hüpoteesist/"geometry.cfg"
hüpoteesist/"textcomp.cfg"
hüpoteesist/"bblopts.cfg"
hüpoteesist/"english.cfg" hüpoteesist/"riemanni_h__poteesist.aux"

Riemanni hüpoteesist

Olger Männik

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Part I
hüpotees

$\exists_{x_1}($
$\zeta(x_1) = 0 \wedge$
$x_1 \in C \wedge$
$\neg(Re(x_1) = 1/2) \wedge$
$\neg(\exists_{x_2}(x_2 \in N \wedge Re(x_1) = -x_2 * 2 \wedge Im(x_1) = 0)$
$)$

Part II
muud seoud väited

1 zetafunktsioonist

1.1 kui reaalosa suurem kui 1

$\forall_{x_1}(x_1 \in C \wedge Re(x_1) < 1 \rightarrow \zeta(-x_1) = \sum_{n=1}^{\infty}(n^{x_1}) = \sum_{n=1}^{\infty}(n^{x_1}) = \sum_{n=1}^{\infty}(n^{Re(x_1)+i*Im(x_1)}) = \sum_{n=1}^{\infty}(n^{Re(x_1)} * n^{i*Im(x_1)}) = \sum_{n=1}^{\infty}(n^{Re(x_1)} * (cos(Im(x_1) * ln(n)) + i * sin(Im(x_1) * ln(n)))))$

1.2 Dirichlet series

avaldis1: Dirichlet_series_Wikipediast

$\forall_{x_1}(x_1 \in C \wedge Re(x_1) > 0 \rightarrow \zeta(x_1) = (x_1 - 1)^{-1} * \sum_{n=1}^{\infty}(\frac{n}{(n+1)^{x_1}} - \frac{n-x_1}{n^{x_1}})$

lihtsustan seda avaldist:

$\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1 + i * x_2) =$

$(\mathrm{x}_1 - 1 + i * x_2)^{-1} * \sum_{n=1}^{\infty}(\frac{n}{(n+1)^{x_1+i*x_2}} - \frac{n-x_1-i*x_2}{n^{x_1+i*x_2}}) =$
$(x_1 - 1 + i * x_2)^{-1} * \sum_{n=1}^{\infty}(\frac{n}{(n+1)^{x_1}*(cos(x_2*ln(n+1))+i*sin(x_2*ln(n+1)))} - \frac{n-x_1-i*x_2}{n^{x_1}*(cos(x_2*ln(n))+i*sin(x_2*ln(n)))}) =$

$\mathrm{x}_1 - 1 - i * x_2 \frac{}{(x_1-1)^2+x_2^2*\sum_{n=1}^{\infty}(n*(n+1)^{-x_1}*(cos(x_2*ln(n+1))-i*sin(x_2*ln(n+1)))-(n-x_1-i*x_2)*n^{-x_1}*(cos(x_2*ln(n))-i*sin(x_2*ln(n))))=}$
$\sum_{n=1}^{\infty}(((x_1 - 1) - i * x_2) * (cos(x_2 * ln(n+1)) - i * sin(x_2 * ln(n+1))) * ((x_1 - 1)^2 + x_2^2)^{-1} * n * (n+1)^{-x_1} -$
$((x_1 - 1) - i * x_2) * (cos(x_2 * ln(n)) - i * sin(x_2 * ln(n))) * ((x_1 - 1)^2 + x_2^2)^{-1} * (n - x_1 - i * x_2) * n^{-x_1}) =$

$\sum_{n=1}^{\infty}((((x_1 - 1) * cos(x_2 * ln(n+1)) - x_2 * sin(x_2 * ln(n+1))) - i * ((x_1 - 1) * sin(x_2 * ln(n+1)) + x_2 * cos(x_2 * ln(n+1)))) * ((x_1 - 1)^2 + x_2^2)^{-1} * n * (n+1)^{-x_1} -$
$((n - x_1) * ((x_1 - 1) * cos(x_2 * ln(n)) - x_2 * sin(x_2 * ln(n))) - x_2 * ((x_1 - 1) * sin(x_2 * ln(n)) + x_2 * cos(x_2 * ln(n))) - i *$

$((n-x_1)*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n)))+x_2*(((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n))))))*((x_1-1)^2+x_2^2)^{-1}*n^{-x_1})=$

$\sum_{n=1}^{\infty}((((x_1-1)*cos(x_2*ln(n+1))-x_2*sin(x_2*ln(n+1)))*((x_1-1)^2+x_2^2)^{-1}*n*(n+1)^{-x_1}-((n-x_1)*((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n)))-x_2*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n))))*((x_1-1)^2+x_2^2)^{-1}*n^{-x_1}$
$-i*((((x_1-1)*sin(x_2*ln(n+1))+x_2*cos(x_2*ln(n+1)))*((x_1-1)^2+x_2^2)^{-1}*n*(n+1)^{-x_1}+((n-x_1)*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n)))+x_2*(((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n)))))*((x_1-1)^2+x_2^2)^{-1}*n^{-x_1}))=$
$((x_1-1)^2+x_2^2)^{-1}*\sum_{n=1}^{\infty}((((x_1-1)*cos(x_2*ln(n+1))-x_2*sin(x_2*ln(n+1)))*n*(n+1)^{-x_1}-((n-x_1)*((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n)))-x_2*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n))))*n^{-x_1})-i*((x_1-1)^2+x_2^2)^{-1}*\sum_{n=1}^{\infty}((((x_1-1)*sin(x_2*ln(n+1))+x_2*cos(x_2*ln(n+1)))*n*(n+1)^{-x_1}-((n-x_1)*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n)))+x_2*((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n))))*n^{-x_1}))=$

))

järgneva väite nimi on zeta2_reaalosa_ja_imaginaarosa_eraldatud:

$\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\rightarrow$
$\zeta(x_1+i*x_2)=$
$((x_1-1)^2+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$((x_1-1)*cos(x_2*ln(n+1))-x_2*sin(x_2*ln(n+1)))*n*(n+1)^{-x_1}-$
$((n-x_1)*((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n)))-x_2*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n))))*n^{-x_1}$
$)$
$-i*((x_1-1)^2+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$((x_1-1)*sin(x_2*ln(n+1))+x_2*cos(x_2*ln(n+1)))*n*(n+1)^{-x_1}-$
$((n-x_1)*((x_1-1)*sin(x_2*ln(n))+x_2*cos(x_2*ln(n)))+x_2*((x_1-1)*cos(x_2*ln(n))-x_2*sin(x_2*ln(n))))*n^{-x_1}$
$)=$
$))$

lihtsustan seda väidet edasi

$\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\rightarrow$
$\zeta(x_1+i*x_2)=$

$(\mathrm{x}_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$sin(x_2*ln(n)+0*(2\pi)/4)*x_2*(n-1)*n^{-x_1}-sin(x_2*ln(n+1)+0*(2\pi)/4)*x_2*n*(n+1)^{-x_1}$
$+sin(x_2*ln(n)+1*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}$
$-sin(x_2*ln(n+1)+1*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)$
$+i*(x_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$sin(x_2*ln(n)+1*(2\pi)/4)*x_2*(n-1)*n^{-x_1}-sin(x_2*ln(n+1)+1*(2\pi)/4)*x_2*n*(n+1)^{-x_1}$
$+sin(x_2*ln(n)+2*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}$
$-sin(x_2*ln(n+1)+2*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)$
$=$

$\lim_{M\rightarrow\infty}(\sum_{n=1}^{M}($
$+sin(x_2*ln(n)+1*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}$
$-sin(x_2*ln(n+1)+1*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)-sin(x_2*ln(M+1)+0*(2\pi)/4)*x_2*M*(M+1)^{-x_1})*$
$(x_1^2-2*x_1+1+x_2^2)^{-1}$
$+i*\lim_{M\rightarrow\infty}(\sum_{n=1}^{M}($
$sin(x_2*ln(n)+2*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}$
$-sin(x_2*ln(n+1)+2*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)-sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2*M*(M+1)^{-x_1})*$
$(x_1^2-2*x_1+1+x_2^2)^{-1}=$

$\lim_{M\rightarrow\infty}(\sum_{n=1}^{M}($
$+sin(x_2*ln(n)+1*(2\pi)/4)*(x_1^2-2*x_1+x_2^2+1)*n^{-x_1}$

$+sin(x_2*ln(n)+1*(2\pi)/4)*(1-x_1)*(n-1)*n^{-x_1}-sin(x_2*ln(n+1)+1*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)-sin(x_2*ln(M+1)+0*(2\pi)/4)*x_2*M*(M+1)^{-x_1})*$
$(x_1^2-2*x_1+1+x_2^2)^{-1}$
$+i*\lim_{M\to\infty}(\sum_{n=1}^{M}($
$+sin(x_2*ln(n)+2*(2\pi)/4)*(x_1^2-2*x_1+x_2^2+1)*n^{-x_1}$
$+sin(x_2*ln(n)+2*(2\pi)/4)*(1-x_1)*(n-1)*n^{-x_1}-sin(x_2*ln(n+1)+2*(2\pi)/4)*(1-x_1)*n*(n+1)^{-x_1}$
$)-sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2*M*(M+1)^{-x_1})*$
$(x_1^2-2*x_1+1+x_2^2)^{-1}=$

$\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+0*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*((1-x_1)^2+x_2^2)^{-1})$

$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*((1-x_1)^2+x_2^2)^{-1})$
$=$

$\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+0*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*(1+1/M)*((1-x_1)^2+x_2^2)^{-1})$

$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*(1+1/M)*((1-x_1)^2+x_2^2)^{-1})$
$=$

$\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+0*(2\pi)/4)*x_2)*M^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)=$

))
Valem zeta9_M_plus_1e_ei_ole:
$\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\to$
$\zeta(x_1+i*x_2)=$

$\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M)+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M)+0*(2\pi)/4)*x_2)*M^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{M}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(M)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M)+1*(2\pi)/4)*x_2)*M^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)$
))

kuivõrd M läheneb lõpmatusele võin igal pool avaldises i asemele panna $floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})$ või floor($e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi/x_2}$).

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$

$\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi}))+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln(floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi}))+$
$0*(2\pi)/4)*x_2)*floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln(floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi}))+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi}))+$
$1*(2\pi)/4)*x_2)*floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$) =$

$\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln((e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi}))+1*(2\pi)/4)*(1-x_1)+sin(x_2*ln((e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi}))+0*(2\pi)/4)*$
$x_2)*(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin(x_2*ln((e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi}))+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln((e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi}))+1*(2\pi)/4)*$
$x_2)*(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})^{1-x_1}*((1-x_1)^2+x_2^2)^{-1}$
$) =$

$\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-(sin((floor(M)*(x_2/abs(x_2))+q_1)*2\pi+1*(2\pi)/4)*(1-x_1)+sin((floor(M)(x_2/abs(x_2))+q_1)*2\pi+0*$
$(2\pi)/4)*x_2)*(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)})*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-(sin((floor(M)*(x_2/abs(x_2))+q_2)*2\pi+2*(2\pi)/4)*(1-x_1)+sin((floor(M)*(x_2/abs(x_2))+q_2)*2\pi+1*$
$(2\pi)/4)*x_2)*(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)})*((1-x_1)^2+x_2^2)^{-1}$
$) =$

$\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1})$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\rightarrow\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$) =$
$))))$

Nagu kvantrite abilgi öeldud on kehtib võrrand mistahes q_1 ja q_2 väärtuste puhul, aga kuna pole kindel, et millised väärtused q_1 ja q_2 asemele pannes saab kõige paremal kujul avaldise, siis loon su subsectionites võrrandist erinevaid variante, kus q_1 ja q_2'el on erinevad väärtused.

asendan siinuse selle Taylori reaga:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}($
$n_0{}^{-x_1} * \sum_{n_1=0}^{\infty}((-1)^{n_1}*(x_2*ln(n_0))^{2*n_1}*factorial(2*n_1)^{-1})$
$)$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}($
$n_0{}^{-x_1} * \sum_{n_1=0}^{\infty}((-1)^{n_1}*(x_2*ln(n_0))^{2*n_1+1}*factorial(2*n_1+1)^{-1})$
$)$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

asendal naturallogaritmi selle maclaurini reaga:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(n_0{}^{-x_1}*\sum_{n_1=0}^{\infty}((\sum_{n_2=0}^{\infty}((2*n_2+1)^{-1}*(n_0-1)^{2*n_2+1}*(n_0+1)^{-2*n_2-1}))^{2*n_1}*x_2^{2*n_1}*factorial(2*$
$n_1)^{-1}*2^{2*n_1}*(-1)^{n_1})$
$)$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(n_0{}^{-x_1}*\sum_{n_1=0}^{\infty}((\sum_{n_2=0}^{\infty}((2*n_2+1)^{-1}*(n_0-1)^{2*n_2+1}*(n_0+1)^{-2*n_2-1}))^{2*n_1+1}*x_2^{2*n_1+1}*$
$factorial(2*n_1+1)^{-1}*2^{2*n_1+1}*(-1)^{n_1})$
$)$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

kasutan multinomial valemit:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(n_0{}^{-x_1}*\sum_{n_1=0}^{M-1}(x_2^{2*n_1}*2^{2*n_1}*(-1)^{n_1}*\sum_{n_2=0}^{(2*n_1+1)^M-1}($
$(\sum_{n_3=0}^{M-1}(\ floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)\ ) = 2*n_1)*$
$\Pi_{n_3=0}^{M-1}(factorial(\ floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)\ )^{-1}*((2*n_3+1)^{-1}*(n_0-1)^{2*n_3+1}*(n_0+1)^{-2*n_3-1})^{floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)}$
$)))$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(n_0{}^{-x_1}*\sum_{n_1=0}^{M-1}(x_2^{2*n_1+1}*2^{2*n_1+1}*(-1)^{n_1}*\sum_{n_2=0}^{(2*n_1+2)^M-1}($
$(\sum_{n_3=0}^{M-1}(\ floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)\ ) = 2*n_1+1)*$
$\Pi_{n_3=0}^{M-1}(factorial(\ floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)\ )^{-1}*((2*n_3+1)^{-1}*(n_0-1)^{2*n_3+1}*(n_0+1)^{-2*n_3-1})^{floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)}$
$)))$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

lihtsustan teades, et korutamise asemel võib astmd liita.

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(n_0{}^{-x_1} * \sum_{n_1=0}^{M-1}(x_2^{2*n_1} * 2^{2*n_1} * (-1)^{n_1} * \sum_{n_2=0}^{(2*n_1+1)^M-1}($
$(\sum_{n_3=0}^{M-1}(\ floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)\ ) = 2*n_1) *$
$(n_0-1)^{\sum_{n_3=0}^{M-1}((2*n_3+1)*(floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)))} *$
$(n_0+1)^{-\sum_{n_3=0}^{M-1}((2*n_3+1)*(floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)))} *$
$\Pi_{n_3=0}^{M-1}(factorial(\ floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)\ )^{-1} * (2*n_3+1)^{-floor(n_2/(2*n_1+1)^{n_3})\%(2*n_1+1)})$
$))$
$)))$
-(sin((q$_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
)
$+i*\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(n_0{}^{-x_1} * \sum_{n_1=0}^{M-1}(x_2^{2*n_1+1} * 2^{2*n_1+1} * (-1)^{n_1} * \sum_{n_2=0}^{(2*n_1+2)^M-1}($
$(\sum_{n_3=0}^{M-1}(\ floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)\ ) = 2*n_1+1) *$
$(n_0-1)^{\sum_{n_3=0}^{M-1}((2*n_3+1)*(floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)))} *$
$(n_0+1)^{-\sum_{n_3=0}^{M-1}((2*n_3+1)*(floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)))} *$
$\Pi_{n_3=0}^{M-1}(factorial(\ floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)\ )^{-1} * (2*n_3+1)^{-floor(n_2/(2*n_1+2)^{n_3})\%(2*n_1+2)})$
$))$
$)))$
-(sin((q$_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
)
))))

selle asemel et üle erinevate n2'ede ristsummade summeeridaarvutan lihtsalt n2'e ristsumma:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(n_0^{-x_1} * \sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2) *$
$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M-1)^{k_2})\%(2*M-1)) < 2*M-1) *$
$(y*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))} *$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))/2} *$
$(x-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))} *$
$(x+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))} *$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1} * (2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$))$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
)
$+i*\lim_{M\to\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(n_0^{-x_1} * \sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2) *$
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M)) < 2*M) *$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))} *$
$(-1)^{(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))+3)/2} *$
$(n_0-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))} *$

$(n_0+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$))$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

kuna Mi lähenedes lõpmatusele see avaldis nagu nii koondub ja selle muutuse tegemine ainult lisab liikmeid, mis on absoluutväärtuselt väiksemad kui oleksid liikmed, mis lisanduksid Mi suurendamisel:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\rightarrow$
$\zeta(x_1+i*x_2)=$
$\lim_{M\rightarrow\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})}(n_0^{-x_1}*\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}((floor(n_1/(2*M-1)^{n_2})\%(2*M-1))+1)\%2)*$
$(y*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M-1)^{n_2})\%(2*M-1))}*$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M-1)^{n_2})\%(2*M-1))/2}*$
$(n_0-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M-1)^{n_2})\%(2*M-1)))}*$
$(n_0+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M-1)^{n_2})\%(2*M-1)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M-1)^{n_2})\%(2*M-1))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M-1)^{n_2})\%(2*M-1)})$
$))/2$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\rightarrow\infty}($
$\sum_{n_0=1}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})}(n_0^{-x_1}*\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))+3)/2}*$
$(n_0-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(n_0+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$))$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

viin $n_0^{-x_1}$ summa sisse ja panen n_0 summa 0 ist algama.

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\rightarrow$
$\zeta(x_1+i*x_2)=$
$\lim_{M\rightarrow\infty}($
$\sum_{n_0=0}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})-1}(\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(1+floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))/2}*$
$n_0^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(n_0+1)^{-x_1}*$
$(n_0+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$))$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$

$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}(\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))+3)/2}*$
$n_0^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(n_0+1)^{-x_1}*$
$(n_0+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$))$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

lihtsustan viies n0-summa n1-summa sisse. ja muudan summade indekseid.

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\to$
$\zeta(x_1+i*x_2)=$
$\lim_{M\to\infty}(\sum_{n_0=0}^{(2*M)^M-1}($
$(\sum_{n_1=0}^{M-1}(1+floor(n_0/(2*M)^{n_1})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))}*$
$(-1)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))/2}*$
$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})-1}($
$n_1^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$(n_1+1)^{-x_1}*$
$(n_1+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$)$
$\Pi_{n_1=0}^{M-1}(factorial(floor(n_0/(2*M)^{n_1})\%(2*M))^{-1}*(2*n_1+1)^{-floor(n_0/(2*M)^{n_1})\%(2*M)})$
$)$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=0}^{(2*M)^M-1}($
$(\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))}*$
$(-1)^{(\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))+3)/2}*$
$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}($
$n_1^{\sum_{n_2=2}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$(n_1+1)^{-x_1}*$
$(n_1+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$)$
$\Pi_{n_1=0}^{M-1}(factorial(floor(n_0/(2*M)^{n_1})\%(2*M))^{-1}*(2*n_1+1)^{-floor(n_0/(2*M)^{n_1})\%(2*M)})$
$)$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

lihtsustan n1-summa(vana n0-summa) sees olevat osa:

$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$
$\lim_{M\to\infty}(\sum_{n_0=0}^{(2*M)^M-1}($
$(\sum_{n_1=0}^{M-1}(1+floor(n_0/(2*M)^{n_1})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))}*$
$(-1)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))/2}*$
$\sum_{n_1=2}^{floor(e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi})+1}($
$(1-2/n_1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$(n_1-1)^{-x_1}*$
$)$
$\Pi_{n_1=0}^{M-1}(factorial(floor(n_0/(2*M)^{n_1})\%(2*M))^{-1}*(2*n_1+1)^{-floor(n_0/(2*M)^{n_1})\%(2*M)})$
$)$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_1/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n_0=0}^{(2*M)^M-1}($
$(\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))}*$
$(-1)^{(\sum_{n_1=0}^{M-1}(floor(n_0/(2*M)^{n_1})\%(2*M))+3)/2}*$
$\sum_{n_1=2}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})+1}($
$(1-2/n_1)^{\sum_{n_2=2}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))}*$
$(n_1-1)^{-x_1}*$
$)$
$\Pi_{n_1=0}^{M-1}(factorial(floor(n_0/(2*M)^{n_1})\%(2*M))^{-1}*(2*n_1+1)^{-floor(n_0/(2*M)^{n_1})\%(2*M)})$
$)$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

1.2.1 tagumine pool nulliks

$sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2 = 0 \wedge$
$sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2 = 0$

$\sin((q_1+1/4)*2\pi)*(1-x_1)+sin(q_1*2\pi)*x_2 = 0 \wedge$
$sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2 = 0$

$\exists_k(k \in N \wedge q_1 = k/2 - arctan((1-x_1)/x_2)/(2\pi))$
$\exists_k(k \in N \wedge q_2 = k/2 + arctan(x_2/(1-x_1))/(2\pi))$

$\exists_k(k \in N \wedge q_2 = k/2 - arctan((1-x_1)/x_2)/(2\pi)+1/4)$

$arctan(x_2/(1-x_1))+arctan((1-x_1)/x_2) = 2\pi/4*sgn((1-x_1)*x_2)$
$arctan(x_2/(1-x_1)) = -arctan((1-x_1)/x_2)+2\pi/4*sgn((1-x_1)*x_2)$

$\exists_k(k \in N \wedge q_2 = k/2 - arctan((1-x_1)/x_2)/(2\pi)+1/4*sgn((1-x_1)*x_2))$

$q_2 = q_1+1/4*sgn((1-x_1)*x_2))+k/2$

$q_2 = q_1 + 1/4$

$\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1 + i * x_2) =$

$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+(k/2-arctan((1-x_1)/x_2)/(2\pi))/x_2)*2\pi})}(sin((x_2 * ln(n)/(2\pi)+1/4)*2\pi)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+(k/2+arctan(x_2/(1-x_1))/(2\pi))/x_2)*2\pi})}(sin((x_2 * ln(n)/(2\pi))*2\pi)*n^{-x_1})) =$

$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{(floor(M)*2\pi/abs(x_2)+k*2\pi/2-arctan((1-x_1)/x_2)/x_2)})}(sin(x_2 * ln(n)+2\pi/4)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{(floor(M)*2\pi/abs(x_2)+k*2\pi/2+arctan(x_2/(1-x_1))/x_2)})}(sin(x_2 * ln(n))*n^{-x_1})) =$

$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{(floor(M)*2\pi/2/abs(x_2)-arctan((1-x_1)/x_2)/x_2)})}(sin(x_2 * ln(n)+2\pi/4)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{(floor(M)*2\pi/2/abs(x_2)+arctan(x_2/(1-x_1))/x_2)})}(sin(x_2 * ln(n))*n^{-x_1})) =$

$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{(floor(M)*2\pi/2/abs(x_2)-arctan((1-x_1)/x_2)/x_2)})}(sin(x_2 * ln(n)+2\pi/4)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{(floor(M)*2\pi/2/abs(x_2)+(-arctan((1-x_1)/x_2)/x_2+2\pi/4*sgn((1-x_1)*x_2))/x_2)})}(sin(x_2 * ln(n))*n^{-x_1})) =$

$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{floor(M)*2\pi/2/abs(x_2)-arctan((1-x_1)/x_2)/x_2})}(sin(x_2 * ln(n)+2\pi/4)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{floor(M)*2\pi/2/abs(x_2)-arctan((1-x_1)/x_2)/x_2+2\pi/4*sgn((1-x_1)*x_2)/x_2})}(sin(x_2 * ln(n))*n^{-x_1})) =$

$))$

Valem zeta13_tagumine_pool_nulliks:

$\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1 + i * x_2) =$
$\lim_{M\to\infty}(\sum_{n=1}^{floor(e^{floor(M)/2*2\pi/abs(x_2)-arctan((1-x_1)/x_2)/x_2})}(sin(x_2 * ln(n)+2\pi/4)*n^{-x_1}))$
$+ i * \lim_{M\to\infty}(-\sum_{n=1}^{floor(e^{(floor(M)/2+1/4)*2\pi/abs(x_2)-arctan((1-x_1)/x_2)/x_2})}(sin(x_2 * ln(n))*n^{-x_1}))$
$))$

asendan siinuse ja logaritmi vastavate Taylori ridadega.

valem zeta14_tagumine_pool_nulliks_tayloriga(ei suutnud kontrollida, aga vb sest arvutusvõime piiratuse tõttu ei saanud piidsavaölt suurt Mi vsalida):

$\forall_{x_1}(\forall_{x_2}(x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \rightarrow$
$\zeta(x_1 + i * x_2) =$
$\lim_{M\to\infty}(\sum_{n_0=0}^{floor(e^{floor(M)/2*2\pi/abs(x_2)-arctan((1-x_1)/x_2)/x_2})}(\sum_{n_1=0}^{(2*M)^M-1}($
$\sum_{n_2=0}^{M-1}(1+floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))/2}*$
$n_0^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(n_0+1)^{-x_1}*$
$(n_0+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$)))$

+i*$\lim_{M\to\infty}(\sum_{n_0=0}^{floor(e^{(floor(M)/2+1/4)*2\pi/abs(x_2)-arctan((1-x_1)/x_2)/x_2})}(\sum_{n_1=0}^{(2*M)^M-1}($
$\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(x_2*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))+1)/2}*$
$n_0^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$

$(n_0+1)^{-x_1}*$
$(n_0+2)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
$)))$

$))$

1.2.2 $q_1 = q_2$

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q/x_2)*2\pi})}(sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1})$
$-(sin((q+1/4)*2\pi)*(1-x_1)+sin((q+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q/x_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+q/x_2)*2\pi})}(sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$
$-(sin((q+2/4)*2\pi)*(1-x_1)+sin((q+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+q/x_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$))))$

$q_1 = 0 \land q_2 = 0$ kui valida, et $q_1 = 0$ ja $q_2 = 0$. Valem zeta12:
$\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{floor(M)*2\pi/abs(x_2)})}(sin(x_2*ln(n)+1*(2\pi)/4)*n^{-x_1})$
$-e^{floor(M)*2\pi*(1-x_1)/abs(x_2)}*((1-x_1)^2+x_2^2)^{-1}*(1-x_1)$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{floor(M)*2\pi/abs(x_2)})}(sin(x_2*ln(n)+2*(2\pi)/4)*n^{-x_1})$
$-e^{floor(M)*2\pi*(1-x_1)/abs(x_2)}*((1-x_1)^2+x_2^2)^{-1}*x_2$
$)=$
$))$

1.2.3 $q_1 = 1/8 \land q_2 = -1/8$

$\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \rightarrow$
$\zeta(x_1+i*x_2) =$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+1/8/x_2)*2\pi})}(sin((x_2*ln(n)/(2\pi)+1/4)*2\pi)*n^{-x_1})$
$-(sin((1/8+1/4)*2\pi)*(1-x_1)+sin((1/8+0/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)+1/8/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)-1/8/x_2)*2\pi})}(sin((x_2*ln(n)/(2\pi)+2/4)*2\pi)*n^{-x_1})$
$-(sin((-1/8+2/4)*2\pi)*(1-x_1)+sin((-1/8+1/4)*2\pi)*x_2)*e^{(floor(M)/abs(x_2)-1/8/x_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+$
$x_2^2)^{-1}$
$)=$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)+1/8/x_2)*2\pi})}(sin((x_2*ln(n)/(2\pi)+1/4)*2\pi)*n^{-x_1})$
$-((1-x_1)+x_2)*e^{(floor(M)/abs(x_2)+1/8/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}*2^{-1/2}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/abs(x_2)-1/8/x_2)*2\pi})}(sin((x_2*ln(n)/(2\pi)+2/4)*2\pi)*n^{-x_1})$
$-((1-x_1)+x_2)*e^{(floor(M)/abs(x_2)-1/8/x_2)*2\pi*(1-x_1)}*((1-x_1)^2+x_2^2)^{-1}*2^{-1/2}$
$)=$

))

1.2.4 kirjutades siinuse ja koosiinuse summana

kasutatud valem $sin(x)=\sum_{m=0}^{\infty}(x^{2*m+1}*((2*m+1)!)^{-1}*(-1)^m)$
$cos(x)=\sum_{m=0}^{\infty}(x^{2*m}*((2*m)!)^{-1}*(-1)^m)$

zeta ise $\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\rightarrow$
$\zeta(x_1+i*x_2)=$
$(x_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$\sum_{m=0}^{\infty}(ln(n*(2*m+1))*x_2^{2*m+1}*((2*m+1)!)^{-1}*(-1)^m)*x_2*(n-1)*n^{-x_1}+$
$\sum_{m=0}^{\infty}(ln(n*2*m)*x_2^{2*m}*((2*m)!)^{-1}*(-1)^m)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}-$
$\sum_{m=0}^{\infty}(ln((n+1)*(2*m+1))*x_2^{2*m+1}*((2*m+1)!)^{-1}*(-1)^m)*x_2*n*(n+1)^{-x_1}-$
$\sum_{m=0}^{\infty}(ln((n+1)*2*m)*x_2^{2*m}*((2*m)!)^{-1}*(-1)^m)*(1-x_1)*n*(n+1)^{-x_1}$
$)$
$+i*(x_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$(sin(x_2*ln(n)+1*(2\pi)/4)*x_2*(n-1)+sin(x_2*ln(n)+2*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2))\ *n^{-x_1}-$
$(sin(x_2*ln(n+1)+1*(2\pi)/4)*x_2+sin(x_2*ln(n+1)+2*(2\pi)/4)*(1-x_1))\ *n*(n+1)^{-x_1}$
$)$
$=$
$(x_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}(\sum_{m=0}^{\infty}(x_2^{2*m}*(-1)^m*((2*m)!)^{-1}*($
$ln(n*(2*m+1))*(2*m+1)^{-1}*x_2^2*(n-1)*n^{-x_1}+$
$ln(n*2*m)*(x_1^2-x_1-n*x_1+n+x_2^2)*n^{-x_1}-$
$ln((n+1)*(2*m+1))*(2*m+1)^{-1}*x_2^2*n*(n+1)^{-x_1}-$
$ln((n+1)*2*m)*(1-x_1)*n*(n+1)^{-x_1}$
$)))$
$+i*(x_1^2-2*x_1+1+x_2^2)^{-1}*\sum_{n=1}^{\infty}($
$(sin(x_2*ln(n)+1*(2\pi)/4)*x_2*(n-1)+sin(x_2*ln(n)+2*(2\pi)/4)*(x_1^2-x_1-n*x_1+n+x_2^2))\ *n^{-x_1}-$
$(sin(x_2*ln(n+1)+1*(2\pi)/4)*x_2+sin(x_2*ln(n+1)+2*(2\pi)/4)*(1-x_1))\ *n*(n+1)^{-x_1}$
$)$
$=))$

2 zetafunktsiooni nullkohad

on võrdsustan zetafunktsiooni avaldisega, mille mujal tuletasin.
$\forall_{q_1}(\forall_{q_2}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1})$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)$
$+i*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_2)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$

$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)+q_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$))))$

kuna nii reaalosa kui imaginaarosa peavad nullid olema, siis võin imaginnarosa suvalise konstandiga läbi korrutada.

$\forall_{q_1}(\forall_{q_2}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$Q_1*\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1})$
$-(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}=0$
$)+$
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_2)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)+q_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$))))$

viin konsatndi sulguse sisse.

$\forall_{q_1}(\forall_{q_2}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$\lim_{M\to\infty}($
$Q_1*\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1})$
$-Q_1*(sin((q_1+1/4)*2\pi)*(1-x_1)+sin((q_1+0/4)*2\pi)*x_2)*e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}+$
$\sum_{n=1}^{floor(e^{(floor(M)+q_2)*2\pi/x_2})}(sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$
$-(sin((q_2+2/4)*2\pi)*(1-x_1)+sin((q_2+1/4)*2\pi)*x_2)*e^{(floor(M)+q_2)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$))))$

muudan kirjutan ümber viies ühiseid kordajaid sulguse ette.

$\forall_{q_1}(\forall_{q_2}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(Q_1*sin(x_2*ln(n)+(2\pi)*1/4)*n^{-x_1}+sin(x_2*ln(n)+(2\pi)*2/4)*n^{-x_1})$
$-((Q_1*sin((q_1+1/4)*2\pi)+sin((q_2+2/4)*2\pi))*(1-x_1)+(Q_1*sin((q_1+0/4)*2\pi)+sin((q_2+1/4)*2\pi))*$
$x_2)*e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})=0$
$))))$

siinuse ja koosinuse summa saab ühiseks siinuseks teha nii, et argumendile on midagi liidetud.

$\forall_{q_1}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(\sqrt{Q_1^2+1}*-sin(x_2*ln(n)+arctan(-Q_1))*n^{-x_1})$
$-((-\sqrt{Q_1^2+1}*sin(q_1*2\pi+arctan(-Q_1)))*(1-x_1)+\sqrt{Q_1^2+1}*sin(q_1*2\pi+arctan(1/Q_1))*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})=0$
$)))$

arctan(-x)=arctan(x)

$\forall_{q_1}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(-sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(-sin(q_1*2\pi-arctan(Q_1))*(1-x_1)+sin(q_1*2\pi+arctan(1/Q_1))*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$)))$

arctan(1/x)=-arctan(x)+sgn(x)*2\pi/4

$\forall_{q_1}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1+i*x_2)=0 \rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(-sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(-sin(q_1*2\pi-arctan(Q_1))*(1-x_1)+sin(q_1*2\pi-arctan(Q_1)+sgn(Q_1)*2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$)))$

korrutan -1ega läbi

$\forall_{q_1}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1+i*x_2)=0 \rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(sin(q_1*2\pi-arctan(Q_1))*(1-x_1)-sin(q_1*2\pi-arctan(Q_1)+sgn(Q_1)*2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$)))$

2pi/4 lahutamine on sama kui 2pi/4 lahutamine ja siis -1'ega läbi korrutamine

$\forall_{q_1}(\forall_{Q_1}(\forall_{x_1}(\forall_{x_2}(x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1+i*x_2)=0 \rightarrow$

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(sin(q_1*2\pi-arctan(Q_1))*(1-x_1)-sin(q_1*2\pi-arctan(Q_1)+2\pi/4)*sgn(Q_1)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$)))$

kui Q_1 on positiivne, siis sgn(Q_1)=1, kui negatiivne, siis sgn(Q_1)=-1

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \land Q_1 \in R \land x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1+i*x_2)=0 \rightarrow ($
$Q_1 > 0 land($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(sin(q_1*2\pi-arctan(Q_1))*(1-x_1)-sin(q_1*2\pi-arctan(Q_1)+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$\lor$
$Q_1 < 0 \land ($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)-arctan(Q_1))*n^{-x_1})$
$-(sin(q_1*2\pi-arctan(Q_1))*(1-x_1)+sin(q_1*2\pi-arctan(Q_1)+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1})$
$)=0$
$)$

)))

arctan(Q_1) võtab väärtuseid -2pi/4 kuni 2pi/4

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \land Q_1 \in R \land x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1+i*x_2)=0 \rightarrow ($
$(Q_1 > -2\pi/4 \land Q_1 < 0) \land ($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)-Q_1)*n^{-x_1})$
$-(sin(q_1*2\pi-Q_1)*(1-x_1)-sin(q_1*2\pi-Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0\lor$

$(Q_1 > 0 \land Q_1 < 2\pi/4) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (sin(x_2 * ln(n) - Q_1) * n^{-x_1})$
$-(sin(q_1 * 2\pi - Q_1) * (1-x_1) + sin(q_1 * 2\pi - Q_1 + 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1-x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$

))))

Ühes kohas Q_1 asemele samanimeline muutuja -Q_1. Teises kohas Q_1 asemele samanimeline muutuja 2\pi/2-Q_1.

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \land Q_1 \in R \land x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1 + i * x_2) = 0 \to ($
$(Q_1 > 0 \land Q_1 < 2\pi/4) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (sin(x_2 * ln(n) + Q_1) * n^{-x_1})$
$-(sin(q_1 * 2\pi + Q_1) * (1-x_1) - sin(q_1 * 2\pi + Q_1 + 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1-x_1)^2 + x_2^2)^{-1}$
$) = 0 \lor$

$(Q_1 > 2\pi/4 \land Q_1 < 2\pi/2) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (sin(x_2 * ln(n) - 2\pi/2 + Q_1) * n^{-x_1})$
$-(sin(q_1 * 2\pi - 2\pi/2 + Q_1) * (1-x_1) + sin(q_1 * 2\pi - 2\pi/2 + Q_1 + 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1-x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$

))))

arvestan, et sin(x-2pi/2)=-sin(x)

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \land Q_1 \in R \land x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1 + i * x_2) = 0 \to ($
$(Q_1 > 0 \land Q_1 < 2\pi/4) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (sin(x_2 * ln(n) + Q_1) * n^{-x_1})$
$-(sin(q_1 * 2\pi + Q_1) * (1-x_1) - sin(q_1 * 2\pi + Q_1 + 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1-x_1)^2 + x_2^2)^{-1}$
$) = 0 \lor$

$(Q_1 > 2\pi/4 \land Q_1 < 2\pi/2) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (-sin(x_2 * ln(n) + Q_1) * n^{-x_1})$
$-(-sin(q_1 * 2\pi + Q_1) * (1-x_1) - sin(q_1 * 2\pi + Q_1 + 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1-x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$

))))

Arvestan, et 0*(-1)=0 ja sin(x+2\pi/2)=-sin(x). Muutuja Q_1 asemele muuutuja Q_1-2\pi/2.

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \land Q_1 \in R \land x_1 \in R \land x_2 \in R \land x_1 > 0 \land \zeta(x_1 + i * x_2) = 0 \to ($
$(Q_1 > 0 \land Q_1 < 2\pi/4) \land ($
$\lim_{M \to \infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})} (sin(x_2 * ln(n) + Q_1) * n^{-x_1})$

$-(sin(q_1*2\pi+Q_1)*(1-x_1)-sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$\vee$

$(Q_1>2\pi/4\wedge Q_1<2\pi/2)\wedge($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(-sin(x_2*ln(n)+Q_1)*n^{-x_1})$
$-(-sin(q_1*2\pi+Q_1)*(1-x_1)-sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$\vee$

(Q$_1>2\pi/2\wedge Q_1<2\pi*3/4)\wedge($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+Q_1)*n^{-x_1})$
$-(sin(q_1*2\pi+Q_1)*(1-x_1)-sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$\vee$

$(Q_1>2\pi*3/4\wedge Q_1<2\pi)\wedge($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(-sin(x_2*ln(n)+Q_1)*n^{-x_1})$
$-(-sin(q_1*2\pi+Q_1)*(1-x_1)-sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$

)

))))

korrutan osad osad -1ega läbi. ja panaen osad kokku.

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1\in R\wedge Q_1\in R\wedge x_1\in R\wedge x_2\in R\wedge x_1>0\wedge\zeta(x_1+i*x_2)=0\to($
$(Q_1>0\wedge Q_1<2\pi/4\vee Q_1>2\pi/2\wedge Q_1<2\pi*3/4)\wedge($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+Q_1)*n^{-x_1})$
$-(sin(q_1*2\pi+Q_1)*(1-x_1)-sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$
$\vee$

$(Q_1>2\pi/4\wedge Q_1<2\pi/2\vee Q_1>2\pi*3/4\wedge Q_1<2\pi)\wedge($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2*ln(n)+Q_1)*n^{-x_1})$
$-(sin(q_1*2\pi+Q_1)*(1-x_1)+sin(q_1*2\pi+Q_1+2\pi/4)*x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2}*((1-x_1)^2+x_2^2)^{-1}$
$)=0$

)

))))

üheks oskas kokku.

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \wedge Q_1 \in R \wedge x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \wedge \zeta(x_1 + i * x_2) = 0 \rightarrow ($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1) * n^{-x_1})$
$-(sin(q_1 * 2\pi + Q_1) * (1 - x_1) - sin(q_1 * 2\pi + Q_1 + 2\pi/4) * sgn(Q_1\%(2\pi/2) - 2\pi/4) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$
$))))$

muutuja Q_1 asemele Q_1/(2\pi)

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \wedge Q_1 \in R \wedge x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \wedge \zeta(x_1 + i * x_2) = 0 \rightarrow ($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$-(sin((q_1 + Q_1) * 2\pi) * (1 - x_1) - sin((q_1 + Q_1 + 1/4) * 2\pi) * ((floor(Q_1 * 4)\%2) * 2 - 1) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$
$))))$

kuna Q_1'ele 2\pi liites...

$\forall_{q_1}(\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(q_1 \in R \wedge Q_1 \in R \wedge x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \wedge \zeta(x_1 + i * x_2) = 0 \rightarrow ($
$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$-(sin((q_1 + Q_1) * 2\pi) * (1 - x_1) - sin((q_1 + Q_1 + 1/4) * 2\pi) * ((floor(Q_1 * 4)\%2) * 2 - 1) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$
$\wedge \lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$-(sin((q_1 + Q_1) * 2\pi) * (1 - x_1) + sin((q_1 + Q_1 + 1/4) * 2\pi) * ((floor(Q_1 * 4)\%2) * 2 - 1) * x_2)$
$e^{(floor(M)+q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$
$)$
$))))$

et see mõlemal juhul 0 oleks sin((q_1+Q_1+1/4)*2\pi)=0 seega q_1=-1/4-Q_1 või q_1=1/4-Q_1

$\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(Q_1 \in R \wedge x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \wedge \zeta(x_1 + i * x_2) = 0 \rightarrow ($

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)-1/4-Q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$+(1 - x_1) * e^{(floor(M)-1/4-Q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$
$\vee \lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)+1/4-Q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$-(1 - x_1) * e^{(floor(M)+1/4-Q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$
$) = 0$

$)$
$)))$

samahästi võib m'i 2 korda aeglasemalt suurendada.

$\forall_{x_1}(\forall_{x_2}(\forall_{Q_1}(Q_1 \in R \wedge x_1 \in R \wedge x_2 \in R \wedge x_1 > 0 \wedge \zeta(x_1 + i * x_2) = 0 \rightarrow ($

$\lim_{M\to\infty}($
$\sum_{n=1}^{floor(e^{(floor(M)/2+1/4-Q_1)*2\pi/x_2})}(sin(x_2 * ln(n) + Q_1 * 2\pi) * n^{-x_1})$
$-(1 - x_1) * ((floor(M)\%2) * 2 - 1) * e^{(floor(M)/2+1/4-Q_1)*2\pi*(1-x_1)/x_2} * ((1 - x_1)^2 + x_2^2)^{-1}$

$) = 0$

$)$
$)))$

3 muu

3.0.1 c

$lim_{M\to\infty}(M*(M+1)^{-x_1} - M^{1-x_1}) =$
$lim_{M\to\infty}(M*(M+1)^{-x_1} - M*(M+1)^{-x_1}*(M+1)/M) =$
$lim_{M\to\infty}(M*(M+1)^{-x_1} - M*(M+1)^{-x_1}*(1+1/M)) =$
$lim_{M\to\infty}(M*(M+1)^{-x_1}*(1-(1+1/M))) =$
$lim_{M\to\infty}(M*(M+1)^{-x_1}*(-1/M)) =$
$lim_{M\to\infty}(-(M+1)^{-x_1}) =$
$lim_{M\to\infty}(\frac{-1}{(M+1)^{x_1}}) =$

$x_1 > 0 \to return(0)$
$x_1 <= 0 \to return(\infty)$¨

3.0.2 b

$lim_{M\to\infty}($
$(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1} -$
$(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M^{1-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1}$
$) =$
$lim_{M\to\infty}((sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*$
$(M*(M+1)^{-x_1} - M^{1-x_1})$
$) =$
$x_1 > 0 \to return(0)$
$x_1 <= 0 \to return(\infty)$

3.0.3 a

$lim_{M\to\infty}($
$(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M*(M+1)^{-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1} -$
$(sin(x_2*ln(M)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M)+1*(2\pi)/4)*x_2)*M^{1-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1}$
$) =$
$lim_{M\to\infty}($
$(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M*(M+1)^{-x_1} -$
$(sin(x_2*ln(M)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M)+1*(2\pi)/4)*x_2)*M^{1-x_1}$
$) =$

3.0.4 d

$lim_{M\to\infty}($
$(sin(x_2*ln(M+1)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M+1)+1*(2\pi)/4)*x_2)*M^{1-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1} -$
$(sin(x_2*ln(M)+2*(2\pi)/4)*(1-x_1)+sin(x_2*ln(M)+1*(2\pi)/4)*x_2)*M^{1-x_1}*(x_1^2-2*x_1+x_2^2+1)^{-1}$
$) =$

$(x_1^2-2*x_1+x_2^2+1)^{-1}*lim_{M\to\infty}(M^{1-x_1}*($
$(1-x_1)*(sin(x_2*ln(M+1)+2*(2\pi)/4)-sin(x_2*ln(M)+2*(2\pi)/4))+$
$x_2*(sin(x_2*ln(M+1)+1*(2\pi)/4)-sin(x_2*ln(M)+1*(2\pi)/4))$
$))=$

$(x_1^2-2*x_1+x_2^2+1)^{-1}*lim_{M\to\infty}(M^{1-x_1}*($
$(cos(x_2*ln(M+1))-cos(x_2*ln(M)))*x_2-$
$(sin(x_2*ln(M+1))-sin(x_2*ln(M)))*(1-x_1)))$

$lim_{M\to\infty}(M^{1-x_1}*($
$abs((cos(x_2*ln(M+1))-cos(x_2*ln(M)))*x_2))+$
$abs((sin(x_2*ln(M+1))-sin(x_2*ln(M)))*(1-x_1)))$
$))$

$lim_{M\to\infty}(M^{1-x_1}*($
$abs((x_2*ln(M+1)-x_2*ln(M))*x_2)+$
$abs((x_2*ln(M+1)-x_2*ln(M))*(1-x_1))$
$))$

$lim_{M\to\infty}(M^{1-x_1}*($
$abs((ln(M+1)-ln(M))*x_2^2)+$
$abs((ln(M+1)-ln(M))*(1-x_1)*x_2)$
$))$

$lim_{M\to\infty}(M^{1-x_1}*($
$(ln(M+1)-ln(M))*x_2^2+$
$(ln(M+1)-ln(M))*abs((1-x_1)*x_2)$
$))$

$lim_{M\to\infty}(M^{1-x_1}*($
$(ln(M+1)-ln(M))*(abs(x_2)*(abs(x_2)+abs(1-x_1)))$
$))$

$lim_{M\to\infty}(M^{1-x_1}*(ln(M+1)-ln(M))*(abs(x_2)*(abs(x_2)+abs(1-x_1))))$

$lim_{M\to\infty}(M^{1-x_1}*(ln(M+1)-ln(M)))$

$lim_{M\to\infty}(M^{-x_1}*\ (ln(M+1)-ln(M))*M)$

$lim_{M\to\infty}(M^{-x_1})$

$x_1>0\to return\ 0$

3.0.5 f

$ln(M)*x_2=(k*2\pi)/2$

$M=e^{(k*2\pi)/(2*x_2)}=e^{\frac{k*2\pi}{2*x_2}}$

$k=2*ln(M)*x_2/(2\pi)=\frac{2*ln(M)*x_2}{2\pi}$

$x_2=k*2\pi/ln(M)/2=\frac{k*2\pi}{ln(M)*2}$
asendus
$M_{uus}=e^{(floor(M)+q)*2\pi/x_2}=e^{\frac{floor(M)*2\pi}{x_2}}=e^{(floor(M)*2\pi+\alpha)/x_2}$

asendus2
$ln(M)*x_2=(k*2\pi)+\alpha$

M=e$^{(k*2\pi+\alpha)/(x_2)}=e^{\frac{k*2\pi+\alpha}{x_2}}$

k=(ln(M)*x$_2-\alpha)/(2\pi)=\frac{ln(M)*x_2-\alpha}{2\pi}$

x$_2=((k*2\pi)+\alpha)/ln(M)$

q=$\alpha/2\pi$

3.0.6 g

$sin(ln(x))=$
$\forall_x(x>-1\wedge x<1\rightarrow$
$ln(x+1)=\sum_{n=1}^{\infty}((-1)^{n+1}*n^{-1}*x^n)$
)
muutuja vahetus x-1
$\forall_x(x>0\wedge x<2\rightarrow$
$ln(x)=\sum_{n=1}^{\infty}((-1)^{n+1}*n^{-1}*(x-1)^n)$
)
mv 1/x
$\forall_x(x>1/2\rightarrow$
$ln(1/x)=\sum_{n=1}^{\infty}((-1)^{n+1}*n^{-1}*(1/x-1)^n)$
)
mv summas
$\forall_x(x>1/2\rightarrow$
$ln(1/x)=\sum_{n=1}^{\infty}((-1)^{n+1}*n^{-1}*(1/x-1)^n)$
)
..

3.0.7 ln maclaurin

https://math.stackexchange.com/questions/585154/taylor-series-for-logx
valem ln_maclaurin:
$\forall_x(x>0\rightarrow$
$ln(x)=2*\sum_{k=0}^{\infty}((2*k+1)^{-1}*(x-1)^{2*k+1}*(x+1)^{-2*k-1})$
)

3.0.8 sin(ln(x)) maclaurin

sin:
$\forall_x(x\in R\rightarrow$
$sin(x)=\sum_{k=0}^{\infty}((-1)^k*x^{2*k+1}*\Gamma(2*k+2)^{-1})$
)
sin(y*ln(x)): Valem sin_y_ln_x_maclaurin_3:
$\forall_x(x>0\rightarrow$
$sin(y*ln(x))=\sum_{k_1=0}^{\infty}((\sum_{k_2=0}^{\infty}((2*k_2+1)^{-1}*(x-1)^{2*k_2+1}*(x+1)^{-2*k_2-1}))^{2*k_1+1}*y^{2*k_1+1}*factorial(2*k_1+1)^{-1}*$
$2^{2*k_1+1}*(-1)^{k_1})$
)
kasutan Multinomial theoreemi. Siin on eeldatud, et True'ga korrutamine on nagu 1ega korrutamine ja Falsega korrutamine on nagu 0'iga korrutamine. Valem sin_y_ln_x_multinomial_1:
$\forall_x(x>0\rightarrow$
$sin(y*ln(x))=lim_{M\rightarrow\infty}(\sum_{k_1=0}^{M-1}(\sum_{k_2=0}^{(2*k_1+2)^M-1}($

$(\sum_{k_3=0}^{M-1}(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ ) = 2*k_1+1)*$
$\Pi_{k_3=0}^{M-1}(factorial(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ )^{-1}*((2*k_3+1)^{-1}*(x-1)^{2*k_3+1}*(x+1)^{-2*k_3-1})^{floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)})$
$)*y^{2*k_1+1}*2^{2*k_1+1}*(-1)^{k_1}))$
$)$

elementide korrutamise asemel võib nende astemed liita:

$\forall_x(x>0\to sin(y*ln(x)) =$
$lim_{M\to\infty}(\sum_{k_1=0}^{M-1}(\sum_{k_2=0}^{(2*k_1+2)^M-1}($
$(\sum_{k_3=0}^{M-1}(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ ) = 2*k_1+1)*$
$\Pi_{k_3=0}^{M-1}(factorial(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ )^{-1}*(2*k_3+1)^{-floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)})*((x-1)/(x+$
$1))^{\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)))})*y^{2*k_1+1}*2^{2*k_1+1}*(-1)^{k_1}))$
$)$

lihtsustan. Valem sin_y_ln_x_multinomial:

$\forall_x(x>0\to sin(y*ln(x)) =$
$lim_{M\to\infty}(\sum_{k_1=0}^{M-1}(y^{2*k_1+1}*2^{2*k_1+1}*(-1)^{k_1}*\sum_{k_2=0}^{(2*k_1+2)^M-1}($
$(\sum_{k_3=0}^{M-1}(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ ) = 2*k_1+1)*$
$(x-1)^{\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)))}*$
$(x+1)^{-\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)))}*$
$\Pi_{k_3=0}^{M-1}(factorial(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ )^{-1}*(2*k_3+1)^{-floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)})$
$)))$
$)$

viin teguri sulgude sisse::

$\forall_x(x>0\to sin(y*ln(x)) =$
$lim_{M\to\infty}(\sum_{k_1=0}^{M-1}(\sum_{k_2=0}^{(2*k_1+2)^M-1}($
$(\sum_{k_3=0}^{M-1}(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ ) = 2*k_1+1)*$
$y^{2*k_1+1}*2^{2*k_1+1}*(-1)^{k_1}*$
$(x-1)^{\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)))}*$
$(x+1)^{-\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)))}*$
$\Pi_{k_3=0}^{M-1}(factorial(\ floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)\ )^{-1}*(2*k_3+1)^{-floor(k_2/(2*k_1+2)^{k_3})\%(2*k_1+2)})$
$)))$
$)$

selle asemel et üle eri n2'e ristsummade summeeridaarvutan lihtsalt n2'e ristsumma. Valem sin_y_ln_x_multinomial_2:

$\forall_x(x>0\to sin(y*ln(x)) =$
$-lim_{M\to\infty}(\sum_{k_1=0}^{(2*M)^M-1}($
$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))\%2)*$
$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M)) < 2*M)*$
$(y*2)^{\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))}*$
$(-1)^{(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))-1)/2}*$
$(x-1)^{\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M)^{k_2})\%(2*M)))}*$
$(x+1)^{-\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M)^{k_2})\%(2*M)))}*$
$\Pi_{k_2=0}^{M-1}(factorial(floor(k_1/(2*M)^{k_2})\%(2*M))^{-1}*(2*k_2+1)^{-floor(k_1/(2*M)^{k_2})\%(2*M)})$
$))$
$)$

kuna Mi lähenedes lõpmatusele see avaldis nagu nii koondub ja selle muutuse tegemine ainult lisab liikmeid, mis on absoluutväärtuselt väiksemad kui oleksid liikmed, mis lisanduksid Mi suurendamisel. Valem sin_y_ln_x_multinomial_4:

$\forall_x(x>0\to sin(y*ln(x)) =$

$lim_{M\to\infty}(\sum_{k_1=0}^{(2*M)^M-1}($
$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))\%2)*$
$(y*2)^{\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))}*$
$(-1)^{(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M)^{k_2})\%(2*M))+3)/2}*$
$(x-1)^{\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M)^{k_2})\%(2*M)))}*$
$(x+1)^{-\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M)^{k_2})\%(2*M)))}*$
$\Pi_{k_2=0}^{M-1}(factorial(floor(k_1/(2*M)^{k_2})\%(2*M))^{-1}*(2*k_2+1)^{-floor(k_1/(2*M)^{k_2})\%(2*M)})$
$))$
$)$

kasutan multimomial astendajategenereerimiseks teist valemit $v[A]=\sum_{k_4=0}^{\infty}(k_2/2^{k_4*M+A}\%2)$. Ehk biti indexi jääk määrab, et mitmenda astendaja bit see on.

3.0.9 cos(ln(x)) maclaurin

cos:

$\forall_x(x\in R\to$
$cos(x)=\sum_{k=0}^{\infty}((-1)^k*x^{2*k}*factorial(2*k)^{-1})$
$)$

cos(y*ln(x)):

$\forall_x(x>0\to$
$sin(y*ln(x))=\sum_{k_1=0}^{\infty}((-1)^{k_1}*(2*\sum_{k_2=0}^{\infty}((2*k_2+1)^{-1}*(x-1)^{2*k_2+1}*(x+1)^{-2*k_2-1}))^{2*k_1}*y^{2*k_1}*\Gamma(2*k_1+1)^{-1})$
$)$

Valem cos_y_ln_x_multinomial:

$\forall_x(x>0\to cos(y*ln(x))=$
$lim_{M\to\infty}(\sum_{k_1=0}^{M-1}(y^{2*k_1}*2^{2*k_1}*(-1)^{k_1}*\sum_{k_2=0}^{(2*k_1+1)^M-1}($
$(\sum_{k_3=0}^{M-1}(\ floor(k_2/(2*k_1+1)^{k_3})\%(2*k_1+1)\ )=2*k_1)*$
$(x-1)^{\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+1)^{k_3})\%(2*k_1+1)))}*$
$(x+1)^{-\sum_{k_3=0}^{M-1}((2*k_3+1)*(floor(k_2/(2*k_1+1)^{k_3})\%(2*k_1+1)))}*$
$\Pi_{k_3=0}^{M-1}(factorial(\ floor(k_2/(2*k_1+1)^{k_3})\%(2*k_1+1)\ )^{-1}*(2*k_3+1)^{-floor(k_2/(2*k_1+1)^{k_3})\%(2*k_1+1)})$
$)))$
$)$

Valem cos_y_ln_x_multinomial_2:

$\forall_x(x>0\to sin(y*ln(x))=$
$lim_{M\to\infty}(\sum_{k_1=0}^{(2*M)^M-1}($
$(\sum_{k_2=0}^{M-1}((floor(k_1/(2*M-1)^{k_2})\%(2*M-1))+1)\%2)*$
$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M-1)^{k_2})\%(2*M-1))<2*M-1)*$
$(y*2)^{\sum_{k_2=0}^{M-1}(floor(k_1/(2*M-1)^{k_2})\%(2*M-1))}*$
$(-1)^{\sum_{k_2=0}^{M-1}(floor(k_1/(2*M-1)^{k_2})\%(2*M-1))/2}*$
$(x-1)^{\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M-1)^{k_2})\%(2*M-1)))}*$
$(x+1)^{-\sum_{k_2=0}^{M-1}((2*k_2+1)*(floor(k_1/(2*M-1)^{k_2})\%(2*M-1)))}*$
$\Pi_{k_2=0}^{M-1}(factorial(floor(k_1/(2*M-1)^{k_2})\%(2*M-1))^{-1}*(2*k_2+1)^{-floor(k_1/(2*M-1)^{k_2})\%(2*M-1)})$
$))/2$
$)$

veel üks valem:

$\forall_x(x>0\to cos(y*ln(x))=$
$lim_{M\to\infty}(\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$

$(\sum_{k_2=0}^{M-1}(floor(k_1/(2*M-1)^{k_2})\%(2*M-1)) < 2*M-1)*$
$(y*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))/2}*$
$(x-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(x+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
))
)

Valem cos_y_ln_x_multinomial_4_2:

$\forall_x(x>0 \to cos(y*ln(x)) =$
$lim_{M\to\infty}(\sum_{n_1=0}^{(2*M)^M-1}($
$(\sum_{n_2=0}^{M-1}(1+floor(n_1/(2*M)^{n_2})\%(2*M))\%2)*$
$(y*2)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))}*$
$(-1)^{\sum_{n_2=0}^{M-1}(floor(n_1/(2*M)^{n_2})\%(2*M))/2}*$
$(x-1)^{\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$(x+1)^{-\sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_1/(2*M)^{n_2})\%(2*M)))}*$
$\Pi_{n_2=0}^{M-1}(factorial(floor(n_1/(2*M)^{n_2})\%(2*M))^{-1}*(2*n_2+1)^{-floor(n_1/(2*M)^{n_2})\%(2*M)})$
))
)

3.0.10 sisemine summa

$A = \sum_{n_2=0}^{M-1}((2*n_2+1)*(floor(n_0/(2*M)^{n_2})\%(2*M)))$

—

$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}($
n_1^A*
$(n_1+1)^{-x_1}*$
$(n_1+2)^{-A}*$
)
kasutan binomial valemit:$\forall_n(\forall_a(\forall_b((a+b)^n = \sum_{k=0}^{\infty}(faktorial(n)*faktorial(k)^{-1}*faktorial(n-k)^{-1}*a^k*b^{n-k})$

saadud tulemus:

$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}($
$\sum_{k=0}^{\infty}(faktorial(-x_1)*faktorial(k)^{-1}*faktorial(-x_1-k)^{-1}*n_1^{k+A})*$
$\sum_{k=0}^{\infty}(faktorial(-A)*faktorial(k)^{-1}*faktorial(-A-k)^{-1}*n_1^{k}*2^{-A-k})*$
)

panen 1 summa 2 sisse:

$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}($
$\sum_{k_1=0}^{\infty}(\sum_{k_2=0}^{\infty}(faktorial(-x_1)*faktorial(k_1)^{-1}*faktorial(-x_1-k_1)^{-1}*n_1^{k_1+A}*faktorial(-A)*faktorial(k_2)^{-1}*$
$faktorial(-A-k_2)^{-1}*n_1^{k_2}*2^{-A-k_2}))*$
)

lihtsustan seest ja viin n1 summa sisse:

$\sum_{k_1=0}^{\infty}(\sum_{k_2=0}^{\infty}(faktorial(-x_1)*faktorial(k_1)^{-1}*faktorial(-x_1-k_1)^{-1}*faktorial(-A)*faktorial(k_2)^{-1}*faktorial(-A-$
$k_2)^{-1}*2^{-A-k_2}*$
$\sum_{n_1=0}^{floor(e^{(floor(M)/abs(x_2)+q_2/x_2)*2\pi})-1}(n_1^{k_1+k_2+A})$

))
kasutan