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33. $y''_{xx} - (a - 2q \cosh 2x)y = 0.$

Modified Mathieu equation. The substitution $x = i\xi$ leads to the [Mathieu equation 2.34](#) :

$$y''_{\xi\xi} + (a - 2q \cos 2\xi)y = 0.$$

For eigenvalues $a = a_n(q)$ and $a = b_n(q)$, the corresponding solutions of the modified Mathieu equation are:

$$\begin{aligned} \text{Ce}_{2n+p}(x, q) &= \text{ce}_{2n+p}(ix, q) = \sum_{k=0}^{\infty} A_{2k+p}^{2n+p} \cosh[(2k+p)x], \\ \text{Se}_{2n+p}(x, q) &= -i \text{se}_{2n+p}(ix, q) = \sum_{k=0}^{\infty} B_{2k+p}^{2n+p} \sinh[(2k+p)x], \end{aligned}$$

where p can be either 0 or 1, and the coefficients A_{2k+p}^{2n+p} and B_{2k+p}^{2n+p} are specified in 2.34.

References

- McLachlan, N. W.**, *Theory and Application of Mathieu Functions*, Clarendon Press, Oxford, 1947.
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