9.3.18

$$M(\nu,\beta)\sim -i\sum_{k=0}^{\infty}\frac{u_{2k+1}(i\cot\beta)}{\nu^{2k+1}}=\frac{3\cot\beta+5\cot^3\beta}{24\nu}-\ldots$$

Also

9.3.19

$$J'_\nu(\nu\sec\beta)=\sqrt{(\sin 2\beta)/(\pi\nu)}\{-N(\nu,\beta)\sin\Psi-O(\nu,\beta)\cos\Psi\}$$

9.3.20

$$Y'_\nu(\nu\sec\beta)=\sqrt{(\sin 2\beta)/(\pi\nu)}\{N(\nu,\beta)\cos\Psi-O(\nu,\beta)\sin\Psi\}$$

where

9.3.21

$$N(\nu,\beta)\sim\sum_{k=0}^{\infty}\frac{v_{2k}(i\cot\beta)}{\nu^{2k}}=1+\frac{135\cot^2\beta+594\cot^4\beta+455\cot^6\beta}{1152\nu^2}-\ldots$$

9.3.22

$$O(\nu,\beta)\sim i\sum_{k=0}^{\infty}\frac{v_{2k+1}(i\cot\beta)}{\nu^{2k+1}}=\frac{9\cot\beta+7\cot^3\beta}{24\nu}-\ldots$$

Asymptotic Expansions in the Transition Regions

When z is fixed, $|\nu|$ is large and $|\arg\nu|<\frac{1}{2}\pi$

9.3.23

$$J_\nu(\nu+z\nu^{1/3})\sim\frac{2^{1/3}}{\nu^{1/3}}\mathrm{Ai}\,(-2^{1/3}z)\{1+\sum_{k=1}^{\infty}\frac{f_k(z)}{\nu^{2k/3}}\}+\frac{2^{2/3}}{\nu}\mathrm{Ai}'\,(-2^{1/3}z)\sum_{k=0}^{\infty}\frac{g_k(z)}{\nu^{2k/3}}$$

9.3.24

$$Y_\nu(\nu+z\nu^{1/3})\sim-\frac{2^{1/3}}{\nu^{1/3}}\mathrm{Bi}\,(-2^{1/3}z)\{1+\sum_{k=1}^{\infty}\frac{f_k(z)}{\nu^{2k/3}}\}-\frac{2^{2/3}}{\nu}\mathrm{Bi}'\,(-2^{1/3}z)\sum_{k=0}^{\infty}\frac{g_k(z)}{\nu^{2k/3}}$$

where

9.3.25

$$f_1(z)=-\frac{1}{5}z$$

$$f_2(z)=-\frac{9}{100}z^5+\frac{3}{35}z^2$$

$$f_3(z)=\frac{957}{7000}z^6-\frac{173}{3150}z^3-\frac{1}{225}$$

$$f_4(z)=\frac{27}{20000}z^{10}-\frac{23573}{147000}z^7+\frac{5903}{138600}z^4+\frac{947}{346500}z$$

9.3.26

$$g_0(z)=\frac{3}{10}z^2$$

$$g_1(z)=-\frac{17}{70}z^3+\frac{1}{70}$$

$$g_2(z)=-\frac{9}{1000}z^7+\frac{611}{3150}z^4-\frac{37}{3150}z$$

$$g_3(z)=\frac{549}{28000}z^8-\frac{110767}{693000}z^5+\frac{79}{12375}z^2$$

The corresponding expansions for $H^{(1)}_\nu(\nu+z\nu^{1/3})$ and $H^{(2)}_\nu(\nu+z\nu^{1/3})$ are obtained by use of **9.1.3** and **9.1.4**; they are valid for $-\frac{1}{2}\pi<\arg\nu<\frac{3}{2}\pi$ and $-\frac{3}{2}\pi<\arg\nu<\frac{1}{2}\pi$, respectively.

9.3.27

$$J'_\nu(\nu+z\nu^{1/3})\sim-\frac{2^{2/3}}{\nu^{2/3}}\mathrm{Ai}'\,(-2^{1/3}z)\{1+\sum_{k=1}^{\infty}\frac{h_k(z)}{\nu^{2k/3}}\}+\frac{2^{1/3}}{\nu^{4/3}}\mathrm{Ai}\,(-2^{1/3}z)\sum_{k=0}^{\infty}\frac{l_k(z)}{\nu^{2k/3}}$$

9.3.28

$$Y'_\nu(\nu+z\nu^{1/3})\sim\frac{2^{2/3}}{\nu^{2/3}}\mathrm{Bi}'\,(-2^{1/3}z)\{1+\sum_{k=1}^{\infty}\frac{h_k(z)}{\nu^{2k/3}}\}-\frac{2^{1/3}}{\nu^{4/3}}\mathrm{Bi}\,(-2^{1/3}z)\sum_{k=0}^{\infty}\frac{l_k(z)}{\nu^{2k/3}}$$

where

9.3.29

$$h_1(z)=-\frac{4}{5}z$$

$$h_2(z)=-\frac{9}{100}z^5+\frac{57}{70}z^2$$

$$h_3(z)=\frac{699}{3500}z^6-\frac{2617}{3150}z^3+\frac{23}{3150}$$

$$h_4(z)=\frac{27}{20000}z^{10}-\frac{46631}{147000}z^7+\frac{3889}{4620}z^4-\frac{1159}{115500}z$$

9.3.30

$$l_0(z)=\frac{3}{5}z^3-\frac{1}{5}$$

$$l_1(z)=-\frac{131}{140}z^4+\frac{1}{5}z$$

$$l_2(z)=-\frac{9}{500}z^8+\frac{5437}{4500}z^5-\frac{593}{3150}z^2$$

$$l_3(z)=\frac{369}{7000}z^9-\frac{999443}{693000}z^6+\frac{31727}{173250}z^3+\frac{947}{346500}$$