 1$

//How to find the inverse problem. Find the χ-value
//for the given degrees of freedom and probability
//p=P(X<χ)

//Here are standard values of probabilities used in statistics

$p90 := 0.9 \quad p95 := 0.95 \quad p99 := 0.99$

$\nu := 10$

$f(\chi) := p90 - F(\chi,\nu)$ //put p95, p99 instead of p90

$maxiter := 20 \quad \delta := 0.5\cdot 10^{-3} \quad konv := maxiter\cdot\delta$

$x1 := 15 \quad x2 := 1.01\cdot x1$

$i := 1$

while $(|konv| > \delta) \wedge (i \le maxiter)$

$x := eval\left(\frac{f(x2)\cdot x1 - f(x1)\cdot x2}{f(x2) - f(x1)}\right)$

$konv := \frac{x - x2}{x + \delta}$

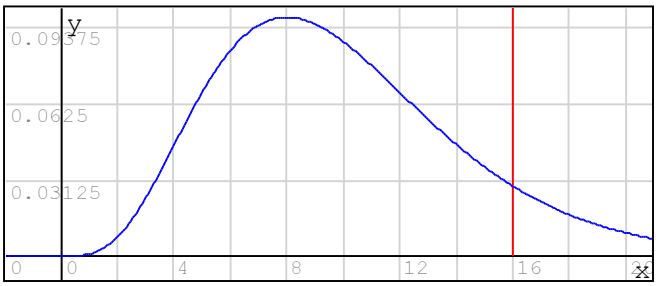
$x1 := x2$

$x2 := x$

$i := i + 1$

$i = 5 \quad konv = 6.5053 \cdot 10^{-6} \quad x = 15.9872$

$liner := \begin{pmatrix} x & 0 \\ x & 0.4 \end{pmatrix}$



critical value

$x = 15.9872$

$fχ2(x, \nu)$

liner

//Check $F(x, \nu) = 0.9$