

PROOF OF FORMULA 4.263.1

$$\int_0^\infty \frac{\ln^4 x \, dx}{(x-1)(x+a)} = \frac{\ln a [\pi^2 + \ln^2 a] [7\pi^2 + 3 \ln^2 a]}{15(a+1)}$$

Paper 1 in the series contains the proof of

$$\int_0^\infty \frac{\ln^{n-1} x \, dx}{(x-1)(x+a)} = \frac{(-1)^n n! (1 + (-1)^n) \zeta(n)}{n(1+a)} + \frac{1}{n(1+a)} \left[\sum_{j=0}^{\lfloor n/2 \rfloor} \binom{n}{2j} (2^{2j} - 2) (-1)^{j-1} B_{2j} \pi^{2j} \log^{n-2j} a \right].$$

This entry corresponds to the case $n = 5$.