$k := 5 \qquad n := 2 \qquad m := 1$

$$\sum_{n=1}^{k}\left[\frac{k!\cdot(-1)^{n}\cdot 1}{n!\cdot(k-n)!}\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\right]-\frac{(-1)^{k}}{k}\rightarrow 0$$

$$\sum_{n=1}^{k}\left[\frac{k!\cdot(-1)^{n}\cdot 1}{n!\cdot(k-n)!}\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\right]=\frac{(-1)^{k}}{k}$$

$$\sum_{n=m}^{k}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\right]-(-1)^{m}\cdot\frac{m}{k}\cdot\frac{k!}{m!\cdot(k-m)!}\rightarrow 0$$

$$\sum_{n=m}^{k}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\right]=(-1)^{m}\cdot\frac{m}{k}\cdot\frac{k!}{m!\cdot(k-m)!}$$

$$(-1)^{m}\cdot\frac{m}{k}\cdot\frac{k!}{m!\cdot(k-m)!}\rightarrow -1$$

$$-1\cdot(1-x)^{k-1}\ \text{series},x\ \rightarrow -1+4\cdot x-6\cdot x^{2}+4\cdot x^{3}-x^{4}$$

$$k!\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\rightarrow 54$$

$$\sum_{in=k-n+1}^{k}\frac{1}{in}=0.45$$

$$\left[\frac{(-1)^{k}\cdot(1-xs)^{k}\cdot(-\ln(x)+\ln(\omega)+\ln(1-xs))-\sum_{n=1}^{k}\left[\frac{k!\cdot(-1)^{n}\cdot(xs)^{k-n}}{n!\cdot(k-n)!}\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\right]}{xs^{k-m}}\right]+\frac{1}{xs^{k-m}}\cdot\ln(x)\cdot\sum_{n=m}^{k}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\cdot(xs)^{k-n}\right]\ \begin{vmatrix}\text{series},xs,18\\ \text{simplify}\\ \text{series},xs,18\end{vmatrix}\rightarrow -5\cdot\ln(\omega)-\frac{65}{12}+\frac{10\cdot\ln(\omega)+\frac{10}{3}}{xs}+xs\cdot\left(\ln(\omega)-\ln(x)+\frac{137}{60}\right)-\frac{10\cdot\ln(\omega)-\frac{10}{3}}{xs^{2}}-\frac{xs^{2}}{6}-\frac{xs^{3}}{42}+\frac{5\cdot\ln(\omega)-\frac{65}{12}}{xs^{3}}-\frac{\ln(\omega)-\frac{137}{60}}{xs^{4}}-\frac{xs^{4}}{168}-\frac{xs^{5}}{504}-\frac{xs^{6}}{1260}-\frac{xs^{7}}{2772}-\frac{xs^{8}}{5544}-\frac{xs^{9}}{10296}-\frac{xs^{10}}{18018}-\frac{xs^{11}}{30030}-\cdots$$

$$\left[\frac{(1-xs)^{k}\cdot\ln(1-xs)-\sum_{n=1}^{k}\left[\frac{k!\cdot(-1)^{n}\cdot xs^{n}}{n!\cdot(k-n)!}\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\right]}{xs^{m}}\right]+\ln(x)\cdot\sum_{n=m}^{k}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\cdot xs^{n-m}\right]\ \text{series},xs,18\ \rightarrow -5\cdot\ln(x)+10\cdot xs\cdot\ln(x)-10\cdot xs^{2}\cdot\ln(x)+5\cdot xs^{3}\cdot\ln(x)-xs^{4}\cdot\ln(x)+\frac{xs^{5}}{6}+\frac{xs^{6}}{42}+\frac{xs^{7}}{168}+\frac{xs^{8}}{504}+\frac{xs^{9}}{1260}+\frac{xs^{10}}{2772}+\frac{xs^{11}}{5544}+\frac{xs^{12}}{10296}+\frac{xs^{13}}{18018}+\frac{xs^{14}}{30030}+\frac{xs^{15}}{48048}+\frac{xs^{16}}{74256}+\frac{xs^{17}}{111384}$$

$$\left[\frac{\left(1-\frac{1}{u}\right)^{k}\cdot\ln\left(\frac{1}{u}-1\right)-\sum_{n=1}^{k}\left[\frac{k!\cdot(-1)^{n}\cdot\left(\frac{1}{u}\right)^{n}}{n!\cdot(k-n)!}\cdot\sum_{in=k-n+1}^{k}\frac{1}{in}\right]}{\left(\frac{1}{u}\right)^{m}}\right]+\ln(x)\cdot\sum_{n=m}^{k}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\cdot\left(\frac{1}{u}\right)^{n-m}\right]\ \begin{vmatrix}\text{series},u,18\\ \text{simplify}\\ \text{series},u,18\end{vmatrix}\rightarrow -\frac{65}{12}-5\cdot\ln(x)+u\cdot\left(\ln\left(\frac{1}{u}\right)+\frac{137}{60}\right)+\frac{10\cdot\ln\left(\frac{1}{u}\right)+10\cdot\ln(x)+\frac{10}{3}}{u}-5\cdot\ln\left(\frac{1}{u}\right)-\frac{u^{2}}{6}-\frac{10\cdot\ln\left(\frac{1}{u}\right)+10\cdot\ln(x)-\frac{10}{3}}{u^{2}}+\frac{5\cdot\ln\left(\frac{1}{u}\right)+5\cdot\ln(x)-\frac{65}{12}}{u^{3}}-\frac{u^{3}}{42}-\frac{\ln\left(\frac{1}{u}\right)+\ln(x)-\frac{137}{60}}{u^{4}}-\frac{u^{4}}{168}-\frac{u^{5}}{504}-\frac{u^{6}}{1260}-\frac{u^{7}}{2772}-\frac{u^{8}}{5544}-\frac{u^{9}}{10296}-\cdots$$

$$-\ln(u)\cdot\sum_{n=0}^{m}\left[\frac{k!\cdot(-1)^{n}}{n!\cdot(k-n)!}\cdot u^{n-(k-m)}\right]\ \text{series},u\ \rightarrow\frac{5\cdot\ln(u)}{u^{3}}-\frac{\ln(u)}{u^{4}}$$

Mathcad - [asymptotic musings 01.xmcdz]

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$$\text{return } (-1)^k \cdot x^{k-m} \cdot \frac{(1-xs)^k}{xs^{k-m}} \cdot (-\ln(xs) + \ln(1-xs)) \quad \text{if } xs > \frac{0}{4}$$

$$fT1(x) \leftarrow \begin{array}{l} \text{return } 0 \text{ if } x = 0 \\ \text{return } (-1)^m \cdot \frac{m}{k} \cdot \frac{k!}{m! \cdot (k-m)!} \cdot x^{k-m} \cdot \ln(x) \quad \text{if } \omega = x \\ \text{return } x^{k-m} \cdot \ln(x) \cdot \sum_{n=m}^{k} \left[\frac{k! \cdot (-1)^n}{n! \cdot (k-n)!} \cdot \left(\frac{\omega}{x}\right)^{n-m} \right] \end{array}$$

$$\text{return } \frac{(-1)^k}{k!} \cdot (fT0(x) + fT1(x))$$

$$\prod_{j=n}$$

$$sgn \leftarrow (1)^{\text{if}(xs<1,k-1,0)}$$

$$\text{return } \frac{sgn}{k \cdot k!} \quad \text{if } xs = 1$$

$$\text{return } \frac{sgn}{xs^{k-m}} \cdot \left[\frac{(1-xs)^k}{k!} \cdot \ln(|1-xs|) + \text{if}\left[k = 0, 0, \sum_{n=0}^{k-1} \left[\frac{(-1)^n}{n! \cdot (k-n)!} \cdot xs^n \cdot \sum_{n1=1}^{k-n} \left(\frac{xs^{n1}}{n1} \right) \right] \right] \right] \quad \text{if } |xs| > \frac{1}{4}$$

$$\text{return } sgn \cdot xs^m \cdot \sum_{n=1}^{200} \frac{xs^n}{\prod_{j=n}^{k+n} j}$$

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Calculus

Programming
Add Line ←
if otherwise
for while
break continue
return on error

$fRecurseY(j,\omega,k,m,t) := fIntegratePowY(j,\omega,k,m,t)$

$\omega := 10^{-4}$

$\omega := 15$

$\omega := t_{j+k+1}$

$\omega := 0$

$$\begin{pmatrix} j \\ k \\ m \end{pmatrix} := \begin{pmatrix} 2 \\ 5 \\ 2 \end{pmatrix} \qquad \begin{pmatrix} 0 \\ 5 \\ 2 \end{pmatrix}$$

$t_0 := 10^{-8}$

$t^T = (0\ \ 0.5\ \ 0.6\ \ 0.7\ \ 0.8\ \ 1\ \ 3\ \ 5\ \ 7\ \ 12\ \ 17\ \ 25\ \ 50\ \ 100\ \ 200)$

$$\begin{pmatrix} t_j \\ t_{j+k+1} \\ \omega \end{pmatrix} = \begin{pmatrix} 0.6 \\ 7 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} x_{min} \\ x_{max} \end{pmatrix} := \begin{pmatrix} 0 \\ 25 \end{pmatrix}$$

$npts := 10$

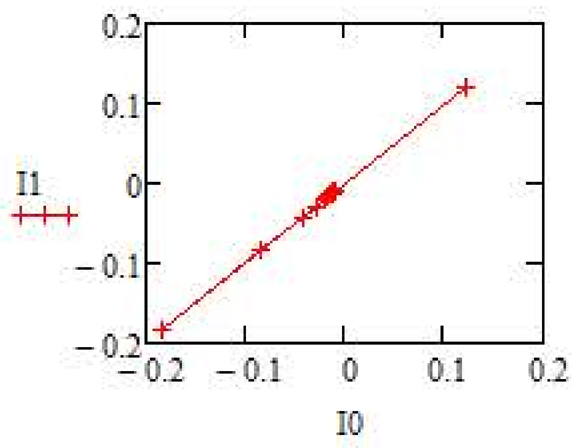
$i := 0 .. npts$

$$x_i := x_{min} + \frac{i}{npts} \cdot (x_{max} - x_{min})$$

$I0_i := fH_{Numeric}(j, x_i, k, m, t)$

$I1_i := fRecurseY(j, x_i, k, m, t)$

$$\begin{pmatrix} fH_{Numeric}(j,\omega,k,m,t) \\ fRecurseY(j,\omega,k,m,t) \\ fH_{Numeric}(j,\omega,k,m,t) - fRecurseY(j,\omega,k,m,t) \end{pmatrix} = \begin{pmatrix} 0.12158434616845150 \\ 0.12158434616843806 \\ 1.34336985979643940 \times 10^{-14} \end{pmatrix}$$



$$\begin{pmatrix} slope(I0,I1) \\ intercept(I0,I1) \end{pmatrix} = \begin{pmatrix} 0.99999999965478110 \\ -1.06055018933570720 \times 10^{-10} \end{pmatrix}$$

$\frac{fRecurseY(j,\omega,k,m,t)}{\ldots} = 0.999999999999890$

$fAsymptote0_{LT}(\omega,\omega,k,m)$ (0.00000000000000000)

Press F1 for help. Calc F9 NUM Page 24