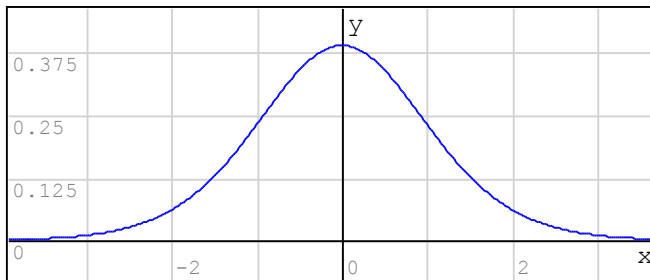


```
//Density function, student t-distribution
```

$$f(t, \nu) := \frac{1}{\sqrt{\nu \cdot \pi}} \cdot \frac{\text{Gamma}\left(\frac{\nu+1}{2}\right)}{\text{Gamma}\left(\frac{\nu}{2}\right)} \cdot \left(1 + \frac{t^2}{\nu}\right)^{-\frac{\nu+1}{2}}$$

```
// ν - degrees of freedom
```

```
ν := 10
```



$f(x, \nu)$

```
//Find the probability for a given t and ν values that p=P(T<t)
```

```
//cumulative probability - quantiles
```

```
left := -10 (put some lower value until the result is not changed)
```

$$F(t, \nu) := \int_{\text{left}}^t f(x, \nu) dx$$

```
//Example
```

```
t := 1    ν := 10    p := F(t, ν)    p = 0.8296
```

```
//Find the probability for a given t and ν values that p=P(-t<T<t)
```

```
// t - positive value
```

$$P(t, \nu) := \int_{-t}^t f(x, \nu) dx$$

```
t := 1    ν := 10    p := P(t, ν)    p = 0.6591
```

```
//How to find the inverse problem. Find the t-value
```

```
//for the given degrees of freedom and probability
```

```
// p=P(T<t) or p=P(-t<T<t)
```

```
//Here are standard values of probabilities used in statistics
```

```
p90 := 0.9    p95 := 0.95    p99 := 0.99
```

```
//p=P(T<t)
```

```
ν := 10
```

```
f(t) := p95 - F(t, ν) //put p95, p99 instead of p90
```

```
maxiter := 20    δ := 0.5 · 10-6    konv := maxiter · δ
```

```
x1 := 2    x2 := 1.01 · x1
```

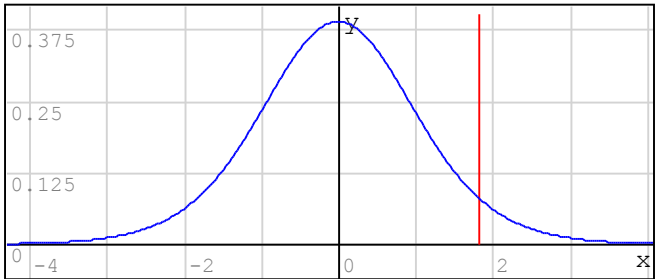
```

i:= 1
while (|konv|>δ)^(i≤maxiter)
  x:= (f(x2)·x1 - f(x1)·x2) / (f(x2) - f(x1))
  konv:= (x - x2) / (x + δ)
  x1:= x2
  x2:= x
  i:= i + 1

```

i = 6 konv = $3.1487 \cdot 10^{-7}$ x = 1.8125

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



critical
value

$$\begin{cases} f(x, v) \\ \text{liner} \end{cases}$$

```
//Check    F(x, v) = 0.95
```

```
//p = P(-t < T < t)
```

```
v := 10
```

```
f(t) := p95 - P(t, v)    //put p95, p99 instead of p90
```

```
maxiter := 20    δ := 0.5 · 10-6    konv := maxiter · δ
```

```
x1 := 2    x2 := 1.01 · x1
```

```
i := 1
```

```
while (|konv|>δ)^(i≤maxiter)
```

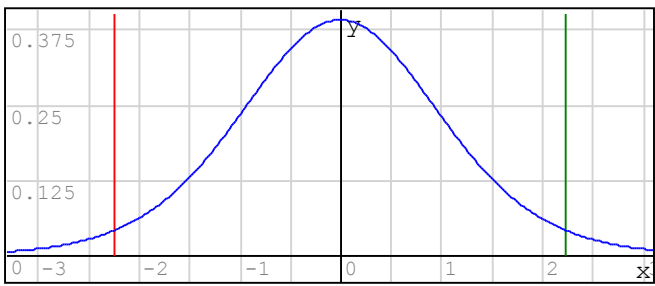
```

  x := (f(x2)·x1 - f(x1)·x2) / (f(x2) - f(x1))
  konv := (x - x2) / (x + δ)
  x1 := x2
  x2 := x
  i := i + 1

```

i = 6 konv = $2.8565 \cdot 10^{-7}$ x = 2.2281

$$\text{lineL} := \begin{pmatrix} -x & 0 \\ -x & 0.4 \end{pmatrix} \quad \text{lineR} := \begin{pmatrix} x & 0 \\ x & 0.4 \end{pmatrix}$$



critical values

left

right

```
{ f(x, v)
  { lineL
  { lineR
```

```
//Check P(x, v) = 0.95
```

```
//END
```