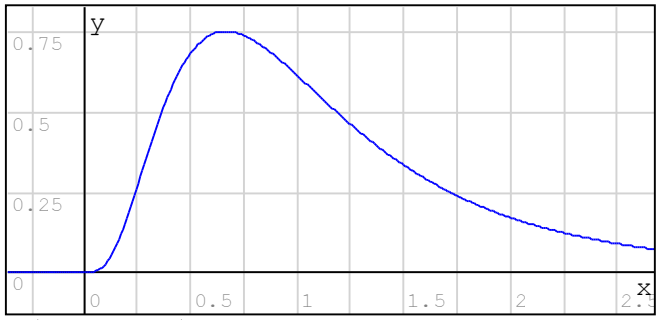
//Density function,F-distribution

$$f(x,\nu1,\nu2) := (x \geq 0)\cdot \frac{\Gamma\left(\frac{\nu1+\nu2}{2}\right)\cdot\left(\frac{\nu1}{\nu2}\right)^{\frac{\nu1}{2}}\cdot x^{\frac{\nu2}{2}-1}}{\Gamma\left(\frac{\nu1}{2}\right)\cdot\Gamma\left(\frac{\nu2}{2}\right)\cdot\left(1+x\cdot\frac{\nu1}{\nu2}\right)^{\frac{\nu1+\nu2}{2}}}$$

// ν1,ν2 - degrees of freedom

$\nu1 := 10 \quad \nu2 := 10$



$f(x,\nu1,\nu2)$

//Find the probability for a given x and ν1,ν2 values that p=P(X<x)
//cumulative probability - quantiles

$$F(f,\nu1,\nu2) := \int_0^f f(x,\nu1,\nu2)\,dx$$

//Example

$x := 50 \quad \nu1 := 10 \quad \nu2 := 10 \quad p := F(x,\nu1,\nu2) \quad p = 1$

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

//Here are standard values of probabilities used in statistics

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

$\nu1 := 10 \quad \nu2 := 10$

$f(x) := p90 - F(x,\nu1,\nu2)$ //put p95, p99 instead of p90

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

$x1 := 1 \quad x2 := 1.01\cdot x1$

$i := 1$

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

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

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

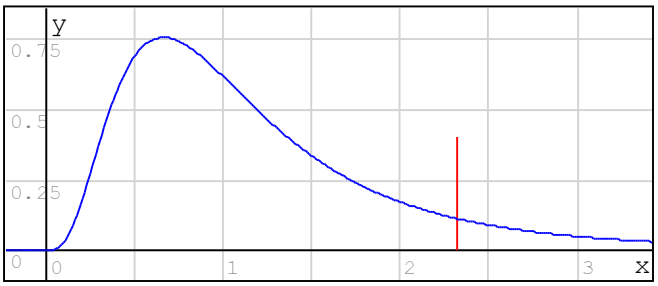
$x1 := x2$

$x2 := x$

$i := i + 1$

$i = 8 \quad konv = 2.3233 \cdot 10^{-5} \quad x = 2.3226$

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



critical value

$x = 2.3226$

$\begin{cases} f(x, \nu1, \nu2) \\ liner \end{cases}$

//Check $F(x, \nu1, \nu2) = 0.9$