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$\Phi(-1, 1, a+1)$

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$$\Phi(-1, 1, a+1) \quad = \quad \frac{1}{2}\psi\left(\frac{a}{2}+1\right) - \frac{1}{2}\psi\left(\frac{a+1}{2}\right)$$

LerchPhi[-1,1,M+1]

$M = \text{Apply}[\text{LCM}, \text{Table}[k, \{k, 1, 12\}]];$

$\text{ContinuedFraction}[2 * M * \text{LerchPhi}[-1, 1, M + 1], 15]$

{0, 1, 55439, 27720, 18480, 13860, 11088, 9240, 7920, 6930, 6160, 5544, 5040, 4620, 4264}

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$$\Phi(-1, 1, a+1) \quad = \quad \frac{1}{2a} \cdot \cfrac{1}{1 + \cfrac{1}{2a - 1 + \cfrac{1}{\frac{2a}{2} + \cfrac{1}{\frac{2a}{3} + \cfrac{1}{\frac{2a}{4} + \cfrac{1}{\frac{2a}{5} + \cfrac{1}{\frac{2a}{6} + \ddots}}}}}}}$$

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$\text{ContinuedFraction}[2 * M * \text{LerchPhi}[-1, 1, M + 1], 15]$

{0, 1, 55439, 27720, 18480, 13860, 11088, 9240, 7920, 6930, 6160, 5544, 5040, 4620, 4264}

$$\Phi(-1, 1, a + 1) \quad = \quad \frac{1}{2a} \cdot \cfrac{1}{1 + \cfrac{1}{2a - 1 + \cfrac{1}{\frac{2a}{2} + \cfrac{1}{\frac{2a}{3} + \cfrac{1}{\frac{2a}{4} + \cfrac{1}{\frac{2a}{5} + \cfrac{1}{\frac{2a}{6} + \ddots}}}}}}}$$

LerchPhi[-1, 2, M+1]

M $=$ Apply[LCM, Table[$k, \{k, 1, 10\}$]]^2;

ContinuedFraction[$2 * M *$ LerchPhi[$-1, 2, M + 1$], 20]

{0, 6350401, 6350400, 6350401, 1587600, 6350401, 705600, 6350401, 396900, 6350401, 254016, 6350401, 176400, 6350401, 129600, 6350401, 99225, 6350401, 78400, 6350401}

LerchPhi[1, 2, M+1]

$M = \text{Apply}[\text{LCM}, \text{Table}[k, \{k, 1, 33\}]]^\wedge 2;$

$\text{ContinuedFraction}[2 * M^\wedge 2 * \text{LerchPhi}[1, 2, M + 1], 20]$

{417047721765894658658419919999, 62557158264884198798762880000,
34753976813824554888201600000, 24327783769677188421741120000,
18767147479465259639628864000, 15291749798082804150808704000,
12908619959420548958474880000, 11170921118729321214064800000,
9846960097250290551657120000, 8804340792835553905011072000,
7961820142803443483478912000, 7266740606526952385714880000,
6683457079581645170808000000, 6186971696527008672405120000,
5759230443433783381473408000, 5386866406142806007671248000,
5059770153777398432252880000, 4770153680328860474851200000,
4511919796882486073205120000, 4280226618123655707283776000}

LerchPhi[1, 3, M+1]

M = Apply[LCM, Table[k, {k, 1, 53}]]^2;

ContinuedFraction[2 $*$ M^3 $*$ LerchPhi[1, 3, M + 1], 20]

{26977851841586159233889184384803850672896639999,
53955703683172318467778368769607701345793280000,
40466777762379238850833776577205776009344960000,
26977851841586159233889184384803850672896640000,
22481543201321799361574320320669875560747200000,
17985234561057439489259456256535900448597760000,
15737080240925259553102024224468912892523040000,
13488925920793079616944592192401925336448320000,
12140033328713771655250132973161732802803488000,
10791140736634463693555673753921540269158656000,
9891879008581591719092700941094745246728768000,
8992617280528719744629728128267950224298880000,
8350287474776668334299033261963096636848960000,
7707957669024616923968338395658243049399040000,