Gamma(x) Lanczos overlord

X(Φ,α,β,ε) ..... RootSecant algo

$$\begin{bmatrix} \text{appVersion}(4) = \text{"0.99.7822.147"} \\ Applications = \text{" 8 s "} \end{bmatrix}$$

$z := 2.5 \cdot i$

$\Gamma(z) = 0.0161290540478 - 0.0267491089459 \cdot i$

$a := 0.5$

$\Phi(x) := \text{eval}(\gamma(a; x) - \Gamma(a; x))$

$\begin{bmatrix} \alpha := 0.2 & \beta := 0.5 & \varepsilon := 10^{-15} \end{bmatrix}$

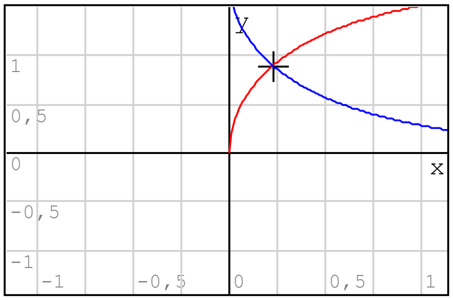
$sol := X(\Phi; \alpha; \beta; \varepsilon)$

Explode the nested 'sol'

$R := \text{row}(sol; \text{rows}(sol))_1$

$$sol = \begin{bmatrix} 1 \cdot 10^{-15} \\ 0.238739753660938 \\ 0.233859672474681 \end{bmatrix}$$

$\begin{bmatrix} R & \Gamma(a; R) \end{bmatrix} = \begin{bmatrix} 0.234 & 0.876 \end{bmatrix}$



Example_1: Multistage XFR

$t0 := \mathrm{time}(1)$

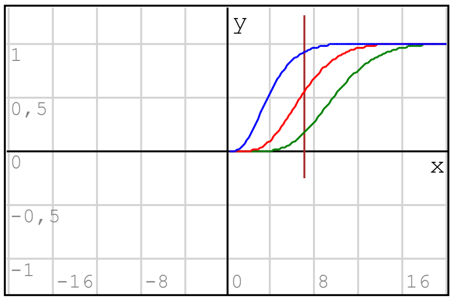
$T := 1$ System TimeConstant $s := 1$ Laplace UnitStep

$$\lambda(x) := \begin{cases} 1 & \text{if } (0 \le x) \land (x \le 20) \\ "" & \text{otherwise} \end{cases}$$

$time := 7$

$$f(n; t) := \frac{\Gamma(n+1) - \Gamma\left(n+1; \frac{t}{T}\right)}{s \cdot \Gamma(n+1)}$$

Laplace XFR multistage system
'n' stages, 'T' time constant



$$\begin{bmatrix} f(3; time) \\ f(6; time) \\ f(9; time) \end{bmatrix} = \begin{bmatrix} 0.92 \\ 0.55 \\ 0.17 \end{bmatrix} \qquad \begin{bmatrix} 0.92 \\ 0.55 \\ 0.17 \end{bmatrix}$$

Example_2: Fitting Mathsoft data set.

$XY :=$

0	127.42
0.1	123.469
0.2	118.008
0.3	111.187
0.4	102.811
0.5	93.554
0.6	84.168
0.7	74.818
0.8	66.373
0.9	58.587
1	51.678
1.1	45.739
1.2	40.675
1.3	36.404
1.4	32.74
1.5	29.581
1.6	26.848
1.7	24.472
1.8	22.395
1.9	20.573
2	18.97
2.1	17.555
2.2	16.3
2.3	15.184
2.4	14.188
2.5	13.295
2.6	12.492
2.7	11.768
2.8	11.12
2.9	10.547
3	10.028

```
plot(data; char; size; clr) := | for k ∈ [1..rows(data)]
                                |    [ r3_k := char  r4_k := size  r5_k := clr ]
                                | augment(data; r3; r4; r5)
```

$pts := plot(XY; \text{"o"}; 5; \text{"black"})$

$[\, yo := 10.028 \;\; a := 143 \;\; b := 1.77 \;\; \eta := 2.5 \,]$ $\qquad \varepsilon := 10^{-15}$

$f(x) := yo + a \cdot \Gamma(b; x)^{\eta}$

```
Ω := | u := [ε; 0.05..3]
     | for i ∈ [1..rows(u)]
     |    vy_i := eval(f(u_i))
     | augment(u; vy)
```

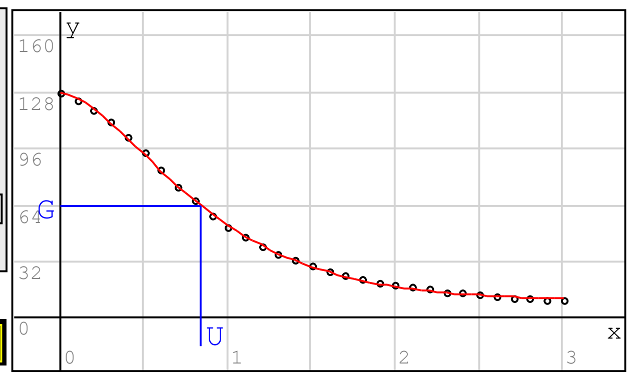
```
| X := [ε; 0.05..3]
| for i ∈ [1..rows(X)]
|    Y_i := eval(f(X_i))
| S(x) := cinterp(X; Y; x)
```

$G := 64$ ... 'G' ▼ ordinate solve abscissa

$U := \text{solve}(S(x) - G = 0; x; \varepsilon; 3) = 0.836$

$$plot := \begin{cases} \begin{bmatrix} 0 & G \\ U & G \\ U & -16 \end{bmatrix} \\ \Omega \\ pts \\ [\, -0.175 \;\; G+7 \;\; \text{"G"} \;\; 12 \;\; \text{"blue"} \,] \\ [\, U \;\; 0 \;\; \text{"U"} \;\; 12 \;\; \text{"blue"} \,] \end{cases}$$

$[\, G \;\; U \,] = [\, 64 \;\; 0.836 \,]$



plot

Example_3: Hypergeometric statistical function.

Hypergeom ...

$\Gamma(x) := \mathrm{Gamma}(x)$ no need for this

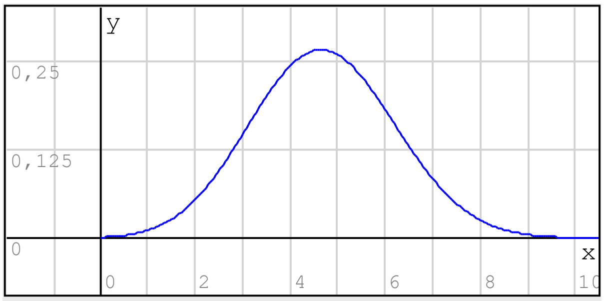
$\Gamma(x) := \mathrm{Lanczos}(x)$ this neither

$$hypergeom(N; n; p; x) := \frac{\Gamma(N+1) \cdot \Gamma(n+1) \cdot \Gamma(N+n-p+1) \cdot \Gamma(p+1)}{\Gamma(x+1) \cdot \Gamma(-x+n+1) \cdot \Gamma(N+n+1) \cdot \Gamma(x+N-p+1) \cdot \Gamma(-x+p+1)}$$

$N := 39 \qquad n := 12 \qquad p := 20$

$hypergeom(x) := hypergeom(N; n; p; x)$

Continuous PDF Hypergeometric




```
if 0≤x
  hypergeom(x)
else
  "outside lower bound"
```

In probability theory and statistics, the hypergeometric distribution is a discrete probability distribution that describes the probability of 'k' successes in 'n' draws, without replacement, from a finite population of size 'N' that contains exactly 'K' successes, wherein each draw is either a success or a failure. In contrast, the binomial distribution describes the probability of 'k' successes in 'n' draws with replacement.

$\mathrm{time}(1) - t0 = 8\ \mathrm{s}$

RemToDo ▲ code recursive