Introduction to Asymptotic Methods

Maxim Efremov
Institut für Quantenphysik, Universität Ulm

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Sheet 3

Exercise 8

By using the Lagrange-Bürmann formula, derive the asymptotic expansion for the functions $W_0(x)$ and $W_{-1}(x)$ as $x \to -e^{-1}$

(4 Points)

Exercise 9

Let $x \tan(x) = u$ be the transcendental equation for $x \in \left(0, \frac{\pi}{2}\right)$ and $u > 0$. Obtain the coefficients a_n with $n = 0, 1, 2, ..$ of the asymptotic expansion

$$x(u) = a_0 + \frac{a_1}{u} + \frac{a_2}{u^2} + \frac{a_3}{u^3} + \mathcal{O}\left(\frac{1}{u^4}\right)$$

for the root $x(u)$ of this equation as $u \to +\infty$.

(2 Points)

Exercise 10

Obtain the asymptotic expansion for the roots x_n $(n = 0, 1, 2, ..)$ of the transcendental equation

$$\sin(x) = \frac{1}{\ln(x)}.$$

(2 Points)

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