

Errata for *Tables of Integrals, Series, and Products* (8th edition)

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NOTES

- The home page for this book is <http://www.mathtable.com/gr>
- The latest errata are available from <http://www.mathtable.com/errata/>
- The current errata is at https://www.mathtable.com/errata/gr8_errata.pdf
- The lead editor can be reached at ZwillingerBooks@gmail.com
- This edition of the errata includes the large number of corrections in the paper: Dirk Veestraeten, *Some remarks, generalizations and misprints in the integrals in Gradshteyn and Ryzhik*, SCIENTIA, Series A: Mathematical Sciences, Vol. 26 (2015), pages 115–131. A special thanks is extended to him for all his efforts.
- This document contains 18 pages of new material (starting below). After the new materials are corrections to the 8th edition. Many of the corrections are relatively minor (e.g., changing parameter bounds) and do not change the structural form of an evaluation.
- The updates since the last set of errata posted to the web (on May 2024) are shown with the date in the margin, as this line has.
- We use the following nomenclature
 - C = Euler's constant
 - G = Catalan's constant

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NEW MATERIAL (TO BE ADDED TO THE 9th EDITION)

1. On page xxxviii add the following entry before “Weber function”

$$E_p(z) \quad \text{Exponential Integral} \quad 8.27$$

2. On page 220 add the following integral

$$2.641.13 \quad \int \frac{x^2 \cos(xb)}{a^2 + x^2} e^{-cx^2} dx \\ = \frac{\sqrt{\pi}}{2\sqrt{c}} e^{-b^2/(4c)} + \frac{a\pi}{4} e^{a^2c} \left\{ -e^{-ab} - e^{ab} + \operatorname{erf}\left(\frac{2ac-b}{2\sqrt{c}}\right) + e^{ab} \operatorname{erf}\left(\frac{2ac+b}{2\sqrt{c}}\right) \right\}_{\text{DO}}$$

3. On page 247, add section 2.9 Other Elementary Functions

4. On page 247, add section 2.91 Minimum & Maximum

$$2.91.1 \quad \int \cdots \int_{[a,b]^n} f(\min x_i, \max x_i) d\mathbf{x} = n(n-1) \int_a^b dv \int_a^v f(u, v) (v-u)^{n-2} du \quad \text{MAR2007}$$

$$2.91.2 \quad \int \cdots \int_{[a,b]^n} f(\mathbf{x}, \min x_i, \max x_i) d\mathbf{x} \\ = \sum_{\substack{j,k=1 \\ j \neq k}}^n \int_a^b dv \int_a^v du \int \cdots \int_{[u,v]^{n-2}} f(\mathbf{x}, u, v \mid x_j = u, x_k = v) \prod_{i \in [n] \setminus \{j,k\}} dx_i \quad \text{MAR2007}$$

5. Add section 2.92 Floor Function

The floor of a number is the largest integer that is less than or equal to the number. For example $\lfloor 2.345 \rfloor = 2$ and $\lfloor 5 \rfloor = 5$.

$$2.92.1 \quad \underbrace{\int_0^1 \cdots \int_0^1}_n f(\lfloor x_1 + \cdots + x_n \rfloor) dx_1 \cdots dx_n = \sum_{k=0}^n \left\langle \begin{matrix} n \\ k \end{matrix} \right\rangle \frac{f(k)}{n!} \quad \text{GR1994, \#6.65, p 316, 557}$$

where the $\left\langle \begin{matrix} n \\ k \end{matrix} \right\rangle$ are Eulerian numbers

6. Add section 2.93 Fractional Part of Numbers

The fractional part of a number is $\{x\} = x - \lfloor x \rfloor$. For example $\{2.345\} = 0.345$ and $\{5\} = 0$.

7. Add section 2.931 Fractional Part and Polynomials

$$2.931.1 \quad \int_a^{a+n} \{x\} dx = \frac{n}{2} \quad [a > 0, \quad n = 1, 2, 3, \dots] \quad \text{FUR2013, 2.42}$$

$$2.931.2 \quad \int_0^1 \{kx\} dx = \frac{1}{2} \quad [k = 1, 2, 3, \dots] \quad \text{FUR2013, 2.28}$$

$$2.931.3 \quad \int_0^1 \{nx\}^k dx = \frac{1}{k+1} \quad [k > -1, \quad n = 1, 2, 3, \dots] \quad \text{FUR2013, 2.44}$$

- 2.931.4 $\int_0^1 (x - x^2)^k \{nx\} \, dx = \frac{(k!)^2}{2(2k+1)!} \quad [k = 0, 1, 2, \dots, \quad n = 1, 2, 3, \dots]$
FUR2013, 2.48
- 2.931.5 $\int_1^\infty \frac{\{x\}}{x^2} \, dx = 1 - \mathbf{C}$
WOFP
- 2.931.6 $\int_1^\infty \frac{\{x\}}{x^{k+1}} \, dx = \frac{1}{k-1} - \frac{\zeta(k)}{k} \quad [k = 2, 3, 4, \dots]$
FUR2013, 2.9
- 2.93.7 $\int_1^\infty \frac{\{x\} - \frac{1}{2}}{x} \, dx = -1 + \ln(\sqrt{2\pi})$
- 2.931.8 $\int_0^1 (\{ax\} - \frac{1}{2})(\{bx\} - \frac{1}{2}) \, dx = \frac{1}{12ab} \quad [\operatorname{Re} a > 0, \quad \operatorname{Re} b > 0]$
OLD
- 2.931.9 $\int_0^1 \left\{ \frac{1}{x} \right\} \, dx = 1 - \mathbf{C}$
WOFP
- 2.931.10 $\int_0^1 \left\{ \frac{q}{x} \right\} \, dx = \begin{cases} q(1 - \mathbf{C} - \ln q) & [0 < q \leq 1] \\ q \left(1 + \frac{1}{2} + \dots + \frac{1}{1+[q]} - \mathbf{C} - \ln q + \frac{[q](\{q\}-1)}{q(1+[q])} \right) & [q > 1] \end{cases}$
FUR2013, 2.5b
- 2.931.11 $\int_0^1 x^m \left\{ \frac{1}{x} \right\} \, dx = \frac{1}{m} - \frac{\zeta(m+1)}{m+1} \quad [m > 0]$
FUR2013, 2.20
- 2.931.12 $\int_0^1 \frac{x}{1-x} \left\{ \frac{1}{x} \right\} \, dx = \mathbf{C}$
FUR2013, 2.15
- 2.931.13 $\int_0^1 \left\{ \frac{1}{x} \right\}^2 \, dx = \ln(2\pi) - 1 - \mathbf{C}$
QIN2011
- 2.931.14 $\int_0^1 \left\{ \frac{k}{x} \right\}^2 \, dx = k \left(\ln(2\pi) - \mathbf{C} + 1 + \frac{1}{2} + \dots + \frac{1}{k} + 2k \ln k - 2k - 2 \ln k! \right)$
[k = 1, 2, 3, ...] FUR2013, 2.6
- 2.931.15 $\int_0^1 \left\{ \frac{1}{x} \right\} \left\{ \frac{1}{1-x} \right\} \, dx = 2\mathbf{C} - 1$
QIN2011
- 2.931.16 $\int_0^{1/2} \left\{ \frac{1}{x} \right\} \left\{ \frac{1}{1-x} \right\} \, dx = \int_{1/2}^1 \left\{ \frac{1}{x} \right\} \left\{ \frac{1}{1-x} \right\} \, dx = \mathbf{C} - \frac{1}{2}$
FUR2013, 2.10
- 2.931.17 $\int_0^1 \left\{ \frac{1}{x} \right\}^2 \left\{ \frac{1}{1-x} \right\} \, dx = \frac{5}{2} - \mathbf{C} - \ln(2\pi)$
FUR2013, 2.12
- 2.931.18 $\int_0^1 \left\{ \frac{1}{x} \right\}^2 \left\{ \frac{1}{1-x} \right\}^2 \, dx = 4 \ln(2\pi) - 4\mathbf{C} - 5$
QIN2011
- 2.931.19 $\int_0^1 \left\{ \frac{1}{x} \right\}^3 \left\{ \frac{1}{1-x} \right\}^3 \, dx = 6\mathbf{C} + 2 - \zeta(2) - 3 \ln(2\pi) - \frac{18\zeta'(2)}{\pi^2}$
QIN2011
- 2.931.20 $\int_0^1 x^m \left\{ \frac{1}{x} \right\}^m \, dx = 1 - \frac{\zeta(2) + \zeta(3) + \dots + \zeta(m+1)}{m+1}$
[m = 1, 2, 3, ...] FUR2013, 2.21

2.932 Fractional Part and Roots

$$2.932.1 \int_0^1 \left\{ \frac{1}{\sqrt[k]{x}} \right\} dx = \frac{k}{k-1} - \zeta(k) \quad [k = 2, 3, 4, \dots] \quad \text{FUR2013, 2.7}$$

$$2.932.2 \int_0^1 \left\{ \frac{k}{\sqrt[k]{x}} \right\} dx = \frac{k}{k-1} - k^k \left(\zeta(k) - \frac{1}{1^k} - \frac{1}{2^k} \cdots - \frac{1}{k^k} \right) \quad [k = 2, 3, 4, \dots] \quad \text{FUR2013, 2.8}$$

$$2.932.3 \int_0^1 \left\{ \frac{1}{k\sqrt[k]{x}} \right\} dx = \frac{1}{k-1} - \frac{\zeta(k)}{k^k} \quad [k = 2, 3, 4, \dots] \quad \text{FUR2013, 2.9}$$

2.933 Fractional Part and other functions

$$2.933.1 \int_0^1 \left\{ (-1)^{\lfloor \frac{1}{x} \rfloor} \frac{1}{x} \right\} dx = 1 + \ln \frac{2}{\pi} \quad \text{FUR2013, 2.13}$$

$$2.933.2 \int_0^1 x \left\{ \frac{1}{x} \right\} \left\lfloor \frac{1}{x} \right\rfloor dx = \frac{\pi^2}{12} - \frac{1}{2} \quad \text{FUR2013, 2.14a}$$

$$2.933.3 \int_0^1 \{\ln x\} x^m dx = \frac{e^{m+1}}{(m+1)(e^{m+1}-1)} - \frac{1}{(m+1)^2} \quad [m > -1] \quad \text{FUR2013, 2.16}$$

2.934 Fractional Part and Multiple integrals

$$2.934.1 \int_0^1 \int_0^1 \left\{ k \frac{x}{y} \right\} dx dy = \frac{k}{2} \left(1 + \frac{1}{2} + \cdots + \frac{1}{k} - \ln k - \mathbf{C} \right) + \frac{1}{4} \quad [k = 1, 2, 3, \dots] \quad \text{FUR2013, 2.28}$$

$$2.934.2 \int_0^1 \int_0^1 \left\{ \frac{mx}{ny} \right\} dx dy = \frac{m}{2n} \left(\ln \frac{n}{m} + \frac{3}{2} - \mathbf{C} \right) \quad [m \text{ and } n \text{ are integers with } m \leq n] \quad \text{FUR2013, 2.29}$$

$$2.934.3 \int_0^1 \int_0^1 \left\{ \frac{x^k}{y} \right\} dx dy = \frac{2k+1}{(k+1)^2} - \frac{\mathbf{C}}{k+1} \quad [k \geq 0] \quad \text{FUR2013, 2.30}$$

$$2.934.4 \int_0^1 \int_0^1 \left\{ \frac{x}{y} \right\} \left(\frac{y}{x} \right)^k dx dy = 1 - \frac{\zeta(2) + \zeta(3) + \cdots + \zeta(k+1)}{2(k+1)} \quad [k = 1, 2, 3, \dots] \quad \text{FUR2013, 2.33}$$

$$2.934.5 \int_0^1 \int_0^1 \left\{ \frac{x}{y} \right\} \frac{y^k}{x^p} dx dy = \frac{1}{k-p+1} - \frac{\zeta(2) + \zeta(3) + \cdots + \zeta(k+1)}{(k+2-p)(k+1)} \quad [k \text{ is an integer, } p \text{ is real, } k-p > -1] \quad \text{FUR2013, 2.34}$$

$$2.934.6 \int_0^1 \int_0^1 \left\{ \frac{x}{y} \right\} \left\{ \frac{y}{x} \right\} dx dy = 1 - \frac{\pi^2}{12} \quad \text{FUR2013, 2.36}$$

$$2.934.7 \int_0^1 \int_0^1 \left\{ \frac{x}{y} \right\}^2 dx dy = \frac{\ln(2\pi)}{2} - \frac{1}{3} - \frac{\mathbf{C}}{2} \quad \text{FUR2013, 2.31}$$

$$2.934.8 \int_0^1 \int_0^1 x^m y^n \left\{ \frac{x}{y} \right\} \left\{ \frac{y}{x} \right\} dx dy = \frac{1}{m+n+1} \left(\frac{1}{n+1} + \frac{1}{m+1} - \frac{\zeta(n+2)}{n+2} - \frac{\zeta(m+2)}{m+2} \right) \quad [m > -1, n > -1] \quad \text{FUR2013, 2.37}$$

$$2.934.9 \int_0^1 \int_0^1 (xy)^n \left\{ \frac{x}{y} \right\} \left\{ \frac{y}{x} \right\} dx dy = \frac{1}{(n+1)^2} - \frac{\zeta(n+1)}{(n+1)(n+2)} \quad [n > -1] \quad \text{FUR2013, 2.38}$$

- 2.934.10 $\int_0^1 \int_0^1 \left\{ \frac{x}{y} \right\}^m \left\{ \frac{y}{x} \right\}^m dx dy = 1 - \frac{\zeta(2) + \zeta(3) + \cdots + \zeta(m+1)}{m+1}$
 $[m = 1, 2, 3, \dots]$ FUR2013, 2.40
- 2.934.11 $\int_0^1 \int_0^1 \left\{ \frac{2x}{y} \right\} \left\{ \frac{2y}{x} \right\} dx dy = \frac{49}{6} - \frac{2\pi^2}{3} - 2 \ln 2$ FUR2013, 2.39
- 2.934.12 $\int_0^1 \int_0^1 \left\{ \frac{x-y}{x+y} \right\} dx dy = \int_0^1 \int_0^1 \left\{ \frac{x+y}{x-y} \right\} dx dy = \frac{1}{2}$ FUR2013, 2.51
- 2.934.13 $\int_0^1 \int_0^1 \left\{ \frac{k}{x-y} \right\} \left\{ \frac{1}{x} \right\} \left\{ \frac{1}{y} \right\} dx dy = \frac{1}{2}(1 - \mathbf{C})^2$ $[k > 0]$ FUR2013, 2.52
- 2.934.14 $\int_0^1 \int_0^1 x \left\{ \frac{1}{1-xy} \right\} dx dy = 1 - \frac{\zeta(2)}{2} = 1 - \frac{\pi^2}{12}$ FUR2013, 2.23
- 2.934.15 $\int_0^1 \int_0^1 \left\{ \frac{1}{x+y} \right\}^m dx dy = \begin{cases} 2 \ln 2 - \frac{\pi^2}{12} & m = 1 \\ \frac{5}{2} - \ln 2 - \mathbf{C} - \frac{\pi^2}{12} & m = 2 \end{cases}$ FUR2013, 2.24
- 2.934.16 $\iint_{0 \leq x, y \leq 1} \left\{ \frac{1}{x+y} \right\}^m dx dy = \begin{cases} 2 \ln 2 - \frac{\pi^2}{12} & m = 1 \\ \frac{3}{2} - \frac{\pi^2}{12} - \ln 2 - \mathbf{C} & m = 2 \end{cases}$ QIN2011, 3.1
- 2.934.17 $\int \int \int_{0 \leq x, y, z \leq 1} \left\{ \frac{1}{x+y+z} \right\}^m dx dy dz = \begin{cases} \frac{9}{2} \ln 3 - \frac{13}{24} - \frac{19}{4} \ln 2 - \frac{\zeta(3)}{3} & m = 1 \\ \frac{53}{24} + 4 \ln 2 - 3 \ln 3 - \frac{\zeta(3)}{3} - \frac{\pi^2}{12} & m = 2 \end{cases}$
QIN2011, 3.2
- 2.934.18 $\int_0^{a_1} \cdots \int_0^{a_n} \{k(x_1 + x_2 + \cdots + x_n)\} dx_n \cdots dx_1 = \frac{1}{2} a_1 a_2 \cdots a_n$ FUR2013, 2.42b

8. On page 349 add the following integral 3.381.12

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$$\int_{-\infty}^{\infty} x^n e^{-ax^2} dx = \begin{cases} 0 & \text{if } n = 1, 3, 5, \dots \\ \frac{1}{(2a)^{n/2}} \frac{(n+1)!!}{n+1} \sqrt{\frac{\pi}{a}} & \text{if } n = 0, 2, 4, \dots \end{cases} \quad \operatorname{Re}[a] > 0$$

(Thanks to Andreas Haselbacher for suggesting this integral.)

9. On page 358 add the following integral

$$3.415.8 \int_0^{\infty} \frac{x dx}{(x^2 + b^2)^4 (e^{2\pi x} - 1)} = -\frac{1}{12b^6} - \frac{5}{64b^7} + \frac{1}{32b^5} \psi'(b) - \frac{1}{32b^4} \psi''(b) + \frac{1}{96b^3} \psi'''(b)$$

$[\operatorname{Re} b > 0]$

(Thanks to Richard J. Mathar for suggesting this integral.)

10. On page 572 add the following integral

$$4.318.3 \int_0^1 \frac{\ln[(1+x^a)(1+x^{1/a})]}{1+x} dx = (\ln 2)^2 \quad [a > 0]$$

11. On page 574 add the following integrals

$$4.325.13 \int_0^1 \frac{\ln(\ln x)}{1+x^2} dx = \frac{\pi}{4} \left(i\pi + \ln \left(\frac{4\pi^3}{\Gamma^4\left(\frac{1}{4}\right)} \right) \right)$$

(Thanks to Robert Reynolds for suggesting the inclusion of this evaluation.)

$$4.325.14 \int_0^\infty \frac{\ln(\ln x)}{1+x^2} dx = \frac{\pi}{4} \left(i\pi + 8 \ln \Gamma\left(\frac{3}{4}\right) - 2 \ln \pi \right) \quad \text{REY1 (13)}$$

(Thanks to Robert Reynolds for suggesting the inclusion of this evaluation.
And thanks to Richard J. Mathar for simplifying the evaluation.)

12. On page 583 add the following integrals

$$4.374.3 \int_0^\infty \ln(1+x^2) \ln\left(\tanh\left(\frac{\pi x}{4}\right)\right) dx = \pi - 4\mathbf{G} \quad \text{REY3 (18)}$$

Here, $\mathbf{G}$ is Catalan's constant.

$$4.374.4 \int_0^\infty \frac{\ln\left(\tanh\frac{ax}{2}\right)}{b^2+x^2} dx = \frac{\pi}{2b} \ln\left(\frac{ab}{2\pi} \frac{\Gamma\left(\frac{\pi+ab}{2\pi}\right)}{\Gamma\left(\frac{2\pi+ab}{2\pi}\right)}\right) \quad [\operatorname{Re} a > 0, \operatorname{Re} b > 0] \quad \text{REY3 (19)}$$

$$4.374.5 \int_0^\infty \frac{1-3x^2}{(1+x^2)^3} \ln\left(\tanh\frac{\pi x}{4}\right) dx = \frac{\pi}{4}(1-2\mathbf{G}) \quad \text{REY3 (20)}$$

Here, $\mathbf{G}$ is Catalan's constant.

(Thanks to Robert Reynolds for suggesting the inclusion of these evaluations.)

13. On page 608 add the following integral

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$$4.552.1 \int_0^\infty \frac{\arctan \frac{x}{q}}{e^{2\pi x} + 1} dx = \frac{1}{4} \left[2q(\ln(4q) - 1) - \ln 2 \right] + \frac{1}{2} \ln \frac{\Gamma(q)}{\Gamma(2q)} \quad [q > 0] \quad \text{CHE TH1.1}$$

(Thanks to Christophe Chesneau for suggesting the inclusion of this integral.)

14. On page 611 add the new section 4.595 with the following integrals

$$4.595.1 \int_0^\infty \frac{\arctan(x)}{x \ln^2(-x)} dx = -i \frac{4-\pi}{2} \quad \text{REY2 (11)}$$

$$4.595.2 \int_0^\infty \frac{\arctan(x)}{x \ln^3(-x)} dx = 2 \frac{\mathbf{G}-1}{\pi} \quad \text{REY2 Table}$$

Here, $\mathbf{G}$ is Catalan's constant.

$$4.595.3 \int_0^\infty \frac{\arctan(x)}{x \ln^2(ix)} dx = -i \ln 2 \quad \text{REY2 (15)}$$

$$4.595.4 \int_0^\infty \frac{\arctan(x)}{x \ln^3(ix)} dx = -\frac{\pi}{24} \quad \text{REY2 Table}$$

(Thanks to Robert Reynolds for suggesting the inclusion of these evaluations.)

15. On page 615 add the following integral

$$4.620.8 \int_{-\infty}^\infty \int_{-\infty}^\infty \frac{dx dy}{\sqrt{(x^2+y^2+a^2)^3} [(x-u)^2 + (y-v)^2 + b^2]} = \frac{2\pi}{a\sqrt{(a+b)^2 + u^2 + v^2}} \quad [a > 0, b > 0, u > 0, v > 0] \quad \text{AMM12247}$$

(Thanks to Mo Li suggesting the inclusion of this integral.)

16. On page 615 add the following integral

$$4.620.8 \quad \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \frac{dx dy}{\sqrt{(x^2 + y^2 + a^2)^3 [(x-u)^2 + (y-v)^2 + b^2]}} = \frac{2\pi}{a\sqrt{(a+b)^2 + u^2 + v^2}} \quad \text{AMM12247}$$

$[a > 0, \quad b > 0, \quad u > 0, \quad v > 0]$

(Thanks to Mo Li suggesting the inclusion of this integral.)

17. On page 617 add the following integral

$$4.626.16 \quad \int_0^1 \int_0^1 [-\ln(1-st)]^n dt ds = (n+1)! - n! \sum_{j=2}^{n+1} \zeta(j) \quad \text{BUS}$$

for $n = 0, 1, 2, \dots$ where $\zeta(\cdot)$ is the Riemann zeta function.

18. On page 617, just before 6.631 add the following text:

See also: 2.91.1, 2.91.2, 2.92.1, 2.96.18

19. On page 622, add section 4.65 Quadruple and Higher Dimension Integrals

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(Thanks to Mo Li suggesting the inclusion of 4.65.1)

(Thanks to Robert Reynolds for suggesting the inclusion of 4.65.2-5)

4.65.1

$$\iiint_{\substack{x+y+z=1 \\ x \geq 0 \\ y \geq 0 \\ z \geq 0}} dS \quad \iiint_{\substack{\xi+\eta+\zeta=1 \\ \xi \geq 0 \\ \eta \geq 0 \\ \zeta \geq 0}} \frac{d\Sigma}{\sqrt{(x-\xi)^2 + (y-\eta)^2 + (z-\zeta)^2}} = \frac{3 \ln 3}{\sqrt{2}}$$

4.65.2

$$\begin{aligned} & \int_0^\infty \int_0^\infty \int_0^\infty \int_0^\infty (t+z)^{-m} (x+y)^{m-1} e^{-p(x+z)-q(t+y)} \ln^k \left(\frac{a(x+y)}{t+z} \right) dx dy dz dt \\ &= \frac{1}{(p-q)^2} (2\pi i)^{k+1} e^{im\pi} p^{-m-1} q^{-m-1} \left(-p^m q^m \Phi(e^{2m\pi i}, -k, \frac{\pi - i \ln a}{2\pi}) \right. \\ & \quad + qp^{2m} \Phi(e^{2m\pi i}, -k, \frac{\pi - i \ln a - i \ln p + i \ln q}{2\pi}) \\ & \quad \left. + qp^{2m} \Phi(e^{2m\pi i}, -k, \frac{\pi - i \ln a + i \ln p - i \ln q}{2\pi}) \right) \end{aligned}$$

REY4 (14)

4.65.3

$$\begin{aligned} & \int_0^\infty \int_0^\infty \int_0^\infty \int_0^\infty \frac{e^{-p(x+z)-q(t+y)} \ln^k \left(\frac{a(x+y)}{t+z} \right)}{\sqrt{t+z} \sqrt{x+y}} dx dy dz dt \\ &= \frac{1}{pq(p-q)^2} i^k 2^{2k+1} \pi^{k+1} \left((p+q) \zeta(-k, \frac{\pi - i \ln a}{4\pi}) - (p+q) \zeta(-k, \frac{3\pi - i \ln a}{4\pi}) \right. \\ & \quad + \sqrt{p} \sqrt{q} \left[-\zeta(-k, \frac{-i \ln a + i \ln p - i \ln q + \pi}{4\pi}) + \zeta(-k, \frac{-i \ln a + i \ln p - i \ln q + 3\pi}{4\pi}) \right. \\ & \quad \left. \left. - \zeta(-k, \frac{-i \ln a - i \ln p + i \ln q + \pi}{4\pi}) + \zeta(-k, \frac{-i \ln a - i \ln p + i \ln q + 3\pi}{4\pi}) \right] \right) \end{aligned}$$

REY4 (15)

4.65.4

$$\int_0^\infty \int_0^\infty \int_0^\infty \int_0^\infty (t+z)^{-m} (x+y)^{m-1} e^{-p(x+z)-q(t+y)} dx dy dz dt$$

$$= -\frac{\pi p^{-m-1} q^{-m-1} \csc(m\pi) (p^m - q^m) (qp^m - pq^m)}{(p-q)^2}$$

REY4 (16)

4.65.5

$$\int_0^\infty \int_0^\infty \int_0^\infty \int_0^\infty \frac{(t-x-y+z)}{\sqrt{t+z}(x+y)^{3/2}} e^{-p(x+z)-q(t+y)} \ln^k \left(\frac{x+y}{t+z} \right) dx dy dz dt$$

$$= \frac{1}{p^{3/2} q^{3/2} (p-q)^2} i^k 2^{2k+1} \pi^{k+1} (p+q) \left(-2\sqrt{p}\sqrt{q}\zeta\left(-k, \frac{1}{4}\right) + 2\sqrt{p}\sqrt{q}\zeta\left(-k, \frac{3}{4}\right) \right.$$

$$+ p\zeta\left(-k, \frac{i \ln p - i \ln q + \pi}{4\pi}\right) - p\zeta\left(-k, \frac{i \ln p - i \ln q + 3\pi}{4\pi}\right)$$

$$\left. + q\zeta\left(-k, \frac{-i \ln p + i \ln q + \pi}{4\pi}\right) - q\zeta\left(-k, \frac{-i \ln p + i \ln q + 3\pi}{4\pi}\right) \right)$$

REY4 (18)

20. On page 622 add the new section 4.67 Multiple integrals of exponentials of linear functions

Notation: $k = |\mathbf{k}|$, $r = |\mathbf{r}|$, $\hat{\mathbf{k}} = \frac{\mathbf{k}}{|\mathbf{k}|}$, $\hat{\mathbf{r}} = \frac{\mathbf{r}}{|\mathbf{r}|}$, and $\int d^n k = \int_{\mathbb{R}^n} d\mathbf{k} = \underbrace{\int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty}}_n dk_1 \cdots dk_n$.

$$4.65.1 \int \frac{d^n k}{(2\pi)^n} e^{i\mathbf{k} \cdot (\mathbf{x} - \mathbf{y})} = \delta^n(\mathbf{x} - \mathbf{y}) \quad \text{WIKIQ}$$

$$4.65.2 \int \frac{d^3 k}{(2\pi)^3} \frac{\exp(i\mathbf{k} \cdot \mathbf{r})}{k^2} = \frac{1}{4\pi r} \quad \text{WIKIQ}$$

$$4.65.3 \int \frac{d^3 k}{(2\pi)^3} \frac{\exp(i\mathbf{k} \cdot \mathbf{r})}{k^2 + m^2} = \frac{e^{-mr}}{4\pi r} \quad \text{WIKIQ}$$

$$4.65.4 \int \frac{d^3 k}{(2\pi)^3} \left(\hat{\mathbf{k}} \cdot \hat{\mathbf{r}} \right)^2 \frac{\exp(i\mathbf{k} \cdot \mathbf{r})}{k^2 + m^2} = \frac{e^{-mr}}{4\pi r} \left[1 + \frac{2}{mr} - \frac{2}{(mr)^2} (e^{mr} - 1) \right] \quad \text{WIKIQ}$$

$$4.65.5 \int \frac{d^3 k}{(2\pi)^3} \left[\hat{\mathbf{k}} \hat{\mathbf{k}} \right] \frac{\exp(i\mathbf{k} \cdot \mathbf{r})}{k^2 + m^2} = \frac{1}{2} \frac{e^{-mr}}{4\pi r} \left((\mathbf{1} - \hat{\mathbf{r}} \hat{\mathbf{r}}) + \left[1 + \frac{2}{mr} - \frac{2}{(mr)^2} (e^{mr} - 1) \right] (\mathbf{1} + \hat{\mathbf{r}} \hat{\mathbf{r}}) \right) \quad \text{WIKIQ}$$

$$4.65.6 \int \frac{d^3 k}{(2\pi)^3} \left[\mathbf{1} - \hat{\mathbf{k}} \hat{\mathbf{k}} \right] \frac{\exp(i\mathbf{k} \cdot \mathbf{r})}{k^2 + m^2} = \frac{1}{2} \frac{e^{-mr}}{4\pi r} \left[-\frac{2}{mr} + \frac{2}{(mr)^2} (e^{mr} - 1) \right] (\mathbf{1} + \hat{\mathbf{r}} \hat{\mathbf{r}}) \quad \text{WIKIQ}$$

$$4.65.7 \int_{\mathbb{R}^n} e^{i\mathbf{x} \cdot \mathbf{r}} \frac{\sin \left[t \sqrt{r^2 + m^2} \right]}{\sqrt{r^2 + m^2}} d\mathbf{r} \quad \text{GLAS}$$

$$= \pi^{(n+1)/2} \left(\frac{m}{2} \right)^{(n-1)/2} (t^2 - k^2)^{(1-n)/4} J_{(1-n)/2} \left(m \sqrt{t^2 - k^2} \right) H(t - k)$$

where $r = |\mathbf{r}|$, $k = |\mathbf{x}|$, H is the unit step function, and $0 < n < 3$.

21. On page 622 add the new section 4.68 Multiple integrals of exponentials of powers

$$\text{Notation: } \int d^n x = \int_{\mathbb{R}^n} d\mathbf{x} = \underbrace{\int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty}}_n dx_1 \cdots dx_n.$$

$$4.66.1 \int_{\mathbb{R}^n} \exp\left(-\frac{1}{2}\mathbf{x}^T A \mathbf{x} + \mathbf{b}^T \mathbf{x}\right) d\mathbf{x} = \sqrt{\frac{(2\pi)^n}{\det A}} \exp\left(\frac{1}{2}\mathbf{b}^T A^{-1} \mathbf{b}\right) \quad \text{WIKIQ}$$

$$4.66.2 \int_{\mathbb{R}^n} \exp\left(-\frac{1}{2}\mathbf{x}^T A \mathbf{x} + i\mathbf{b}^T \mathbf{x}\right) d\mathbf{x} = \sqrt{\frac{(2\pi)^n}{\det A}} \exp\left(-\frac{1}{2}\mathbf{b}^T A^{-1} \mathbf{b}\right) \quad \text{WIKIQ}$$

$$4.66.3 \int_{\mathbb{R}^n} \exp\left(-\frac{i}{2}\mathbf{x}^T A \mathbf{x} + i\mathbf{b}^T \mathbf{x}\right) d\mathbf{x} = \sqrt{\frac{(2\pi i)^n}{\det A}} \exp\left(-\frac{i}{2}\mathbf{b}^T A^{-1} \mathbf{b}\right) \quad \text{WIKIQ}$$

22. On page 622 add the new section 4.70 Multiple integrals and the Omega Calculus

In the Omega calculus, the Omega operator is defined by $\stackrel{\lambda}{\Omega} \sum_{\alpha_1=-\infty}^{\infty} \cdots \sum_{\alpha_n=-\infty}^{\infty} A_{\alpha} \lambda^{\alpha} = A_0$ when

$A_{\alpha} \in \mathbb{C}^{n \times n}$ for $\alpha \in \mathbb{Z}^n$ and $\lambda^{\alpha} = \lambda_1^{\alpha_1} \cdots \lambda_n^{\alpha_n}$,

$$4.70.1 \int_0^t \int_0^{s_1} \cdots \int_0^{s_{k-2}} e^{(t-s_1)A_{1,1}} A_{1,2} e^{(s_1-s_2)A_{2,2}} A_{2,3} e^{(s_2-s_3)A_{3,3}} A_{3,4} \cdots \\ e^{(s_{k-2}-s_{k-1})A_{k-1,k-1}} A_{k-1,k} e^{s_{k-1}A_{k,k}} ds_1 \cdots ds_{k-1} \quad \text{NETO}$$

$$= \stackrel{\mu}{\Omega} e^{\mu t} B_{1,1} \frac{A_{1,2}}{\mu} B_{2,2} \frac{A_{2,3}}{\mu} B_{3,3} \cdots B_{k-1,k-1} \frac{A_{k-1,k}}{\mu} B_{k,k}$$

where A_{ij} are matrices, $B_{i,i} = \left(I - \frac{A_{i,i}}{\mu}\right)^{-1}$, and $\stackrel{\lambda}{\Omega}$ is the Omega operator.

$$4.70.2 \int_0^t e^{sA} B ds = \stackrel{\mu}{\Omega} e^{\mu t} \left(I - \frac{A}{\mu}\right)^{-1} \frac{B}{\mu} \quad \text{where } A \text{ and } B \text{ are matrices} \quad \text{NETO}$$

23. On page 632 add the new section 5.24 Generalized Exponential Integral

24. On page 632 add the new section 5.24.1 General Index

Add the following integrals

$$5.24.1.1 \int_z^{\infty} E_{p-1}(t) dt = E_p(z) \quad [|\arg z| < \pi] \quad \text{DLMF 8.19.23}$$

$$5.24.1.2 \int_0^{\infty} e^{-ax} E_n(x) dx = \frac{(-1)^{n-1}}{a^n} \left(\ln(1+a) + \sum_{k=1}^{n-1} \frac{(-1)^k a^k}{k} \right) \\ [n = 1, 2, \dots, \quad \text{Re } a > -1] \quad \text{DLMF 8.19.24}$$

$$5.24.1.3 \int_0^{\infty} e^{-ax} x^{b-1} E_p(x) dx = \frac{\Gamma(b)(1+a)^{-b}}{p+b-1} F\left(1, b; p+b; \frac{a}{1+a}\right) \\ [\text{Re } a > -1, \quad \text{Re}(p+b) > 1] \quad \text{DLMF 8.19.25}$$

$$5.24.1.4 \int_0^{\infty} E_p(x) E_q(x) dx = \frac{L(p) + L(q)}{p+q-1} \quad [p > 0, \quad q > 0, \quad p+q > 1] \\ \text{where } L(p) = \int_0^{\infty} e^{-t} E_p(t) dt = \frac{1}{2p} F(1, 1; 1+p; \tfrac{1}{2}) \quad \text{DLMF 8.19.26}$$

$$5.24.1.5 \int_0^z x^\lambda E_\nu(x^\mu) dx = \frac{\gamma\left(\frac{1+\lambda}{\mu}, z^\mu\right) + z^{1+\lambda} E_\nu(z^\mu)}{1 + \lambda + \mu(\nu - 1)} \quad [\mu > 0, \quad z \geq 0, \quad \lambda > \max(-1, -1 - \mu(\nu - 1))] \quad \text{CIO2020}$$

25. On page 632 add the new section 5.24.2 Indefinite Exponential Integrals of Index 1
Add the following indefinite integrals

$$5.24.2.1 \int E_1(ax) dx = x E_1(ax) - \frac{1}{a} e^{-ax} \quad [a > 0] \quad \text{GEL (4.1-1)}$$

$$5.24.2.2 \int x E_1(ax) dx = \frac{1}{2} x^2 E_1(ax) - \frac{1}{2a^2} (1 + ax) e^{-ax} \quad [a > 0] \quad \text{GEL (4.1-4)}$$

$$5.24.2.3 \int x^p E_1(ax) dx = \frac{x^{p+1}}{p+1} E_1(ax) + \frac{1}{(p+1)a^{p+1}} \gamma(p+1, ax) \quad [a > 0, \quad p > -1] \quad \text{GEL (4.1-14)}$$

$$5.24.2.4 \int e^{-ax} E_1(bx) dx = \frac{1}{a} (E_1[(a+b)x] - e^{-ax} E_1(bx)) \quad [a > 0, \quad b > 0] \quad \text{GEL (4.2-1)}$$

$$5.24.2.5 \int e^{ax} E_1(bx) dx = -\frac{1}{a} (E_1[(b-a)x] - e^{ax} E_1(bx)) \quad [b > a > 0] \quad \text{GEL (4.2-2)}$$

$$5.24.2.6 \int x e^{-ax} E_1(bx) dx = \frac{1}{a^2} \left(E_1[(a+b)x] - (1+ax) e^{-ax} E_1(bx) + \left(\frac{a}{a+b} \right) e^{-(a+b)x} \right) \quad [a, b, c > 0] \quad \text{GEL (4.2-10)}$$

$$5.24.2.7 \int x e^{cx} E_1(ax+b) dx = \frac{1}{c} \left(x - \frac{1}{c} \right) e^{cx} E_1(ax+b) - \frac{e^{(a-c)x+b}}{c(a-c)} + \frac{(a+bc)e^{-bc/a}}{ac^2} E_1\left(\frac{(a-c)(ax+b)}{a}\right) \quad [a > c > 0, \quad b > 0] \quad \text{GEL (4.2-13)}$$

$$5.24.2.8 \int \frac{e^{-x}}{x} E_1(ax) dx = -\frac{1}{2} [E_1(ax)]^2 \quad [a > 0] \quad \text{GEL (4.2-30)}$$

$$5.24.2.9 \int \ln x E_1(ax) dx = \frac{1}{a} [(1 - \ln x) e^{-ax} - (1 + ax - ax \ln x) E_1(ax)] \quad [a > 0] \quad \text{GEL (4.4-1)}$$

$$5.24.2.10 \int E_1(ax) E_1(bx) dx = x E_1(ax) E_1(bx) + \left(\frac{1}{a} + \frac{1}{b} \right) E_1([a+b]x) - \frac{1}{a} e^{-ax} E_1(bx) - \frac{1}{b} e^{-bx} E_1(ax) \quad [a, b > 0] \quad \text{GEL (4.6-1)}$$

26. On page 632 add the new section 5.24.3 Definite Exponential Integrals of Index 1
Add the following definite integrals

$$5.24.3.1 \int_0^\infty E_1(ax) dx = \frac{1}{a} \quad [a > 0] \quad \text{GEL (4.1-3)}$$

$$5.24.2.2 \int_0^\infty x^p E_1(ax) dx = \frac{\Gamma(p+1)}{(p+1)a^{p+1}} \quad [a > 0, \quad p > -1] \quad \text{GEL (4.1-15)}$$

$$5.24.2.3 \int_0^\infty e^{-ax} E_1(bx) dx = \frac{1}{a} \ln \left(1 + \frac{a}{b} \right) \quad [a > 0, \quad b > 0] \quad \text{GEL (4.2-3)}$$

$$5.24.2.4 \int_0^\infty e^{ax} E_1(bx) dx = -\frac{1}{a} \ln \left(1 - \frac{a}{b} \right) \quad [b > a > 0] \quad \text{GEL (4.2-4)}$$

$$5.24.2.5 \quad \int_0^\infty x^p e^{ax} E_1(bx) dx = \frac{\Gamma(p+1)}{b^{p+1}(p+1)} {}_2F_1\left(p+1, p+1; p+2; \frac{a}{b}\right) \quad [b > a > 0, \quad p > -1] \quad \text{GEL (4.2-21)}$$

$$5.24.2.6 \quad \int_{-\infty}^\infty e^{ax} e^{-ibx} E_1(ax) dx = \frac{b\pi}{b+ia} \quad [a, b > 0] \quad \text{GEL (4.2-34)}$$

$$5.24.2.7 \quad \int_0^\infty x^n \ln x E_1(ax) dx = -\frac{n!}{(n+1)a^{n+1}} \left[\gamma + \ln a + \frac{1}{n+1} - \sum_{m=1}^n \frac{1}{m} \right] \quad [n = 1, 2, \dots, \quad a > 0] \quad \text{GEL (4.4-7)}$$

$$5.24.2.8 \quad \int_0^\infty \sin(bx) e^{cx} E_1(ax) dx = \frac{1}{b^2 + c^2} \left[\frac{b}{2} \ln \left(\frac{(a-c)^2 + b^2}{a^2} \right) + c \tan^{-1} \left(\frac{b}{a-c} \right) \right] \quad [a \geq c > 0, \quad b > 0] \quad \text{GEL (4.3-10)}$$

$$5.24.2.9 \quad \int_0^\infty \cos(bx) e^{cx} E_1(ax) dx = \frac{1}{b^2 + c^2} \left[-\frac{c}{2} \ln \left(\frac{(a-c)^2 + b^2}{a^2} \right) + b \tan^{-1} \left(\frac{b}{c-a} \right) \right] \quad [a \geq c > 0, \quad b > 0] \quad \text{GEL (4.3-13)}$$

$$5.24.2.10 \quad \int_0^\infty x E_1(ax) E_1(bx) dx = \frac{1}{2} \left(\frac{1}{a^2} + \frac{1}{b^2} \right) \ln(a+b) - \frac{1}{2a^2} \ln b - \frac{1}{2b^2} \ln a - \frac{1}{2ab} \quad [a, b > 0] \quad \text{GEL (4.6-8)}$$

$$5.24.2.11 \quad \int_0^\infty E_1(x) J_0(ax) dx = \frac{\operatorname{arcsinh} a}{a} \quad [a > 0] \quad \text{GEL (4.7-1)}$$

27. On page 634 add the new section 5.57 Bessel Function Combinations

Add the following integrals

$$5.57.1 \quad \int \frac{dx}{x J_p^2(x)} = \frac{\pi}{2} \frac{Y_p(x)}{J_p(x)} \quad \text{WA (pg 133)}$$

$$5.57.2 \quad \int \frac{dx}{x J_p(x) Y_p(x)} = \frac{\pi}{2} \ln \frac{Y_p(x)}{J_p(x)} \quad \text{WA (pg 133)}$$

$$5.57.3 \quad \int \frac{dx}{x Y_p^2(x)} = -\frac{\pi}{2} \frac{J_p(x)}{Y_p(x)} \quad \text{WA (pg 133)}$$

(Thanks to Brady Metherall for suggesting the inclusion of these evaluations.)

28. On page 634 add the new section 5.58 Bessel Function Convolutions

Add the following integrals

$$5.58.1 \quad \int_0^x J_\mu(t) J_\nu(x-t) dt = 2 \sum_{n=0}^{\infty} (-1)^n J_{\mu+\nu+2n+1}(x) \quad \text{WA 380 (2)} \quad \boxed{10/25}$$

$$5.58.2 \quad \int_0^x J_\mu(t) J_\nu(x-t) \frac{dt}{t} = \frac{J_{\mu+\nu}(x)}{\mu} \quad [\operatorname{Re} \mu > 0, \quad \operatorname{Re} \nu > -1] \quad \text{WA 380 (3)} \quad \boxed{10/25}$$

$$5.58.3 \quad \int_0^x J_\mu(t) J_{-\mu}(x-t) dt = \sin x \quad [-1 < \operatorname{Re} \mu < 1] \quad \text{WA 380 (4a)} \quad \boxed{10/25}$$

$$5.58.4 \quad \int_0^x J_\mu(t) J_{1-\mu}(x-t) dt = J_0(x) - \cos x \quad [-1 < \operatorname{Re} \mu < 2] \quad \text{WA 380 (4b)} \quad \boxed{10/25}$$

$$5.58.5 \quad \int_0^x \frac{J_\mu(t)}{t} \frac{J_\nu(x-t)}{x-t} dt = \left(\frac{1}{\mu} + \frac{1}{\nu} \right) \frac{J_{\mu+\nu}(x)}{x} \quad [\operatorname{Re} \mu > 0, \quad \operatorname{Re} \nu > 0] \quad \text{WA 380 (5)} \quad \boxed{10/25}$$

$$5.58.5 \quad \int_0^x J_0(t) \cos(x-t) dt = x J_0(x) \quad \text{WA 380 (1)} \quad \boxed{10/25}$$

$$5.58.6 \quad \int_0^x J_0(t) \sin(x-t) dt = x J_1(x) \quad \boxed{10/25}$$

29. On page 635, create new section 5.8 Lambert W-function

$$5.8.1 \quad \int W(x) dx = x W(x) - x + e^{W(x)} \quad \text{COR1 (3.14)}$$

$$5.8.2 \quad \int x W(x) dx = \frac{1}{2} (W(x) - \frac{1}{2}) (W^2(x) + \frac{1}{2}) e^{2W(x)} \quad \text{COR1 (3.15)}$$

$$5.8.3 \quad \int \frac{W(x)}{x} dx = \int e^{-W(x)} dx = \frac{1}{2} W^2(x) + W(x)$$

$$5.8.4 \quad \int \frac{W(x)}{x^2} dx = \operatorname{Ei}(-W(x)) - e^{-W(x)}$$

$$5.8.5 \quad \int x \sin(W(x)) dx = \frac{1}{2} \left(x + \frac{x}{W(x)} \right) \sin(W(x)) - \frac{x}{2} \cos(W(x)) \quad \text{COR2}$$

$$5.8.6 \quad \int W(ae^{bx}) dx = \frac{W(ae^{bx})^2}{2b} + \frac{W(ae^{bx})}{b}$$

(Thanks to Brady Metherall for suggesting the inclusion of many of these evaluations.)

30. On page 640 add the following integrals

$$6.142.3 \quad \int_0^1 \frac{k \mathbf{K}(k)}{(z+k^2)^{n+3/2}} dk = \frac{(-2)^n}{(2n+1)!!} \frac{d^n}{dz^n} \left(\frac{\operatorname{arccot}(\sqrt{z})}{\sqrt{z(z+1)}} \right) \quad z > 0 \text{ and } n = 0, 1, 2, \dots$$

CIO2019

$$6.142.4 \quad \int_0^1 \frac{k \mathbf{K}(k)}{(1+k^2)^{3/2}} dk = \frac{\pi}{4\sqrt{2}} \quad \text{CIO2019}$$

$$6.142.5 \quad \int_0^1 \frac{k \mathbf{K}(k)}{(1+k^2)^{5/2}} dk = \frac{4+3\pi}{24\sqrt{2}} \quad \text{CIO2019}$$

$$6.142.6 \quad \int_0^1 \frac{k \mathbf{K}(k)}{(1+k^2)^{7/2}} dk = \frac{40+19\pi}{240\sqrt{2}} \quad \text{CIO2019}$$

$$6.142.7 \quad \int_0^1 \frac{k \mathbf{K}(k)}{(1+k^2)^{9/2}} dk = \frac{484+189\pi}{3360\sqrt{2}} \quad \text{CIO2019}$$

(Thanks to Luca Ciotti for suggesting the inclusion of these integrals.)

31. On page 672 add the following integral:

$$6.517.1 \quad \int_0^z Y_0(\sqrt{z^2-x^2}) dx = \frac{2}{\pi} [\operatorname{ci}(z) \sin(z) - \operatorname{si}(z) \cos(z)]$$

(Thanks to W. A. Horowitz for suggesting the inclusion of this integral.)

32. On page 681 add integral 6.541.5:

$$\begin{aligned} \int_0^\infty \frac{x^3}{x^2 + c^2} J_\nu(ax) J_\nu(bx) \\ &= \frac{\delta(b-a)}{a} - c^2 I_\nu(bc) K_\nu(ac) \quad [n = -1, \nu = 0, 1, \dots, \operatorname{Re} c > 0, 0 < b < a] \\ &= \frac{\delta(b-a)}{a} - c^2 I_\nu(ac) K_\nu(bc) \quad [n = -1, \nu = 0, 1, \dots, \operatorname{Re} c > 0, 0 < a < b] \end{aligned}$$

(Thanks to Peter J. Hobson for suggesting the inclusion of these evaluations.)

33. On page 715 add the following integrals:

$$\begin{aligned} 6.633.6 \quad \int_0^\infty x e^{-ax^2} J_0(x) Y_0(x) dx &= -\frac{e^{-1/2a}}{2\pi a} K_0\left(\frac{1}{2a}\right) & \operatorname{Re}[a] > 0 & \quad \text{MCP (2)} & \quad \boxed{10/25} \\ 6.633.7 \quad \int_0^\infty x e^{-ax^2} J_1(x) Y_1(x) dx &= \frac{e^{-1/2a}}{2\pi a} K_1\left(\frac{1}{2a}\right) - \frac{1}{\pi} & \operatorname{Re}[a] > 0 & \quad \text{MCP (19)} \\ 6.633.8 \quad \int_0^\infty x e^{-ax^2} J_2(x) Y_2(x) dx &= -\frac{e^{-1/2a}}{2\pi a} K_2\left(\frac{1}{2a}\right) - \frac{2(1-2a)}{\pi} & \operatorname{Re}[a] > 0 & \quad \text{MCP (20)} \\ 6.633.9 \quad \int_0^\infty x e^{-ax^2} J_n(x) Y_n(x) dx &= \frac{(-1)^{n+1} e^{-1/2a}}{2\pi a} K_n\left(\frac{1}{2a}\right) - \frac{1}{\pi} \sum_{k=0}^{n-1} \frac{(-2a)^k}{(2k+1)!!} \frac{\Gamma(n+k+1)}{\Gamma(n-k)} \\ & \quad [\operatorname{Re}[a] > 0, \quad n = 0, 1, 2, \dots] & \quad \text{MCP (18)} & \quad \boxed{10/25} \end{aligned}$$

(Thanks to Brady Metherall for suggesting several of these integrals.)

34. On page 717 add the following integral

$$6.645.4 \quad \int_{-1}^1 (1-x^2)^{\frac{1}{2}\nu} e^{-\alpha x} I_\nu\left(\beta\sqrt{1-x^2}\right) dx = \sqrt{2\pi}\beta^\nu (\alpha^2 + \beta^2)^{-\frac{1}{2}\nu - \frac{1}{4}} I_{\nu+\frac{1}{2}}\left(\sqrt{\alpha^2 + \beta^2}\right) \\ [\nu \geq 0]$$

(Thanks to Christoph Gierull for suggesting the inclusion of this integral.)

35. On page 726, create a new section 6.6711 and add the following integral

$$6.6711.1 \quad \int_0^1 J_0(ax) \arccos(x) dx = \frac{\operatorname{Si}(a)}{a} \quad [\operatorname{Re}(a) > 0] \quad \text{MA}$$

(Thanks to Luca Ciotti for suggesting the inclusion of this integral.)

36. On page 738 add the following extra cases to the existing integrals

$$6.699.1 \quad \text{integral} = \frac{2^{\nu-1} \Gamma(-\frac{1}{2} - \lambda) \Gamma(\frac{3}{2} + \frac{1}{2}\lambda + \frac{1}{2}\nu)}{a^{\lambda+1} \Gamma(\nu - \lambda) \Gamma(\frac{1}{2} - \frac{1}{2}\lambda - \frac{1}{2}\nu)} \\ [b = a, \quad a > 0, \quad -1 < \operatorname{Re} \nu < \operatorname{Re}(1 + \lambda) < \frac{1}{2}] \quad \text{ET 1 6.8(10)}$$

$$6.699.2 \text{ integral} = \frac{2^{\nu-1} \Gamma(-\frac{1}{2} - \lambda) \Gamma(1 + \frac{1}{2} \lambda + \frac{1}{2} \nu)}{a^{\lambda+1} \Gamma(\frac{1}{2} \lambda - \frac{1}{2} \nu) \Gamma(\nu - \lambda)}$$

$$[b = a, \quad a > 0, \quad -\operatorname{Re} \nu < \operatorname{Re}(1 + \lambda) < \frac{1}{2}] \quad \text{ET 1 6.8(11)}$$

(Thanks to Shenhui Liu for suggesting the inclusion of these evaluations.)

37. On page 749, add the following integral

10/25

$$6.737.7 \int_0^\infty x \frac{\sin(b\sqrt{x^2 - a^2})}{\sqrt{x^2 - a^2}} J_0(cx) dx = \frac{1}{\sqrt{b^2 - c^2}} \cosh(a\sqrt{b^2 - c^2}) \quad [b > c] \quad \text{ROB21}$$

(Thanks to Peter A. Robinson for suggesting this integral.)

38. On page 770, create new section 6.88 Spherical Bessel Functions with the following text and integrals

10/25

The spherical, or half-order, Bessel functions are given by $j_k(x) = \sqrt{\frac{\pi}{2x}} J_{k+1/2}(x)$.

When $r_1 \neq 0$, define the functions $R_{\pm\pm} = \frac{1}{r_1} (-ip^2 \pm r_2 \pm r_3)$.

6.88.1 Define the integrals

$$f_{\ell_1, \ell_2, \ell_3}(r_1, r_2, r_3; p) = \int_0^\infty x^2 e^{-px^2} j_{\ell_1}(x r_1) j_{\ell_2}(x r_2) j_{\ell_3}(x r_3) dx \quad \text{CS (1)}$$

6.88.2 Which have the recursion

$$f_{\ell_1, \ell_2+1, \ell_3} = \left(\frac{r_1}{r_2}\right) \left(\frac{2\ell_2+1}{2\ell_1+1}\right) (f_{\ell_1-1, \ell_2, \ell_3} + f_{\ell_1+1, \ell_2, \ell_3}) - f_{\ell_1, \ell_2-1, \ell_3} \quad \text{CS (3)}$$

The three needed base cases from which the recursion can be used are as follows:

$$6.88.3 \quad f_{\ell_1, 0, 0} = -\frac{(-i)^{\ell_1+1}}{4r_1 r_2 r_3} [Q_{\ell_1}(R_{--}) - Q_{\ell_1}(R_{-+}) - Q_{\ell_1}(R_{+-}) + Q_{\ell_1}(R_{++})] \quad \text{CS (9)}$$

$$6.88.3 \quad f_{\ell_1, -1, 0} = -\frac{(-i)^{\ell_1}}{4r_1 r_2 r_3} [Q_{\ell_1}(R_{--}) - Q_{\ell_1}(R_{-+}) + Q_{\ell_1}(R_{+-}) - Q_{\ell_1}(R_{++})] \quad \text{CS (11)}$$

$$6.88.4 \quad f_{\ell_1, -1, -1} = \frac{(-i)^{\ell_1+1}}{4r_1 r_2 r_3} [Q_{\ell_1}(R_{--}) + Q_{\ell_1}(R_{-+}) + Q_{\ell_1}(R_{+-}) + Q_{\ell_1}(R_{++})] \quad \text{CS (12)}$$

39. On page 852, add the following integrals

10/25

$$7.741.6 \int_0^\infty e^{-x^2/4} \cos(bx) [D_{2\nu-1/2}(x) + D_{2\nu-1/2}(-x)] dx = \sqrt{2\pi} e^{-b^2/2} b^{2(\nu-1/4)} \sin\left[\pi\left(\nu + \frac{1}{4}\right)\right]$$

$$[\operatorname{Re} \nu > \frac{1}{4}, \quad b \text{ real}] \quad \text{MAR2022 (12)}$$

$$7.741.7 \int_0^\infty e^{-ax^2} \cos(bx) [D_{2\nu-1/2}(x) + D_{2\nu-1/2}(-x)] dx$$

$$= \frac{2^{\nu-1/4} \pi}{\Gamma(\frac{3}{4} - \nu)} \frac{(a - \frac{1}{4})^{\nu-1/4}}{(a + \frac{1}{4})^{\nu+1/4}} e^{-b^2/(4a+1)} \Phi\left(-\nu + \frac{1}{4}, \frac{1}{2}; -\frac{2b^2}{(4a+1)(4a-1)}\right)$$

$$[\operatorname{Re} \nu > \frac{1}{4}, \quad a > \frac{1}{4}, \quad b \text{ real}] \quad \text{MAR2022 (8)}$$

(Thanks to Richard J. Mathar for suggesting these integrals.)

40. On page 875, add section 7.9 Lambert W-function

$$7.9.1 \int_0^\infty W(x)x^{-3/2} dx = \sqrt{8\pi}$$

$$7.9.2 \int_0^e W(x) dx = e - 1$$

$$7.9.3 \int_0^e \frac{x}{W(x)} dx = \frac{3e^2}{4}$$

41. On page 900, add section 8.27: Generalized Exponential Integral

8.271 Definition

$$8.271.1 E_p(z) = z^{p-1} \Gamma(1-p, z) = z^{p-1} \int_z^\infty \frac{e^{-t}}{t^p} dt \quad \text{DLMF 8.19.2}$$

$$8.271.2 E_p(z) = \int_a^\infty \frac{e^{-zt}}{t^p} dt \quad [|\arg z| < \tfrac{1}{2}\pi] \quad \text{DLMF 8.19.3}$$

$$8.271.3 E_p(z) = \frac{z^{p-1} e^{-z}}{\Gamma(p)} \int_0^\infty \frac{t^{p-1} e^{-zt}}{1+t} dt \quad [|\arg z| < \tfrac{1}{2}\pi, \operatorname{Re} p > 0] \quad \text{DLMF 8.19.3}$$

$$8.271.4 E_0(z) = z^{-1} e^{-z} \quad [z \neq 0] \quad \text{DLMF 8.19.5}$$

$$8.271.5 E_p(0) = \frac{1}{p-1} \quad [\operatorname{Re} p > 1] \quad \text{DLMF 8.19.6}$$

$$8.271.6 E_1(-x \pm i0) = -\operatorname{Ei}(x) \mp i\pi \quad \text{DLMF 6.5.1}$$

$$8.271.7 E_p(x) = \begin{cases} \frac{e^{-x} - x E_{p-1}(x)}{p-1} & p \neq 1 \\ \frac{e^{-x} - p E_{p+1}(x)}{z} & \end{cases}$$

42. On page 945, add section 8.5181: The series $\sum J_{k+\nu}(x) J_{k+\mu}(x)$

$$8.5181.1 \sum_{k=0}^\infty J_{k+\nu}(x) J_{k+\mu}(x) = K(\mu, \nu) \quad [\mu \text{ and } \nu \text{ are real}]$$

$$K(\mu, \nu) = \frac{(x/2)^{\mu+\nu}}{\Gamma(\mu+1)\Gamma(\nu+1)} {}_2F_3 \left[\frac{\mu+\nu}{2}, \frac{\mu+\nu+1}{2}; \mu+1, \nu+1, \mu+\nu; -x^2 \right]$$

$$8.5181.2 \sum_{k=L}^M J_{k+\nu}(x) J_{k+\mu}(x) = K(\mu+L, \nu+L) - K(\mu+M+1, \nu+M+1)$$

$$8.5181.3 \sum_{k=0}^\infty J_k(x) J_{k+\mu}(x) = \frac{x}{2\mu} [J_0(x) J_{\mu-1}(x) + J_1(x) J_\mu(x)] \quad [\mu \text{ is real}]$$

$$8.5181.4 \sum_{k=0}^\infty J_k(x) J_{k+1}(x) = \frac{x}{2} [J_0^2(x) + J_1^2(x)]$$

$$8.5181.5 \sum_{k=0}^\infty J_k(x) J_{k+2}(x) = \frac{x}{4} [J_0(x) J_1(x) + J_1(x) J_2(x)] = \frac{1}{2} J_1^2(x)$$

$$8.5181.6 \quad \sum_{k=0}^{\infty} J_k(x) J_{k+3}(x) = \frac{x}{6} \left[J_0(x) J_2(x) + J_1(x) J_3(x) \right]$$

(Thanks to David A. Kessler for suggesting the inclusion of these sums.)

43. On page 945, add section 8.5182 The series $\sum a_k J_k^2(x)$

$$8.5182.1 \quad \sum_{k=0}^{\infty} k J_k^2(x) = \frac{x^2}{2} \left[J_0^2(x) + J_1^2(x) \right] - \frac{x}{2} J_0(x) J_1(x)$$

$$8.5181.2 \quad \sum_{k=0}^{\infty} k^2 J_k^2(x) = \frac{x^2}{4}$$

$$8.5181.3 \quad \sum_{k=1}^{\infty} \left[J_{k-1}^2(k\nu) + J_{k+1}^2(k\nu) \right] = \frac{1}{\sqrt{1-\nu^2}} \quad [0 \leq \nu < 1] \quad \text{BL2 B.1}$$

(Thanks to David A. Kessler for suggesting the inclusion of these sums.)

(Thanks to Cameron Bunney for suggesting the inclusion of 8.158.3.)

44. On pages 1105–1108 add the following references:

10/25

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- WIKIW Wikipedia contributors, ”Lambert W function,” Wikipedia, The Free Encyclopedia, https://en.wikipedia.org/w/index.php?title=Lambert_W_function&oldid=1019399859 (accessed April 20, 2021).
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ERRATA FOR THE 8th EDITION

1. On pages xix–xxiii, **Acknowledgements**, add the following names:

10/25

- | | |
|-----------------------------|---|
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| • Aaron Hendrickson | • Dr. Michal Wierzbicki |
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| • Julian Huddell | • Dr. Martin Zofka |
| • Dr. David A. Kessler | |
| • Martin Kreh | |

10/25

(a) The name “Dr. M. A. F. Sanjun” is incorrect; it should be “Dr. Miguel A. F. Sanjuan.”

- (b) The name “Dr. D. Rudermann” is incorrect; it should have been “Dr. Dan Ruderman.”
 (c) The name “Richard Marthar” should be removed. The correct spelling (“Richard J. Mathar”) is already present.

2. Page xxxvii, Index of Special Functions: After the ψ entry add the following entry

$\Psi(\alpha, \gamma; z)$ Confluent hypergeometric function 9.210

(Thanks to Lasse Schmieding for correcting this error.)

3. Page 9, Formula 0.232.3 the entire right hand side should be multiplied by b^a . That is the evaluation

begins $\frac{b^a}{(b-1)^{a+1}} \sum_{i=1}^a$

(Thanks to J. P. Balthasar Müller for correcting this error.)

4. Page 24, Formula 0.435: replace $\frac{d^n(y^3)}{dx^n} x^n$ with $\frac{d^n(y^3)}{dx^n}$

(Thanks to Steven Reyes for correcting this error.)

5. Page 32, Formula 1.323.6: replace “cosh” with “cos”

(Thanks to Farid Bouttout for correcting this error.)

6. Page 49, Summations 1.449.4–1.449.10:

10/25

The definitions of $C(x)$ and $S(x)$ (just before 1.449.4) can be missed, and these functions confused with the Fresnel integrals. Hence, replace $S(x)$ with $\hat{S}(x)$ and replace $C(x)$ with $\hat{C}(x)$.

7. Page 49, Summation 1.449.4: Replace

$[S(ax) - \cos(\pi a) \dots$ with

$[S(ax) + \cos(\pi a) \dots$

(Thanks to Ubaldo Bafle for correcting this error.)

8. Page 68, Integral 2.110.7: The evaluation is incorrect. When corrected, in variables consistent with the other integrals in this section, we have

$$\int x^b (a + bx^k)^m dx = \frac{b^m}{k} \sum_{i=0}^m \frac{(-1)^i m! \Gamma\left(\frac{b+1}{k}\right) \left(x^k + \frac{a}{b}\right)^{m-i}}{(m-i)! \Gamma\left(\frac{b+1}{k} + i + 1\right)} x^{b+1+ki}$$

9. Page 71, Integral 2.124: The first evaluation is incorrect; replace $x\sqrt{\frac{ab}{a}}$ with $x\sqrt{\frac{b}{a}}$.

(Thanks to Leland Langston for correcting this error.)

10. Page 75, Integral 2.144.1: The auxiliary functions are incorrect. They should have been

$$P_k = \frac{1}{2} \ln \left(x^2 - 2x \cos \frac{2k\pi}{n} + 1 \right), \quad Q_k = \arctan \left(\frac{x - \cos \frac{2k\pi}{n}}{\sin \frac{2k\pi}{n}} \right)$$

Additionally, the reference should be changed to be INT31.

11. Page 75, Integral 2.144.2: The integral evaluation is incorrect. It should have been

$$\int \frac{dx}{1-x^n} = -\frac{1}{n} \ln(1-x) - \frac{2}{n} \sum_{k=1}^{\frac{n-1}{2}} P_k \cos \frac{2k\pi}{n} + \frac{2}{n} \sum_{k=1}^{\frac{n-1}{2}} Q_k \sin \frac{2k\pi}{n}$$

Additionally, the reference should be changed to be INT31.

12. Page 79, Integral 2.172: The evaluation is improved by replacing $\left(\frac{b+2cx}{\sqrt{-\Delta}}\right)$ with $\left(\frac{\sqrt{-\Delta}}{b+2cx}\right)$ for the case $\Delta < 0$. Since $\operatorname{arctanh} z$ is equal to $\operatorname{arctanh} \frac{1}{z}$ plus a constant, the evaluation is structurally the same. However, complex constants are avoided since the $\operatorname{arctanh}$ argument does not exceed one. (Thanks to Leland Langston for this improvement.)

13. Page 90, Integral 2.245.2: The differential is currently “dz”, which is incorrect; it should be “dx”.

14. Page 105, Constraints in 2.292.1, 2.292.2, and 2.292.3 are incorrect and should be written as:

$$\begin{aligned} 2.292.1 \quad z &= \sqrt{x(1-x)(1-k^2x)} \\ 2.292.2 \quad z &= \frac{\sqrt{x(1-x)(1-k^2x)}}{1-x} \\ 2.292.3 \quad z &= \frac{\sqrt{x(1-x)(1-k^2x)}}{1-k^2x} \end{aligned}$$

The current statements for 2.292.2 and 2.292.3 are incorrect since they made simplifications such as $\frac{\sqrt{y}}{y} = \frac{1}{\sqrt{y}}$ which is only sometimes true, because of branch cuts.

(Thanks to Sam Blake for correcting these errors.)

15. Page 107, Integral 2.325: The term $(-1)^{z+1\gamma}$ should have been $(-1)^{z+1}$

10/25

16. Page 109, Integral 2.33.16: replace “exp” with “erf”.

(Thanks to Aaron Hendrickson for correcting this error.)

17. Page 110, Integral 2.412.3 replace $(-1)^n \sum_{k=0}^m$ with $(-1)^m \sum_{k=0}^m$

10/25

18. Page 120, Integral 2.424.5 replace $\sum_{k=1}^n \frac{1}{2n}$ with $\sum_{k=1}^n \frac{1}{2k}$

10/25

19. Page 132, Integral 2.459.4

Move the footnote into the body of the text

10/25

20. Page 135, Integral 2.464.2, the result is missing a minus sign. Instead of

$$F(\dots) \quad \text{the result should be} \quad -F(\dots)$$

(Thanks to Markus Bier for correcting this error.)

10/25

21. Page 137, Integral 2.464.32, the result is missing a minus sign. Instead of

$$\frac{2}{\sqrt{a+b}} F\left(\dots\right) \quad \text{the result should be} \quad -\frac{2}{\sqrt{a+b}} F\left(\dots\right)$$

(Thanks to Markus Bier for correcting this error.)

10/25

22. Page 142, Integral 2.473.12: the term

$$\left(z_1^4 + 20 \frac{b^2}{k^2} z_1 + 120 \frac{b^4}{k^4}\right) \quad \text{should be}$$

$$\left(z_1^4 + 20 \frac{b^2}{k^2} z_1^2 + 120 \frac{b^4}{k^4}\right)$$

10/25

23. Page 148, Integral 2.479.1:

The current reference is (see **4.477** 2) which is incorrect.

The correct reference is (see **2.477** 2)

10/25

24. Page 163, Integral 2.534.1:

The current reference is **Pe** which is incorrect.

The correct reference is **PE**

10/25

25. Page 163, Integral 2.534.2:

(a) The current evaluation is $-2i \int \frac{z^{p+n-1}}{1-z^{2n}} dz$ which is incorrect.

The correct evaluation is $-2i \int \frac{z^{p+n-1}}{1+z^{2n}} dz$

(b) The current reference is **Pe** which is incorrect.

The correct reference is **PE**

10/25

26. Page 180, Integral 2.573.1:

The is an extra close brace symbol. Currently we have

$$E(\alpha, r) \} - \tan \quad \text{which is incorrect, it should have been}$$

$$E(\alpha, r) - \tan \quad (\text{The remaining braces should be the same size.})$$

10/25

27. Page 182, Integral 2.575.4:

The current reference is (291.01) which is incomplete.

The correct reference is **BY** (291.01)

10/25

28. Page 184, line 7: Disregard the spurious text “ndexsquare roots”

29. Page 184, integral 2.581.1

To correct this integral, in the first line of the evaluation change

$$[m+n-2(m+r-1)k^2] \quad \text{to}$$

$$[(m+n-2)+(m+r-1)k^2].$$

(Thanks to Peng Zhang for correcting this error.)

30. Page 191, Integral 2.584.24, change $\cos x^2$ to $\cos^2 x$

10/25

31. Page 194, integral 2.584.63.

The last term in the evaluation is incorrect; the power of Δ in the denominator should be Δ^3 (not Δ).

That is, the last term should be
$$\frac{k^2(2k^2 - 1) \sin^2 x - 3k^2 + 2}{3k'^2 \Delta^3} \sin x \cos x$$

(Thanks to Michael James Unga for correcting this error.)

32. Page 218, Integral 2.637.4: replace the first
- $\frac{3}{2}$
- (in the parentheses) with
- $-\frac{3}{2}$
- and replace
- $\frac{1}{54}$
- with
- $-\frac{1}{54}$
- .

33. Page 219, Integral 2.639.3: remove one of the (duplicated) “dx” terms

10/25

(Thanks to Allen Stenger for correcting this error.)

34. Page 221, Integral 2.643.3: in the reference, replace TU with GU

10/25

35. Page 223, Integral 2.645.6, is missing the “dx” term

10/25

36. Page 224, Integral 2.647.6: replace
- $\frac{\pi}{2}$
- with
- $\frac{x}{2}$
- .

37. Page 244, Integral 2.832.2: make a cosmetic change, change
- $-\frac{\pi}{2} \ln \frac{1}{x}$
- to
- $\frac{\pi}{2} \ln x$

38. Page 247, Integral 2.857: the term
- $(2)!!$
- should be
- $“(2n)!!”$

10/25

(Thanks to David Trestini and Giulia Ventagli for correcting this error.)

39. Page 255, expressions in 3.112: the two expansions are each missing a plus sign.

They should be (the additional plus signs are shown boxed):

$$g_n(x) = b_0 x^{2n-2} \boxed{+} b_1 x^{2n-4} + \cdots + b_{n-1},$$

$$h_n(x) = a_0 x^n \boxed{+} a_1 x^{n-1} + \cdots + a_n,$$

(Thanks to Mo Li for correcting these errors.)

40. Page 255, Integrals in 3.112

- 3.112.1 The correct evaluation is
- $(-1)^{n+1} \frac{\pi i}{a_0} \frac{M_n}{\Delta_n}$

(The first term was missing.)

Additionally, add the following text after the two determinants:

The matrices for $n = 5$ are:

$$\Delta_5 = \begin{vmatrix} a_1 & a_3 & a_5 & 0 & 0 \\ a_0 & a_2 & a_4 & 0 & 0 \\ 0 & a_1 & a_3 & a_5 & 0 \\ 0 & a_0 & a_2 & a_4 & 0 \\ 0 & 0 & a_1 & a_3 & a_5 \end{vmatrix}, \quad M_5 = \begin{vmatrix} b_0 & b_1 & b_2 & b_3 & b_4 \\ a_0 & a_2 & a_4 & 0 & 0 \\ 0 & a_1 & a_3 & a_5 & 0 \\ 0 & a_0 & a_2 & a_4 & 0 \\ 0 & 0 & a_1 & a_3 & a_5 \end{vmatrix}$$

- 3.112.3 The correct evaluation is
- $$\frac{-a_2 b_0 + a_0 b_1 - \frac{a_0 a_1 b_2}{a_3}}{a_o(a_0 a_3 - a_1 a_2)}$$

(There were two operators missing.)

(Thanks to Hongjun Xiang for correcting these errors.)

41. Page 264, Integral 3.137.7: replace the evaluation with the following:

10/25

$$\frac{2}{(b-r)\sqrt{a-c}} \left[\frac{b-a}{a-r} \Pi \left(\mu, \frac{b-r}{a-r}, q \right) + F(\mu, q) \right]$$

(Thanks to Elliot Blackstone for correcting this error.)

42. Page 265, Integrals 3.138.7 and 3.138.8:

10/25

- Integral 3.137.7: change a to α
- Integral 3.137.8: change a to α
- Integral 3.137.8: change arccot to arctan

(Thanks to Marco Saragnese for correcting these errors.)

43. Page 277, Integral 3.145.3(2): change the first integral from $\int_u^a$ to $\int_u^\alpha$

(Thanks to Dominik Beck for correcting this error.)

44. Page 284, Integral 3.154.2: change the constraint from

10/25

$$[a \geq u > 0] \quad \text{to}$$

$$[b \geq u > 0]$$

(Thanks to Marco Saragnese for correcting this error.)

45. Page 285, Integral 3.155.5: change the last term in the evaluation from

10/25

$$+\frac{u}{3}\sqrt{(a^2+u^2)(b^2-u^2)} \quad \text{to}$$

$$-\frac{u}{3}\sqrt{(a^2+u^2)(b^2-u^2)}$$

(Thanks to Marco Saragnese for correcting this error.)

46. Page 286, Integral 3.156.4: change the arguments of the elliptic functions from (γ, s) to (ξ, s)

10/25

(Thanks to Martin Zofka for correcting this error.)

47. Page 326, Integral 3.248.5

When integral 3.248.5 in the 6th edition was found to be incorrect the entry was removed; neither the 7th or 8th edition had an entry for 3.248.5. The correct evaluation was determined in the paper AR.

The integral (6th edition, page 321) is

$$\int_0^\infty \frac{dx}{(1+x^2)^{3/2}} \frac{1}{\sqrt{\phi(x) + \sqrt{\phi(x)}}} = \frac{\pi}{2\sqrt{6}} \quad \boxed{\text{incorrect}}$$

which is incorrect. It should have been

$$\int_0^\infty \frac{dx}{(1+x^2)^{3/2}} \frac{1}{\sqrt{\phi(x) + \sqrt{\phi(x)}}} = \frac{\sqrt{3}-1}{\sqrt{2}} \Pi \left(\frac{\pi}{2}, k, 3^{-1/2} \right) - \frac{1}{\sqrt{2}} F \left(\alpha, 3^{-1/2} \right)$$

with $\phi(x) = 1 + \frac{4}{3} \left(\frac{x}{1+x^2} \right)^2$, $k = 2 - \sqrt{3}$, and $\alpha = \arcsin \sqrt{k}$ and the reference AR.

48. Page 326, add the new Integral 3.248.7

In the search for the correct evaluation of 3.248.5 (see note above), a small variation of the integral was found (in an unpublished paper by Juan Arias de Reyna, Petr Blaschke, and Victor H. Moll). This, perhaps, explains a typographic error in 3.248.5 in earlier editions.

$$\int_0^\infty \frac{dx}{(1+x^2)^{3/2}} \frac{1}{\sqrt{\phi(x) + \sqrt{\phi(x)^3}}} = \frac{\pi}{2\sqrt{6}}$$

$$\text{with } \phi(x) = 1 + \frac{4}{3} \left(\frac{x}{1+x^2} \right)^2.$$

49. Page 329, Integral 3.252.11: replace $(\beta^2 - 1)$ with $(1 - \beta^2)$.

10/25

50. Page 332, Integral 3.264.2: replace $[\mu = \frac{1}{2}]$ with $[\mu = 1]$

(Thanks to Christophe Chesneau for correcting this error.)

51. Page 336, Integral 3.311.1: add the constraint $\operatorname{Re} p > 0$; add the reference VE2015

52. Page 336, Integral 3.311.5: replace $\operatorname{Re} \nu < 1$ with $\operatorname{Re} \nu < 0$; add the reference VE2015

53. Page 337, Integral 3.312.1: replace $\operatorname{Re} \nu > 0$ with $\operatorname{Re} \nu > 1$; add the reference VE2015

54. Page 338, Integral 3.318.2:

- replace $\sqrt{\pi} e^{\dots}$ with $\sqrt{\pi} e^{\dots}$
- add the reference VE2015

55. Page 338, Integral 3.321.1: remove the first term containing $\Phi(u)$; the entry should begin

10/25

$$\frac{\sqrt{\pi}}{2} \operatorname{erf}(u) =$$

56. Page 338, Integral 3.321.2: in the evaluation, replace the function Φ with the function erf

10/25

57. Page 338, Integral 3.321.3: replace $\frac{\sqrt{\pi}}{2q} [q > 0]$ with $\frac{\sqrt{\pi}}{2\sqrt{q^2}} [\operatorname{Re} q^2 > 0]$; add the reference VE2015

58. Page 338, Integral 3.321.5: in the evaluation, replace the function Φ with the function erf

10/25

59. Page 339, Integral 3.321.7: in the evaluation, replace the function Φ with the function erf

10/25

60. Page 339, Integral 3.322.1: remove $\operatorname{Re} \beta > 0, u > 0$; add the reference VE2015

61. Page 339, Integral 3.323.2: replace $\frac{\sqrt{\pi}}{p}$ with $\frac{\sqrt{\pi}}{\sqrt{p^2}}$; add the reference VE2015

62. Page 339, Integral 3.323.3: add the constraint $[\operatorname{Re} a > 0]$; add the reference VE2015

63. Page 339, Integral 3.323.4: add the constraint $[\operatorname{Re} \beta^2 > 0, \operatorname{Re} \gamma^2 > 0]$; add the reference VE2015

64. Page 343, Integral 3.352.7

The current evaluation of the integral is incorrect. The correct evaluation is

$$= \begin{cases} 0 & \text{if } \text{Im}(a) < 0 \\ 2\pi i e^{iap} & \text{if } \text{Im}(a) > 0 \end{cases}$$

(Thanks to Agostino Migliore for correcting this error.)

65. Page 344, Integral 3.354.5: replace $\frac{\pi}{a}$ with $\frac{\pi}{|a|}$; add the reference VE2015

66. Page 350, Integral 3.383.5

- The evaluation of the integral is incorrect. The correct evaluation is

$$= \frac{\pi^2}{p^q \Gamma(\nu) \sin[\pi(q - \nu)]} \left[\left(\frac{p}{a}\right)^\nu \frac{L_{-\nu}^{\nu-q}\left(\frac{p}{a}\right)}{\sin(\pi\nu) \Gamma(1 - q)} - \left(\frac{p}{a}\right)^q \frac{L_{-q}^{q-\nu}\left(\frac{p}{a}\right)}{\sin(\pi q) \Gamma(1 - \nu)} \right]$$

- The constraint

$$\begin{aligned} [\nu \neq \pm 1, \pm 2, \dots] & \quad \text{must be modified to be} \\ [\nu \neq \pm 1, \pm 2, \dots, \quad q \neq \pm 1, \pm 2, \dots, \quad (q - \nu) \neq \pm 1, \pm 2, \dots,] \end{aligned}$$

(Thanks to Mohammad S. Alhassoun and Chu Lenong for correcting these errors.)

67. Page 351, Integral 3.385

- (a) The evaluation of the integral is incorrect; the term

$$\Phi_1(\nu, \varrho, \lambda + \nu, -\mu, b)$$

$$\Phi_1(\nu, \varrho, \lambda + \nu, b, -\mu)$$

- (b) The reference is incorrect. It is now “ET 1 39(24)”, it should be “ET 1 139(24)”.

(Thanks to Travis Porco for correcting these errors.)

68. Page 356, Integral 3.411.16 change the result from

$$\pi^3 \cos^2 \mu \pi (2 - \sin^2 \mu \pi) \quad \text{to}$$

$$\pi^3 \csc^2(\mu \pi) (2 - \sin^2 \mu \pi)$$

(Thanks to David MacIver for correcting this error.)

69. Page 358, Integral 3.415.4: remove the constraint $[\text{Re } \mu > 0]$

(Thanks to Richard J. Mathar for correcting this error.)

70. Page 358, Integral 3.416.3: replace 2^{2^n} with 2^{2n} ; add the reference VE2015

71. Page 358, Integral 3.417.1:

$$\text{replace } \frac{\pi}{2ab} \ln \left(\frac{b}{a} \right) \quad [ab > 0]$$

$$\text{with } \frac{\pi}{2|ab|} \ln \left(\left| \frac{b}{a} \right| \right) \quad [a \neq 0, \quad b \neq 0];$$

add the reference VE2015

72. Page 361, Integral 3.426.2

The numerator of the integrand is incorrect; the term “ $(e^x - ae^{-x})$ ” should be “ $(e^x + ae^{-x})$ ”.

10/25

73. Page 361, Integral 3.461.7

The integrand is currently $\exp\left(-a\sqrt{x^2 + b^2}\right)$ which is incorrect.

The integrand should have been $x^2 \exp\left(-a\sqrt{x^2 + b^2}\right)$

(Thanks to Mungon Nam for correcting this error.)

74. Page 369, Integral 3.462.22: replace “ $K_1(ab)$ ” with “ $K_2(ab)$ ”.

(Thanks to Peter Brown for correcting this error.)

75. Page 369, Integral 3.462.25: replace $\operatorname{Re} b > 0$ with $\operatorname{Re} p > 0$; add the reference VE2015

76. Page 369, Integral 3.466.1: expand the evaluation with

$$\begin{aligned} & [1 - \Phi(b\mu)] \frac{\pi}{2b} e^{b^2\mu^2} & [\operatorname{Re} b > 0, \quad |\arg \mu| < \frac{\pi}{4}] \\ & - [1 + \Phi(b\mu)] \frac{\pi}{2b} e^{b^2\mu^2} & [\operatorname{Re} b < 0, \quad |\arg \mu| < \frac{\pi}{4}] \end{aligned}$$

and add the reference VE2015

77. Page 369, Integral 3.468.2: the u should have been a μ ; but it better to write the integral using a single parameter

$$\int_0^\infty \frac{x e^{-\beta^2 x^2} dx}{\sqrt{1+x^2}} = \frac{\sqrt{\pi}}{2\beta} e^{\beta^2} [1 - \Phi(\beta)] \quad [\operatorname{Re} \beta^2 > 0]$$

78. Page 370, Integral 3.471.4, replace K_u with K_μ

(Thanks to Luca Citi for for correcting this error.)

10/25

79. Page 374, Integral 3.511.6

The results is now $\pi \frac{\sin \frac{\pi a}{2} \cos \frac{\pi b}{2}}{\cos \pi a + \cos \pi b}$ and is incorrect.

This should have been $\pi \frac{\cos \frac{\pi a}{2} \cos \frac{\pi b}{2}}{\cos \pi a + \cos \pi b}$

(Thanks to Julian Huddell for correcting this error.)

10/25

80. Page 374, Integral 3.512.2

(a) Replace $\frac{1}{2} B\left(\frac{\mu+1}{2}, \frac{\nu-\boxed{1}}{2}\right)$ with $\frac{1}{2} B\left(\frac{\mu+1}{2}, \frac{\nu-\mu}{2}\right)$

(b) Replace the constraints with $[\operatorname{Re}(\nu) > \operatorname{Re}(\mu) > -1]$

(Thanks to Shotaro Yamazoe for correcting this error.)

81. Page 377, Integral 3.518.6 currently has

10/25

$${}_2F_1\left(\dots\right) 2B\left(\dots\right) \quad \text{which is incorrect. It should be}$$

$$\frac{1}{2} {}_2F_1\left(\dots\right) B\left(\dots\right)$$

82. Page 382, Integral 3.527.13: in the denominator of the integrand replace “ $\cosh^2 x$ ” with “ $\sinh^2 x$ ”.

83. Page 384, Integral 3.536.2: in the denominator of the integrand replace “ $\cosh^2 x$ ” with “ $\cosh x^2$ ”.

84. Page 400, Integral 3.631.17

10/25

Replace the integrand, the evaluation, and the reference. This should have been

$$\int_0^\pi \cos^n x \cos mx \, dx = [1 + (-1)^{m+n}] \int_0^{\pi/2} \cos mx \, dx$$

$$= [1 + (-1)^{m+n}] \begin{cases} \frac{s n!}{(m-n)(m-n+2) \cdots (m+n)} & \text{if } n < m \\ \frac{\pi}{2^{n+1}} \binom{n}{k} & \text{if } m \leq n \text{ and } n-m = 2k \\ \frac{n!}{(2k+1)!! (2m+2k+1)!!} & \text{if } m < n \text{ and } n-m = 2k+1 \end{cases}$$

$$\text{where } s = \begin{cases} 0 & \text{if } m-n = 2k \\ 1 & \text{if } m-n = 4k+1 \\ -1 & \text{if } m-n = 4k-1 \end{cases} \quad \text{GW (332)(14a)}$$

85. Page 419, Integral 3.691.2: replace $S(\sqrt{a})$ with $S\left(\sqrt{\frac{2a}{\pi}}\right)$; add the reference VE2015

86. Page 419, Integral 3.691.3: replace $C(\sqrt{a})$ with $C\left(\sqrt{\frac{2a}{\pi}}\right)$; add the reference VE2015

87. Page 419, for Integrals 3.691.4 and 3.691.6:

- replace $C\left(\frac{b}{\sqrt{a}}\right)$ with $C\left(b\sqrt{\frac{2}{a\pi}}\right)$
- replace $S\left(\frac{b}{\sqrt{a}}\right)$ with $S\left(b\sqrt{\frac{2}{a\pi}}\right)$;
- add the reference VE2015

88. Page 419, for Integrals 3.691.8 and 3.691.9:

10/25

- replace $C\left(\frac{a}{2b}\right)$ with $C\left(\frac{a}{b\sqrt{2\pi}}\right)$
- replace $S\left(\frac{a}{2b}\right)$ with $S\left(\frac{a}{b\sqrt{2\pi}}\right)$;

- add the reference VE2015

89. Page 429, Integral 3.725.3: the evaluation of the integral should be changed to the following

$$\begin{array}{ll}
 \gamma_1 & [\operatorname{Re} \beta > 0, \quad 0 < a < b] \\
 \gamma_1 & [\operatorname{Re} \beta > 0, \quad a < 0 < b] \\
 -\gamma_1 & [\operatorname{Re} \beta < 0, \quad b < a < 0] \\
 \gamma_2 & [\operatorname{Re} \beta < 0, \quad 0 < a < b] \\
 \gamma_2 & [\operatorname{Re} \beta < 0, \quad a < 0 < b] \\
 -\gamma_2 & [\operatorname{Re} \beta > 0, \quad b < a < 0] \\
 \gamma_3 & [\operatorname{Re} \beta > 0, \quad 0 < b < a] \\
 \gamma_3 & [\operatorname{Re} \beta > 0, \quad b < 0 < a] \\
 -\gamma_3 & [\operatorname{Re} \beta < 0, \quad a < b < 0] \\
 \gamma_4 & [\operatorname{Re} \beta < 0, \quad 0 < b < a] \\
 \gamma_4 & [\operatorname{Re} \beta < 0, \quad b < 0 < a] \\
 -\gamma_4 & [\operatorname{Re} \beta > 0, \quad a < b < 0]
 \end{array}$$

where

$$\begin{aligned}
 \gamma_1 &= \frac{\pi}{2\beta^2} e^{-b\beta} \sinh(a\beta) \\
 \gamma_2 &= -\frac{\pi}{2\beta^2} e^{b\beta} \sinh(a\beta) \\
 \gamma_3 &= -\frac{\pi}{2\beta^2} e^{-a\beta} \cosh(b\beta) + \frac{\pi}{2\beta^2} \\
 \gamma_4 &= -\frac{\pi}{2\beta^2} e^{a\beta} \cosh(b\beta) + \frac{\pi}{2\beta^2}
 \end{aligned}$$

and add the reference VE2015

90. Page 439, Integral 3.755.1: add the constraint $\operatorname{Re} b > 0$; add the reference VE2015

91. Page 447, Integral 3.772.5: replace “ET I 12(4)” with “read ET I 12(14)”; add the reference VE2015

92. Page 448, Integral 3.773.1: replace $\Gamma(\mu - \mu + \frac{3}{2})$ with $\Gamma(\nu - \mu + \frac{3}{2})$ 10/25

93. Page 457, Integral 3.812.3: replace $\frac{\pi}{a} \ln \frac{2(1+a-\sqrt{1+a})}{2}$ with $\frac{\pi}{a} \ln \frac{a(1+a-\sqrt{1+a})}{2}$ 10/25

94. Page 473, Integral 3.835.2: in the reference, replace LI with BI 10/25

95. Page 480, Integral 3.894: the current evaluation 10/25

$$\frac{2\pi\Gamma(\nu+1) P_\nu^m(\beta)}{\Gamma(\nu+m+1)} \quad \text{is incorrect. It should have been (missing a factor and } m \rightarrow n)$$

$$(-i)^n \frac{2\pi\Gamma(\nu+1) P_\nu^n(\beta)}{\Gamma(\nu+n+1)}$$

(Thanks to Dominique Hirondel for correcting these errors.)

96. Page 489, Integrals 3.891.1 and 3.891.2.

In each case the results are correct, but only when m and n are non-negative integers. The result when m and n can be any integers are:

$$3.891.1 \quad \int_0^{2\pi} e^{imx} \sin nx \, dx = \begin{cases} 0 & |m| \neq |n| \text{ or } m = n = 0 \\ \pi i & m = n \neq 0 \\ -\pi i & m = -n \neq 0 \end{cases}$$

$$3.891.2 \quad \int_0^{2\pi} e^{imx} \cos nx \, dx = \begin{cases} 0 & |m| \neq |n| \\ \pi & |m| = n \neq 0 \\ 2\pi & m = n = 0 \end{cases}$$

(Thanks to Guillem Blanco for correcting these errors.)

97. Page 495, Integral 3.914.6:

- (a) change the reference from “ET I 175(35)” to “ET I 75(35)” to
- (b) add the constraints $[\operatorname{Re} \beta > 0, \operatorname{Re} \gamma > 0]$

(Thanks to Claudio Severi and Howard Haber for correcting these errors.)

98. Page 495, Integral 3.914.9: add the constraints $[\operatorname{Re} \beta > 0, \operatorname{Re} \gamma > 0]$

(Thanks to Howard Haber for correcting this error.)

99. Pages 499-500, Section 3.932.

10/25

- (a) For **3.932.1** add $[m > 0]$ EK (31)
 Additionally, indicate the the integral is 0 when $m = 0$.
- (b) For **3.932.2** add $[m > 0]$ EK (32)
 Additionally, indicate the the integral is π when $m = 0$.

(Thanks to Robert C. Elliott for correcting these errors.)

100. Page 500, Section 3.936.

10/25

- At the beginning of the section, include the text
 “In **3.936.1–3**, if $p = m = 0$ then $p^m = 0^0$ has the value 1.”
- For **3.936.1** add the reference EK (33)
- For **3.936.2** remove the constraint $[p > 0]$ and add the reference EK (37)
- For **3.936.3** remove the constraint $[p > 0]$ and add the reference EK (38)
- For **3.936.4** add the constraint $[m = 0, 1, 2, \dots]$

(Thanks to Robert C. Elliott for correcting these errors.)

101. Page 500, Section 3.937.

10/25

- Replace all the text in this **Notation** section with the following

In formulas **3.937.1** and **3.937.2**, define the following

$$\begin{aligned} A_1 &= \frac{p_R + a_I - q_I + b_R}{2}, & A_2 &= \frac{p_R - a_I + q_I + b_R}{2}, \\ B_1 &= \frac{p_I - a_R + q_R + b_I}{2}, & B_2 &= \frac{p_I + a_R - q_R + b_I}{2}, \\ C_1 &= \frac{1}{4} \left[(p_R + a_I)^2 + (q_R + b_I)^2 - (p_I - a_R)^2 - (q_I - b_R)^2 \right] \\ C_2 &= \frac{1}{4} \left[(p_R - a_I)^2 + (q_R - b_I)^2 - (p_I + a_R)^2 - (q_I + b_R)^2 \right] \\ D_1 &= \frac{1}{2} \left[(p_I - a_R)(p_R + a_I) + (q_I - b_R)(q_R + b_I) \right] \\ D_2 &= \frac{1}{2} \left[(p_I + a_R)(p_R - a_I) + (q_I + b_R)(q_R - b_I) \right] \end{aligned}$$

where, for the complex variables $\{a, b, p, q\}$, the subscripts “ R ” and “ I ” denote the real and imaginary parts. Also, if $m = 0$ in these two integrals then 0^0 appears and it should be given the value “1.”

- Replace the right hand side of **3.937.1** with the following

$$\frac{i\pi}{m!} [(A_1 + iB_1)^m {}_0F_1(; m+1, C_1 + iD_1) - (A_2 + iB_2)^m {}_0F_1(; m+1, C_2 + iD_2)]$$

EK (25)

- Replace the right hand side of **3.937.2** with the following

$$\frac{\pi}{m!} [(A_1 + iB_1)^m {}_0F_1(; m+1, C_1 + iD_1) + (A_2 + iB_2)^m {}_0F_1(; m+1, C_2 + iD_2)]$$

EK (26)

- Replace the right hand side of **3.937.3** with the following

$$= \frac{2\pi}{m!} (p^2 + q^2)^{m/2} \sin [m \arg(p + iq)] \quad [m > 0, \quad p \text{ and } q \text{ are real}] \quad \text{EK (45b)}$$

$$= \frac{i\pi}{m!} [(p - iq)^m - (p + iq)^m] \quad [m > 0, \quad p \text{ and } q \text{ are complex}] \quad \text{EK (46c)}$$

- Replace the right hand side of **3.937.4** with the following

$$= \frac{2\pi}{m!} (p^2 + q^2)^{m/2} \cos [m \arg(p + iq)] \quad [m > 0, \quad p \text{ and } q \text{ are real}] \quad \text{EK (45b)}$$

$$= \frac{\pi}{m!} [(p - iq)^m + (p + iq)^m] \quad [m > 0, \quad p \text{ and } q \text{ are complex}] \quad \text{EK (47c)}$$

(Thanks to Robert C. Elliott for correcting these errors.)

102. Page 521, Integral 4.113.10.

10/25

The evaluation is incorrect. The correct evaluation is

$$\begin{aligned} & \frac{(-1)^m e^{(m+\frac{1}{2})a}}{2m+1} [a + \ln(1 + e^{-a})] - \frac{e^{-a/2}}{2m+1} \sum_{j=0}^{m-1} \frac{(-1)^j e^{-ja}}{j-m} \\ & + \frac{e^{-a/2}}{(2m+1)(m+1)} {}_2F_1 \left(\begin{matrix} 1 & m+1 \\ m+2 \end{matrix} \middle| -e^{-a} \right) \end{aligned}$$

103. Page 525, Integral 4.124.2: delete the current integral and replace with the following

$$\int_0^u \frac{\cos px \cosh(q\sqrt{u^2 - x^2})}{\sqrt{u^2 - x^2}} dx = \frac{\pi}{2} J_0 \left(u\sqrt{p^2 - q^2} \right) \quad [u > 0]$$

(Thanks to Mark Coffey for correcting this error.)

104. Page 534, Integral 4.222.8: delete the current evaluation and replace it with the following

$$\int_0^\infty \ln(1 + ax) x^b e^{-x} dx = - \sum_{k=0}^b \frac{b!}{(b-k)!} \frac{1}{(-a)^{b-k}} \times \left[e^{1/a} \text{Ei} \left(-\frac{1}{a} \right) - \sum_{j=1}^{b-k} (j-1)! (-a)^j \right]$$

[$a > 0$, $b > 0$ an integer]

105. Page 535, Integral 4.224.12: remove the evaluation for $a^2 \geq 1$ and remove the reference

(Thanks to Martin Kreh and Richard Hunt for correcting these errors.)

106. Page 535, Integral 4.224.12 (1)

The integrand has the exponent of “2” in the wrong place. The evaluation is correct. That is, replace the current entry with

$$\int_0^\pi \ln(1 + a \cos x)^2 dx = \begin{cases} 2\pi \ln \left(\frac{1 + \sqrt{1 - a^2}}{2} \right) & \text{for } a^2 \leq 1 \\ 2\pi \ln \left(\frac{|a|}{2} \right) & \text{for } a^2 \geq 1 \end{cases}$$

And add the reference “BI (330)(1)”.

(Thanks to Martin Kreh and Richard Hunt for correcting these errors.)

107. Page 535, Integral 4.224.13.¹²: In the evaluation, replace

$$\frac{2^k (k!)^2}{(2k+1)(2k+1)!!} \quad \text{with} \quad \frac{2^{2k} (k!)^2}{(2k+1)(2k+1)!}$$

(Thanks to Juan Carlos Lopez, Rosalba Mendoza Suárez, and Jairo Alonso Mendoza for correcting this error.)

108. Page 539, Integral 4.231.19

The correct evaluation of this integral is (the “2” should be a “12”)

$$\int_0^1 \frac{x \ln x}{1+x} dx = -1 + \frac{\pi^2}{12}$$

(Thanks to Kendall Richards for correcting this error.)

109. Page 539, Integral 4.232.1

For consistency with other entries, the term “log” appearing in the output should be “ln”.

10/25

110. Page 558, Integral 4.283.9

The correct evaluation of this integral is as follows (the q was missing from the integrand and the evaluation had switched a and q)

$$\int_0^1 \left[x^q + \frac{1}{a \ln x - 1} \right] \frac{dx}{x \ln x} = \ln \left(\frac{q}{a} \right) + C$$

111. Page 564, Integral 4.295.12

10/25

The integrand is currently

$$\ln^2(1 - x^2) \frac{dx}{x^2}$$

which is incorrect. It should have been

$$\ln |1 - x^2| \frac{dx}{x^2}$$

112. Page 565, Integral 4.295.22

10/25

The expression that is currently written is

$$\int_0^\infty \frac{\ln(1 + p^2 x^2)}{r^2 + q^2 x^2} dx = \int_0^\infty \frac{\ln(p^2 + x^2)}{q^2 + r^2 x^2} dx = \frac{\pi}{qr} \ln \frac{q + pr}{r}$$

However, the two integrals are not the same. The correct statements are:

$$\begin{aligned} \bullet \int_0^\infty \frac{\ln(1 + p^2 x^2)}{r^2 + q^2 x^2} dx &= \frac{\pi}{qr} \ln \left(\frac{q + pr}{q} \right) \\ \bullet \int_0^\infty \frac{\ln(p^2 + x^2)}{q^2 + r^2 x^2} dx &= \frac{\pi}{qr} \ln \left(\frac{q + pr}{r} \right) \end{aligned}$$

(Thanks to Carlos Maña Barrera for correcting this error.)

113. Page 572, Integral 4.319.1, replace the current evaluation with

(while only one sign is fixed, the new representation better illustrates the solution's structure)

$$-\frac{\pi}{2} \left(2a + \ln \left(\frac{\Gamma^2(a+1)}{2\pi a^{2a+1}} \right) \right) \quad \operatorname{Re}(a) > 0 \quad \text{REY3 (16)}$$

114. Page 572, Integral 4.319.2, replace the current evaluation with

(while only one sign is fixed, the new representation better illustrates the solution's structure)

$$-\frac{\pi}{2} \left(2a + \ln \left(\frac{\Gamma^2(a + \frac{1}{2})}{2\pi a^{2a}} \right) \right) \quad \operatorname{Re}(a) > 0 \quad \text{REY3 (15)}$$

(Thanks to Robert Reynolds correcting this error.)

115. Page 579, Integral 4.356.7

10/25

The current evaluation is $K_0(2\sqrt{ab})$, which is incorrect.

The correct evaluation is $2K_0(2\sqrt{ab})$.

(Thanks to Paolo Maccallini for correcting this error.)

116. Page 580, Integral 4.358.2: replace $\zeta(2, \nu - 1)$ with $\zeta(2, \nu)$; add the reference VE2015

117. Page 590, Integral 4.391.3

10/25

The reference has “Zsurround7” when it should have had “(7)”

(Thanks to Allen Stenger for correcting this error.)

118. Page 598, Integral 4.442 (1) and (2)

10/25

In these integrals the $\ln$ should have been a $\ln(x)$ They should have been

$$\begin{aligned} & \bullet \int \ln(x) \sin(ax) x^{\mu-1} dx \quad \text{and not } \int \ln \sin \dots \\ & \bullet \int \ln(x) \cos(ax) x^{\mu-1} dx \quad \text{and not } \int \ln \cos \dots \end{aligned}$$

(Thanks to Allen Stenger for correcting this error.)

10/25

119. Page 632, Integral 5.33.3: The third term in the evaluation is now

$$\begin{aligned} & -\frac{1}{2\alpha} [\operatorname{si}(\alpha x + \beta x) + \operatorname{si}(\beta x + \alpha x)] \quad \text{which is incorrect. It should have been} \\ & -\frac{1}{2\alpha} [\operatorname{si}(\alpha x + \beta x) + \operatorname{si}(\beta x - \alpha x)] \end{aligned}$$

(Thanks to David Billingham for correcting this error.)

120. Page 634, Integral 5.54.3: for the evaluation, replace $\frac{x^4}{4}$ with $\frac{x^2}{4}$

(Thanks to Adriana Brancaccio and Brady Metherall for (independently) correcting this error.)

121. Page 634, Integral 5.54.3: add the reference WA 134(10)

(Thanks to Brady Metherall for correcting this error.)

122. Page 654, Integral 6.282.2: add the constraint $\operatorname{Re} \mu > 0$; add the reference VE2015

123. Page 654, Integral 6.283.1: replace “ $\operatorname{Re} \alpha > 0$ ” with “ $\operatorname{Re} \beta < 0$ ”; add the reference VE2015

124. Page 654, Integral 6.285.1: expand the evaluation by replacing

$$\frac{\arctan \mu}{\sqrt{\pi} \mu} \quad [\operatorname{Re} \mu > 0]$$

with

$$\frac{\arctan \sqrt{\mu^2}}{\sqrt{\pi} \sqrt{\mu^2}} \quad [\operatorname{Re} \mu^2 > 0]$$

Add the reference VE2015

125. Page 654, Integral 6.285.2: change sign of result by replacing $-\frac{1}{2ai\sqrt{\pi}}$ with $\frac{1}{2ai\sqrt{\pi}}$; add the reference VE2015

126. Page 655, Integral 6.291: replace $\frac{\mu}{a}$ with $\frac{\mu}{4}$; add the reference VE2015

127. Page 655, Integral 6.295.2: replace $-\frac{1}{\mu^2}$ with $-\frac{1}{\mu}$; add the reference VE2015
128. Page 656, Integral 6.296: replace “ $a > 0$ ” with “ a real”; add the reference VE2015
129. Page 656, Integral 6.297.1: add the constraint $\operatorname{Re}(\gamma^2 - \mu) < 0$; add the reference VE2015
130. Page 656, Integral 6.297.2: replace “ $a > 0, b > 0, \operatorname{Re} \mu > 0$ ” with “ $b > 0, \operatorname{Re}(\mu^2 - a^2) > 0$ ”; add the reference VE2015
131. Page 656, Integral 6.297.3: remove $a > 0$; add the reference VE2015
132. Page 656, Integral 6.298: replace the constraint with “ $[b > 0, \operatorname{Re} \mu > 0, \operatorname{Re}(\mu - a^2) > 0]$ ”; add the reference VE2015
133. Page 656, Integral 6.299: replace $K_\nu(a^2)$ with $K_\nu(\frac{1}{2}a^2)$; add the reference VE2015
134. Page 656, Integral 6.311: generalize the evaluation to be

$$\begin{aligned} \frac{1}{b} \left(1 - e^{-b^2/4a^2} \right) & \quad [a > 0, \quad b \neq 0] \\ \frac{1}{b} \left(1 + e^{-b^2/4a^2} \right) & \quad [a < 0, \quad b \neq 0] \end{aligned}$$

and add the reference VE2015

135. Page 656, Integral 6.312: expand the evaluation, and correct the constraint, with

$$\begin{aligned} \frac{1}{4\sqrt{2\pi b}} \left[\ln \left(\frac{b + a^2 + a\sqrt{2b}}{b + a^2 - a\sqrt{2b}} \right) + 2 \arctan \left(\frac{a\sqrt{2b}}{b - a^2} \right) \right] & \quad [a > 0, \quad b > 0, \quad a < \sqrt{b}] \\ \frac{1}{4\sqrt{2\pi b}} \left[\ln \left(\frac{b + a^2 + a\sqrt{2b}}{b + a^2 - a\sqrt{2b}} \right) + 2 \arctan \left(\frac{a\sqrt{2b}}{b - a^2} \right) + 2\pi \right] & \quad [a > 0, \quad b > 0, \quad a > \sqrt{b}] \end{aligned}$$

and add the reference VE2015

136. Page 657, Integral 6.314.1: the integral and its solution should be replaced by

$$\int_0^\infty \sin(bx) \Phi \left(\sqrt{\frac{a}{x}} \right) dx = \frac{1}{b} \left(1 - \cos \left(\sqrt{2ab} \right) \exp^{-\sqrt{2ab}} \right) \quad [\operatorname{Re} a > 0, \quad \operatorname{Re} b > 0]$$

and add the reference VE2015

137. Page 657, Integral 6.314.2: the integral and its solution should be replaced by

$$\int_0^\infty \cos(bx) \Phi \left(\sqrt{\frac{a}{x}} \right) dx = \frac{1}{b} \sin \left(\sqrt{2ab} \right) \exp^{-\sqrt{2ab}} \quad [\operatorname{Re} a > 0, \quad \operatorname{Re} b > 0]$$

and add the reference VE2015

138. Page 657, Integral 6.315.3: replace $b > 0$ with $b \neq 0$; add the reference VE2015

139. Page 657, Integral 6.315.4: replace $\operatorname{Ei} \left(\frac{p}{4a^2} \right)$ with $\operatorname{Ei} \left(-\frac{p}{4a^2} \right)$ and replace $p > 0$ with $p \neq 0$; add the reference VE2015

140. Page 657, Integral 6.315.5: expand the evaluation, and correct the constraint, with

$$\frac{1}{2\sqrt{2\pi b}} \left[\ln \left(\frac{b + a\sqrt{2b} + a^2}{b - a\sqrt{2b} + a^2} \right) + 2 \arctan \left(\frac{a\sqrt{2b}}{b - a^2} \right) \right] \quad [a > 0, \quad b > 0, \quad a < \sqrt{b}]$$

$$\frac{1}{2\sqrt{2\pi b}} \left[\ln \left(\frac{b + a\sqrt{2b} + a^2}{b - a\sqrt{2b} + a^2} \right) + 2 \arctan \left(\frac{a\sqrt{2b}}{b - a^2} \right) + 2\pi \right] \quad [a > 0, \quad b > 0, \quad a > \sqrt{b}]$$

and add the reference VE2015

141. Page 657, Integral 6.317: expand the evaluation, and correct the constraint, with

$$\frac{i}{a} \frac{\sqrt{\pi}}{2} e^{-\frac{b^2}{4a^2}} \quad [\operatorname{Re} a^2 > 0, \quad b > 0]$$

$$-\frac{i}{a} \frac{\sqrt{\pi}}{2} e^{-\frac{b^2}{4a^2}} \quad [\operatorname{Re} a^2 > 0, \quad b < 0]$$

and add the reference VE2015

142. Page 657, Integral 6.318: the correct evaluation is

$$\frac{1}{2p} \left(e^{-p^2} - 1 \right) + \frac{\sqrt{\pi}}{2} \Phi(p) \quad [\operatorname{Re} p > 0]$$

and add the reference VE2015

143. Page 668, Integral 6.511.7: generalize the result to

$$\int_0^a J_1(xy) \, dx = \frac{1}{y} [1 - J_0(ay)] \quad [a > 0, \quad y \neq 0]$$

and add the reference VE2015

144. Page 668, Integral 6.511.9: remove the constraint; add the reference VE2015

145. Page 668, Integrals 6.511.12 and 6.511.13: add the missing dx

(Thanks to Donato Posa for correcting these errors.)

146. Page 669, Integral 6.512.9: replace $b > 0$ with $b \neq 0$; add the reference VE2015

147. Page 669, Integral 6.512.10: replace the constraint with $[a > 0, \quad b \neq 0, \quad a > |b|]$; add the reference VE2015

148. Page 671, Integral 6.516.1: include the additional evaluation

$$-\frac{1}{b} J_\nu \left(\frac{a^2}{4b} \right) \quad [a > 0, \quad b < 0, \quad \operatorname{Re} \nu > -\frac{1}{2}]$$

and add the reference VE2015

149. Page 671, Integral 6.516.4: add the constraint $\operatorname{Re} \nu > -\frac{1}{2}$; add the reference VE2015

150. Page 673, Integral 6.521.2: replace the constraint with $[\operatorname{Re}(a \pm ib) > 0, \operatorname{Re} \nu > -1]$; add the reference VE2015
151. Page 673, Integrals 6.521.5–6.521.15: add the missing dx
(Thanks to Donato Posa for correcting these errors.)
152. Page 673, Integral 6.521.7: remove $b > 0$; add the reference VE2015
153. Page 673, Integral 6.521.8: replace the constraint with $[a > |b| \geq 0]$; add the reference VE2015
154. Page 673, Integral 6.521.9: replace the constraint with $[a > |b| \geq 0]$; add the reference VE2015
155. Page 673, Integral 6.521.12: remove $b > 0$; add the reference VE2015
156. Page 673, Integral 6.521.13: replace the constraint with $[a > 0]$; add the reference VE2015
157. Page 673, Integral 6.521.14: replace the constraint with $[a > |b| \geq 0]$; add the reference VE2015
158. Page 673, Integral 6.521.15: replace the constraint with $[a > |b| \geq 0]$; add the reference VE2015
159. Page 674, Integral 6.522.4: in the first constraint remove $c > 0$; in the second constraint remove $a > 0$; add the reference VE2015
160. Page 674, Integral 6.522.5: remove the constraint $c > 0$ (in 2 places); add the reference VE2015
161. Page 676, Integral 6.524.2: in the evaluation replace “ a ” with “ $|a|$ ”; replace the constraint with $[a \neq 0, b > 0]$; add the reference VE2015
162. Page 676, Integral 6.525.1: replace the first constraint with $[\operatorname{Re} b > |\operatorname{Im} a|]$; replace the second constraint with $[\operatorname{Re} a > |\operatorname{Im} b|]$; add the reference VE2015
163. Page 676, Integral 6.525.2: remove the constraint $c > 0$; add the reference VE2015
164. Page 676, Integral 6.525.3: replace $K_0(bx)$ with $K_1(bx)$; replace the constraints with $[\operatorname{Re} b > 0]$; add the reference VE2015
165. Page 676, Integral 6.526.1: replace “ $(2a)^{-1}$ ” with “ $(2|a|)^{-1}$ ”; replace the constraints with $[a \neq 0, b \geq 0, \operatorname{Re} \nu > -1]$; add the reference VE2015
166. Page 679, Integral 6.532.4: expand the evaluation with

$$\begin{aligned} K_0(ak) & \quad \text{if } [a > 0, \operatorname{Re} k > 0] \text{ or } [a < 0, \operatorname{Re} k < 0] \\ K_0(-ak) & \quad \text{if } [a > 0, \operatorname{Re} k < 0] \text{ or } [a < 0, \operatorname{Re} k > 0] \end{aligned}$$

and add the reference VE2015

167. Page 679, Integral 6.532.5: expand the evaluation with

$$\begin{aligned} -\frac{K_0(ak)}{k} & \quad [a > 0, \operatorname{Re} k > 0] \\ \frac{K_0(-ak)}{k} & \quad [a > 0, \operatorname{Re} k < 0] \end{aligned}$$

and add the reference VE2015

168. Page 679, Integral 6.532.6: expand the evaluation with

$$\begin{aligned} \frac{\pi}{2k} [I_0(-ak) - \mathbf{L}_0(-ak)] & \quad [a < 0, \quad \operatorname{Re} k > 0] \\ -\frac{\pi}{2k} [I_0(-ak) - \mathbf{L}_0(-ak)] & \quad [a > 0, \quad \operatorname{Re} k < 0] \\ -\frac{\pi}{2k} [I_0(ak) - \mathbf{L}_0(ak)] & \quad [a < 0, \quad \operatorname{Re} k < 0] \end{aligned}$$

and add the reference VE2015

169. Page 679, Integral 6.533.3: expand the evaluation with

$$\begin{aligned} -\frac{b}{4} \left[1 + 2 \ln \left(\left| \frac{a}{b} \right| \right) \right] & \quad \text{if } (a + b < 0) \text{ and } ([0 < b < a] \text{ or } [a < b < 0] \text{ or } [a < 0 < b]) \\ -\frac{b}{4} \left[1 + 2 \ln \left(\left| \frac{a}{b} \right| \right) \right] & \quad [a + b > 0, \quad b < 0 < a] \\ -\frac{a^2}{4b} & \quad \text{if } (a + b > 0) \text{ and } ([0 < a < b] \text{ or } [b < a < 0] \text{ or } [a < 0 < b]) \\ -\frac{a^2}{4b} & \quad [a + b < 0, \quad b < 0 < a] \end{aligned}$$

and add the reference VE2015

170. Page 680, Integral 6.537, the integrand is now

$$\frac{x^2 J_0(bx)}{x^4 + a^4} \quad \text{which is incorrect, it should have been} \quad \frac{x J_0(bx)}{x^4 + a^4}$$

10/25

171. Page 683, Integral 6.554.1: expand the evaluation with

$$\begin{aligned} y^{-1} e^{ay} & \quad [y > 0, \quad \operatorname{Re} a < 0] \\ -y^{-1} e^{ay} & \quad [y < 0, \quad \operatorname{Re} a > 0] \\ -y^{-1} e^{-ay} & \quad [y < 0, \quad \operatorname{Re} a < 0] \end{aligned}$$

and add the reference VE2015

172. Page 687, Integral 6.566.2: the evaluation is also valid for the constraints $[a < 0, \operatorname{Re} b < 0, -1 < \operatorname{Re} \nu < \frac{3}{2}]$; add the reference ET II 23(12)

173. Page 687, Integral 6.566.3: expand the evaluation with

$$\begin{aligned} \frac{\pi^2 b^{\nu-1}}{4 \cos \nu \pi} [\mathbf{H}_{-\nu}(ab) - Y_{-\nu}(ab)] & \quad [a > 0, \quad \operatorname{Re} b > 0, \quad \operatorname{Re} \nu > -\tfrac{1}{2}] \\ \frac{\pi^2 (-b)^{\nu-1}}{4 \cos \nu \pi} [\mathbf{H}_{-\nu}(-ab) - Y_{-\nu}(-ab)] & \quad [a > 0, \quad \operatorname{Re} b < 0, \quad \operatorname{Re} \nu > -\tfrac{1}{2}] \end{aligned}$$

and add the reference VE2015

174. Page 687, Integral 6.566.4: expand the evaluation with

$$\begin{aligned} \frac{\pi^2}{4b^{\nu+1} \cos \nu \pi} [\mathbf{H}_{\nu}(ab) - Y_{\nu}(ab)] & \quad [a > 0, \quad \operatorname{Re} b > 0, \quad \operatorname{Re} \nu < \tfrac{1}{2}] \\ \frac{\pi^2}{4(-b)^{\nu+1} \cos \nu \pi} [\mathbf{H}_{\nu}(-ab) - Y_{\nu}(-ab)] & \quad [a > 0, \quad \operatorname{Re} b < 0, \quad \operatorname{Re} \nu < \tfrac{1}{2}] \end{aligned}$$

and add the reference VE2015

175. Page 687, 6.566.5: expand the evaluation with

$$\begin{aligned} & \frac{\pi}{2b^{\nu+1}} [I_\nu(ab) - \mathbf{L}_\nu(ab)] & [a > 0, \quad \operatorname{Re} b > 0, \quad \operatorname{Re} \nu > -\tfrac{5}{2}] \\ & -\frac{\pi}{2(-b)^{\nu+1}} [I_\nu(-ab) - \mathbf{L}_\nu(-ab)] & [a < 0, \quad \operatorname{Re} b > 0, \quad \operatorname{Re} \nu > -\tfrac{5}{2}] \\ & \frac{\pi}{2(-b)^{\nu+1}} [I_\nu(-ab) - \mathbf{L}_\nu(-ab)] & [a > 0, \quad \operatorname{Re} b < 0, \quad \operatorname{Re} \nu > -\tfrac{5}{2}] \\ & \frac{\pi}{2(-b)^{\nu+1}} [I_\nu(-ab) + \mathbf{L}_\nu(-ab)] & [a < 0, \quad \operatorname{Re} b < 0, \quad \operatorname{Re} \nu > -\tfrac{5}{2}] \end{aligned}$$

and add the reference VE2015

176. Page 699, Integral 6.592.7: replace $\sqrt{\pi} \sec(\nu\pi)$ with $\pi \sec(\frac{1}{2}\nu\pi)$; add the constraint $a \neq 0$; add the reference VE2015

177. Page 702, Integral 6.611.1: replace the reference WA 422(8) with WA 386(8)

(Thanks to Yuzhi Dai for correcting this error.)

178. Page 702, Integral 6.611.2: replace the constraints with $[\operatorname{Re}(\alpha \pm ib) > 0, \quad |\operatorname{Re} \nu| < 1]$; replace the references with VE2015

179. Page 703, Integral 6.611.9:

(a) replace the “ a ” in the constraints with “ α ”

(b) replace the correct $\frac{1}{\sqrt{\alpha^2 - b^2}} \ln \left(\frac{\alpha}{b} + \sqrt{\frac{\alpha^2}{b^2} - 1} \right)$ with the simpler $\frac{1}{\sqrt{\alpha^2 - b^2}} \operatorname{arccosh} \left(\frac{\alpha}{b} \right)$

(Thanks to Angelo Melino for correcting the error and suggesting the simplification.)

180. Page 704, Integral 6.612.4: the current evaluation is incorrect; the correct evaluation is

$$\frac{1}{b\pi\sqrt{1 + \frac{\alpha^2}{4b^2}}} \mathbf{K} \left(\frac{1}{1 + \frac{\alpha^2}{4b^2}} \right)$$

(Thanks to the Bogazici Physics seniors of 2018 for correcting this error.)

181. Page 705, Integral 6.613: add the constraint $\operatorname{Re} z \geq 0$; add the reference VE2015

182. Page 714, Integral 6.633.2:

(a) replace “ $a > 0$ ” with “ a real”

(b) add the reference VE2015

(c) update the reference WA433(1) to be WA395(1)

10/25

(Thanks to Brady Metherall for correcting one of these errors.)

183. Page 715, Integral 6.633.r: remove the reference WA 434 (their result is incorrect)

10/25

(Thanks to Brady Metherall for correcting this error.)

184. Page 718, Integral 6.648: replace $\left(\frac{a + be^x}{ae^x + b}\right)$ with $\left(\frac{a + be^x}{ae^x + b}\right)^\nu$; add the reference VE2015

185. Page 725, Integral 6.671.4

The term “ $+\cot(\nu\pi)$ ” is incorrect and should have been “ $\cot(\nu\pi)$ ”; that is, there should be a multiplication here and not an addition.

Correcting this, and simplifying the terms results in the following evaluation

$$= -\frac{\sin\left(\frac{\nu\pi}{2}\right)}{\sqrt{b^2 - a^2}} \left\{ \frac{a^\nu \cot(\nu\pi)}{\left(b + \sqrt{b^2 - a^2}\right)^\nu} + \frac{\left(b + \sqrt{b^2 - a^2}\right)^\nu}{a^\nu \sin(\nu\pi)} \right\}$$

(Thanks to Junggi Yoon for correcting this error.)

186. Page 725, Integral 6.671.7: add the evaluation of “ ∞ ” when $a = b$; add the reference VE2015

187. Page 731, Integrals 6.681.5 and 6.681.6: add the constraint $[n = 0, 1, 2, \dots]$ for each of these.

(Thanks to Jim Morehead for correcting this error.)

188. Page 732, Integral 6.681.12: replace $\frac{\pi}{2}$ with $\frac{\pi^2}{4}$; add the constraint $a \neq 0$; add the reference VE2015

10/25

189. Page 732, Integral 6.683.1:

(a) The constraint is now $[\operatorname{Re} \nu > \operatorname{Re} \mu > -1]$ which is incorrect.

It should have been $[\operatorname{Re} \mu > \operatorname{Re} \nu > -1]$

(b) The reference is now WA 407(4) which is incorrect.

It should have been WA 374(4)

(Thanks to Hideshi Yamane for correcting these errors.)

10/25

190. Page 732, Integral 6.683.2:

The reference is now WA 410(1) which is incorrect.

It should have been WA 376(1)

(Thanks to Hideshi Yamane for correcting this error.)

10/25

191. Page 732, Integral 6.683.4:

The reference is now WA 407(2) which is incorrect. The reference should be deleted.

(Thanks to Hideshi Yamane for correcting this error.)

10/25

192. Page 732, Integral 6.683.5:

The reference is now WA 407(3) which is incorrect.

It should have been WA 374(3)

(Thanks to Hideshi Yamane for correcting this error.)

193. Page 734, Integral 6.686.5: replace the constraints with $[a \neq 0, \quad b \neq 0]$; add the reference VE2015

194. Page 738, Integral 6.699.1 add the evaluation for the case $a = b$

$$\frac{\cos\left((\nu + \lambda)\frac{\pi}{2}\right)}{\sqrt{\pi}(2a)^{\lambda+1}} \frac{\Gamma(\nu + \lambda + 1)\Gamma(-\lambda - \frac{1}{2})}{\Gamma(\nu - \lambda)} \quad [b = a, \quad a \geq 0, \quad \operatorname{Re} \lambda < -\frac{1}{2}, \quad \operatorname{Re}(\nu + \lambda) > -2]$$

195. Page 738, Integral 6.699.2, add the evaluation for the case $a = b$

$$\frac{(-1)^{1-\lambda/2}}{\sqrt{\pi}(2a)^{\lambda+1}} \frac{\Gamma(-\lambda - \frac{1}{2})\Gamma(1 + \nu + \lambda)}{\Gamma(\nu - \lambda)} \sin(\frac{1}{2}\nu\pi) \quad [b = a, \quad a \geq 0, \quad \operatorname{Re} \nu > -\lambda - 1, \quad \lambda = -2, -4, \dots]$$

$$\frac{(-1)^{(3-\lambda)/2}}{\sqrt{\pi}(2a)^{\lambda+1}} \frac{\Gamma(-\lambda - \frac{1}{2})\Gamma(\nu + \lambda + 1)}{\Gamma(\nu - \lambda)} \cos(\frac{1}{2}\nu\pi) \quad [b = a, \quad a \geq 0, \quad \operatorname{Re} \nu > -\lambda - 1, \quad \lambda = -1, -3, \dots]$$

196. Page 748, Integral 7.737.1, add the text

For $b = 0$ see 6.699.5. 10/25

(Thanks to Peter A. Robinson for this suggestion.)

197. Page 754, 6.772.1: expand the evaluations to be

$$-\frac{1}{a} [\ln(2a) + \mathbf{C}] \quad [a > 0]$$

$$\frac{1}{a} [\ln(-2a) + \mathbf{C}] \quad [a < 0]$$

and add the reference VE2015

198. Page 754, Integral 6.772.2: expand the evaluations to be

$$-\frac{1}{a} \left[\ln\left(\frac{a}{2}\right) + \mathbf{C} \right] \quad [a > 0]$$

$$-\frac{1}{a} \left[\ln\left(-\frac{a}{2}\right) + \mathbf{C} \right] \quad [a < 0]$$

and add the reference VE2015

199. Page 754, Integral 6.772.3: replace $\frac{2}{b} (K_0(ab) + \ln a)$ with $\frac{2}{b} (K_0(|ab|) + \ln |a|)$; add the constraints $[a \neq 0, \quad b \neq 0]$; add the reference VE2015

200. Page 754, Integral 6.772.4: expand the evaluations to be

$$\frac{2}{x} \operatorname{ker}(x) \quad x > 0$$

$$\frac{2}{x} \operatorname{ker}(-x) \quad x < 0$$

and add the reference VE2015

201. Page 755, Integral 6.784.1: the solution is wrong. The correct solution is

$$\frac{1}{2\sqrt{\pi}} \left(\frac{b}{2}\right)^\nu \frac{1}{a^{2\nu+2}} \frac{\Gamma(\nu + \frac{3}{2})}{\Gamma(\nu + 2)} \Phi\left(\nu + \frac{3}{2}, \nu + 2; -\frac{b^2}{4a^2}\right)$$

In the constraints, replace $b > 0$ with $b \neq 0$; add the reference VE2015

202. Page 758, Integral 6.794.9

The current evaluation is

$$\frac{\pi^{3/2}a}{2^{5/2}\sqrt{b}} \exp\left(-b - \frac{a^2}{8b}\right)$$

which is incorrect. The correct evaluation is

$$\frac{\pi^{3/2}a}{2^{7/2}\sqrt{b}} \exp\left(-b - \frac{a^2}{8b}\right)$$

(Thanks to Angelo Melino for correcting this error.)

203. Page 760, Integral 6.812.1: expand the evaluations to be

$$\begin{aligned} \frac{\pi}{2a} [I_1(ab) - \mathbf{L}_1(ab)] & \quad [\operatorname{Re} a > 0, \quad b > 0] \\ \frac{\pi}{2a} [I_1(-ab) - \mathbf{L}_1(-ab)] & \quad [\operatorname{Re} a > 0, \quad b < 0] \\ -\frac{\pi}{2a} [I_1(-ab) - \mathbf{L}_1(-ab)] & \quad [\operatorname{Re} a < 0, \quad b > 0] \\ -\frac{\pi}{2a} [I_1(ab) - \mathbf{L}_1(ab)] & \quad [\operatorname{Re} a < 0, \quad b < 0] \end{aligned}$$

and add the reference VE2015

204. Page 761, Integral 6.812.2: replace $\frac{a^2b^2}{2}$ with $\frac{a^2b^2}{4}$; add the reference VE2015

205. Page 761, Integral 6.813.4: replace $a > 0$ with $a \neq 0$; add the reference VE2015

206. Page 761, Integral 6.813.5: replace $a > 0$ with $a \neq 0$; add the reference VE2015

207. Page 770, Integral 6.876.1: replace “ $x \operatorname{kei} x J_1(ax)$ ” with “ $\operatorname{kei}(x) J_1(ax)$ ”; replace $a > 0$ with $a \neq 0$; add the reference VE2015

208. Page 770, Integral 6.876.2: replace “ $x \operatorname{ker} x J_1(ax)$ ” with “ $\operatorname{ker}(x) J_1(ax)$ ”; replace $a > 0$ with $a \neq 0$; add the reference VE2015

209. Page 779, Integral 7.132.1: replace $\Gamma(\lambda + \frac{1}{2}\nu + 1)$ with $\Gamma(\lambda + \frac{1}{2}\nu + \frac{1}{2})$.

(Thanks to Bruno Daniel for correcting this error.)

210. Page 798, Integral 7.226.3: replace the current constraints

$$[|p| < 1] \quad \text{with} \quad [p > -1, \quad m = 0, 1, 2, \dots]$$

10/25

(Thanks to Clement Staelen for correcting this error.)

211. Page 799, Integral 7.233: replace $\Gamma(\mu + n)$ with $\Gamma(\mu + n + 1)$

(Thanks to Ramakrishna Janaswamy for correcting this error.)

212. Page 801, Formula 7.249 2:

$$(a) \text{ change } \sum_{t=0}^{t-1} \text{ to } \sum_{r=0}^{t-1}$$

(b) change $[t > n]$ to $[\text{any integer } t > n]$

(Thanks to Matt Majic for correcting this error.)

213. Page 801, Integral 7.251.3: replace $y > 0$ with $y \neq 0$; add the reference VE2015

214. Page 802, Integral 7.251.7: replace $\Gamma\left(\frac{1}{2} + \frac{1}{2}\nu - n\right)$ with $\Gamma\left(\frac{1}{2}\mu + \frac{1}{2}\nu - n\right)$

(Thanks to Ramakrishna Janaswamy for correcting this error.)

215. Page 810, Integral 7.354.1: replace $J_{2n+1}(x)$ with $J_{2n+1}(z)$.

(Thanks to Farid Bouttout for correcting this error.)

216. Page 810, Integral 7.355.1: remove the constraint $a > 0$; add the reference VE2015

217. Page 810, Integral 7.355.2: remove the constraint $a > 0$; add the reference VE2015

218. Page 811, Integral 7.374.4: the correct evaluation is $\sqrt{\pi}2^{n-1}\frac{(2m+n)!}{m!}(a^2-1)^ma^n$

219. Page 811, Integral 7.374.7: replace $L_n^{n-m}(-2y^2)$ with $L_m^{n-m}(-2y^2)$; remove the constraint $m \leq n$; add the reference VE2015

220. Page 812, Integral 7.376.3: replace $\Gamma\left(\frac{\nu+1}{2}\right)$ with $\Gamma\left(\frac{\nu}{2}+1\right)$; add the reference VE2015

221. Page 812, Integral 7.377: replace y^{n-m} with z^{n-m}

(Thanks to Christophe De Beule for correcting this error.)

222. Page 819, Integral 7.421.1: remove $y > 0$; add the reference VE2015

223. Page 821, Integral 7.512.6

(a) The evaluation of the integral is incorrect.

$$\text{The evaluation should be } = \frac{B(\lambda, \beta - \lambda)}{(1-z)^\alpha} = \frac{\Gamma(\beta - \lambda)\Gamma(\lambda)}{\Gamma(\beta)} \frac{1}{(1-z)^\alpha}$$

(b) The additional constraint $\text{Re } \lambda > 0$ needs to be added

(Thanks to Gerald Edgar for correcting this error.)

224. Page 821, Integral 7.512.6: replace

225. Page 821, Integral 7.521.9: replace $(1-z)^\sigma$ with $(1-z)^{-\sigma}$

(Thanks to Gerald Edgar for correcting this error.)

226. Page 822, Integral 7.522.1

The current evaluation, which is incorrect, is

$$\frac{\Gamma(\delta)\lambda^{-\gamma}}{\Gamma(\alpha)\Gamma(\beta)}E(\alpha; \beta : \gamma; \delta : \lambda)$$

The correct evaluation, which only differs in the “punctuation” is

$$\frac{\Gamma(\delta)\lambda^{-\gamma}}{\Gamma(\alpha)\Gamma(\beta)}E(\alpha, \beta, \gamma : \delta : \lambda)$$

(Thanks to Aaron Hendrickson for correcting this error.)

227. Page 825, Integral 7.531.1: add the constraint $c > 0$; add the reference VE2015

228. Page 840, Integral 7.662.4: the solution for $[a < 0, \operatorname{Re} y > 0, \operatorname{Re} \mu > -\frac{1}{2}]$ is the negative of the solution shown. add the reference VE2015

229. Page 851, Integral 7.731.1: replace $\operatorname{Re}^2 a > 0$ with $\operatorname{Re} a^2 > 0$; add the reference VE2015

230. Page 852, Integral 7.741.5 The current evaluation is incorrect, it should be replaced with

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$$\frac{\sqrt{2}\pi}{\Gamma(\frac{3}{4} - \nu)} \left(\frac{2}{3}\right)^{\nu + \frac{1}{4}} e^{-b^2/3} \Phi\left(-\nu + \frac{1}{4}; \frac{1}{2}; -\frac{2b^2}{3}\right)$$

Also, replace the constraints with

$$[\operatorname{Re} \nu > \frac{1}{4}, \quad b \text{ real}]$$

and add the reference

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(Thanks to Richard J. Mathar for correcting this error.)

231. Page 853, Integral 7.751.1: replace the constraint with $[y \neq 0, \quad a \neq 0, \quad n = 1, 3, 5, 7, \dots]$; add the reference VE2015

232. Page 853, Integral 7.751.2: replace the constraint with $[y \neq 0, \quad a \neq 0]$; add the reference VE2015

233. Page 853, Integral 7.751.3

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The current integrand can be slightly generalized, and the evaluation simplified, as follows:

$$\begin{aligned} & \int_0^\infty J_0(xy) D_\nu(ax) D_{\nu+1}(ax) dx \\ &= \begin{cases} -\frac{1}{y} \left[D_\nu\left(\frac{y}{a}\right) D_{\nu+1}\left(-\frac{y}{a}\right) - \frac{\sqrt{\pi}}{\sqrt{2}\Gamma(-\nu)} \right] & [y \neq 0, \quad a > 0] \\ -\frac{1}{y} D_\nu\left(\frac{y}{a}\right) D_{\nu+1}\left(-\frac{y}{a}\right) & [y \neq 0, \quad a \neq 0, \quad \nu = 0, 1, 2, \dots] \end{cases} \end{aligned}$$

add the reference VE2015 (3.6)

This should replace the current value in the 8th edition (which corresponds to the value $a = 1$).

234. Page 853, Integral 7.752.1: replace $y > 0$ with $y \neq 0$; add the reference VE2015

235. Page 853, Integral 7.752.3: replace $y > 0$ with $y \neq 0$; add the reference VE2015

236. Page 853, Integral 7.752.4: replace $y > 0$ with $y \neq 0$; add the reference VE2015

237. Page 853, Integral 7.752.5: replace $y > 0$ with $y \neq 0$; add the reference VE2015

238. Page 854, Integral 7.752.10: replace $y > 0$ with $y \neq 0$; add the reference VE2015

239. Page 854, Integral 7.752.12: replace $y > 0$ with $y \neq 0$; add the reference VE2015

240. Page 856, Integral 7.755.1: replace $y > 0$ with $y \neq 0$; replace $2^{-3/2}$ with $2^{-1/2}$; add the reference VE2015

241. Page 857, Integral 7.771: add $\beta > 0$ to each constraint, replace “ET II 298(22)” with “ET II 398(22)”

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242. Page 879, Table in 8.151.3: below the table are many reference to WH. Combine them all together so that the row below the table only has SI 19, SI 18(13), WH

243. Page 896, Integral 8.250.1: The definition is incorrect. The entry should be split into two:

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$$\mathbf{8.250.1} \quad \operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$$

$$\mathbf{8.250.1^*} \quad \Phi(x) = \frac{1}{\sqrt{2\pi}} \int_0^x e^{-t^2/2} dt = \frac{1}{2} \operatorname{erf}\left(\frac{x}{\sqrt{2}}\right)$$

244. Page 897, Integral 8.250.5:

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- add the constraint $[\operatorname{Re} p > 0, \quad y > 0]$
- add the reference VE2015
- change each of the two “ Φ ” functions to be “ erf ”

245. Page 897, Integral 8.250.6: replace the entry with

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$$\int_0^\infty \frac{e^{-px} \cos(a\sqrt{x})}{p+x} dx = \sqrt{\pi} e^{p^2} \left[\sum_{k=0}^\infty \frac{\Gamma(-k, p^2)}{\Gamma(k + \frac{1}{2})} \left(-\frac{p a^2}{4}\right)^k \right] \quad [p > 0, \quad a \text{ is real}]$$

246. Page 897, Integral 8.250.7: replace the entire entry (the two integrals and the evaluation) with the following:

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$$\int_0^p e^{-x^2} \operatorname{erf}(p-x) dx = \frac{\sqrt{\pi}}{2} \left[\operatorname{erf}\left(\frac{p}{\sqrt{2}}\right) \right]^2$$

247. Page 897, Integral 8.250.8: replace the entire entry with

$$\int_0^p x^2 e^{-x^2} \operatorname{erf}(p-x) dx = \frac{\sqrt{\pi}}{4} \left[\operatorname{erf}\left(\frac{p}{\sqrt{2}}\right) \right]^2 - \frac{p}{2\sqrt{2}} e^{-p^2/2} \operatorname{erf}\left(\frac{p}{\sqrt{2}}\right)$$

248. Page 897, Integral 8.250.9 replace the entire entry with

$$\int_{(a+b)/\sqrt{2}}^{(b-a)/\sqrt{2}} e^{-x^2} \operatorname{erf}(b\sqrt{2}-x) dx + \int_{(a+b)/\sqrt{2}}^{(a-b)/\sqrt{2}} e^{-x^2} \operatorname{erf}(a\sqrt{2}-x) dx = -\sqrt{\pi} \operatorname{erf}(a) \operatorname{erf}(b)$$

249. Page 898, Formula 8.254: replace “ $|\arg(-z)| \leq$ ” with “ $|\arg(z)| \leq$ ”.

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250. Page 898, Formula 8.253.1: replace “ F_1 ” with “ ${}_1F_1$ ”; add the reference VE2015

251. Page 900, Integral 8.258.5: in the evaluation replace “ $1 - \arctan(\sqrt{\beta})$ ” with “ $\arctan(\sqrt{\beta})$ ”; add the reference VE2015

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252. Page 902, Formula 8.314: replace $\sum_{n=0}^\infty$ with $\sum_{k=0}^\infty$

(Thanks to Angelo Melino for correcting this error.)

253. Page 909, Formula 8.352.3: replace $\sum_{k=1}^m$ with $\sum_{k=1}^n$.

(Thanks to Mariam Mousa Harb for correcting this error.)

254. Page 909, Integral 8.352.7: replace e^{-z} with e^{-x} .

(Thanks to Mariam Mousa Harb for correcting this error.)

255. Page 912, After 8.361.8, replace “**4.482** 5” with “**4.282** 5”

(Thanks to Allen Stenger for correcting this error.)

256. Page 916, Relation 8.375.1

(a) The evaluation on the right hand side is incorrect. The correct evaluation is obtained by replacing

$$\sum_{k=0}^{\lfloor \frac{q-1}{2} \rfloor} \quad \text{with} \quad 2 \sum_{k=0}^{\lfloor \frac{q-1}{2} \rfloor}$$

(b) The comment says (See also **6.362** 5–7)

which is incorrect. It should be (See also **6.363** 5–7)

(Thanks to Allen Stenger for correcting these errors.)

257. Page 918, Formula 8.382.2: there is a missing equals sign

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The formula should begin $\ln B\left(\frac{1+x}{2}, \frac{1}{2}\right) = \ln \sqrt{2\pi} + \dots$

(Thanks to Christian Tanguy for correcting this error.)

258. Page 921, Formula 8.411.4: make the following cosmetic changes

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- Remove the initial factor of 2
- Change the upper limit of integration from $\frac{\pi}{2}$ to π

259. Page 950, Text 8.544

10/25

The text currently includes:

Suppose also that y_ν is the smallest positive zero of the function $Y_\nu(z)$. Then, $x_\nu < y_\nu < x'_\nu$.

which is incorrect. The correct (and expanded) statement should be

Suppose also that y_ν and y'_ν are the smallest positive zeros of the functions $Y_\nu(z)$ and $Y'_\nu(z)$. Then, $x'_\nu < y_\nu < y'_\nu < x_\nu$.

Additionally, the reference DLMF 10.21.3 should be added.

(Thanks to Julius Seeger for correcting this error.)

260. Page 984, Relation 8.816

The evaluation on the right hand side is incorrect.

The correct evaluation is obtained by replacing “ $(-1)^m$ ” with “ $(-i)^m$ ”.

(Thanks to Joseph Gangestad for correcting this error.)

261. Page 985, Relation 8.820.7

For clarity, replace with (this keeps some of the terms and removes others)

$$P_\nu(z) = P_{-\nu-1}(z)$$

(Thanks to Angelo Melino for suggesting this clarification.)

262. Page 985, Relation 8.822.1

For clarity, replace the constraint with (this keeps some of the terms and removes others)

$$\left[\operatorname{Re} z > 0 \right]$$

(Thanks to Angelo Melino for suggesting this clarification.)

263. Page 997, Relations in 8.922

(a) (8.922.1) For clarity, change the summation upper limit from ∞ to n

(b) (8.922.2) For clarity, change the summation upper limit from ∞ to n

(c) (8.922.1) Add the additional evaluation

$$z^{2n} = \sum_{k=0}^n 2^{2n-2k+1} (4n-4k+1) \frac{(2n)!(2n-k+1)!}{k!(4n-2k+2)!} P_{2n-2k}(z)$$

(d) (8.922.2) Add the additional evaluation

$$z^{2n+1} = \sum_{k=0}^n 2^{2n-2k+2} (4n-4k+3) \frac{(2n+1)!(2n-k+2)!}{k!(4n-2k+4)!} P_{2n-2k+1}(z)$$

(Thanks to Patrick Bruno for correcting these errors.)

264. Page 1004, Integral 8.949.7: replace $(1-x^2)^{c\frac{1}{2}}$ with $(1-x^2)^{\frac{1}{2}}$.

(Thanks to Farid Bouttout for correcting this error.)

265. Page 1005, Integral 8.949.10:

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- replace $U_m(x)U_n(x)(1-x^2)^{-1/2}$ with $U_m(x)U_n(x)(1-x^2)^{1/2}$
- replace $\pi/8$ with $\pi/2$

(Thanks to Koki Tokeshi for correcting these errors.)

266. Page 1008, Relation 8.961.1

While correct, the relation is not in its most general form.

The current

$$P_n^{(\alpha,\alpha)}(-x) = (-1)^n P_n^{(\alpha,\alpha)}(x)$$

should be replaced with

$$P_n^{(\alpha,\beta)}(-x) = (-1)^n P_n^{(\beta,\alpha)}(x)$$

(Thanks to Michal Wierzbicki for this observation.)

267. Page 1019, Formula 9.136.3: the left hand side of this expression is incorrect; it should have been:

10/25

$$4\sqrt{\pi} \frac{\Gamma(\alpha + \beta - \frac{1}{2})}{\Gamma(\alpha - \frac{1}{2})\Gamma(\beta - \frac{1}{2})} \sqrt{z} F\left(\alpha, \beta, ; \frac{3}{2}; z\right)$$

(Thanks to Jerome Benoit for this correction.)

268. Page 1021, Formula 9.153.3, the first summation in the expansion of u_2 is incorrect. Within the first summation, there should be a factor of $\frac{1}{k!}$

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(Thanks to Yanky Landau for this correction.)

269. Page 1034, Integral 9.221: add the constraint $\text{Re}(\mu \pm \lambda) > -\frac{1}{2}$; add the reference VE2015

270. Page 1037, Formula 9.237.1: replace Ψ (representing the confluent hypergeometric function) with ψ (representing the psi function, the logarithmic derivative of the gamma function).

(Thanks to Lasse Schmieding for correcting this error.)

271. Page 1038, Formula 9.245.1: replace “ x is real” with “ $x \geq 0$ ”; add the reference VE2015

272. Page 1066, Formula 10.618.1: replace $x_1 = \sqrt{\dots}$ with $x_1 = u_3 \sqrt{\dots}$

(Thanks to Michele Cappellari for correcting this error.)

273. Page 1107, line 13, Reference LI:

(a) Author should be C. F. Lindman, not C. E. Lindeman

(b) “Amsterdam 1867” is part of the title, not the place and date of publication (that is, it should be included in the italicized part)

(Thanks to Allen Stenger for correcting this error.)

274. Page 1122, last line of the *Index of Concepts*, the zeta function should additionally reference page 1046 (i.e., section 9.5).

10/25

(Thanks to Allen Stenger for correcting this error.)