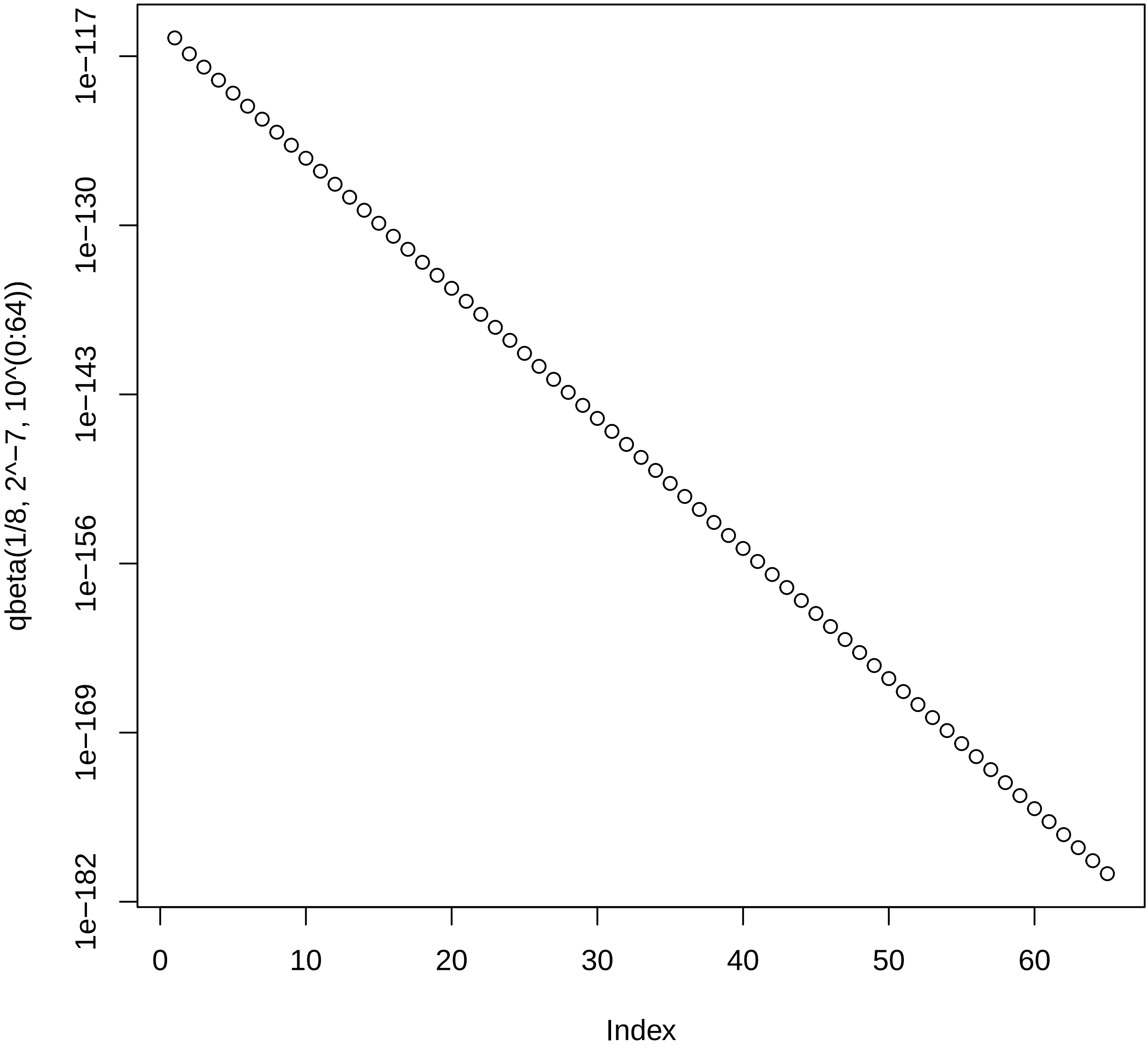
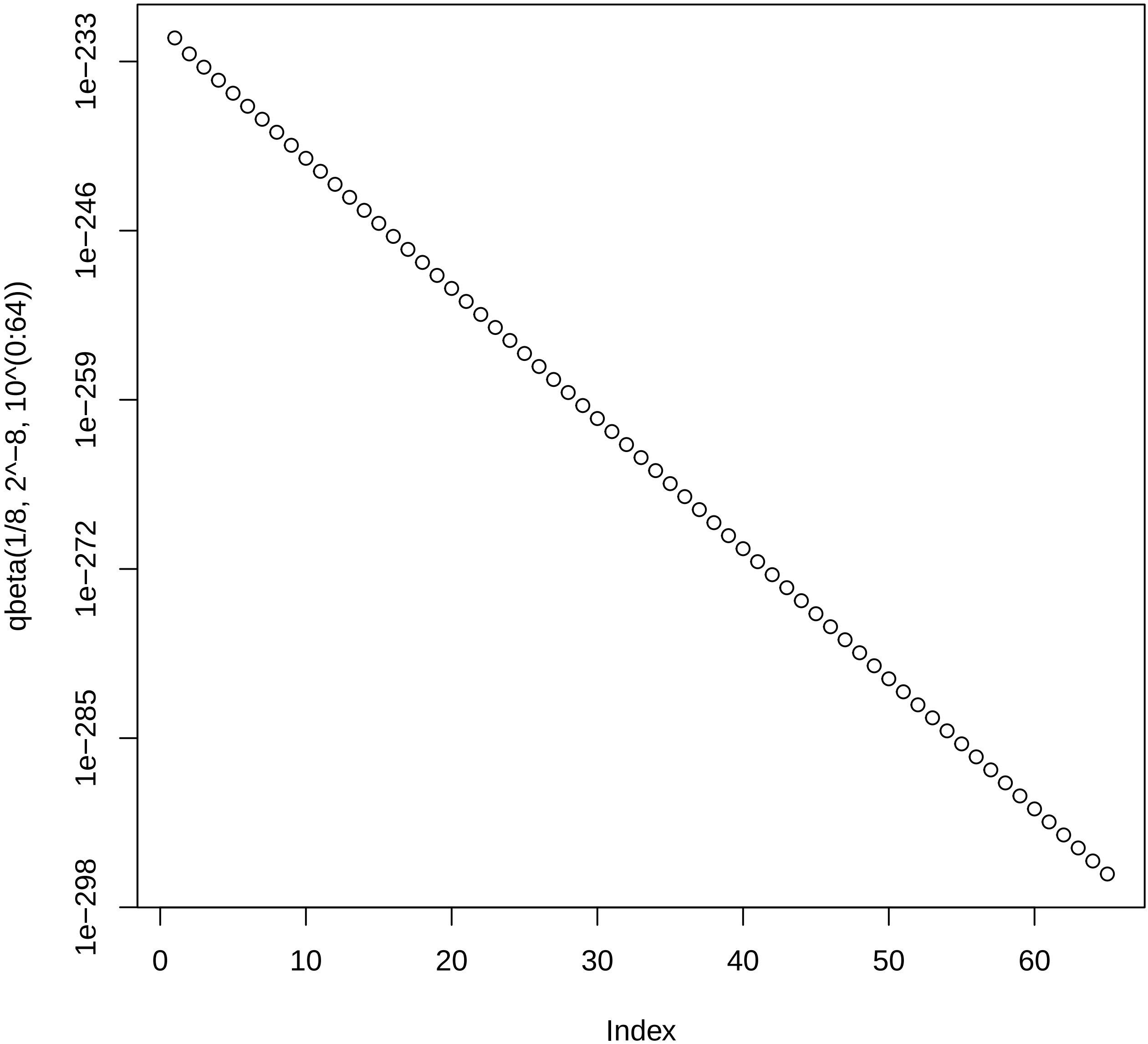
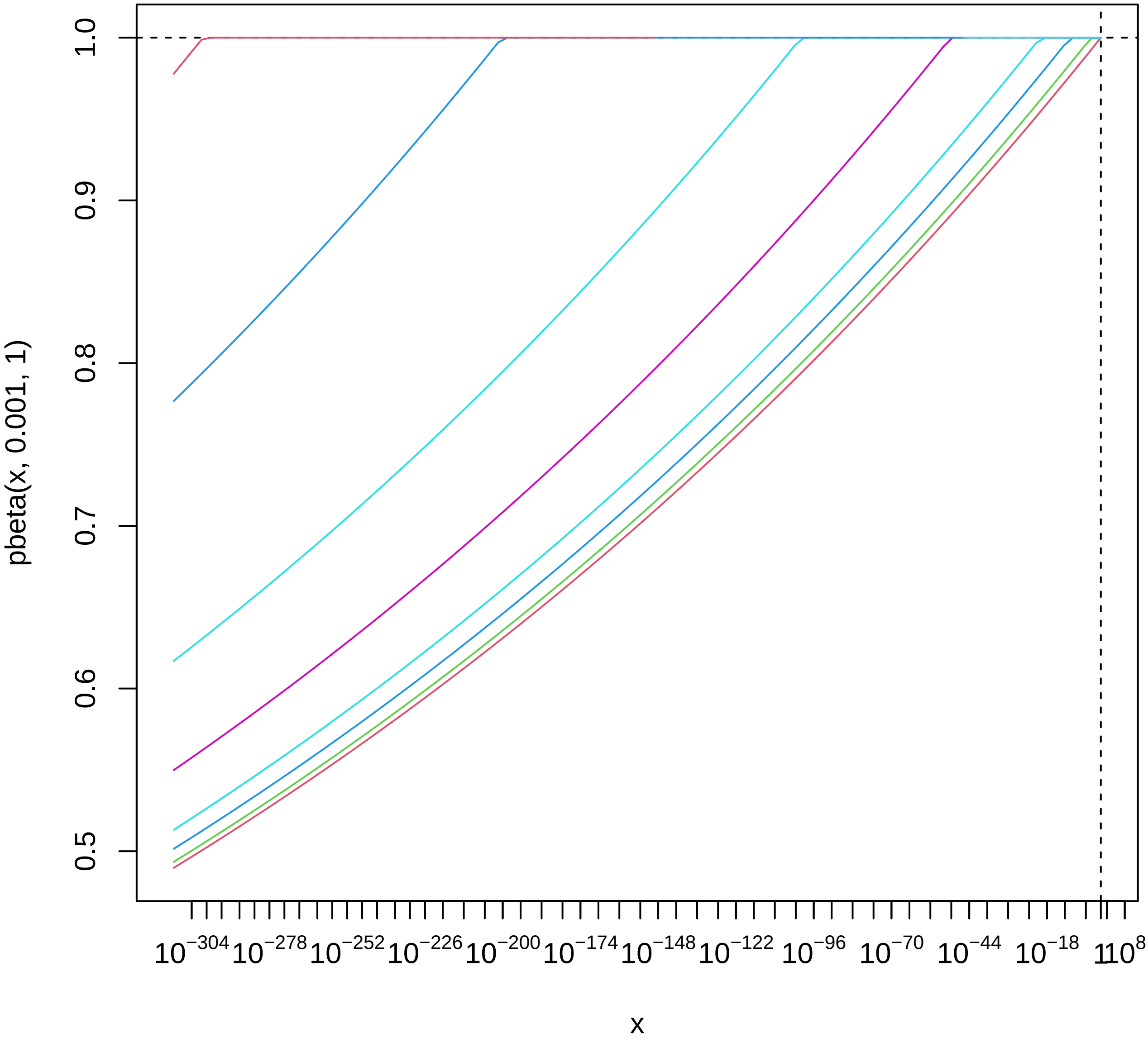
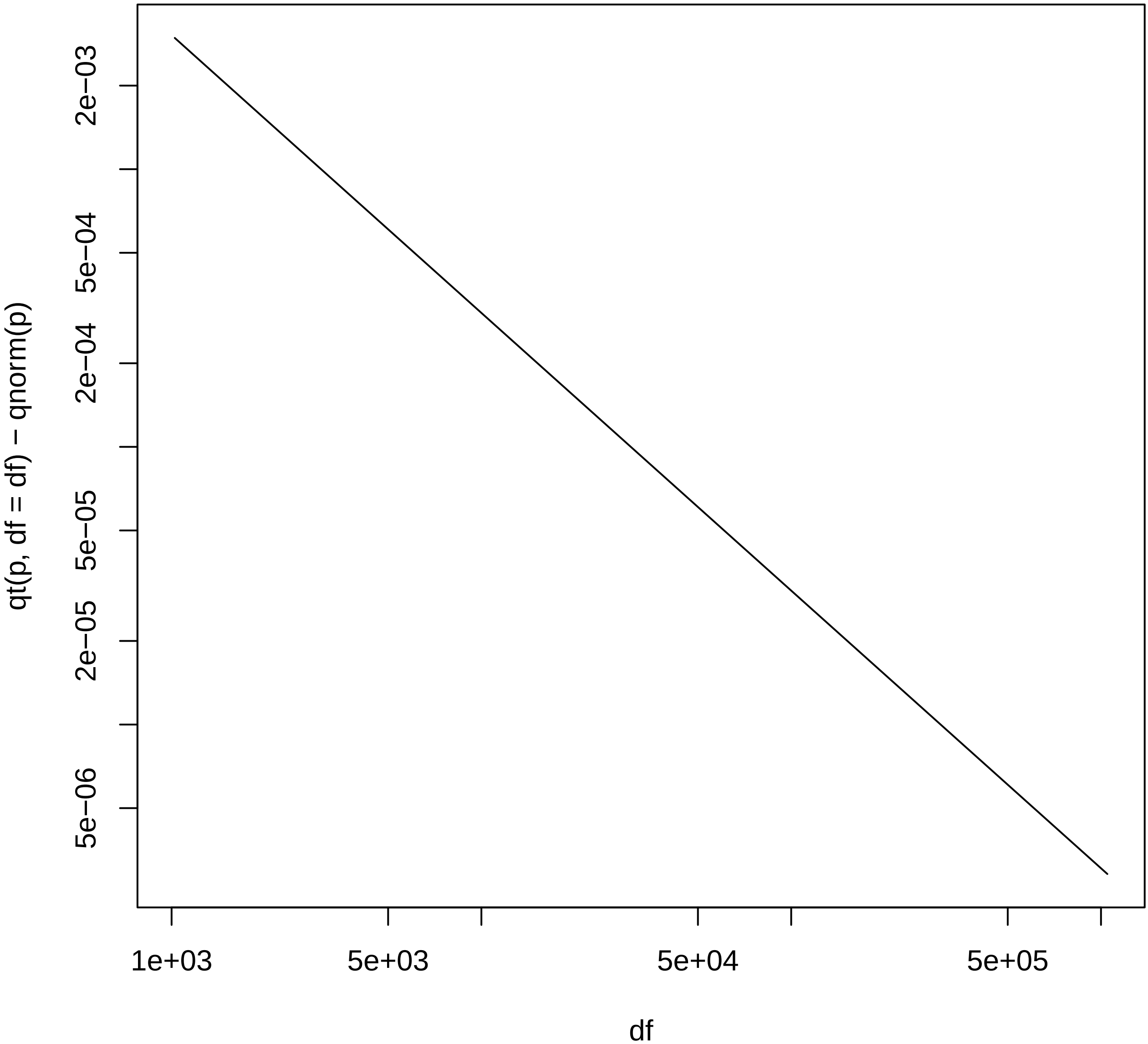


qbeta(1/8, 2^−7, 10^(0:64))
1e−117
1e−130
1e−143
1e−156
1e−169
1e−182
0
10
20
30
40
50
60
Index

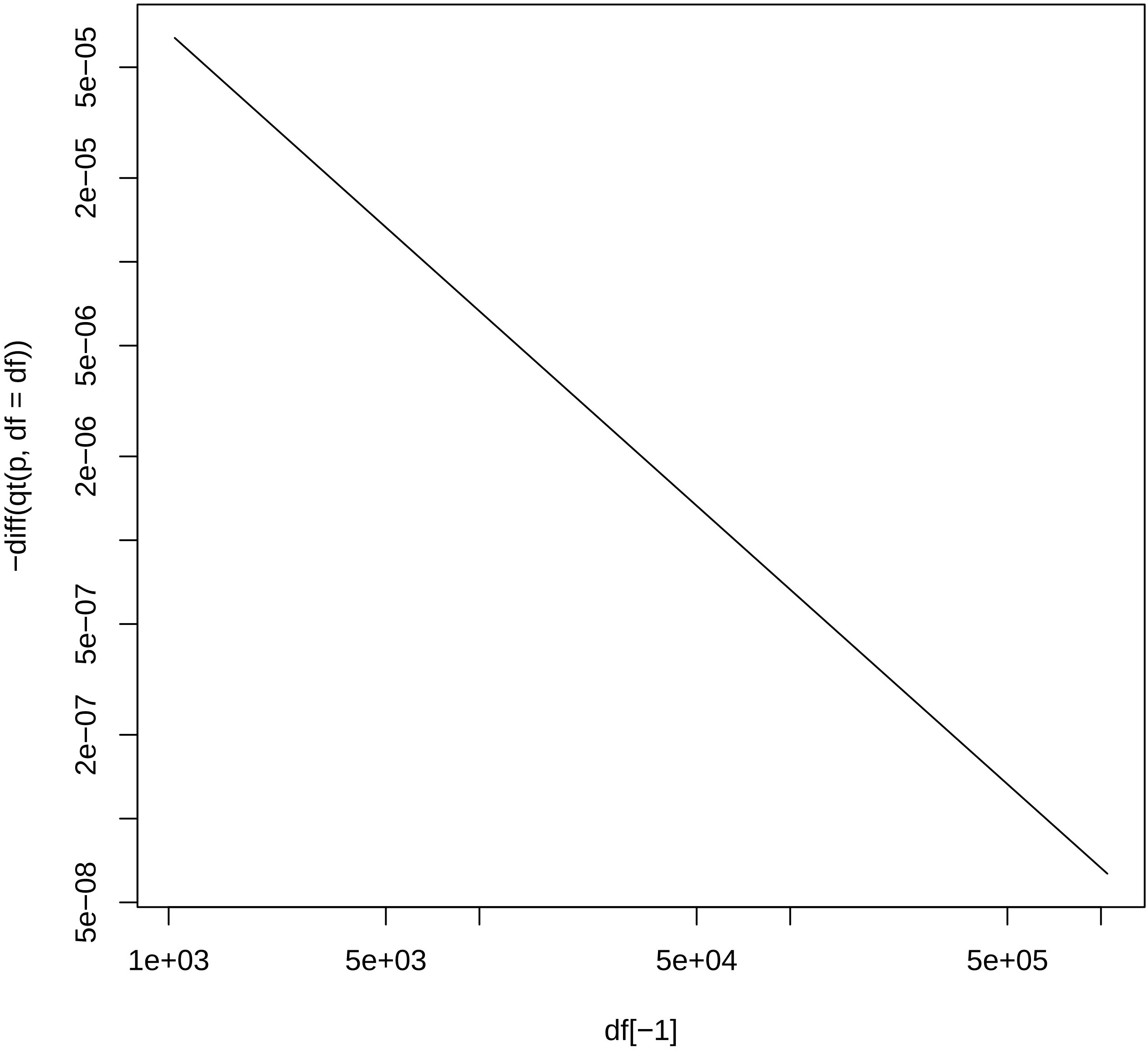

qbeta(1/8, 2^−8, 10^(0:64))
1e−233
1e−246
1e−259
1e−272
1e−285
1e−298
0
10
20
30
40
50
60
Index



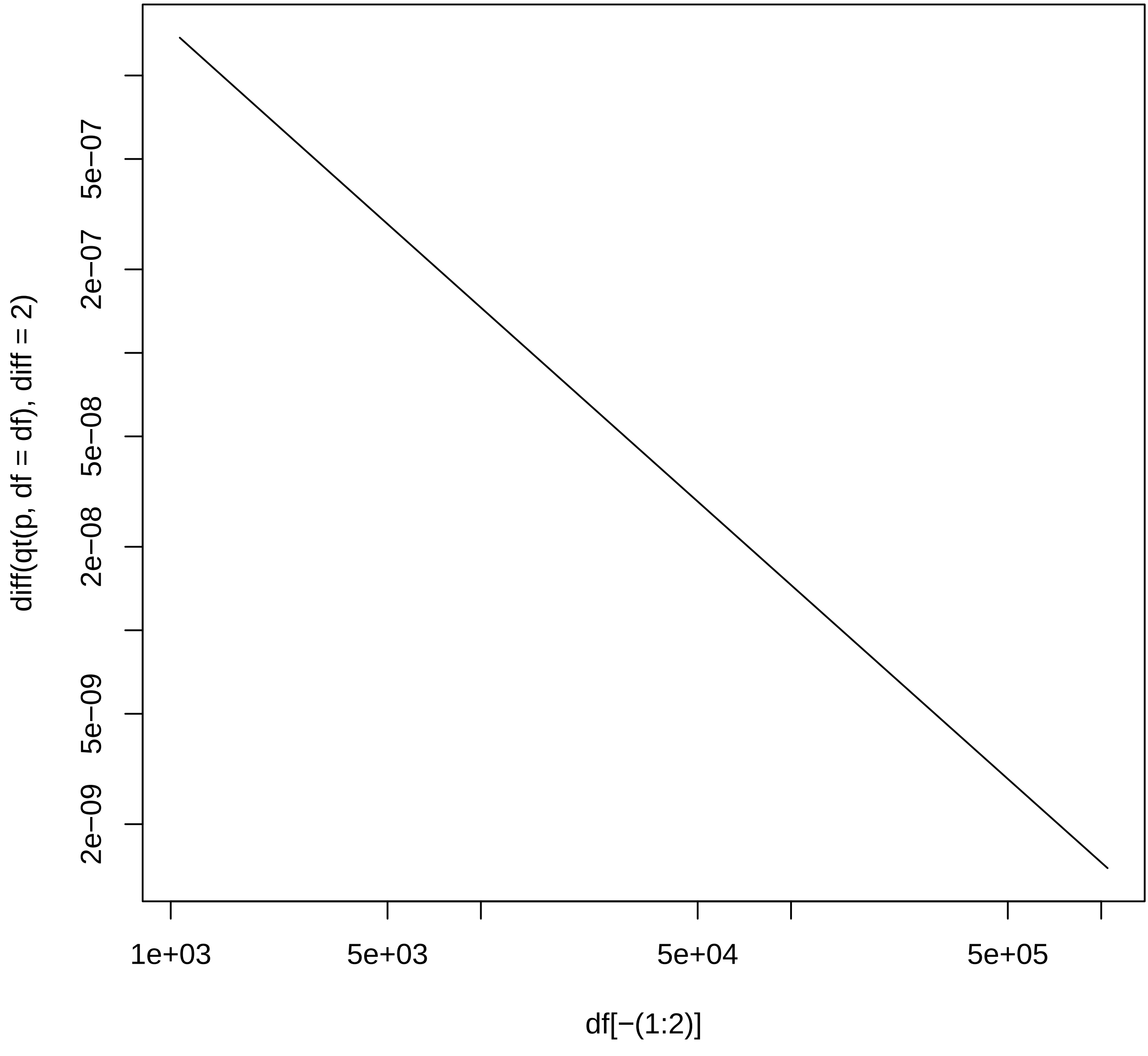
pbeta(x, 0.001, 1)
1.0
0.9
0.8
0.7
0.6
0.5
10^−304 10^−278 10^−252 10^−226 10^−200 10^−174 10^−148 10^−122 10^−96 10^−70 10^−44 10^−18 1 10^8
x

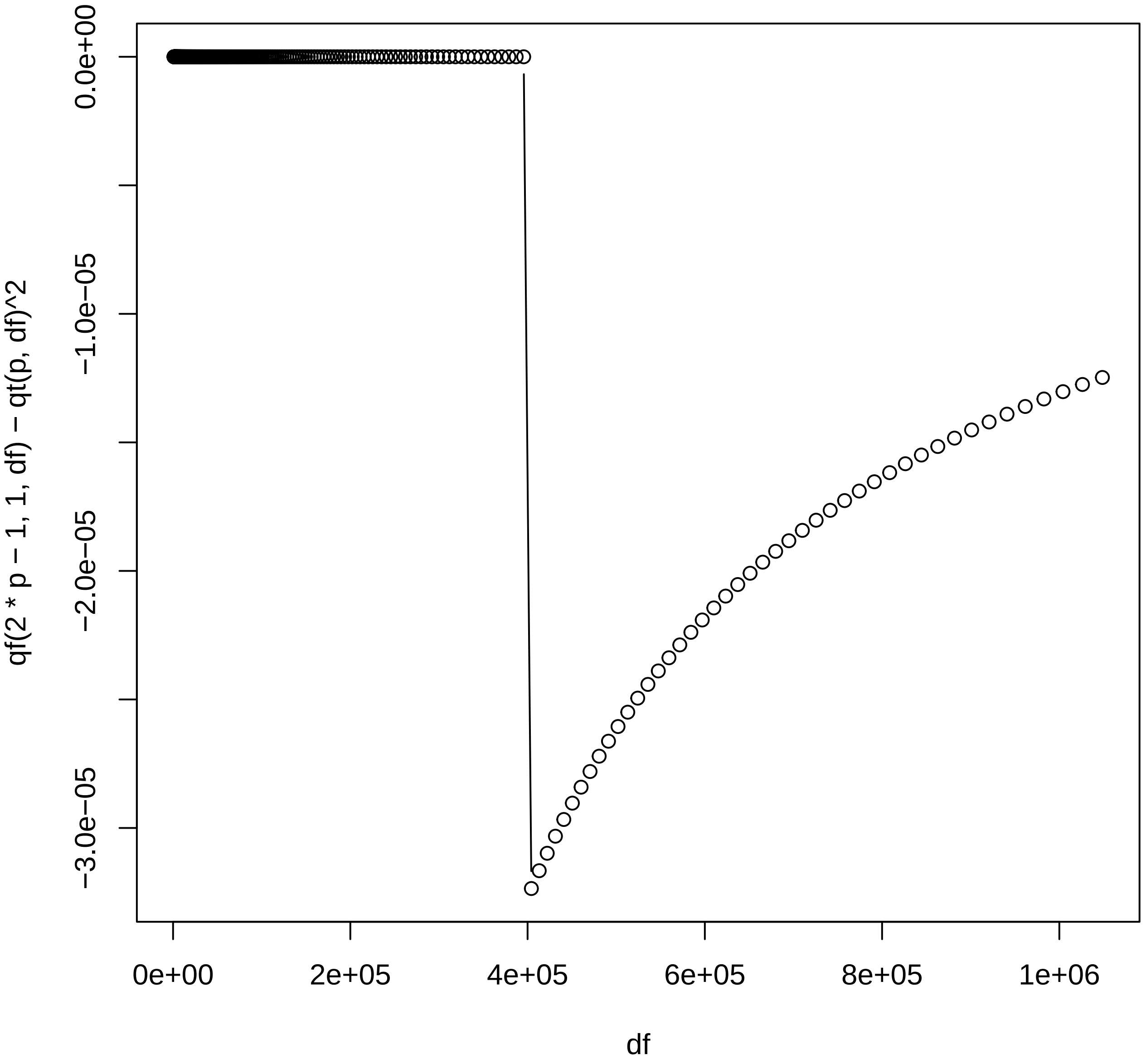


qt(p, df = df) − qnorm(p)
2e−03
5e−04
2e−04
5e−05
2e−05
5e−06
1e+03
5e+03
5e+04
5e+05
df

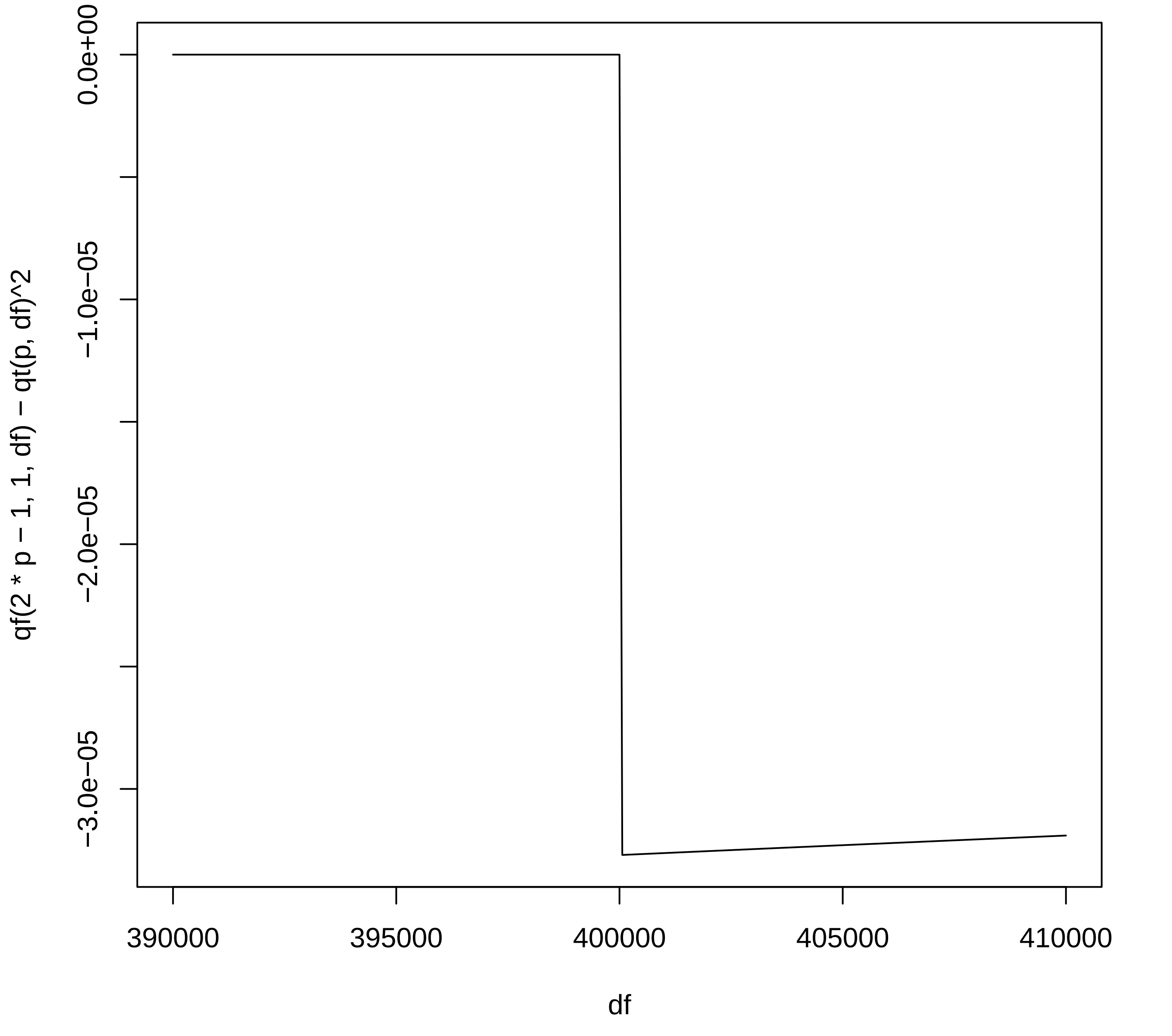


5e−05
2e−05
5e−06
2e−06
5e−07
2e−07
5e−08
−diff(qt(p, df = df))
1e+03
5e+03
5e+04
5e+05
df[−1]

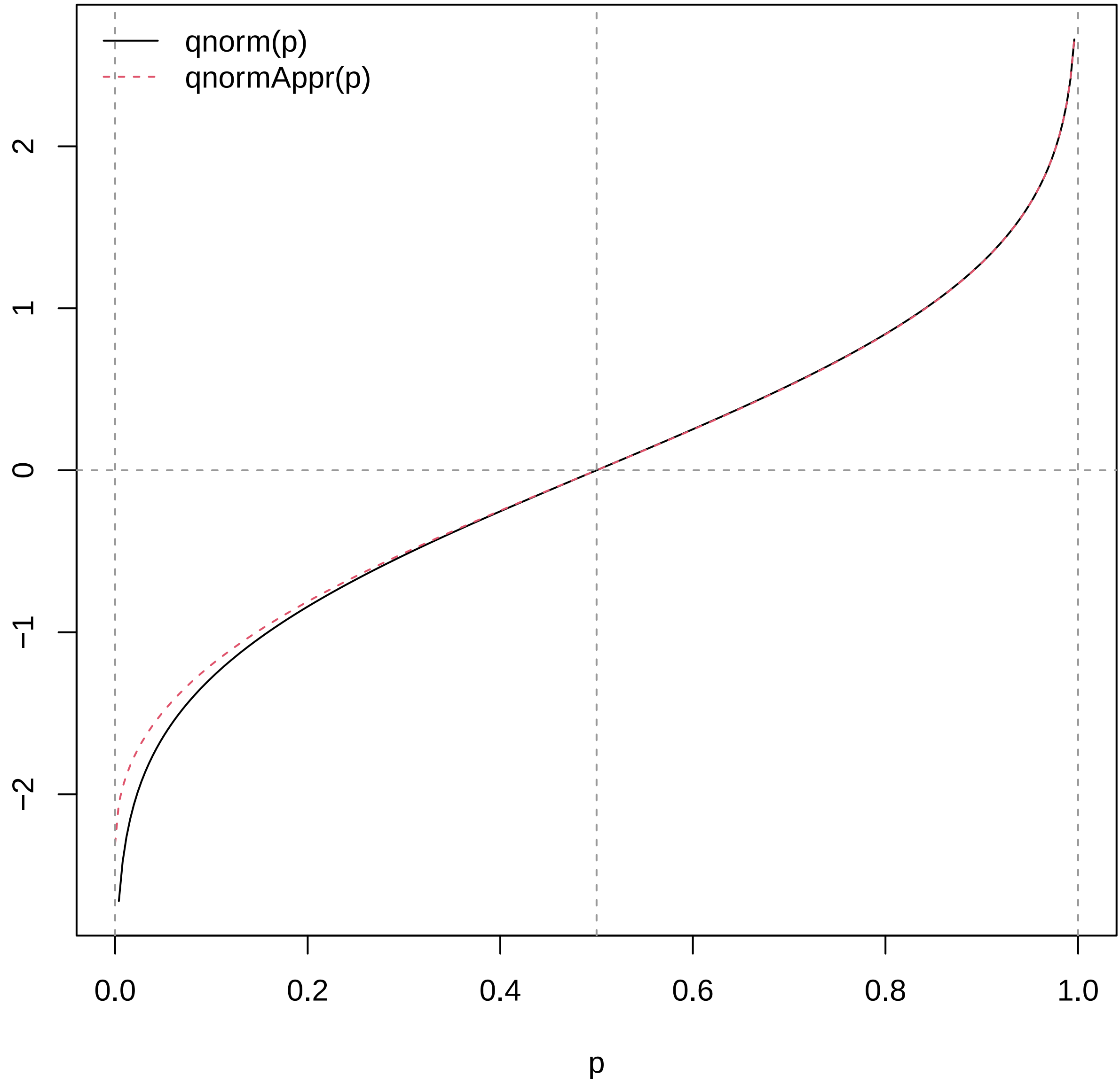

diff(qt(p, df = df), diff = 2)
5e−07
2e−07
5e−08
2e−08
5e−09
2e−09
1e+03
5e+03
5e+04
5e+05
df[−(1:2)]



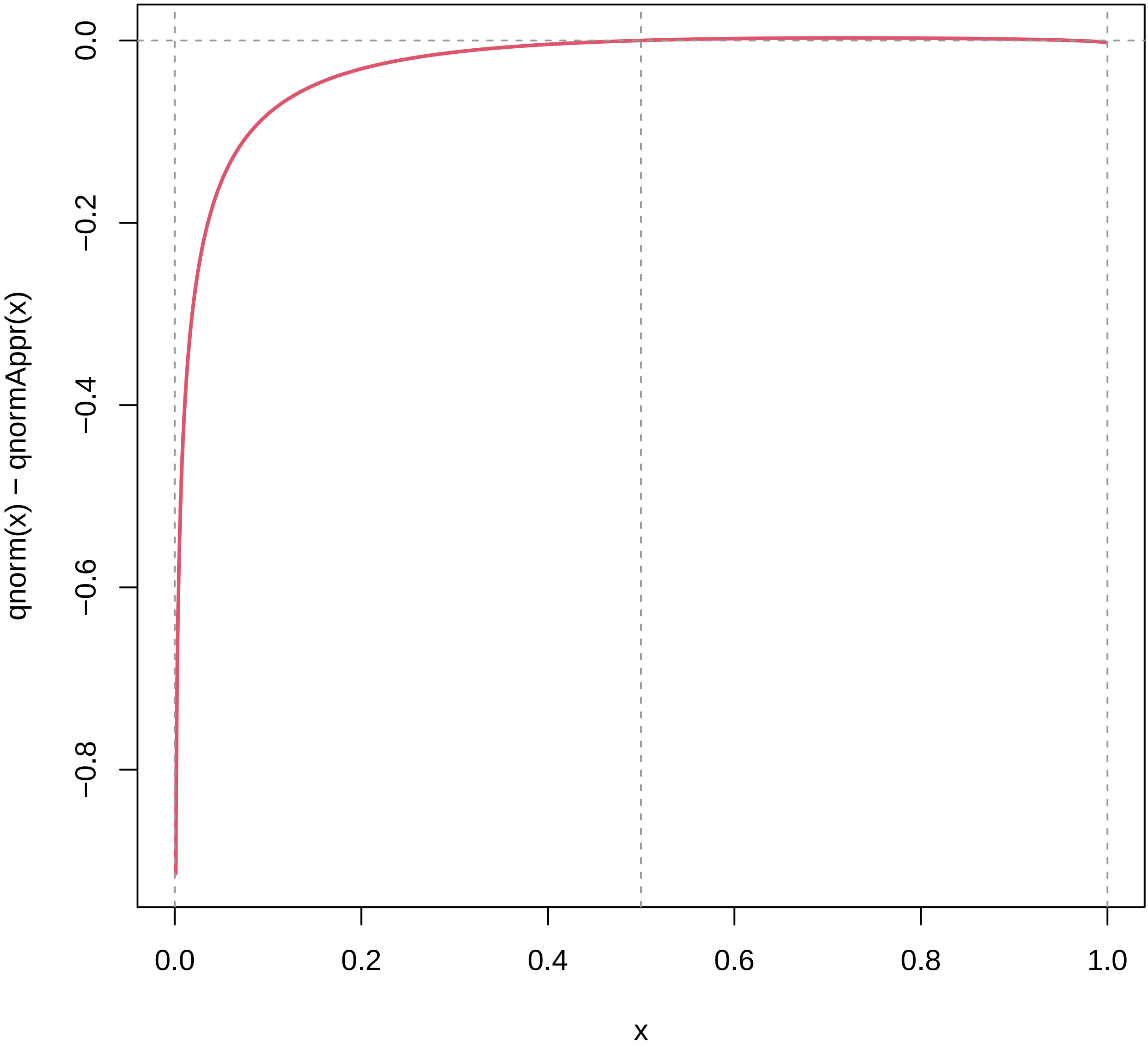
0.0e+00
−1.0e−05
−2.0e−05
−3.0e−05
qf(2 * p − 1, 1, 1, df) − qt(p, df)^2
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
df



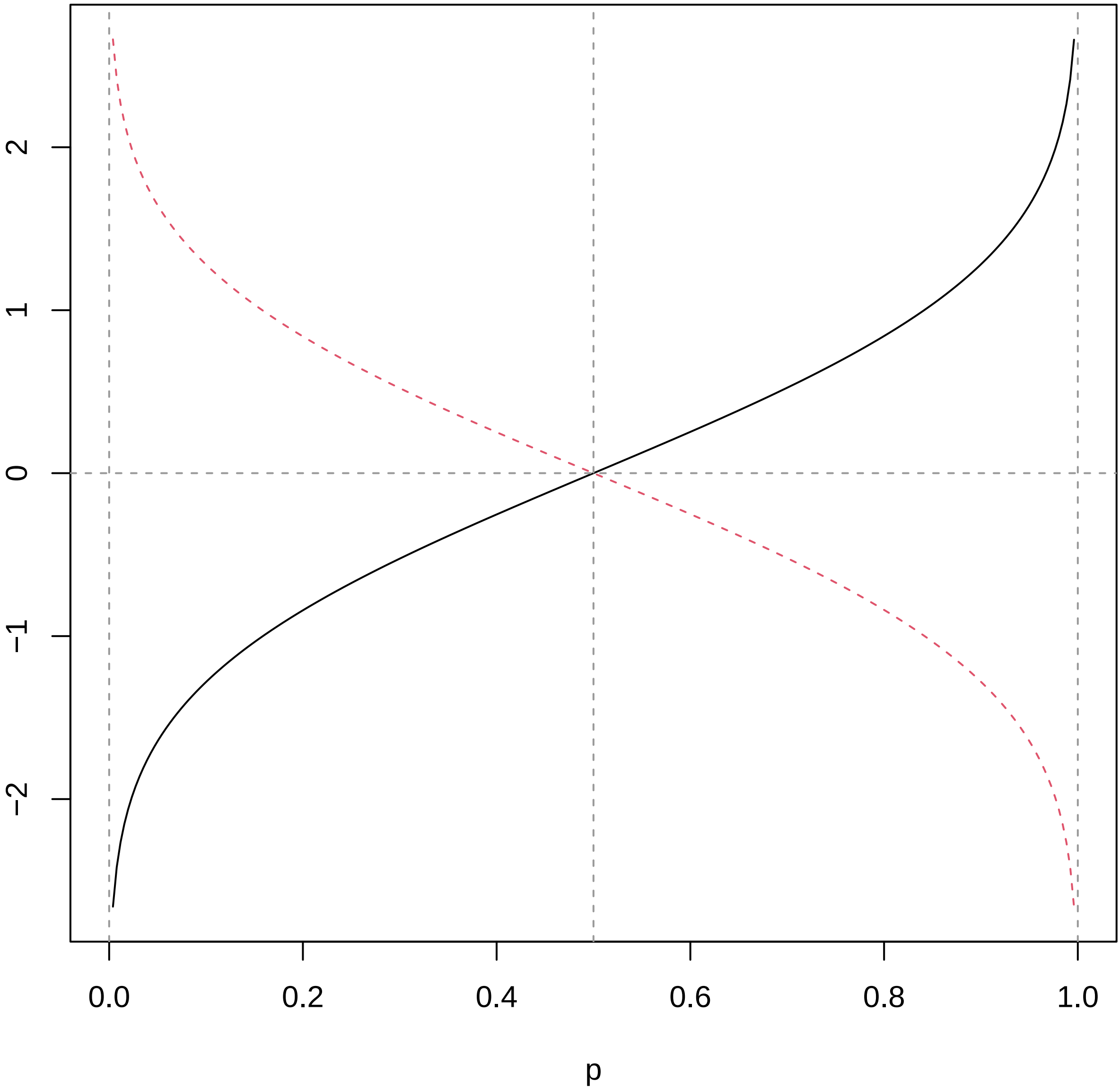
0.0e+00
−1.0e−05
−2.0e−05
−3.0e−05
qf(2 * p − 1, 1, df) − qt(p, df)^2
390000
395000
400000
405000
410000
df



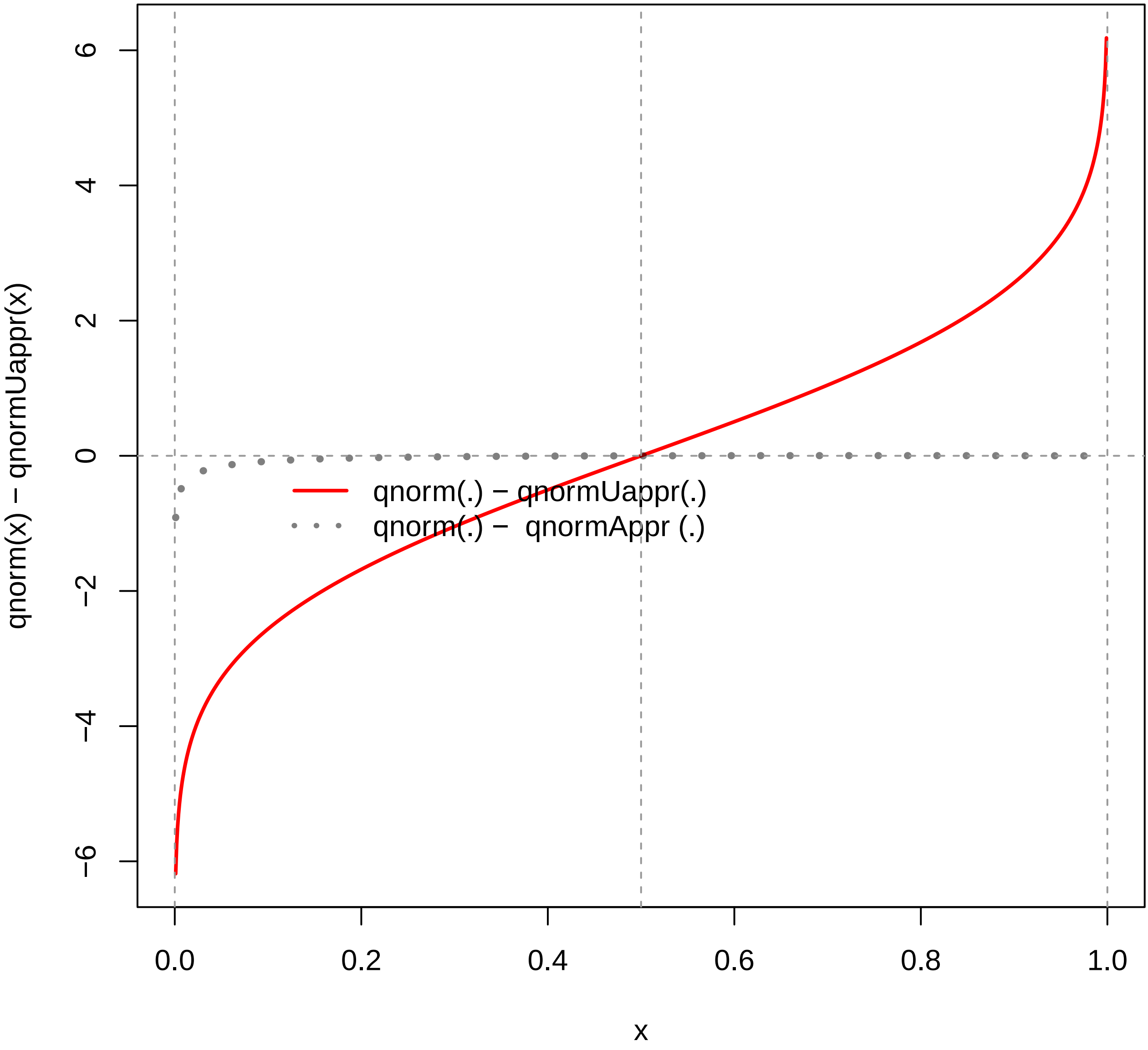
qnorm(p)
qnormAppr(p)
2
1
0
−1
−2
0.0
0.2
0.4
0.6
0.8
1.0
p

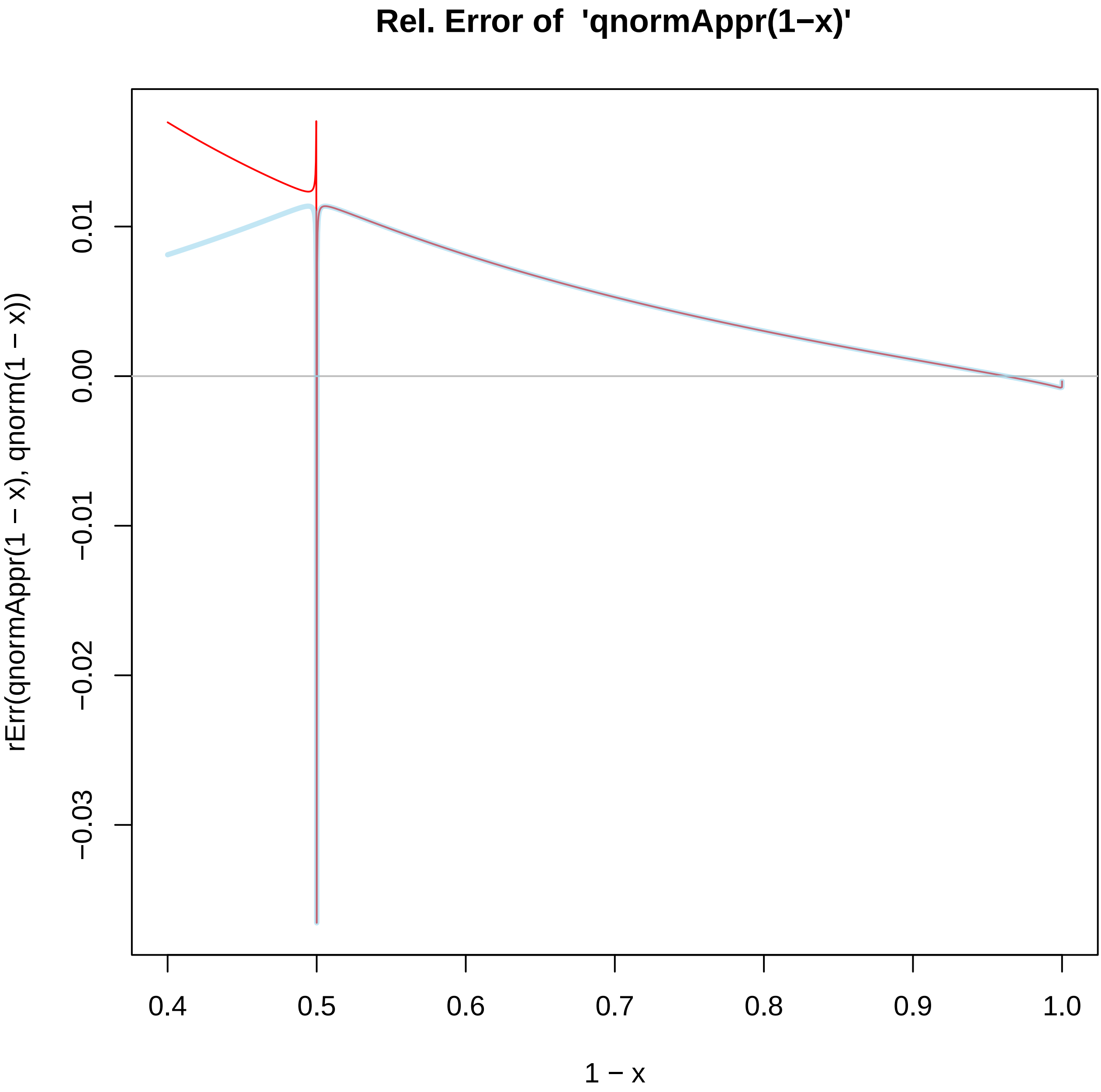


0.0
−0.2
−0.4
−0.6
−0.8
qnorm(x) − qnormAppr(x)
0.0
0.2
0.4
0.6
0.8
1.0
x

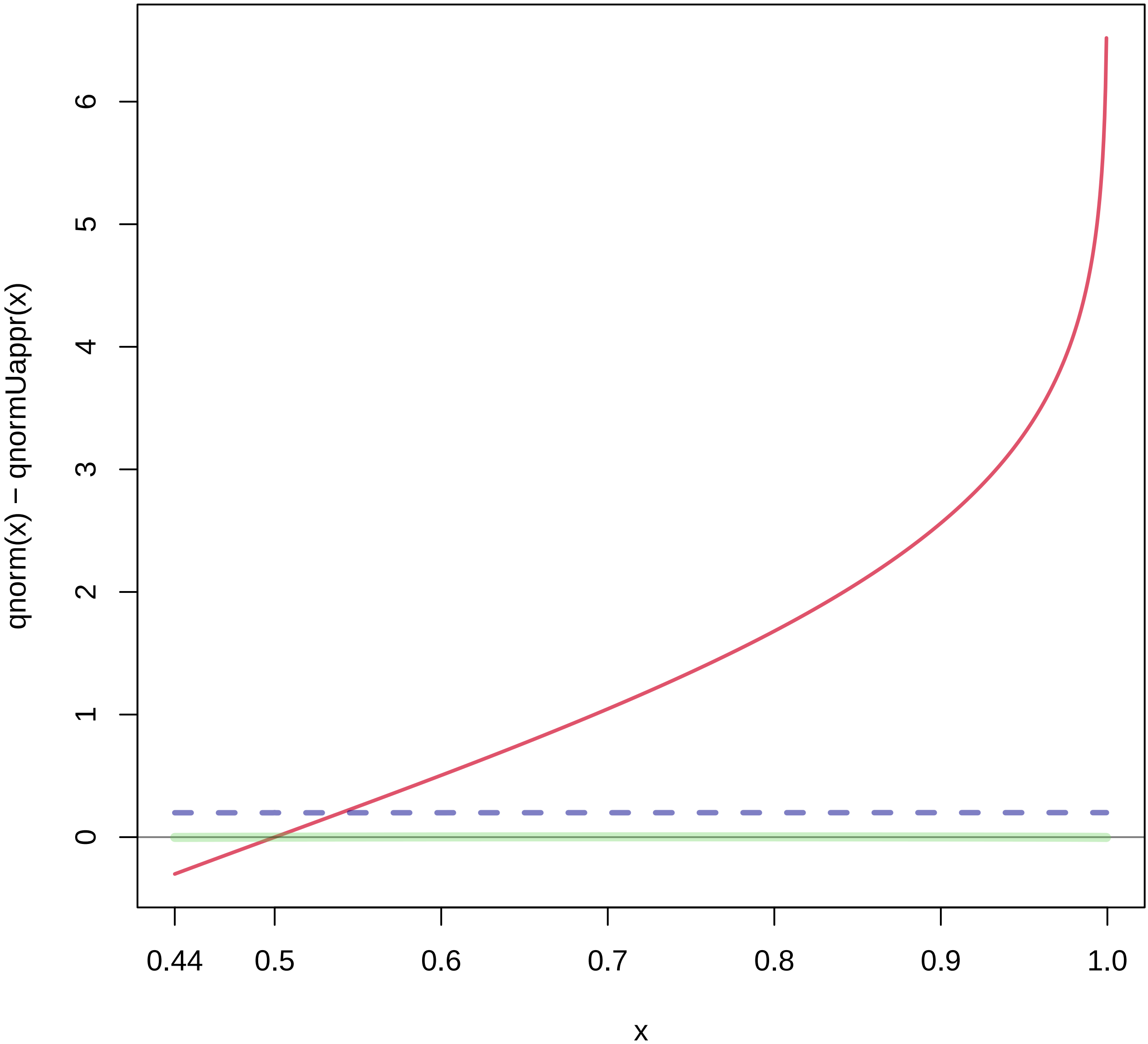


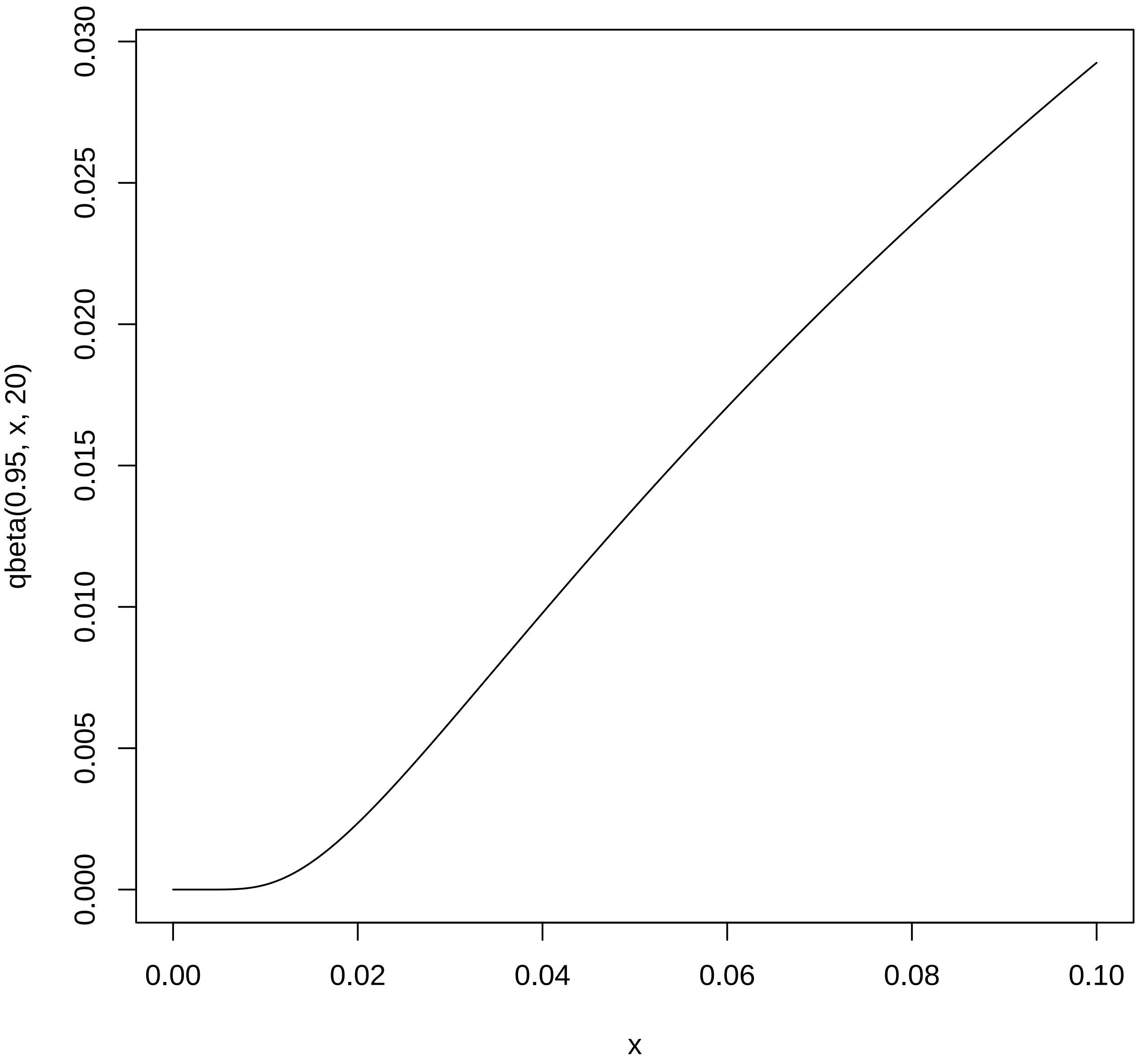
2
1
0
−1
−2
0.0
0.2
0.4
0.6
0.8
1.0
p

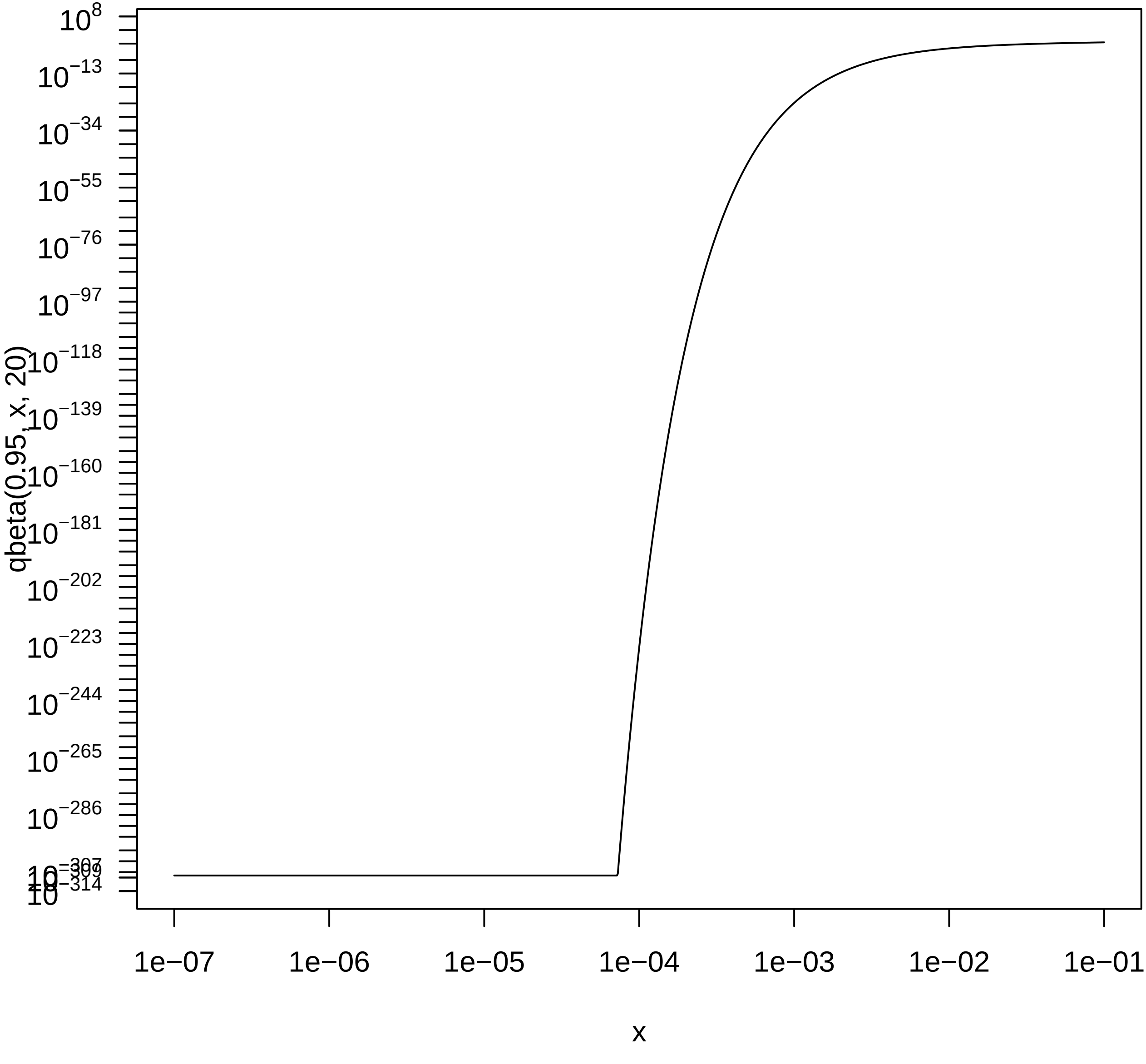

qnorm(.) − qnormUappr(.)
qnorm(.) − qnormAppr (.)
qnorm(x) − qnormUappr(x)
x
6
4
2
0
−2
−4
−6
0.0
0.2
0.4
0.6
0.8
1.0



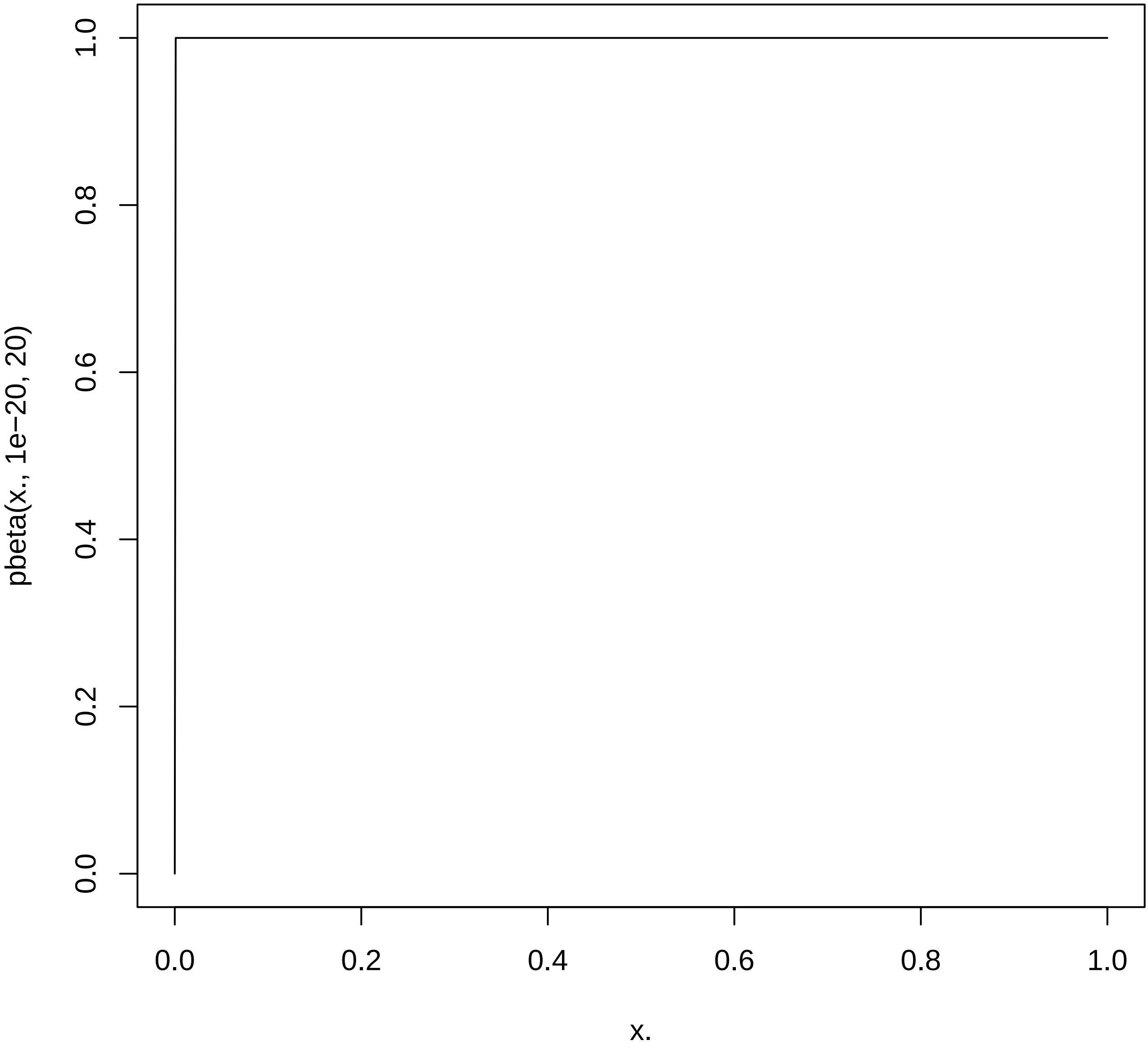
Rel. Error of 'qnormAppr(1−x)'
rErr(qnormAppr(1 − x), qnorm(1 − x))
0.01
0.00
−0.01
−0.02
−0.03
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1 − x


qnorm(x) − qnormUappr(x)
0
1
2
3
4
5
6
0.44
0.5
0.6
0.7
0.8
0.9
1.0
x

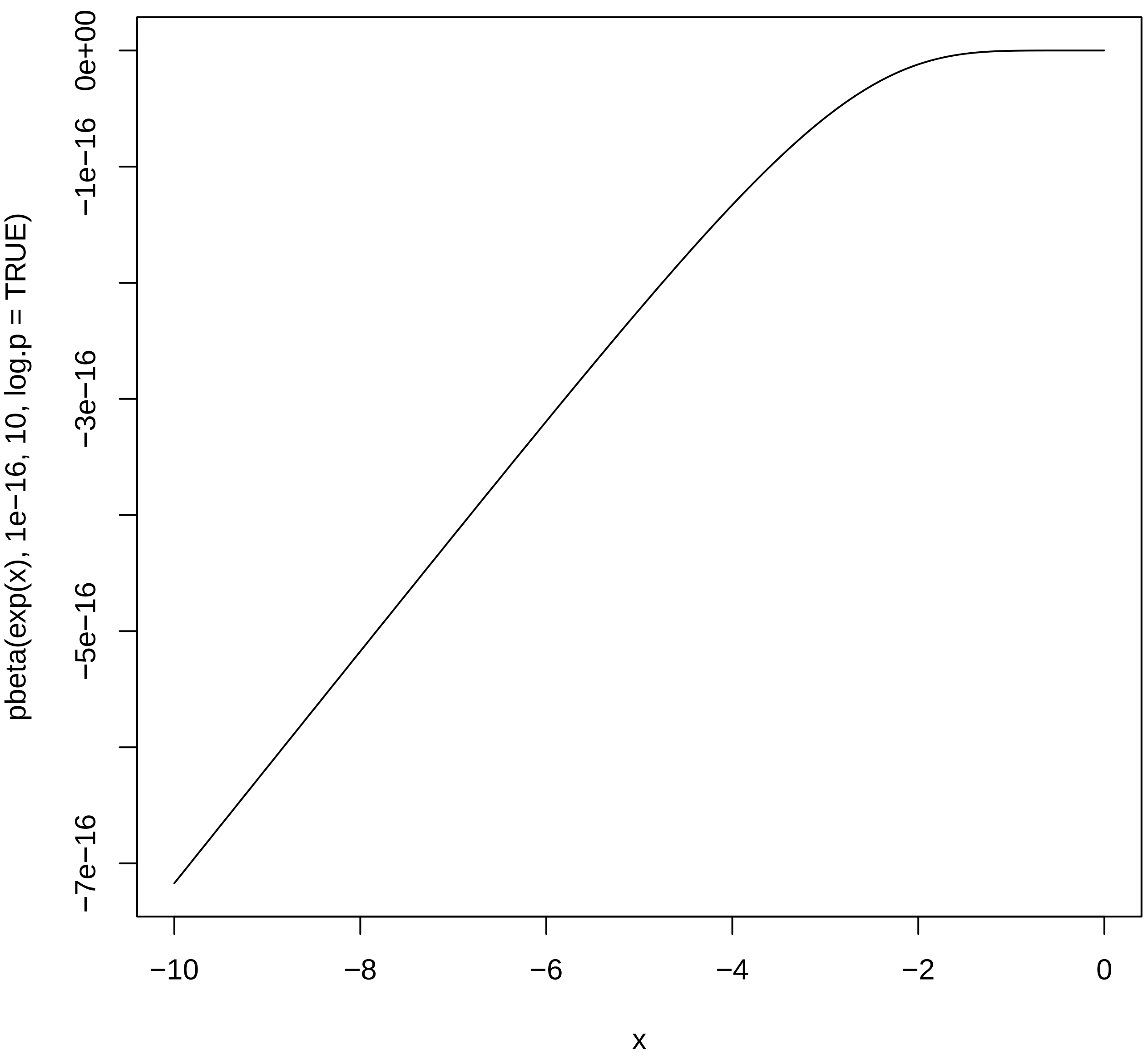

0.030
0.025
0.020
0.015
0.010
0.005
0.000
qbeta(0.95, x, 20)
0.00
0.02
0.04
0.06
0.08
0.10
x



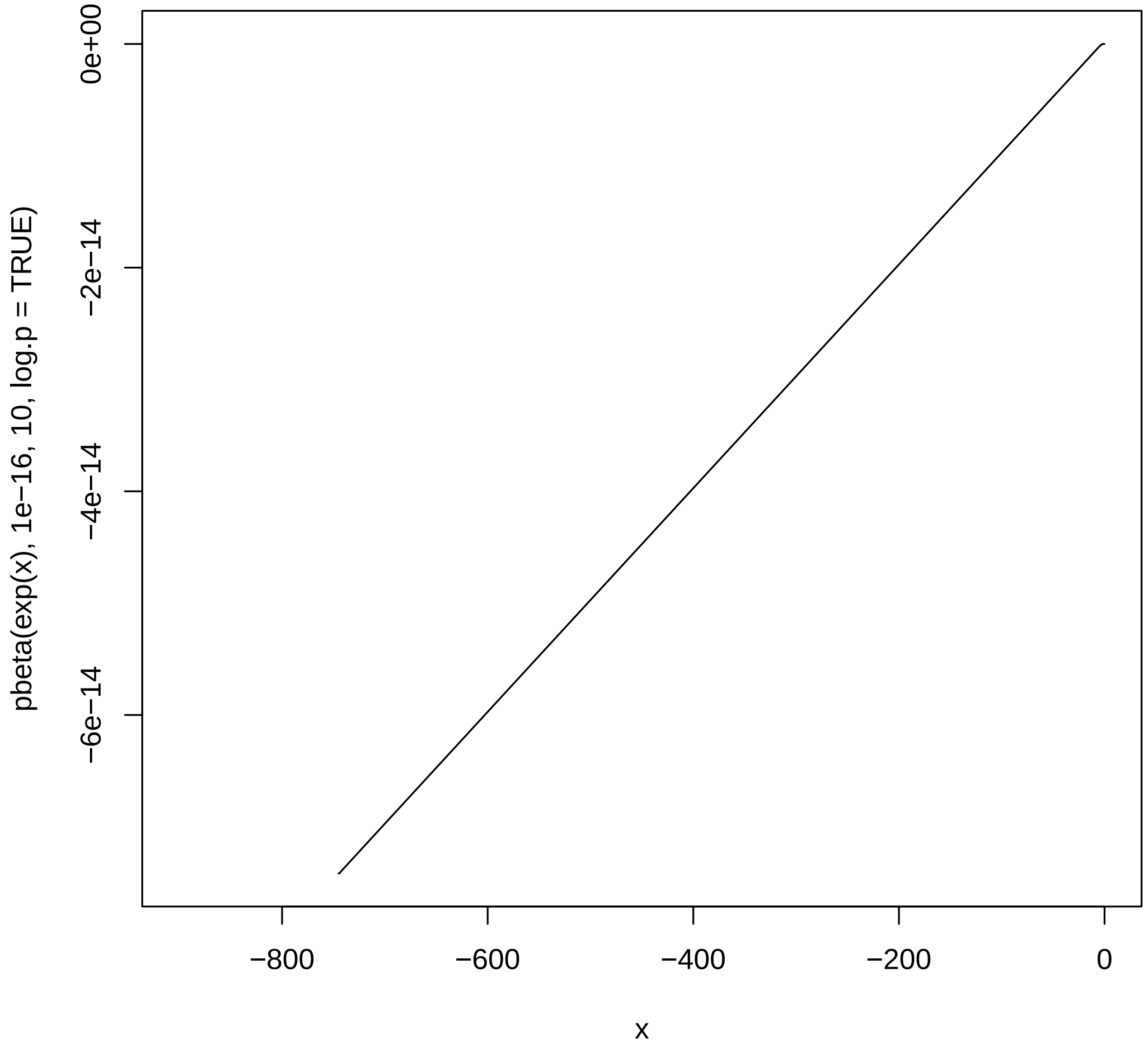
10^8
10^−13
10^−34
10^−55
10^−76
10^−97
10^−118
10^−139
10^−160
10^−181
10^−202
10^−223
10^−244
10^−265
10^−286
10^−307
10^−309
10^−314
qbeta(0.95, x, 20)
1e−07
1e−06
1e−05
1e−04
1e−03
1e−02
1e−01
x



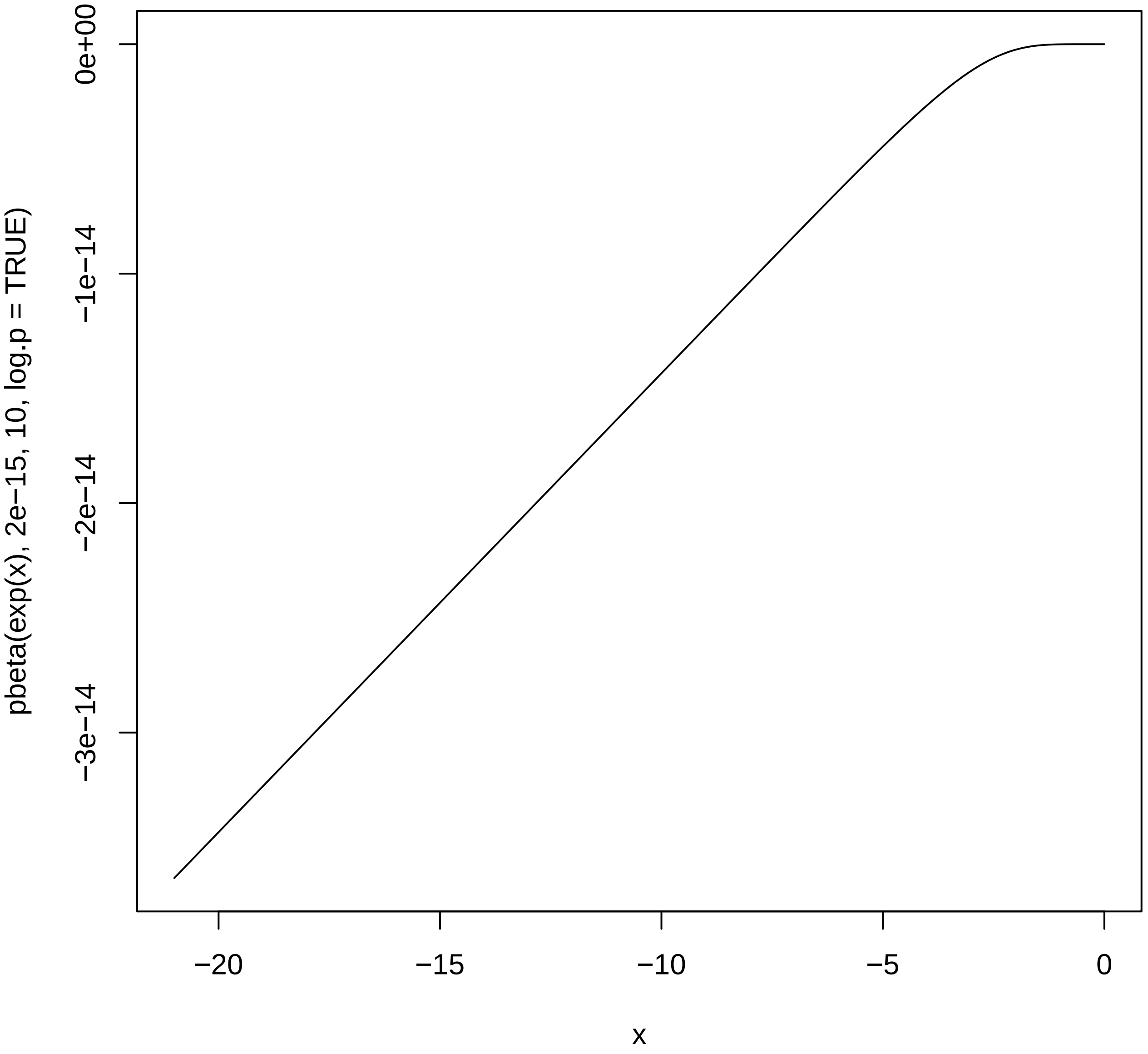
pbeta(x., 1e−20, 20)
x.
0.0
0.2
0.4
0.6
0.8
1.0



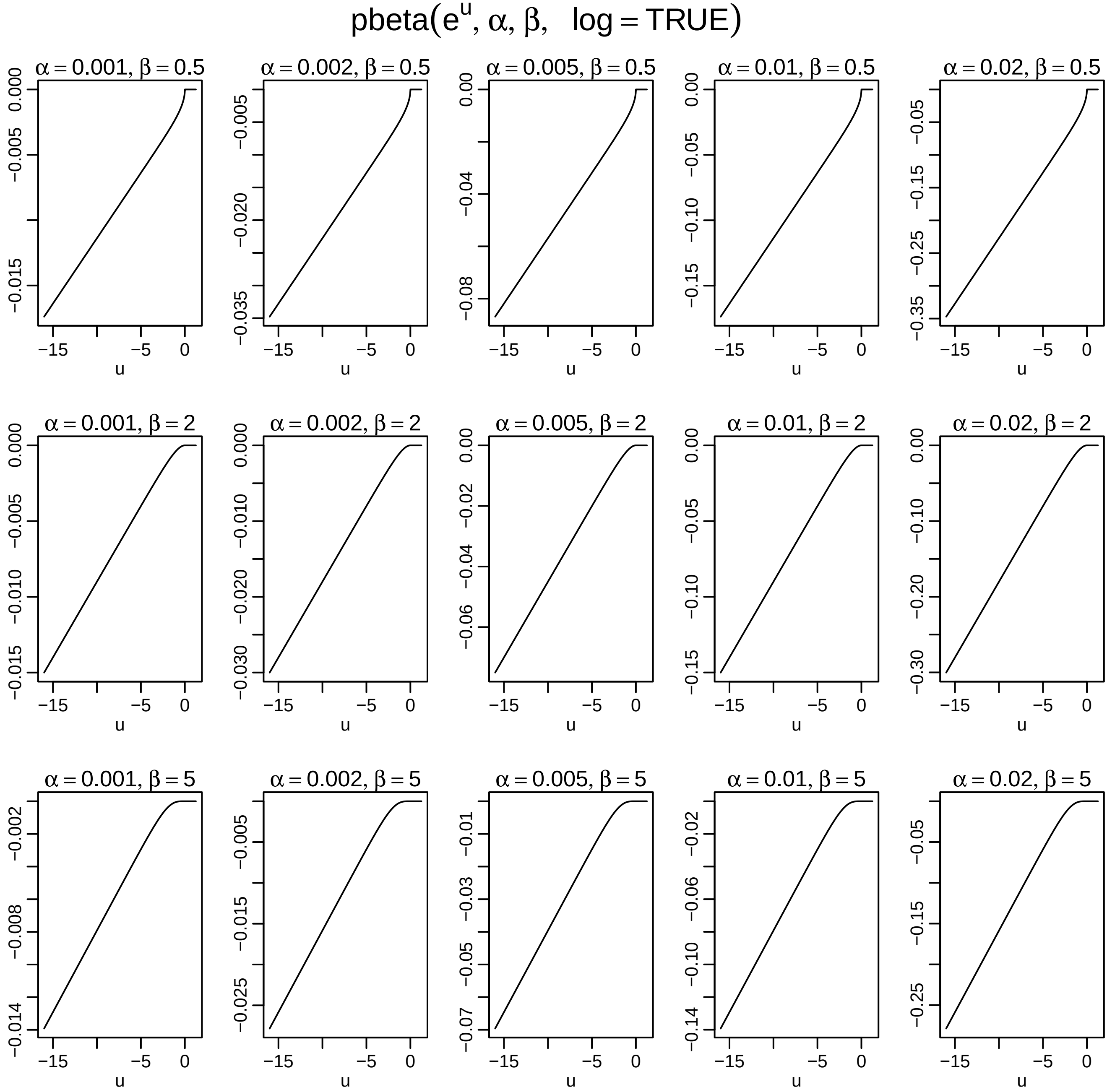
pbeta(exp(x), 1e−16, 10, log.p = TRUE)
0e+00
−1e−16
−3e−16
−5e−16
−7e−16
−10
−8
−6
−4
−2
0
x



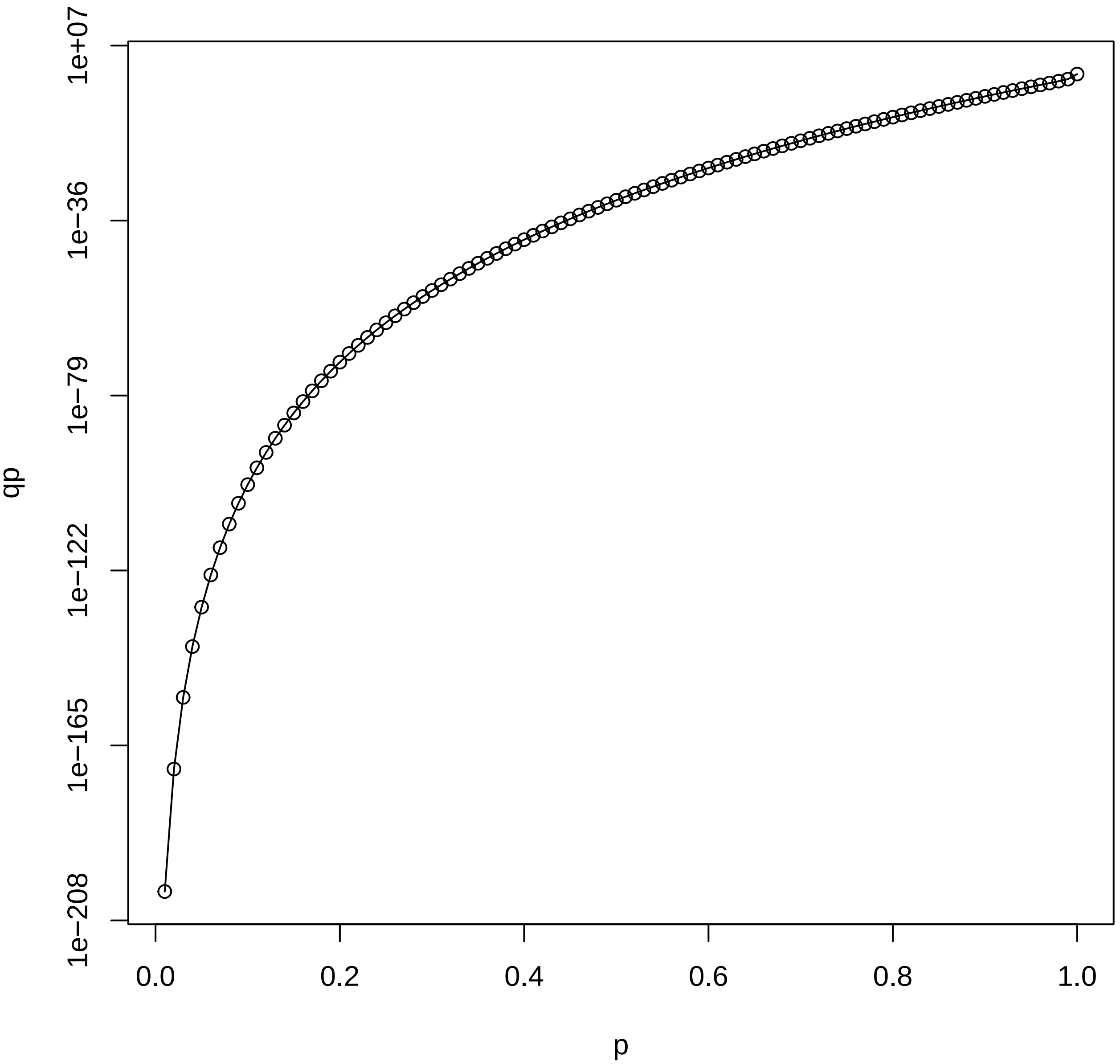
0e+00
−2e−14
−4e−14
−6e−14
pbeta(exp(x), 1e−16, 10, log.p = TRUE)
−800
−600
−400
−200
0
x



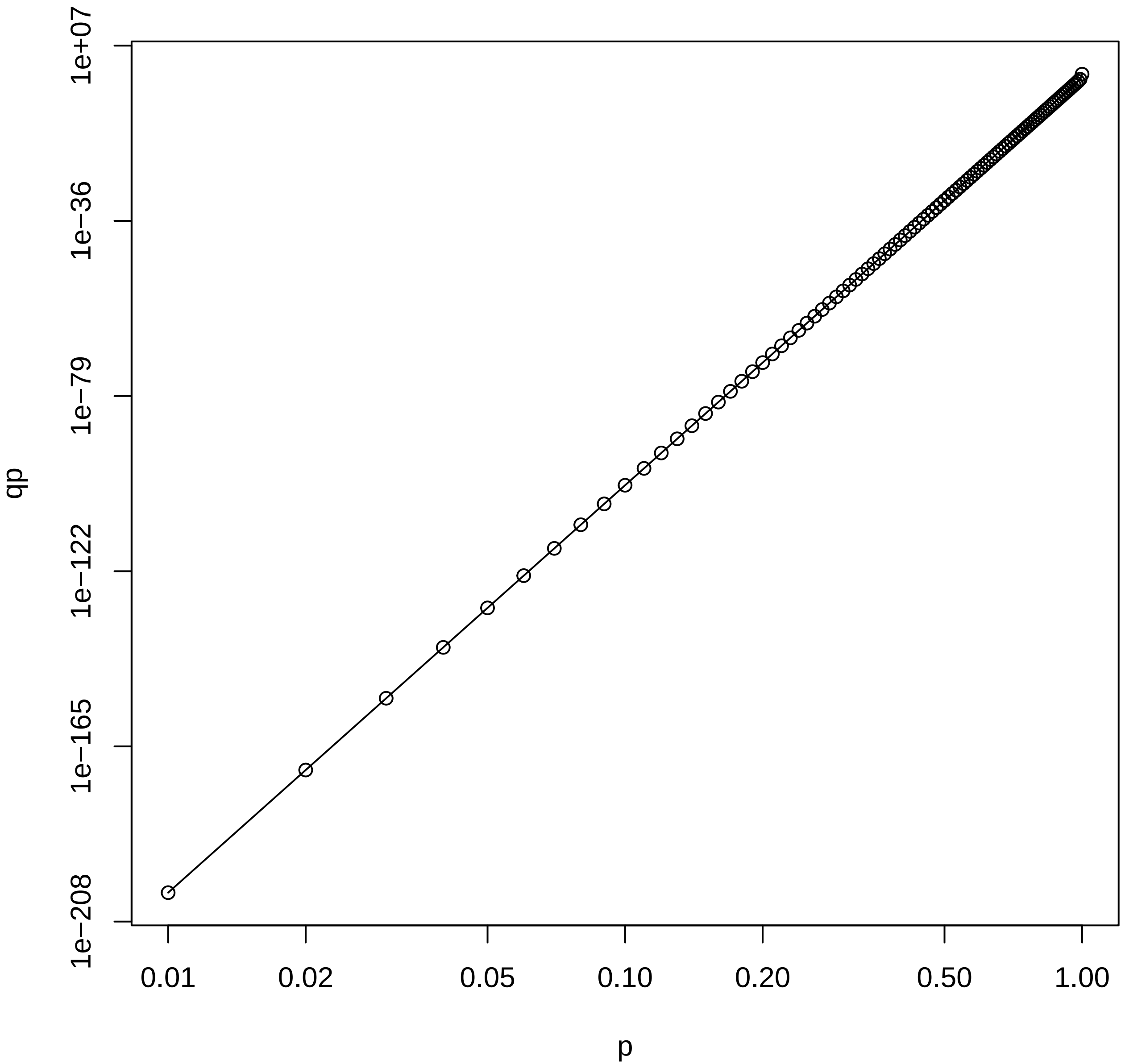
0e+00
−1e−14
−2e−14
−3e−14
pbeta(exp(x), 2e−15, 10, log.p = TRUE)
−20
−15
−10
−5
0
x

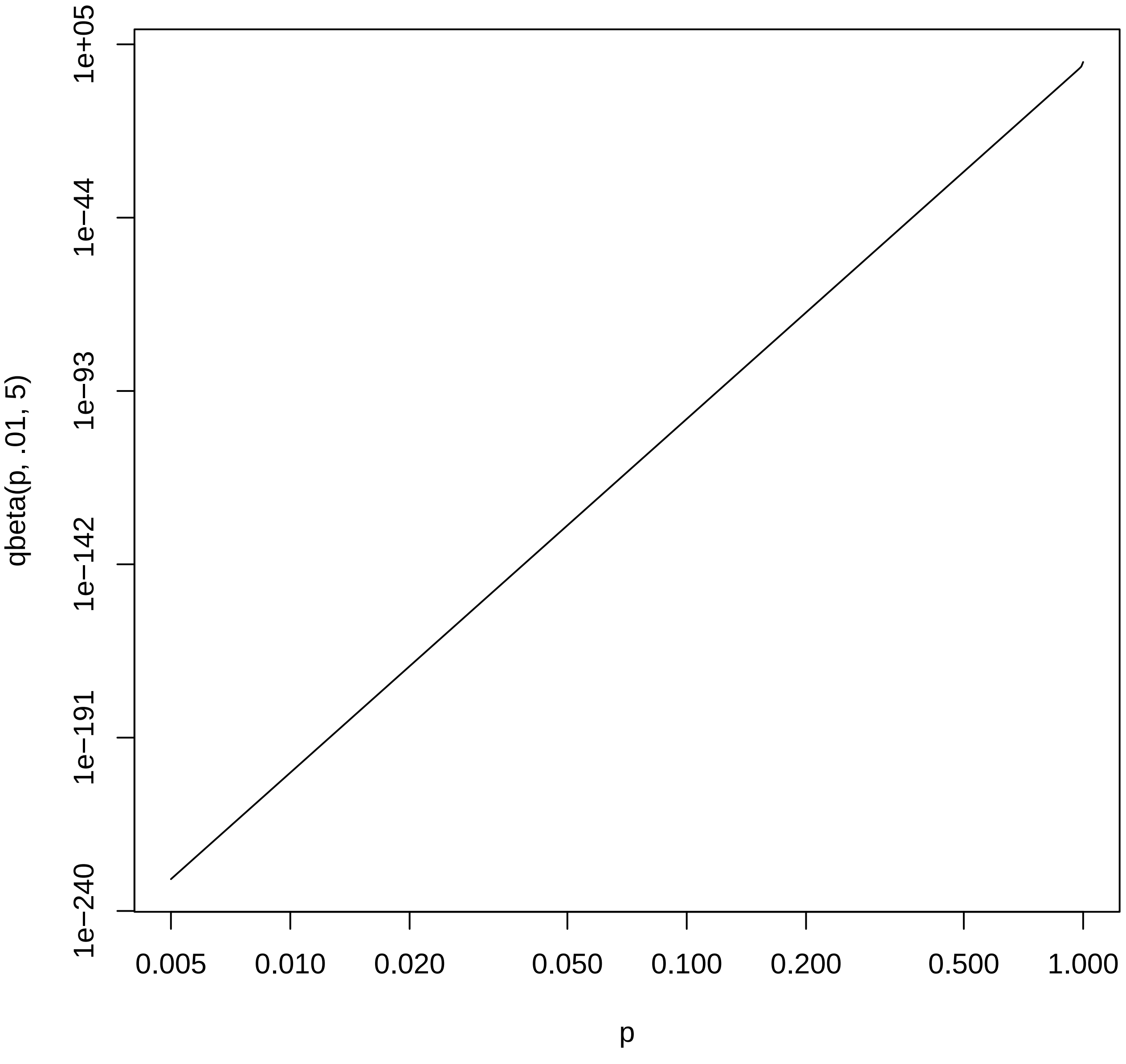


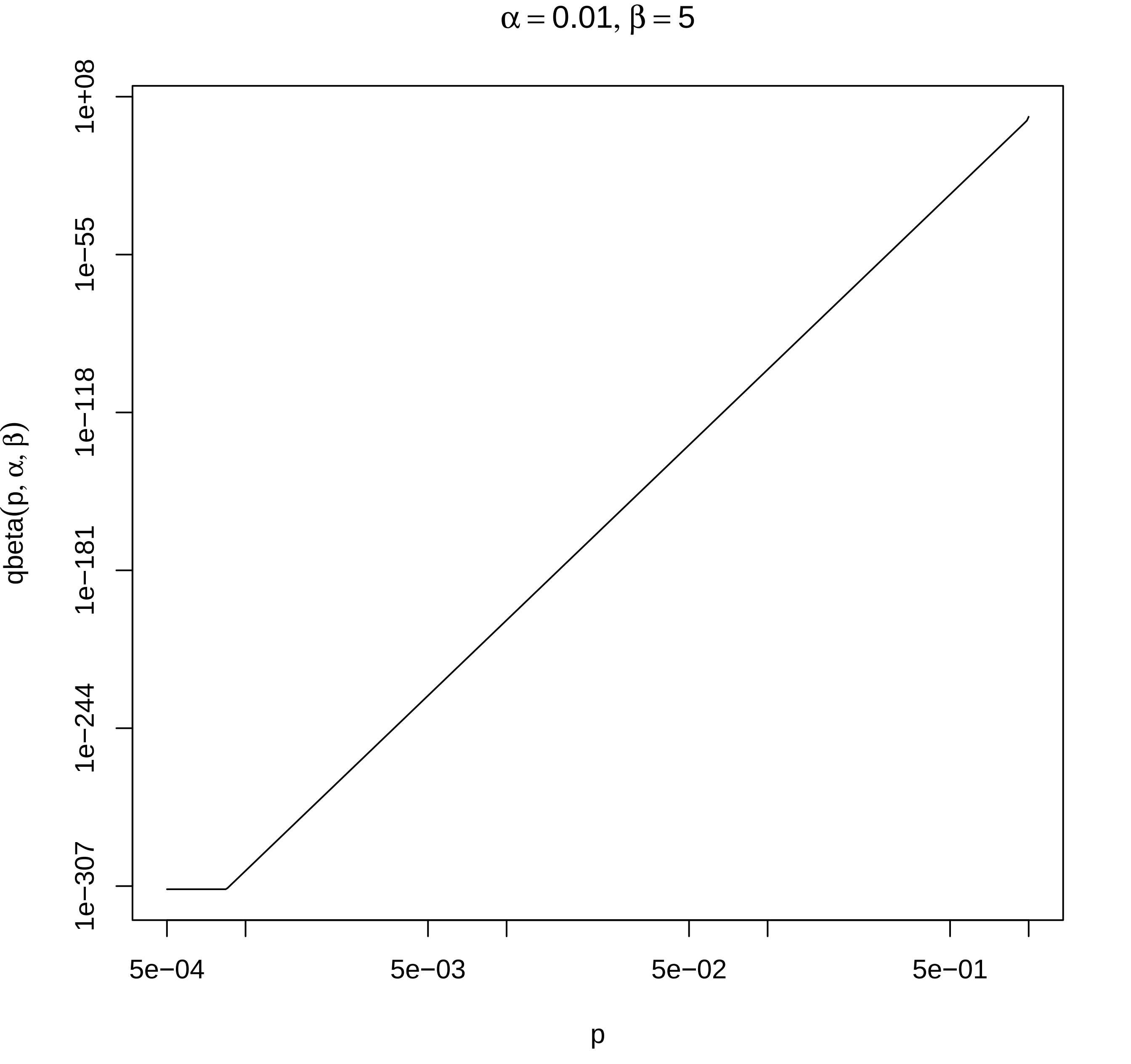
pbeta(e^u, α, β, log = TRUE)
α = 0.001, β = 0.5
α = 0.002, β = 0.5
α = 0.005, β = 0.5
α = 0.01, β = 0.5
α = 0.02, β = 0.5
α = 0.001, β = 2
α = 0.002, β = 2
α = 0.005, β = 2
α = 0.01, β = 2
α = 0.02, β = 2
α = 0.001, β = 5
α = 0.002, β = 5
α = 0.005, β = 5
α = 0.01, β = 5
α = 0.02, β = 5
u



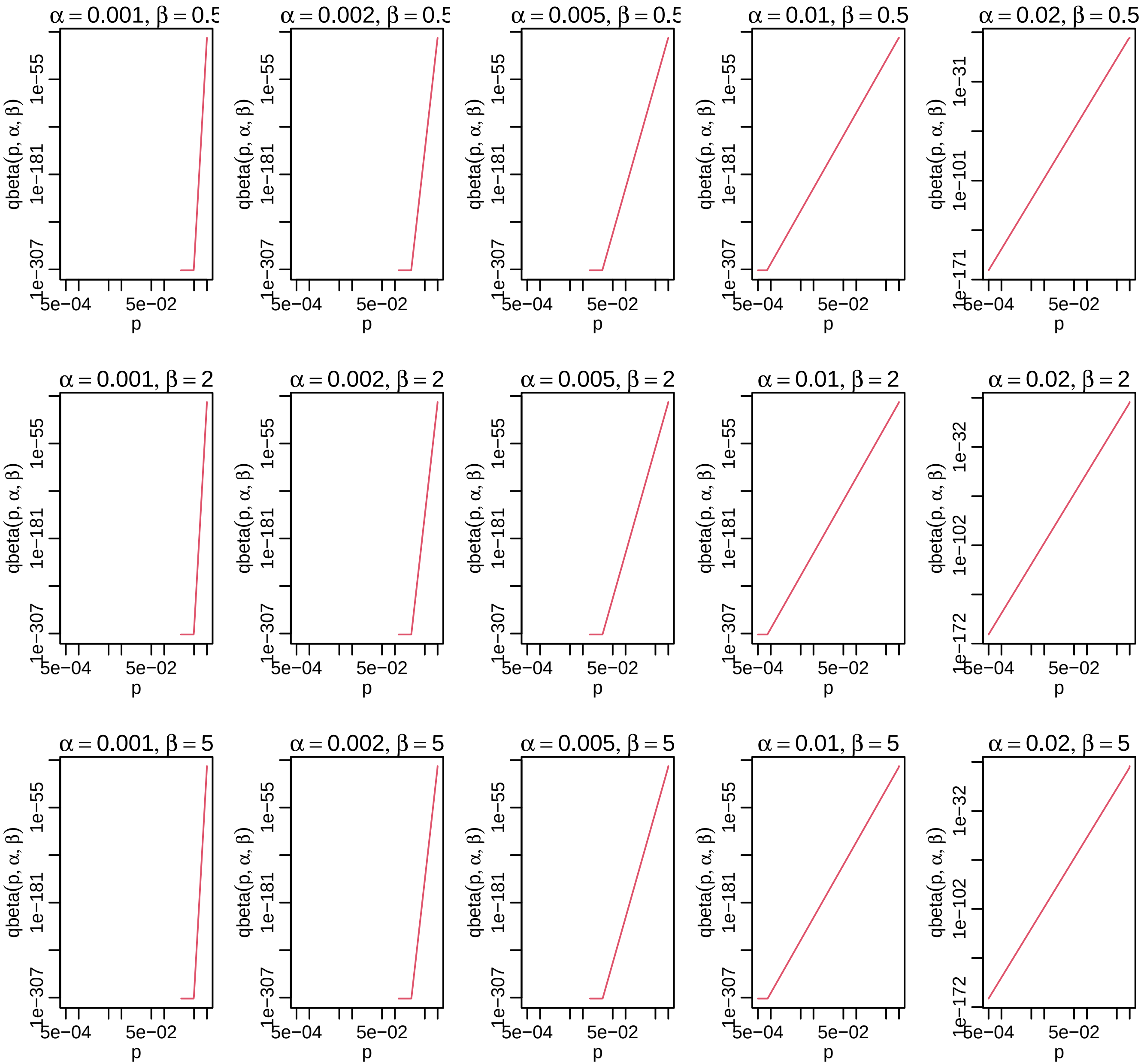
1e+07
1e−36
1e−79
1e−122
1e−165
1e−208
qp
0.0
0.2
0.4
0.6
0.8
1.0
p

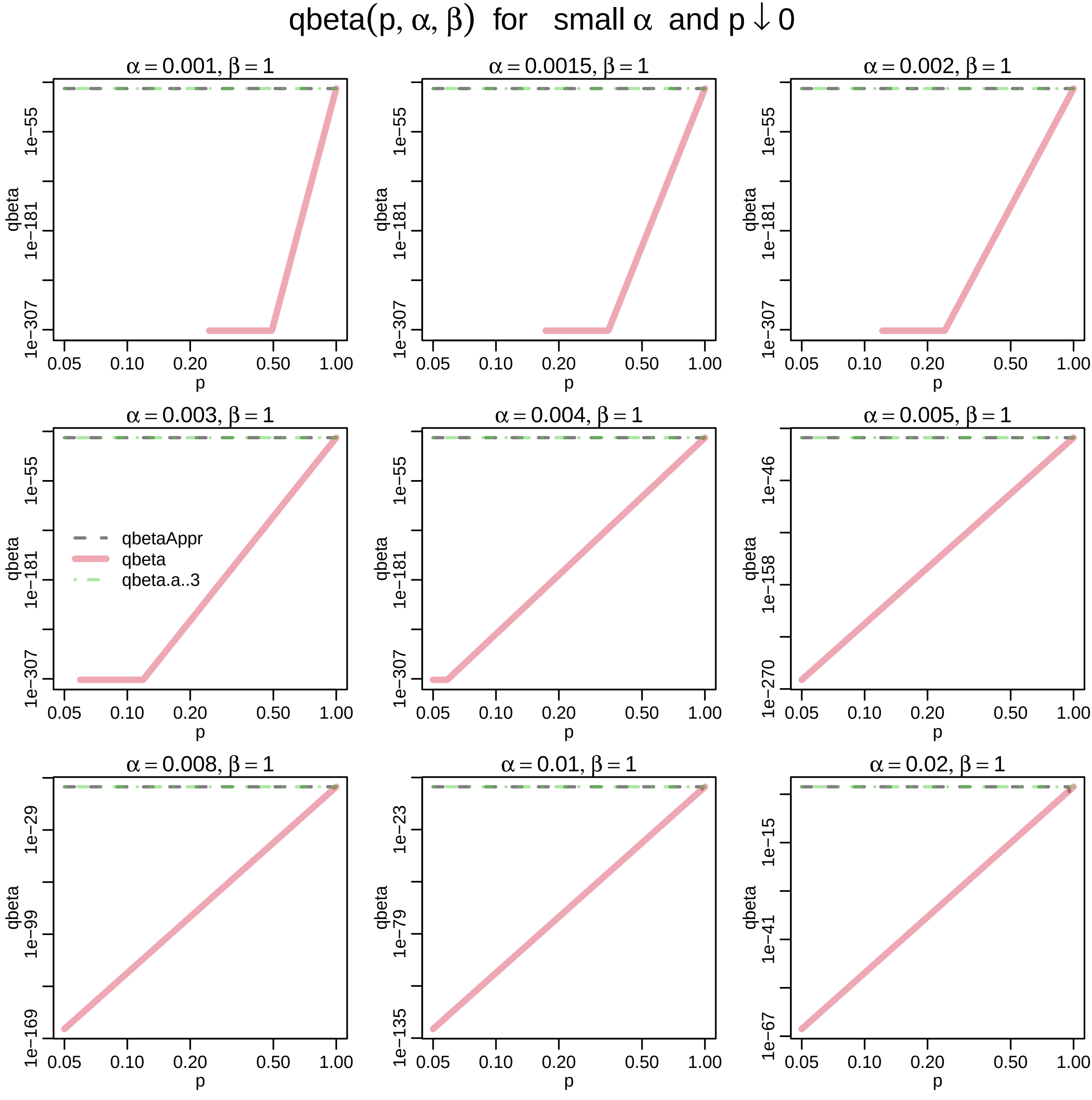

1e+07
1e−36
1e−79
1e−122
1e−165
1e−208
qp
0.01
0.02
0.05
0.10
0.20
0.50
1.00
p


qbeta(p, .01, 5)
1e+05
1e−44
1e−93
1e−142
1e−191
1e−240
0.005
0.010
0.020
0.050
0.100
0.200
0.500
1.000
p

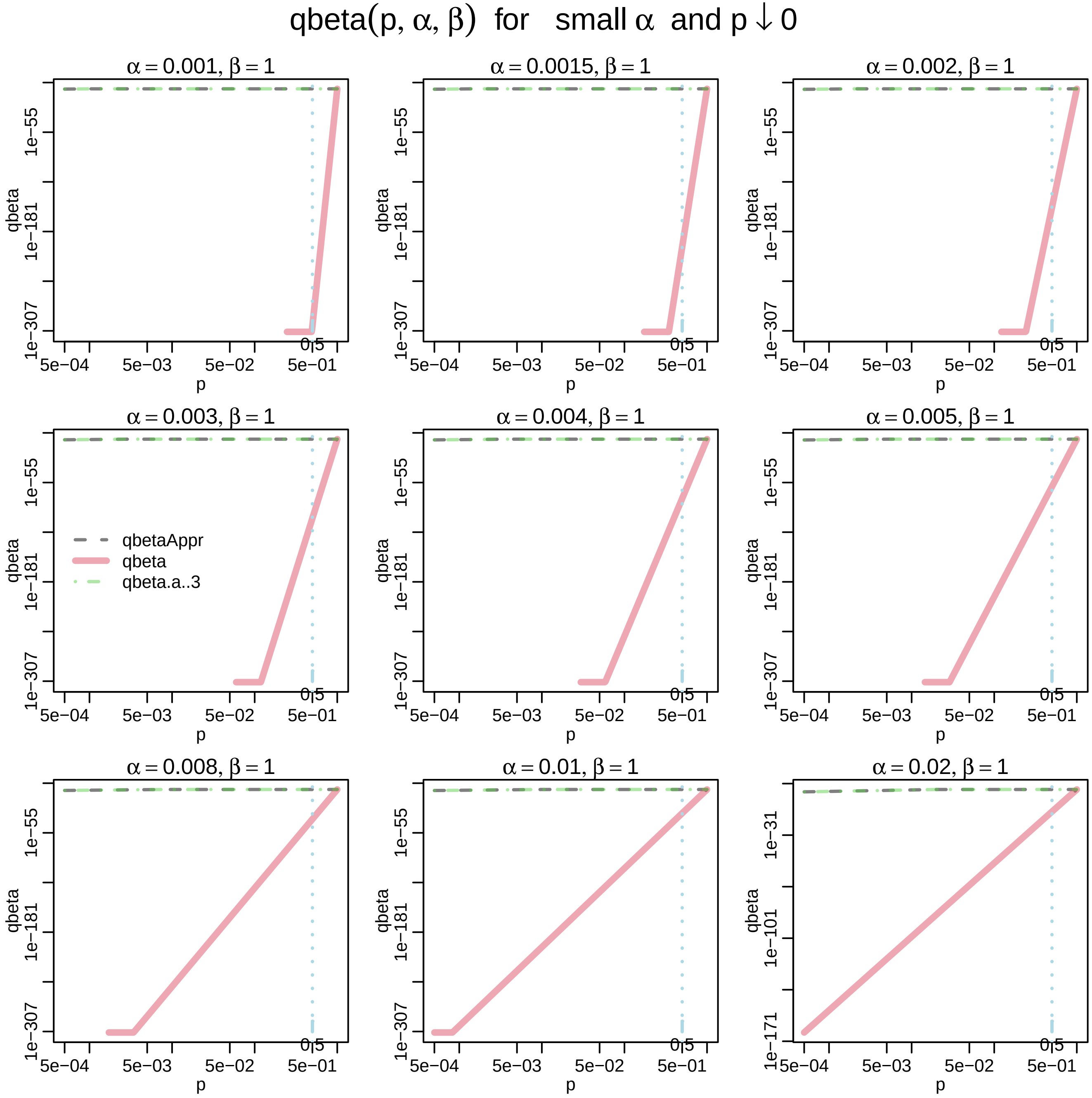

α = 0.01, β = 5
qbeta(p, α, β)
1e+08
1e−55
1e−118
1e−181
1e−244
1e−307
5e−04
5e−03
5e−02
5e−01
p

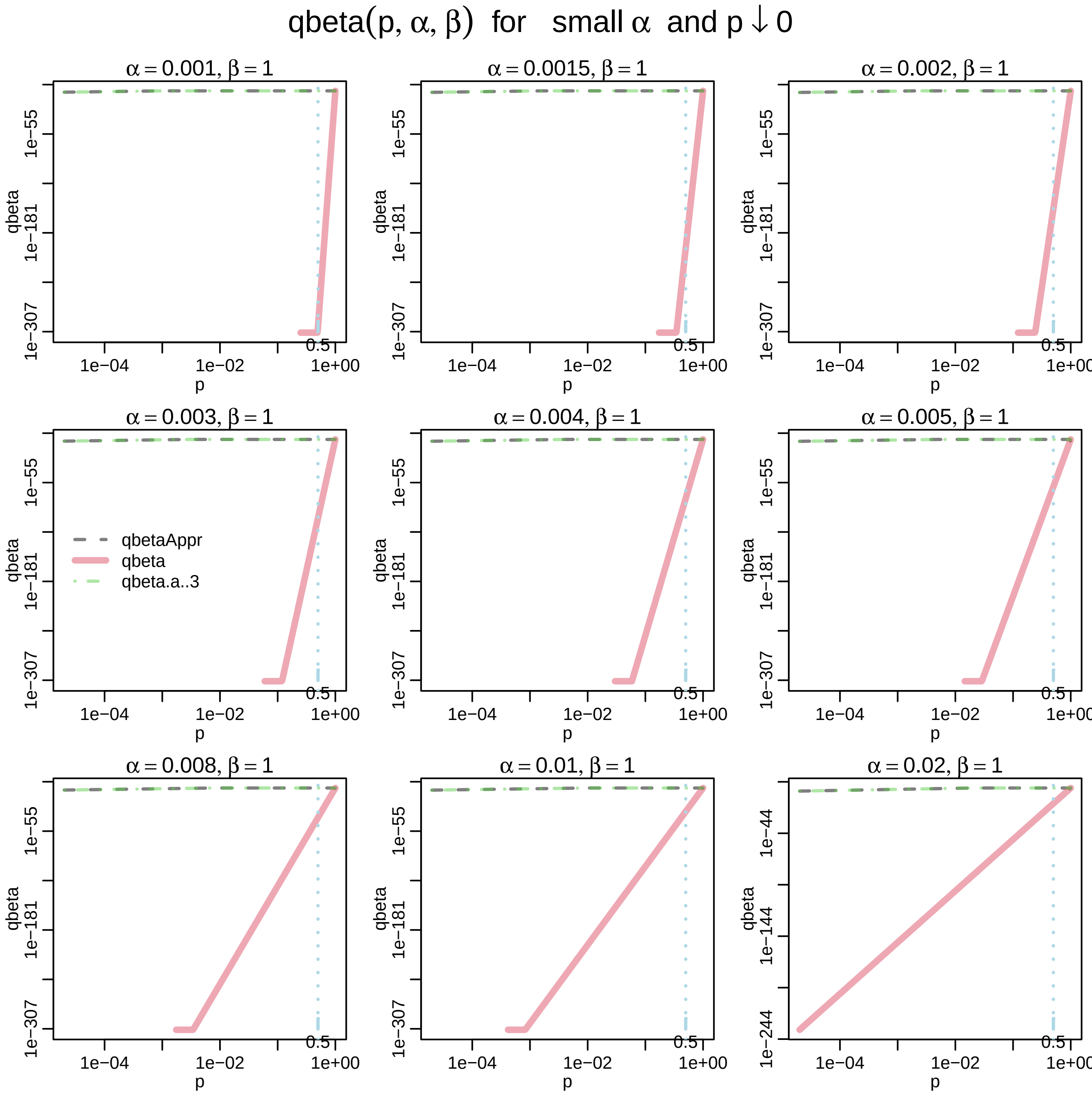
qbeta(p, <small>, .) vs p for p → 0



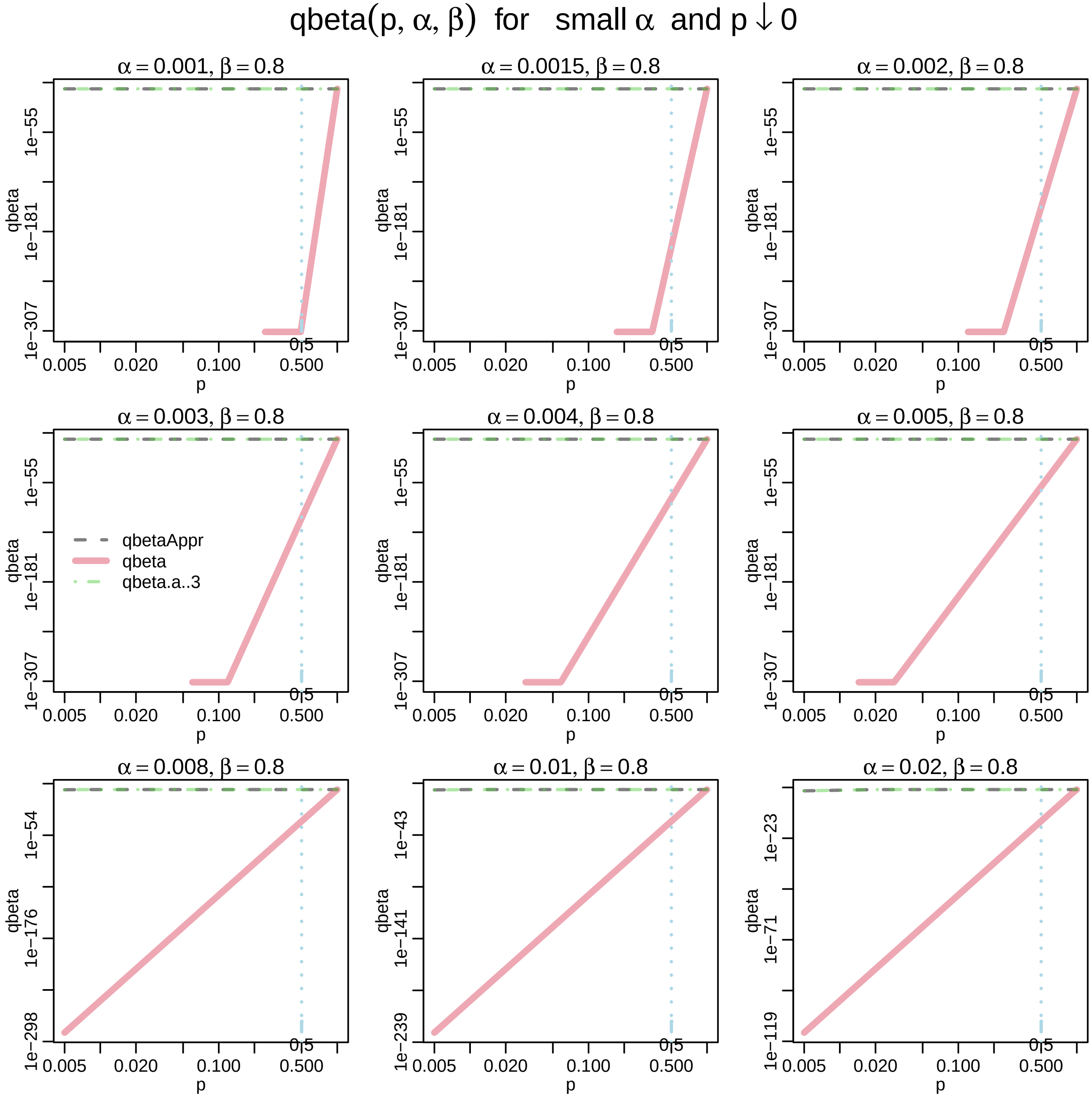


qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 1
α = 0.0015, β = 1
α = 0.002, β = 1
α = 0.003, β = 1
α = 0.004, β = 1
α = 0.005, β = 1
α = 0.008, β = 1
α = 0.01, β = 1
α = 0.02, β = 1
qbeta
p
qbetaAppr
qbeta
qbeta.a..3

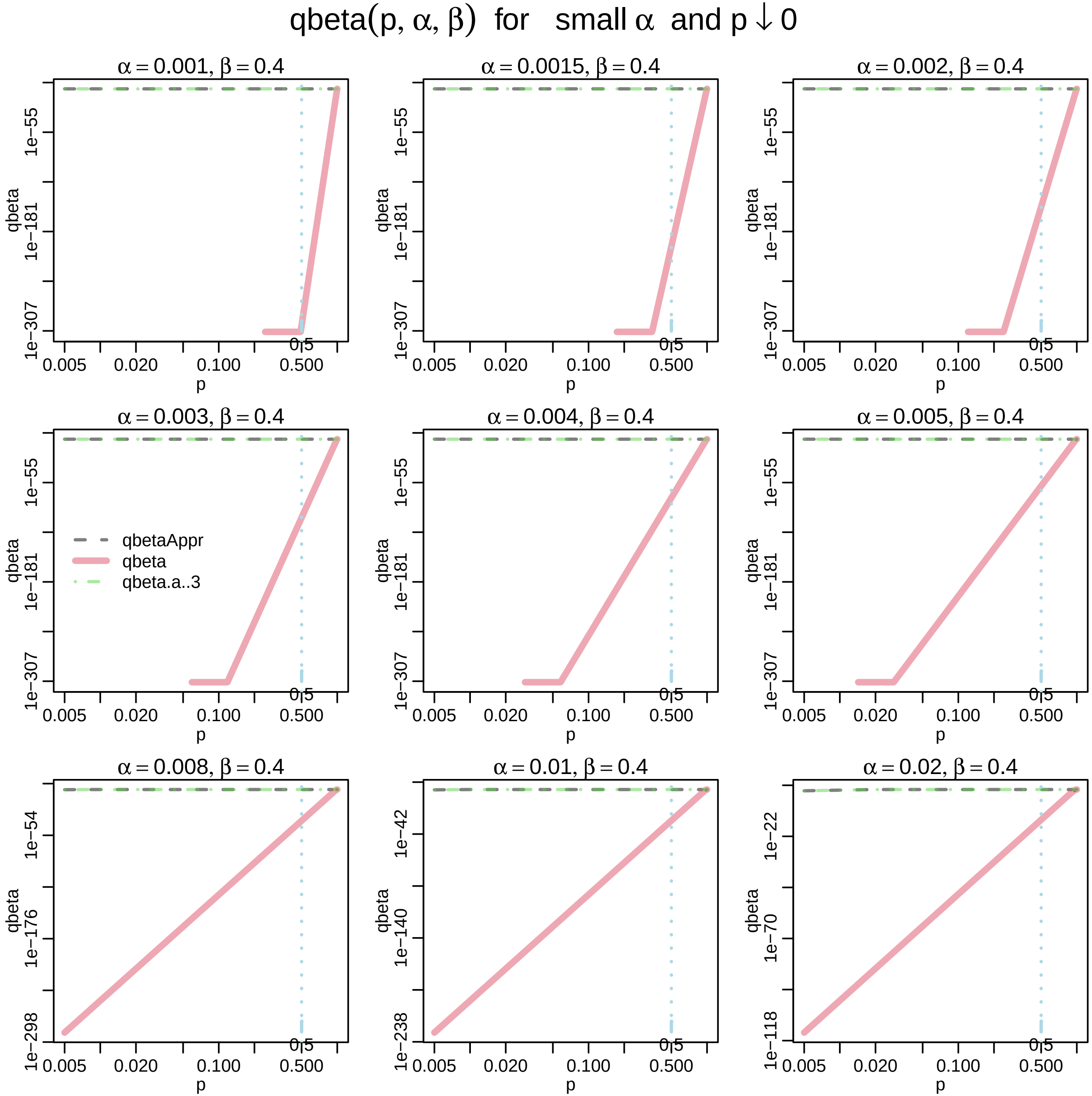

qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 1
α = 0.0015, β = 1
α = 0.002, β = 1
α = 0.003, β = 1
α = 0.004, β = 1
α = 0.005, β = 1
α = 0.008, β = 1
α = 0.01, β = 1
α = 0.02, β = 1
qbeta
1e−307
1e−181
1e−55
1e−171
1e−101
1e−31
p
5e−04
5e−03
5e−02
5e−01
0.5
qbetaAppr
qbeta
qbeta.a..3



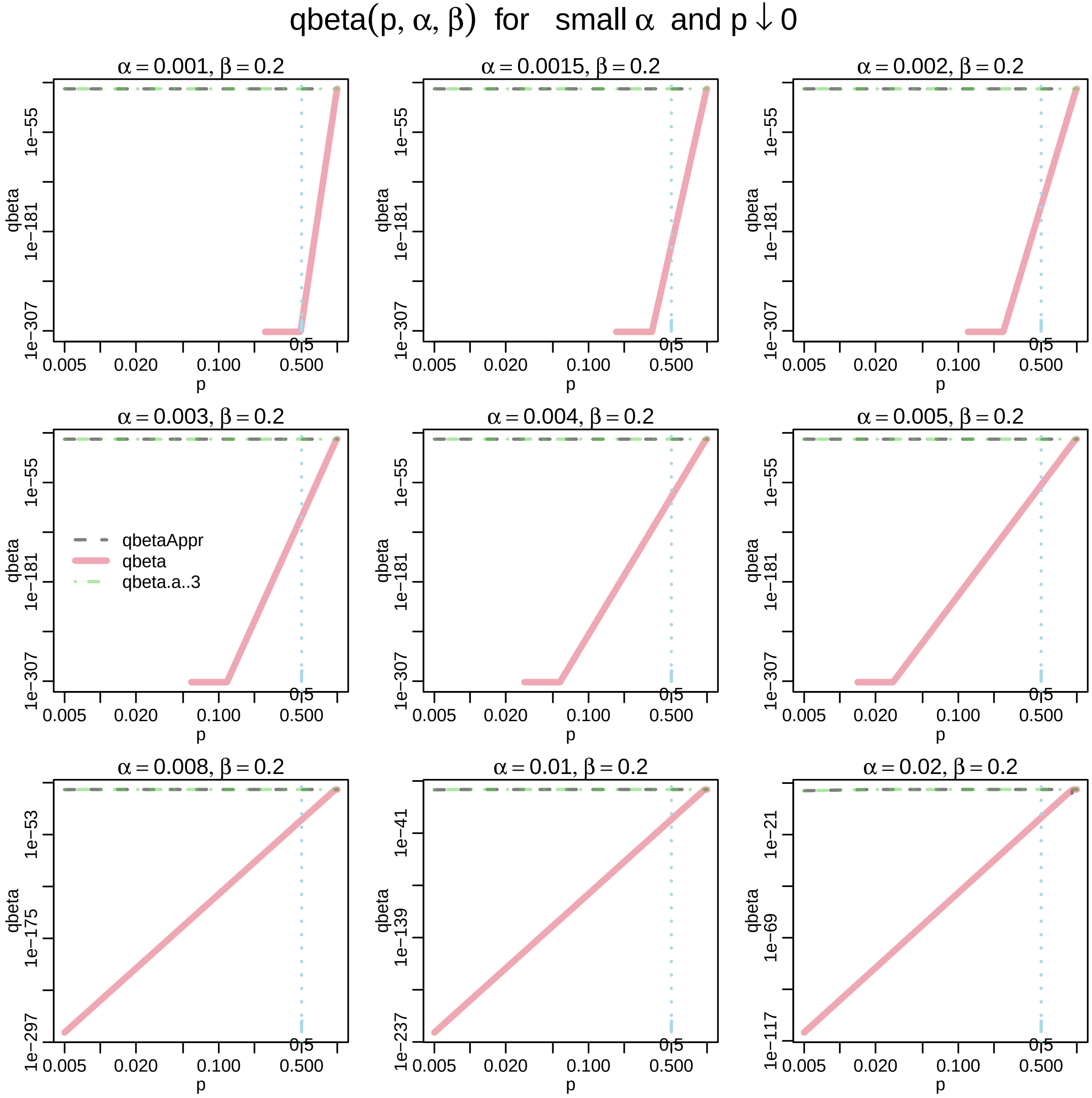
qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 1
α = 0.0015, β = 1
α = 0.002, β = 1
α = 0.003, β = 1
α = 0.004, β = 1
α = 0.005, β = 1
α = 0.008, β = 1
α = 0.01, β = 1
α = 0.02, β = 1
qbeta
1e−55
1e−181
1e−307
1e−44
1e−144
1e−244
p
1e−04
1e−02
1e+00
0.5
qbetaAppr
qbeta
qbeta.a..3



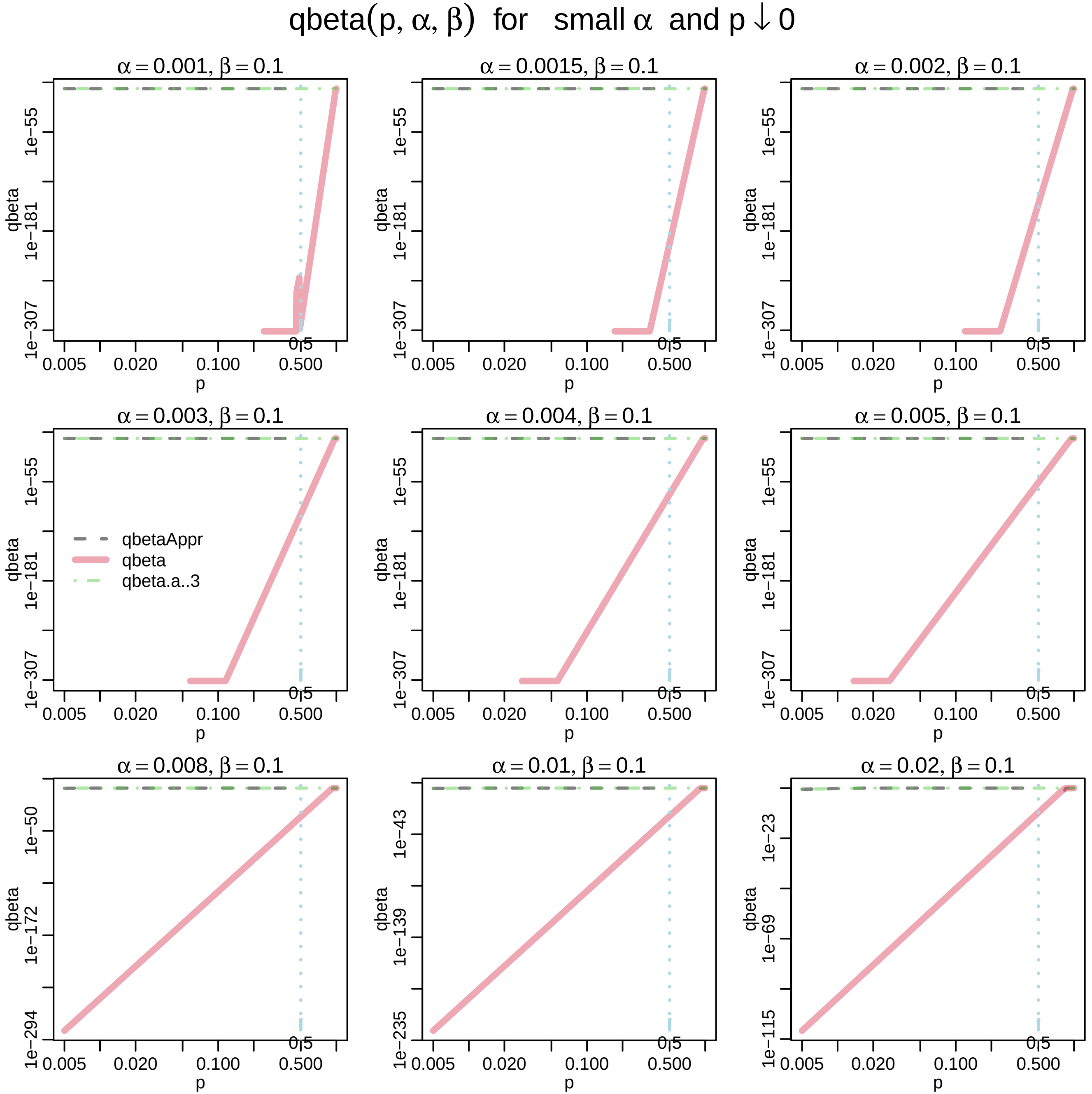
qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 0.8
α = 0.0015, β = 0.8
α = 0.002, β = 0.8
α = 0.003, β = 0.8
α = 0.004, β = 0.8
α = 0.005, β = 0.8
α = 0.008, β = 0.8
α = 0.01, β = 0.8
α = 0.02, β = 0.8
qbetaAppr
qbeta
qbeta.a..3
qbeta
p
0.005
0.020
0.100
0.500
0.5
1e−55
1e−181
1e−307
1e−54
1e−176
1e−298
1e−43
1e−141
1e−239
1e−23
1e−71
1e−119



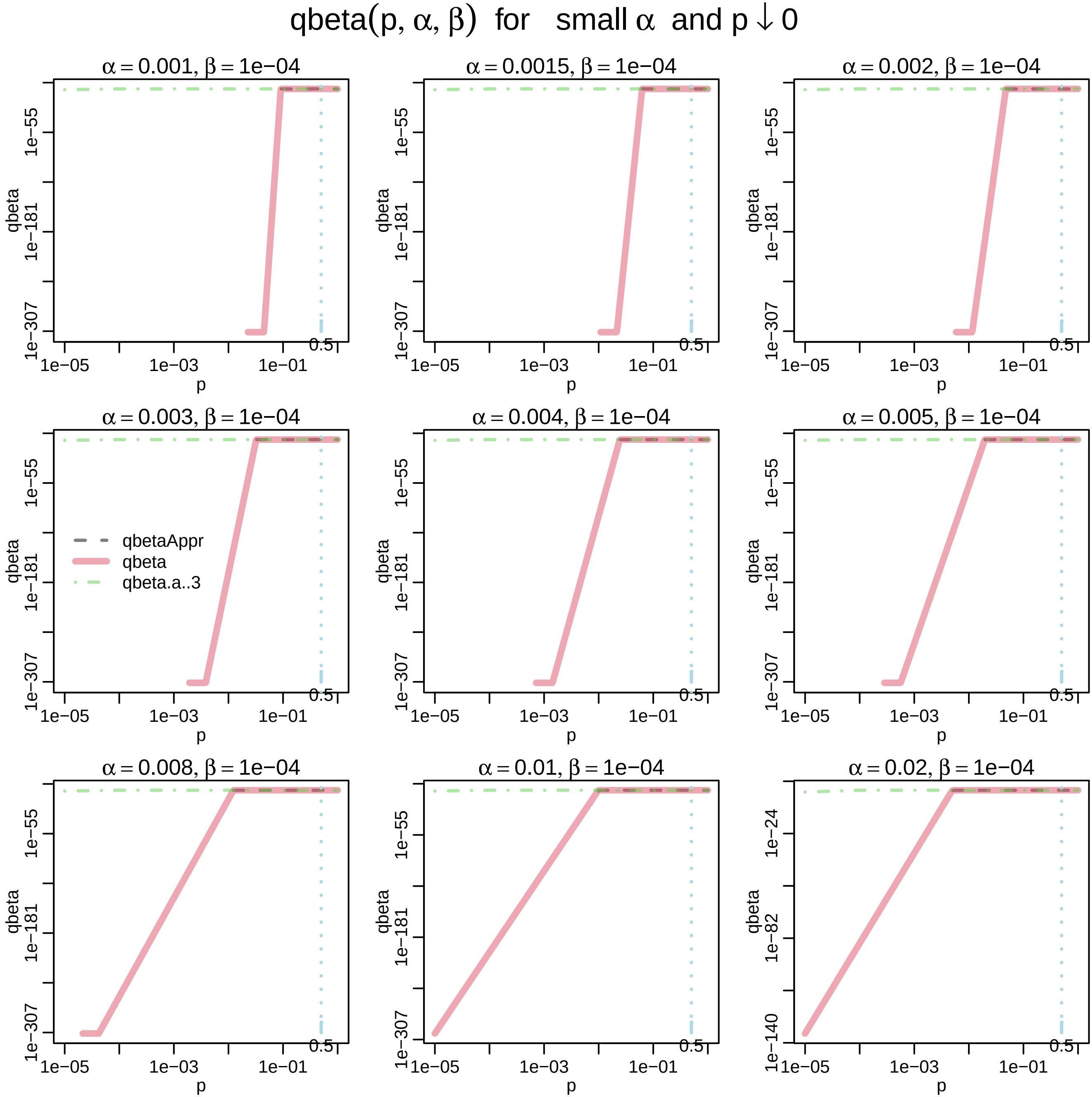
qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 0.4
α = 0.0015, β = 0.4
α = 0.002, β = 0.4
α = 0.003, β = 0.4
α = 0.004, β = 0.4
α = 0.005, β = 0.4
α = 0.008, β = 0.4
α = 0.01, β = 0.4
α = 0.02, β = 0.4
qbetaAppr
qbeta
qbeta.a..3
qbeta
p
0.005
0.020
0.100
0.500
0.5
1e−307
1e−181
1e−55
1e−298
1e−176
1e−54
1e−238
1e−140
1e−42
1e−118
1e−70
1e−22

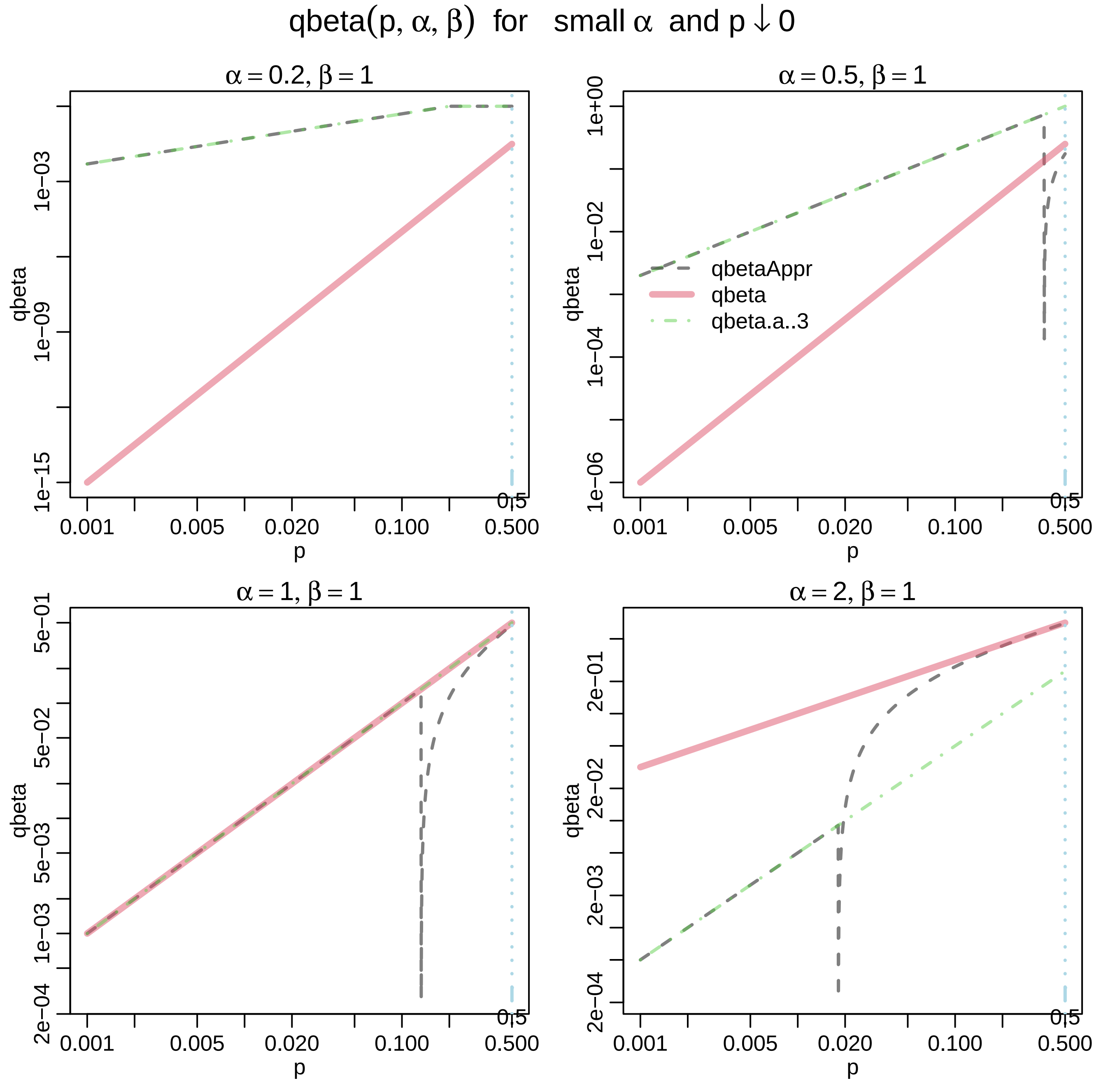


qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 0.2
α = 0.0015, β = 0.2
α = 0.002, β = 0.2
α = 0.003, β = 0.2
α = 0.004, β = 0.2
α = 0.005, β = 0.2
α = 0.008, β = 0.2
α = 0.01, β = 0.2
α = 0.02, β = 0.2
qbetaAppr
qbeta
qbeta.a..3
qbeta
p
0.005
0.020
0.100
0.500
0.5
1e−55
1e−181
1e−307
1e−53
1e−175
1e−297
1e−41
1e−139
1e−237
1e−21
1e−69
1e−117

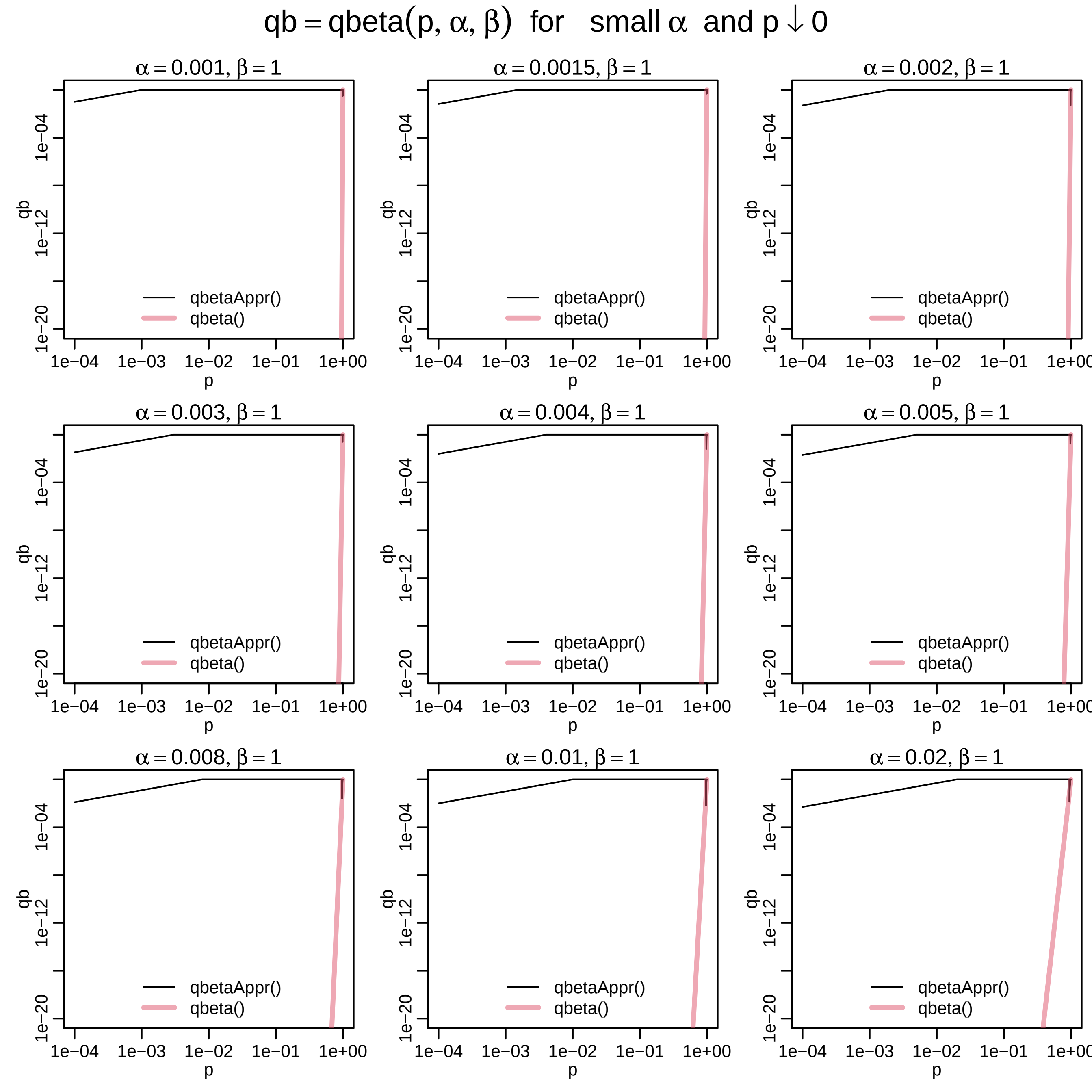


qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 0.1
α = 0.0015, β = 0.1
α = 0.002, β = 0.1
α = 0.003, β = 0.1
α = 0.004, β = 0.1
α = 0.005, β = 0.1
α = 0.008, β = 0.1
α = 0.01, β = 0.1
α = 0.02, β = 0.1
qbeta
p
0.005
0.020
0.100
0.500
0.5
1e−55
1e−181
1e−307
1e−50
1e−172
1e−294
1e−43
1e−139
1e−235
1e−23
1e−69
1e−115
qbetaAppr
qbeta
qbeta.a..3

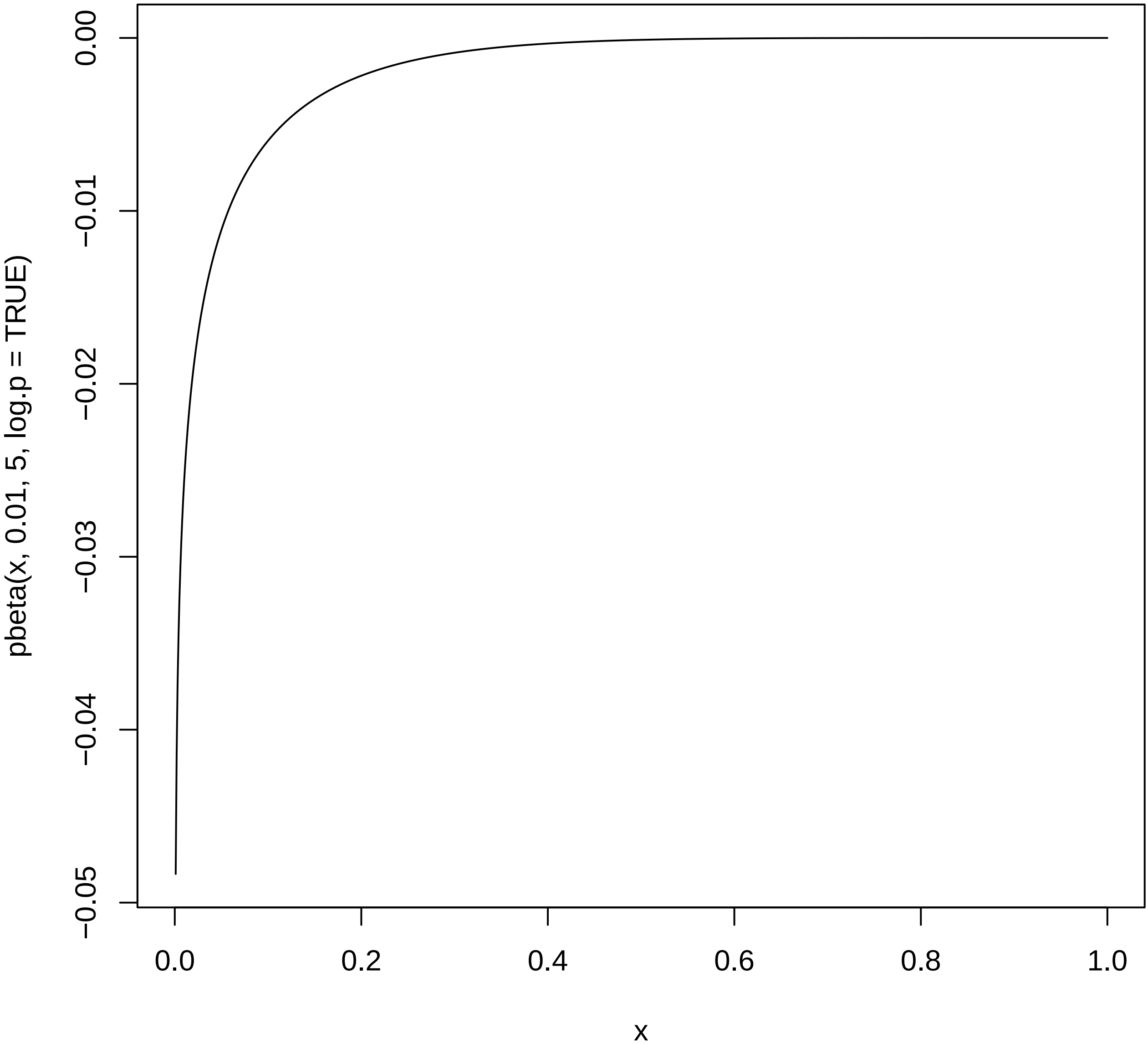

qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 1e−04
α = 0.0015, β = 1e−04
α = 0.002, β = 1e−04
α = 0.003, β = 1e−04
α = 0.004, β = 1e−04
α = 0.005, β = 1e−04
α = 0.008, β = 1e−04
α = 0.01, β = 1e−04
α = 0.02, β = 1e−04
qbeta
1e−307
1e−181
1e−55
1e−140
1e−82
1e−24
p
1e−05
1e−03
1e−01
0.5
qbetaAppr
qbeta
qbeta.a..3



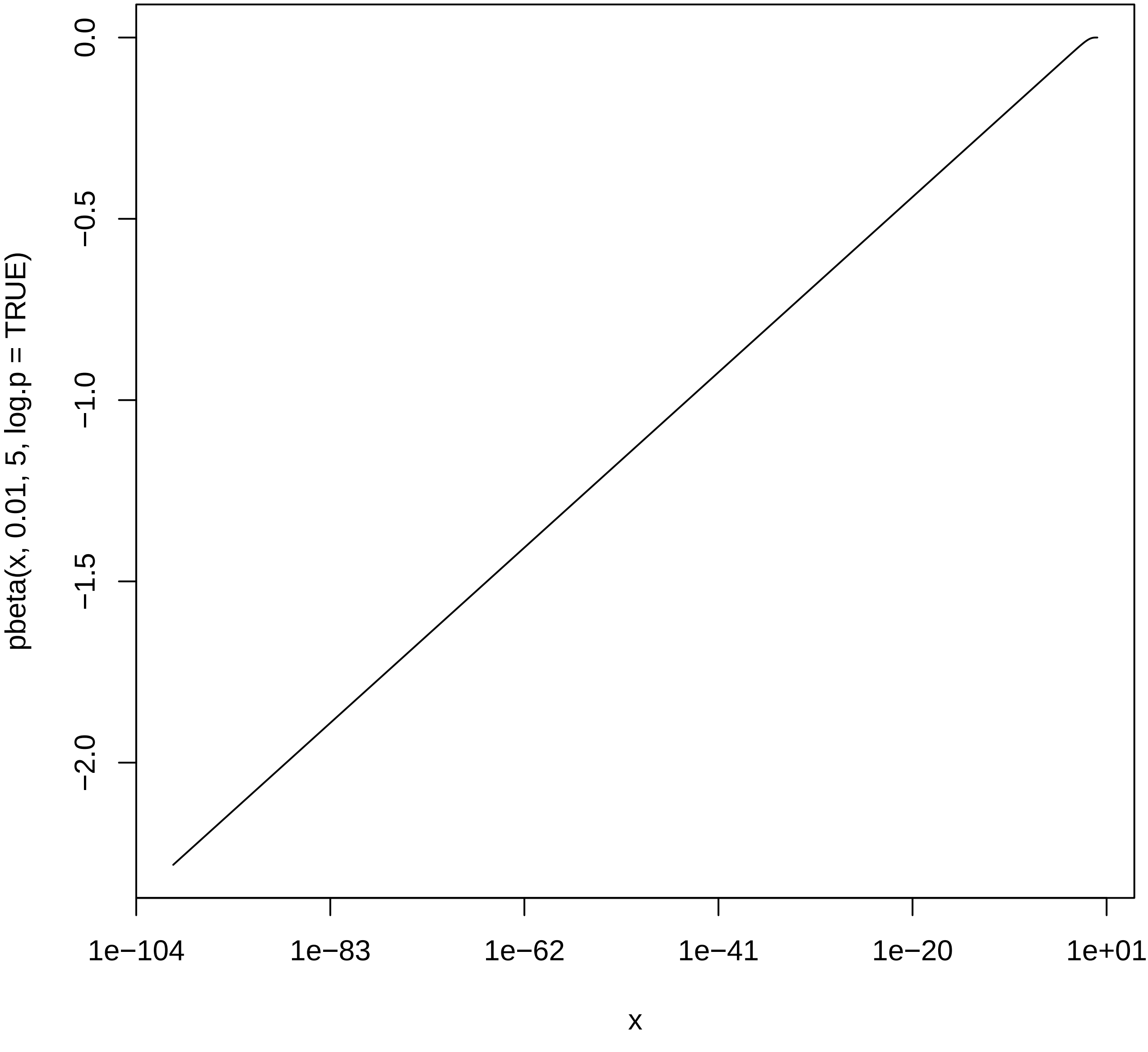
qbeta(p, α, β) for small α and p ↓ 0
α = 0.2, β = 1
α = 0.5, β = 1
α = 1, β = 1
α = 2, β = 1
qbetaAppr
qbeta
qbeta.a..3
qbeta
p
0.001
0.005
0.020
0.100
0.500
0.5
1e−15
1e−09
1e−03
1e−06
1e−04
1e−02
1e+00
2e−04
1e−03
5e−03
5e−02
5e−01
2e−03
2e−02
2e−01



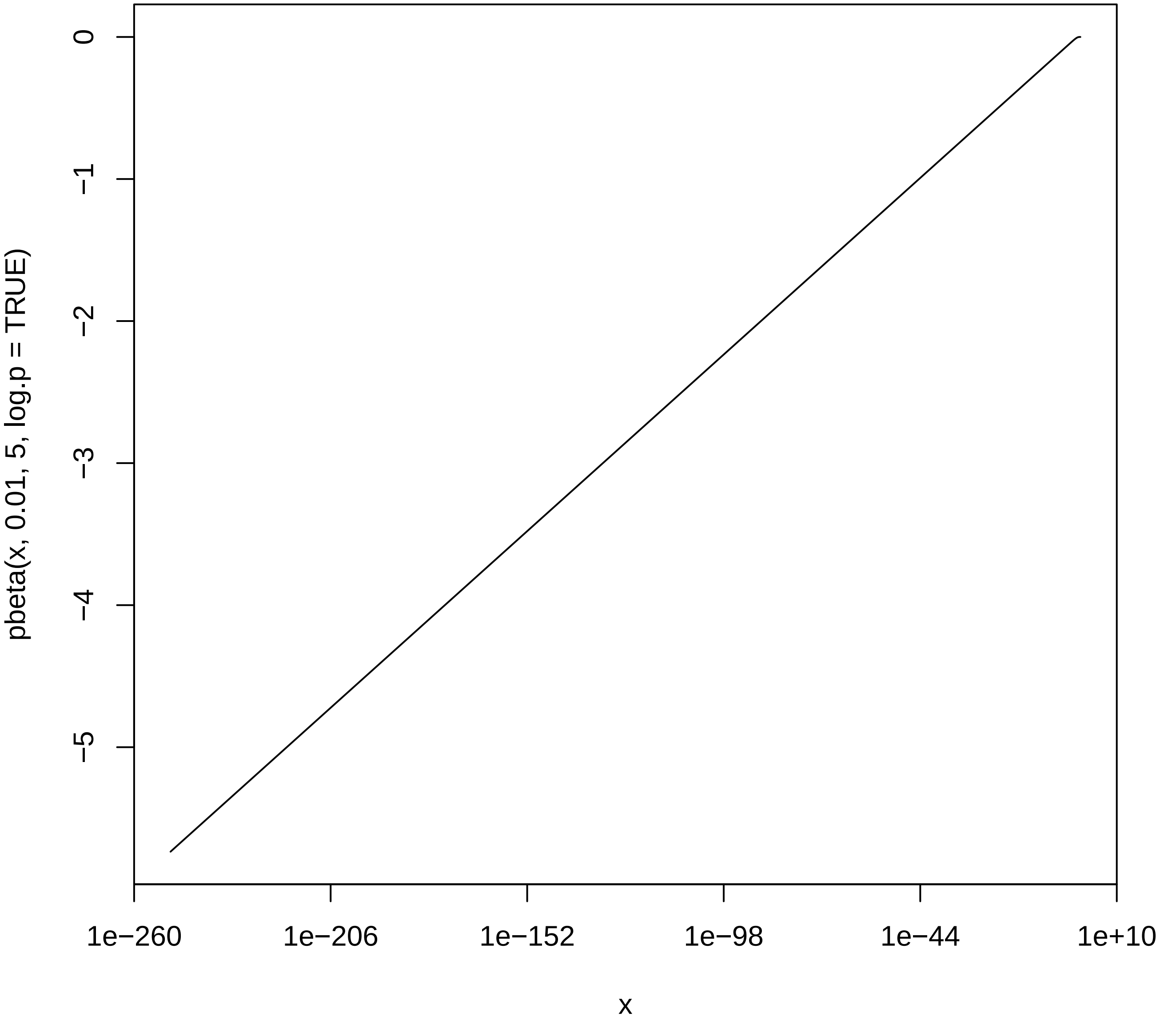
qb = qbeta(p, α, β) for small α and p ↓ 0
α = 0.001, β = 1
α = 0.0015, β = 1
α = 0.002, β = 1
α = 0.003, β = 1
α = 0.004, β = 1
α = 0.005, β = 1
α = 0.008, β = 1
α = 0.01, β = 1
α = 0.02, β = 1
qbetaAppr()
qbeta()
qb
p
1e−04
1e−12
1e−20
1e−04
1e−03
1e−02
1e−01
1e+00



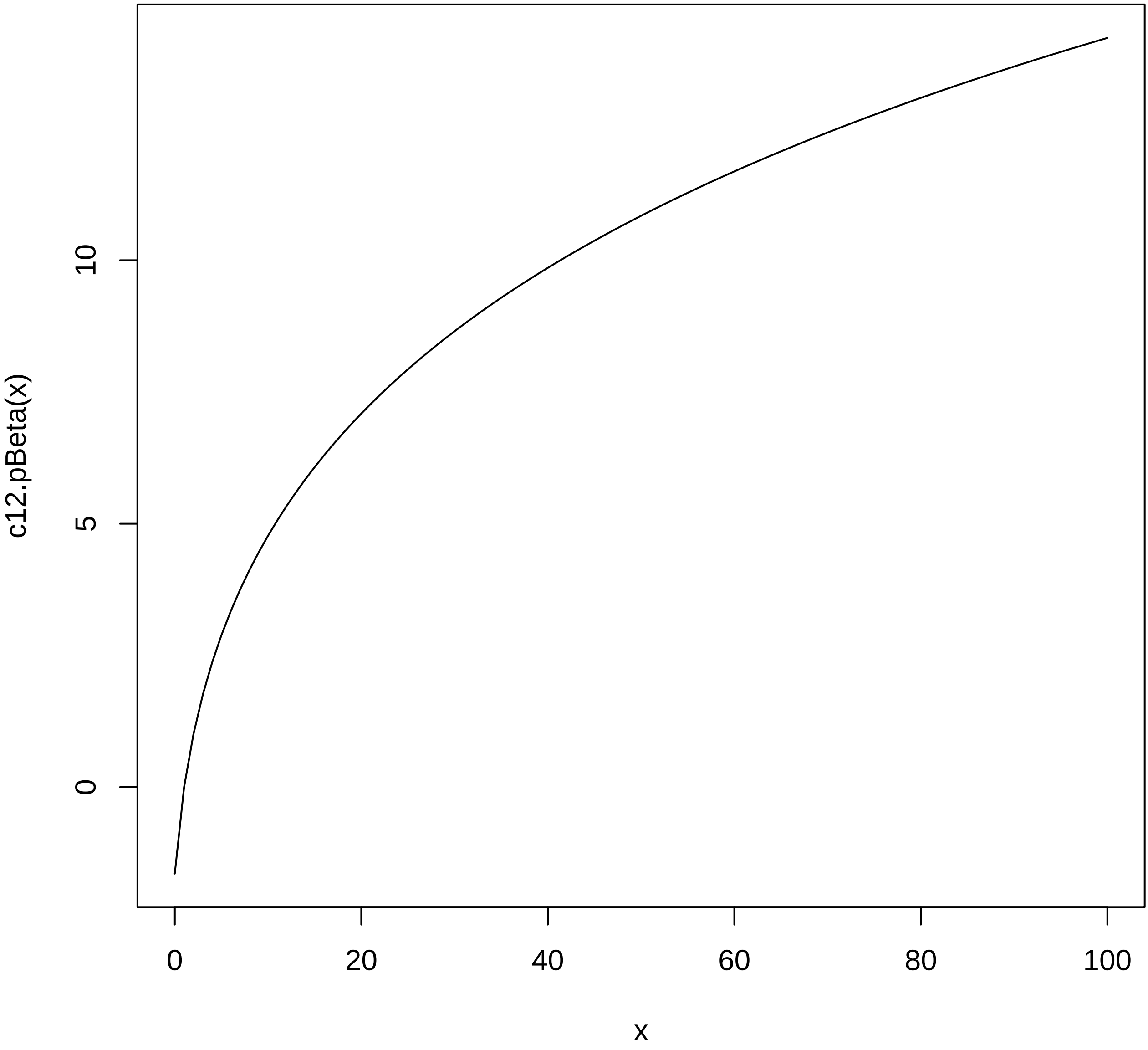
pbeta(x, 0.01, 5, log.p = TRUE)
0.00
−0.01
−0.02
−0.03
−0.04
−0.05
0.0
0.2
0.4
0.6
0.8
1.0
x

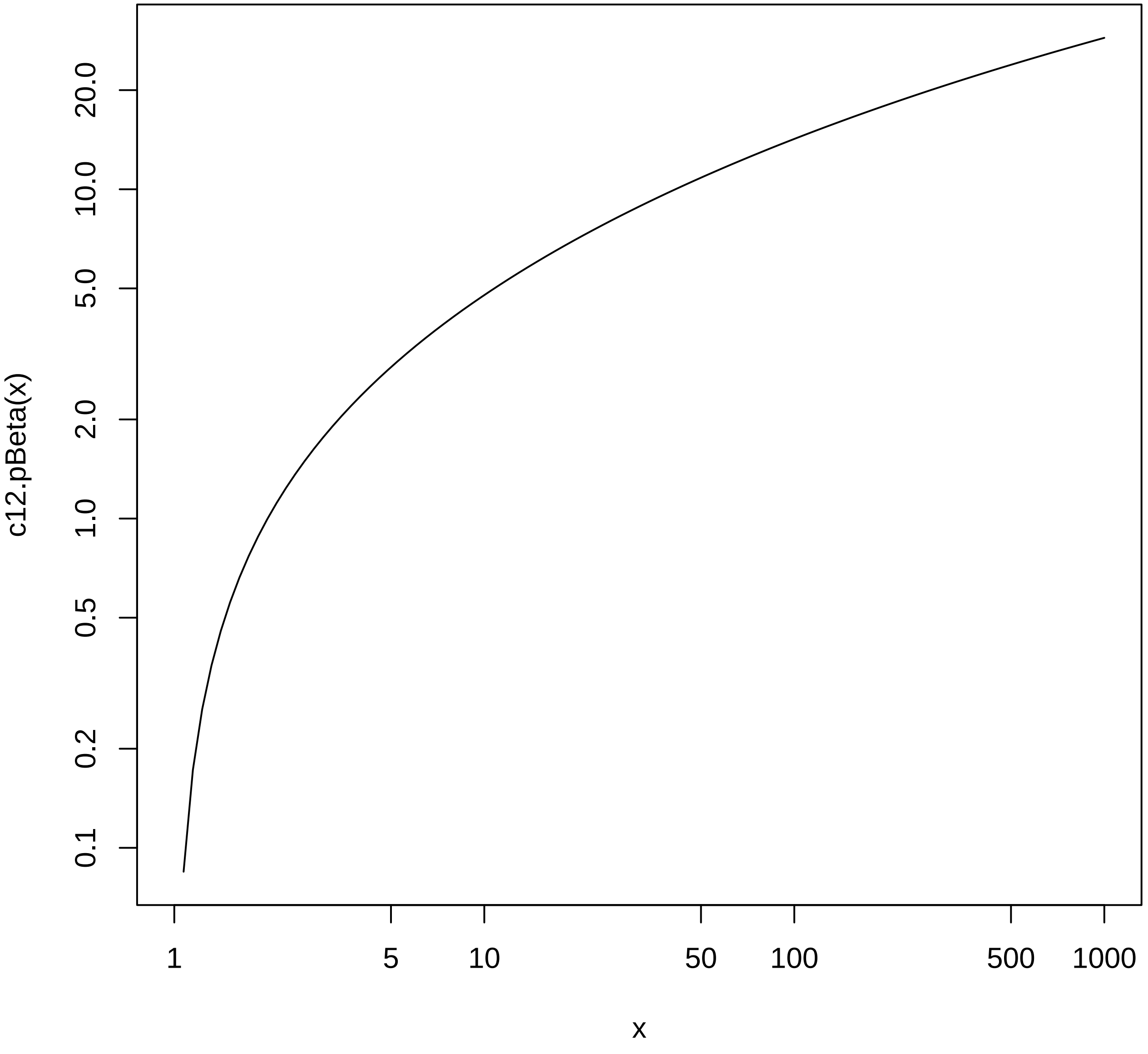


0.0
−0.5
−1.0
−1.5
−2.0
pbeta(x, 0.01, 5, log.p = TRUE)
1e−104
1e−83
1e−62
1e−41
1e−20
1e+01
x

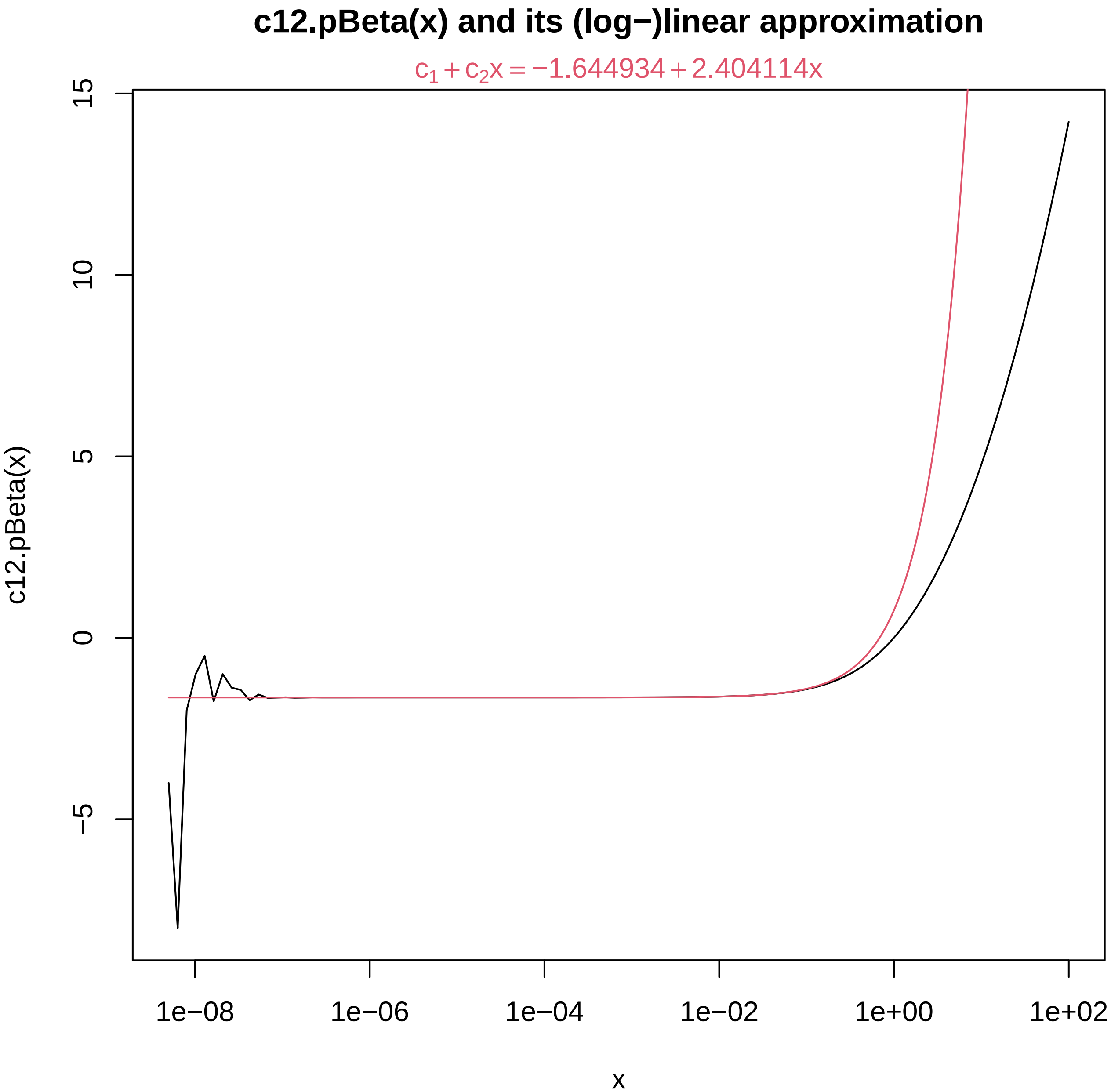


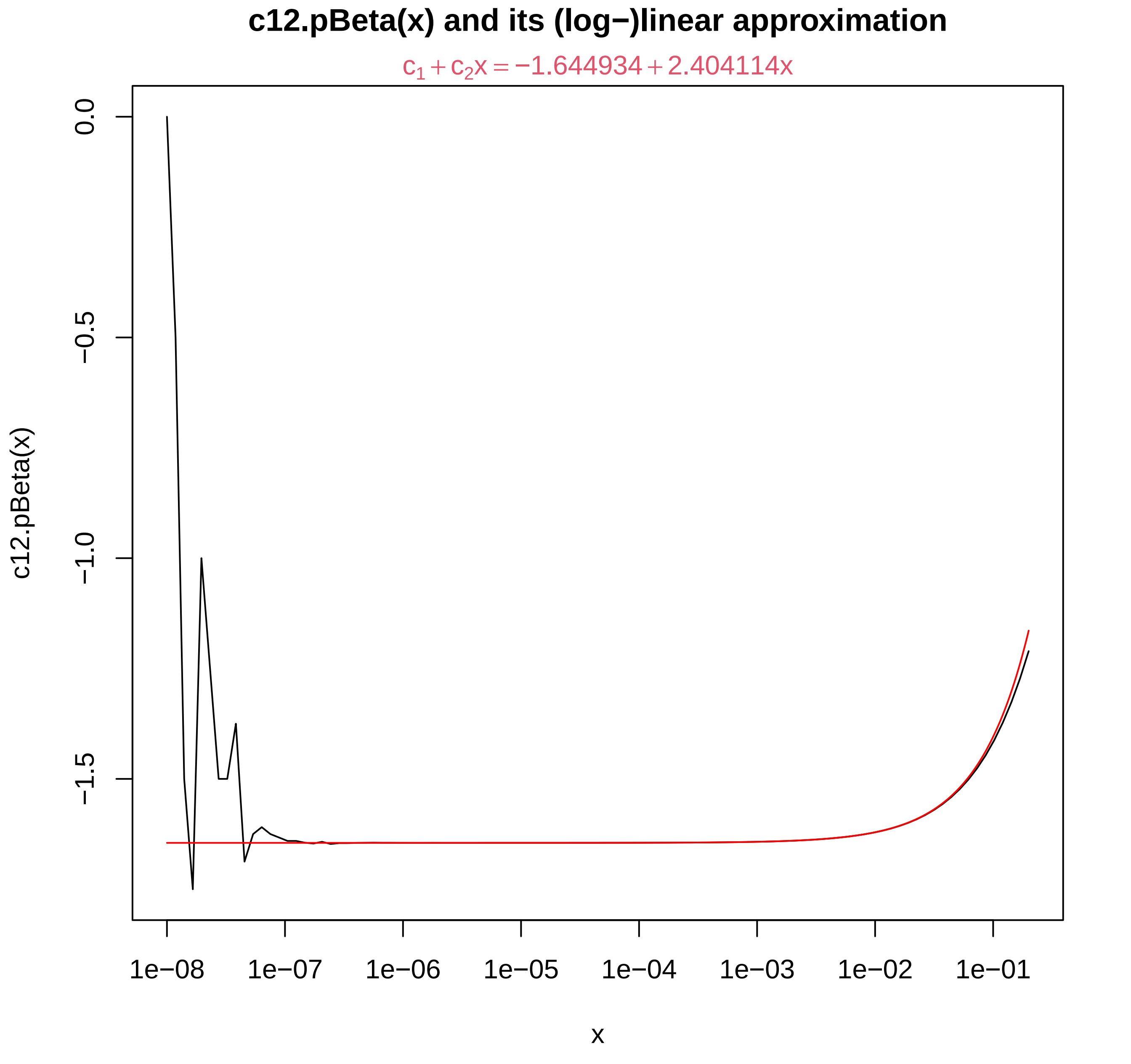
pbeta(x, 0.01, 5, log.p = TRUE)
0
−1
−2
−3
−4
−5
1e−260
1e−206
1e−152
1e−98
1e−44
1e+10
x

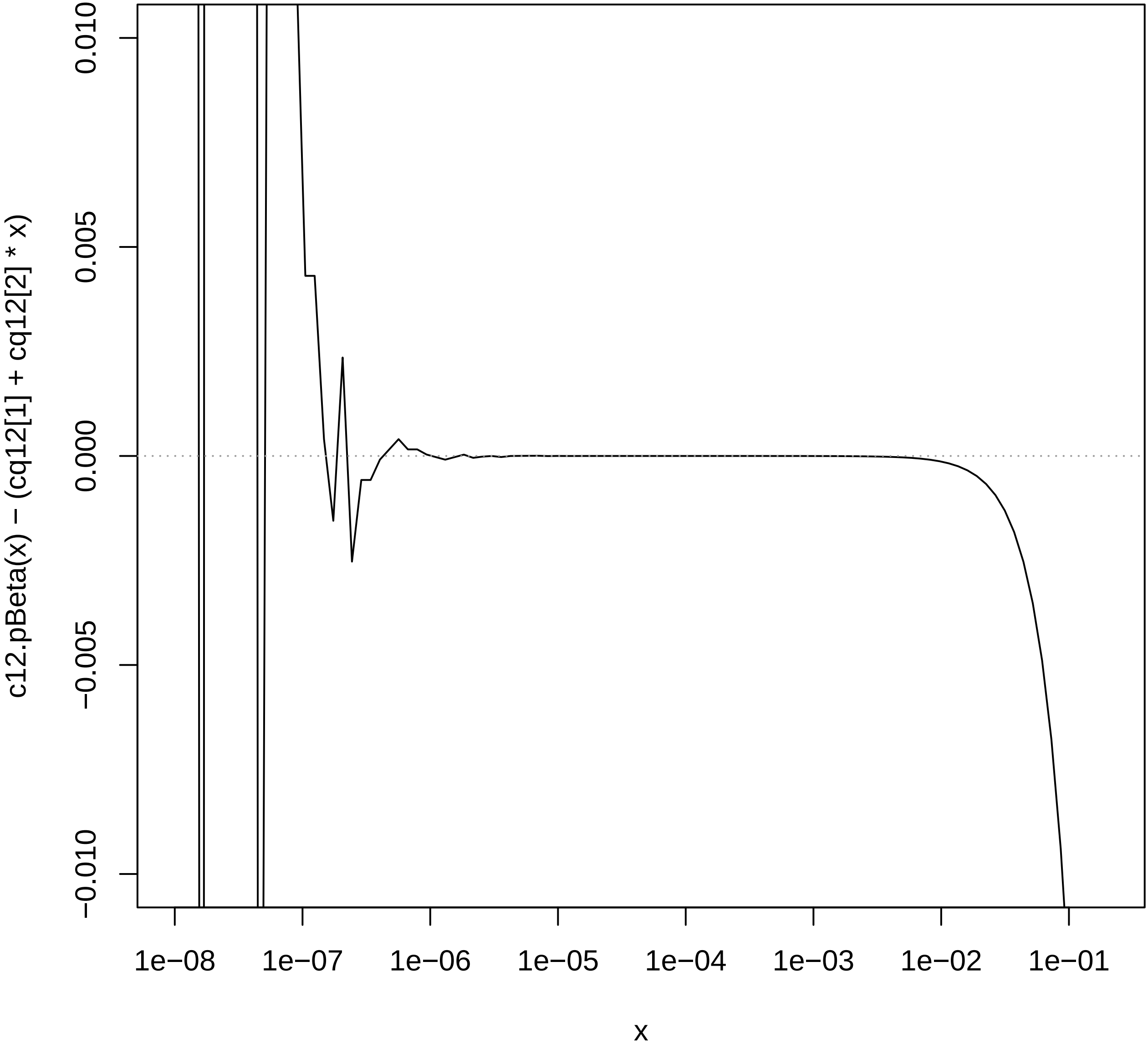

c12.pBeta(x)
0
5
10
0
20
40
60
80
100
x



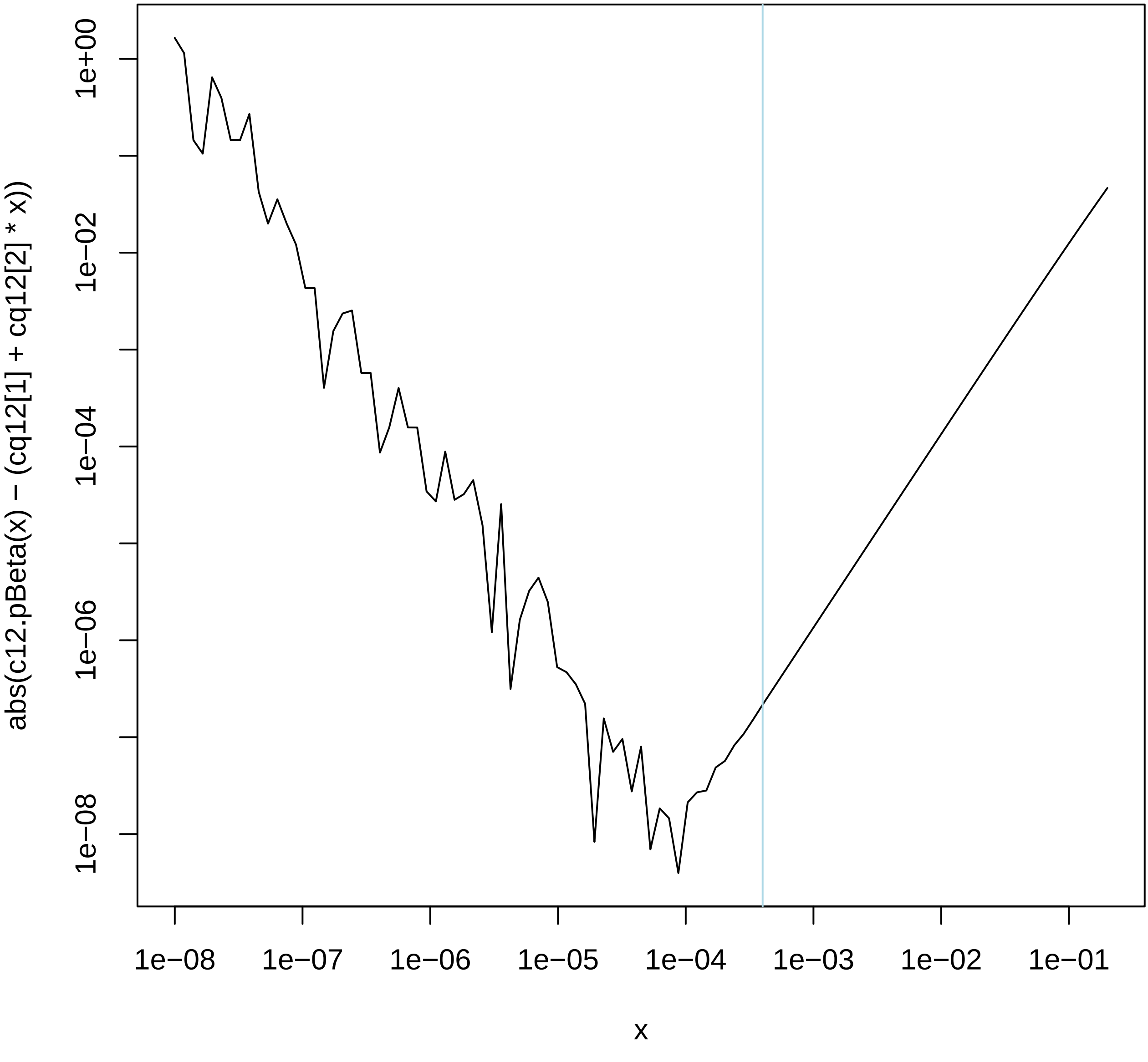
c12.pBeta(x)
0.1
0.2
0.5
1.0
2.0
5.0
10.0
20.0
1
5
10
50
100
500
1000
x


c12.pBeta(x) and its (log−)linear approximation
$c_1 + c_2 x = -1.644934 + 2.404114x$
15
10
5
0
−5
c12.pBeta(x)
1e−08
1e−06
1e−04
1e−02
1e+00
1e+02
x

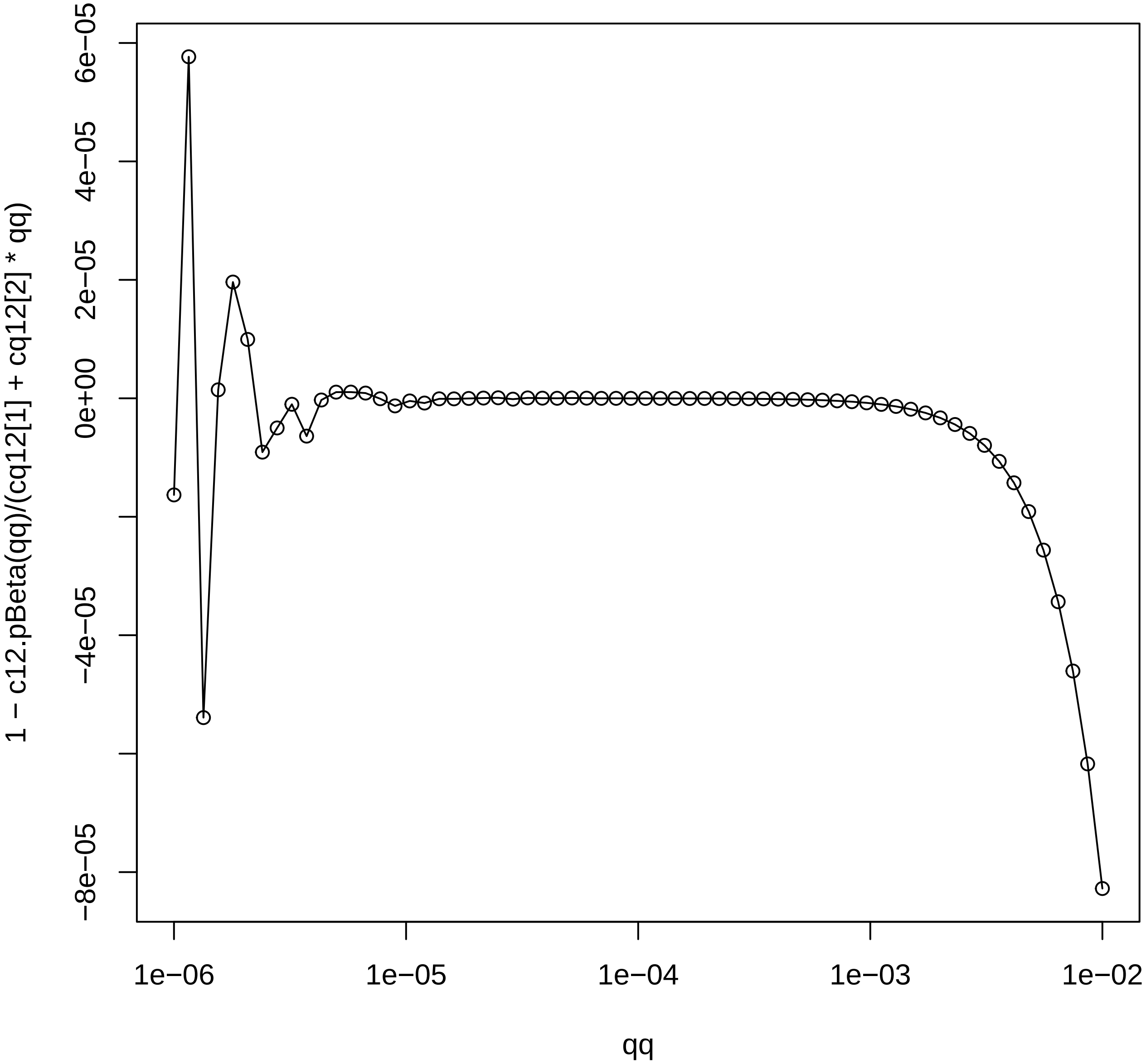

c12.pBeta(x) and its (log−)linear approximation
$c_1 + c_2 x = -1.644934 + 2.404114x$
c12.pBeta(x)
0.0
−0.5
−1.0
−1.5
1e−08
1e−07
1e−06
1e−05
1e−04
1e−03
1e−02
1e−01
x



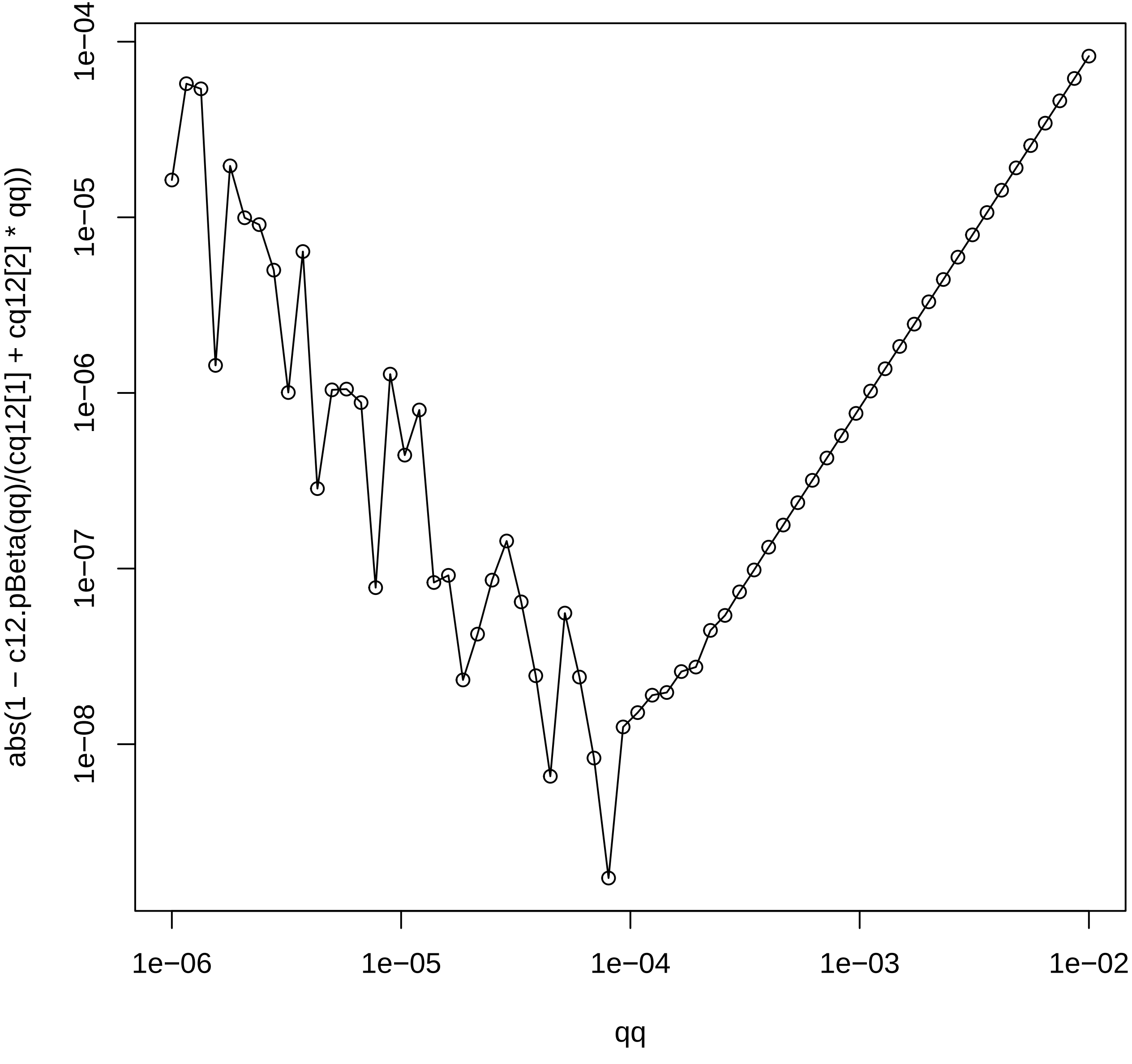
c12.pBeta(x) − (cq12[1] + cq12[2] * x)
0.010
0.005
0.000
−0.005
−0.010
1e−08
1e−07
1e−06
1e−05
1e−04
1e−03
1e−02
1e−01
x



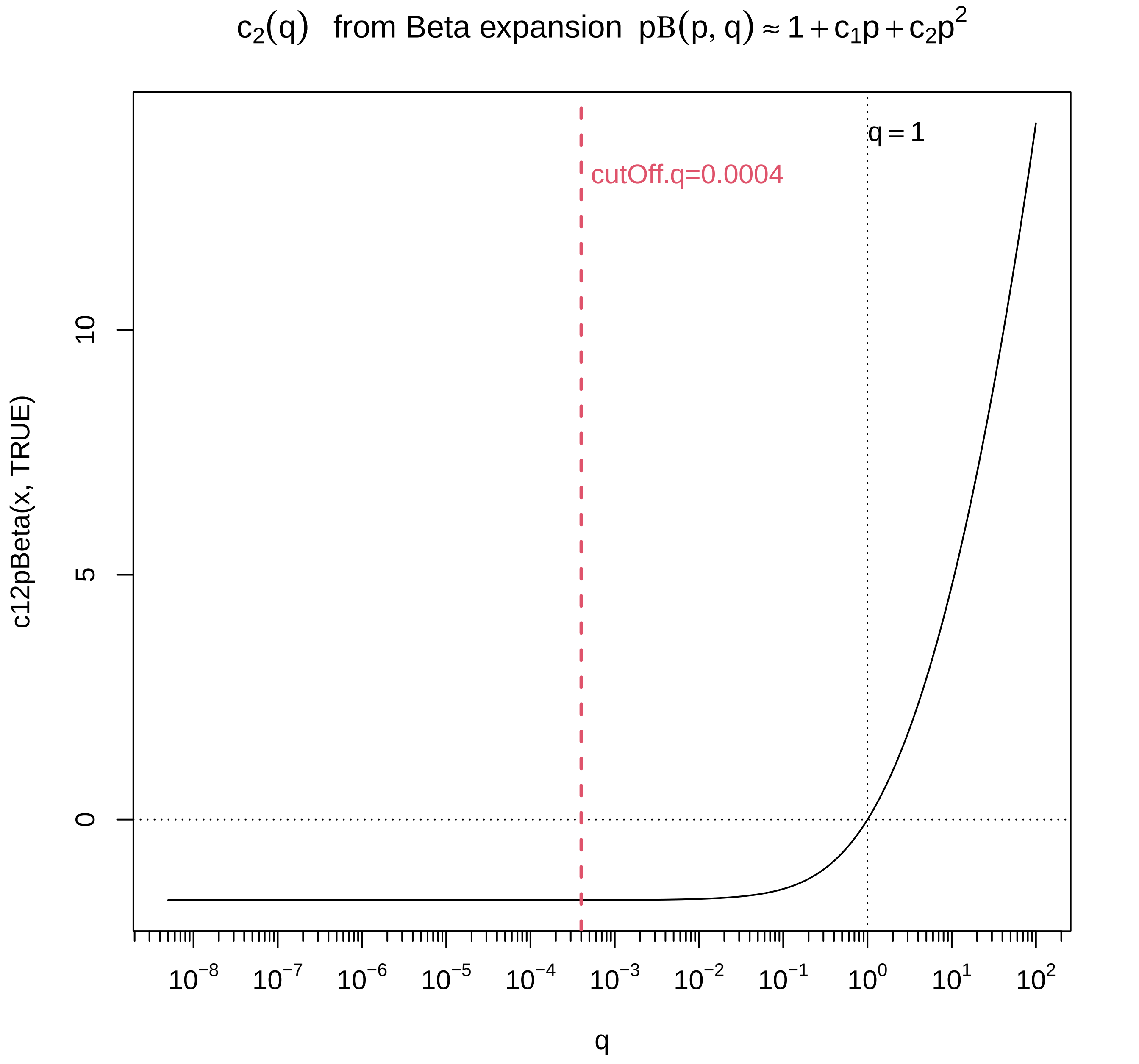
1e+00
1e−02
1e−04
1e−06
1e−08
abs(c12.pBeta(x) − (cq12[1] + cq12[2] * x))
1e−08
1e−07
1e−06
1e−05
1e−04
1e−03
1e−02
1e−01
x



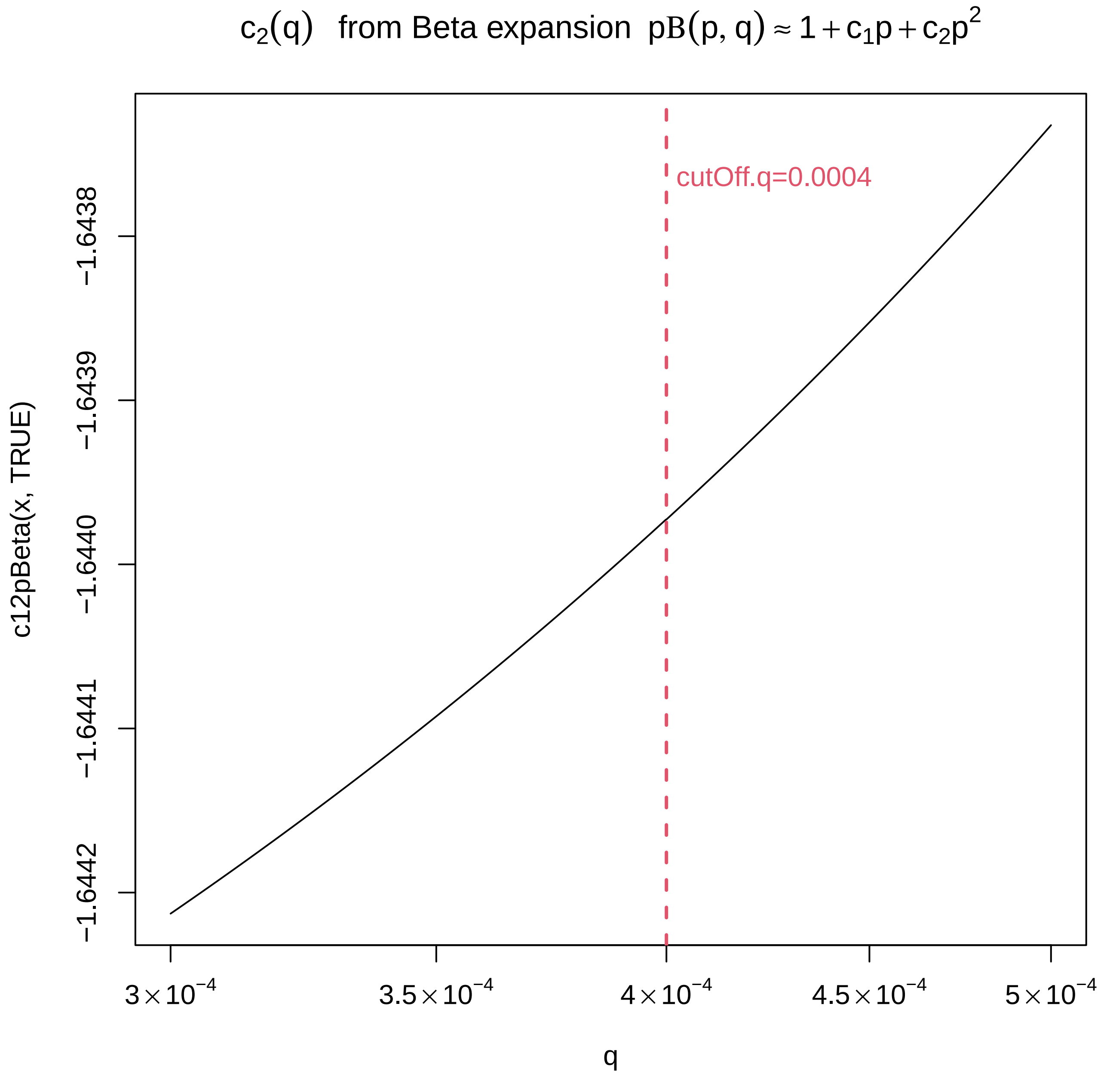
6e−05
4e−05
2e−05
0e+00
−4e−05
−8e−05
1 − c12.pBeta(qq)/(cq12[1] + cq12[2] * qq)
1e−06
1e−05
1e−04
1e−03
1e−02
qq



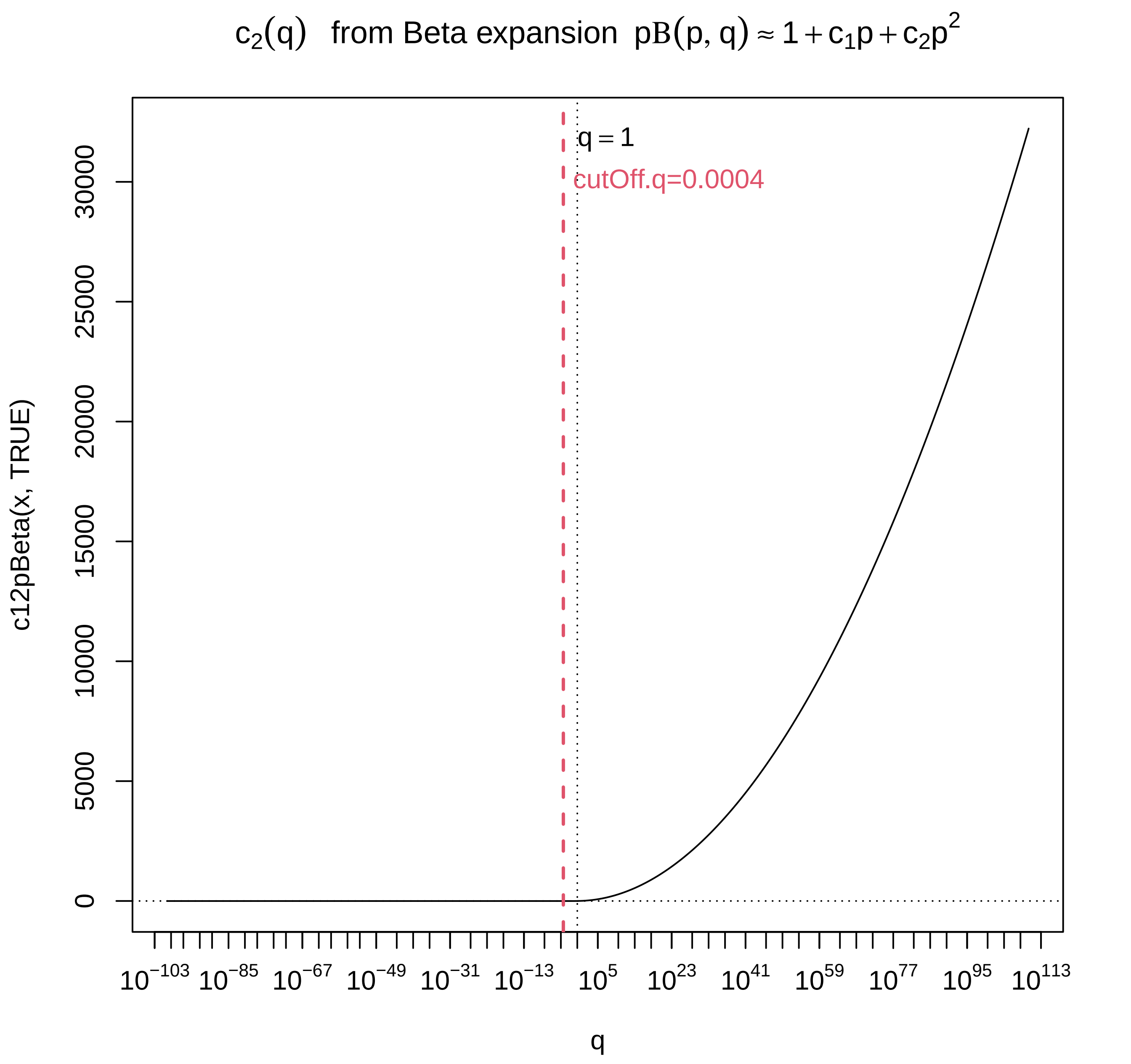
1e−04
1e−05
1e−06
1e−07
1e−08
abs(1 − c12.pBeta(qq)/(cq12[1] + cq12[2] * qq))
1e−06
1e−05
1e−04
1e−03
1e−02
qq



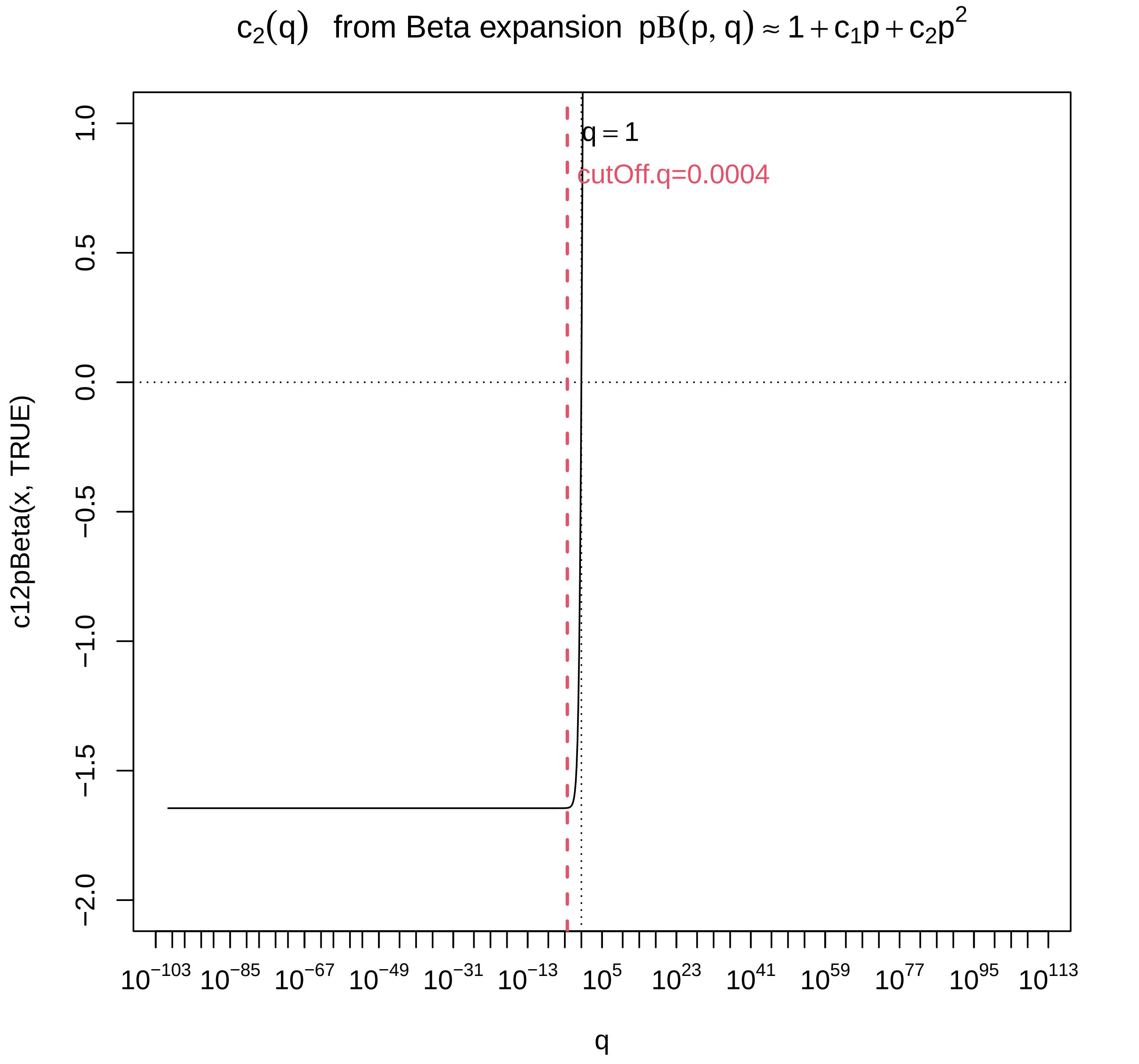
$c_2(q)$ from Beta expansion $pB(p, q) \approx 1 + c_1 p + c_2 p^2$
cutOff.q=0.0004
q = 1
c12pBeta(x, TRUE)
0
5
10
10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}
q



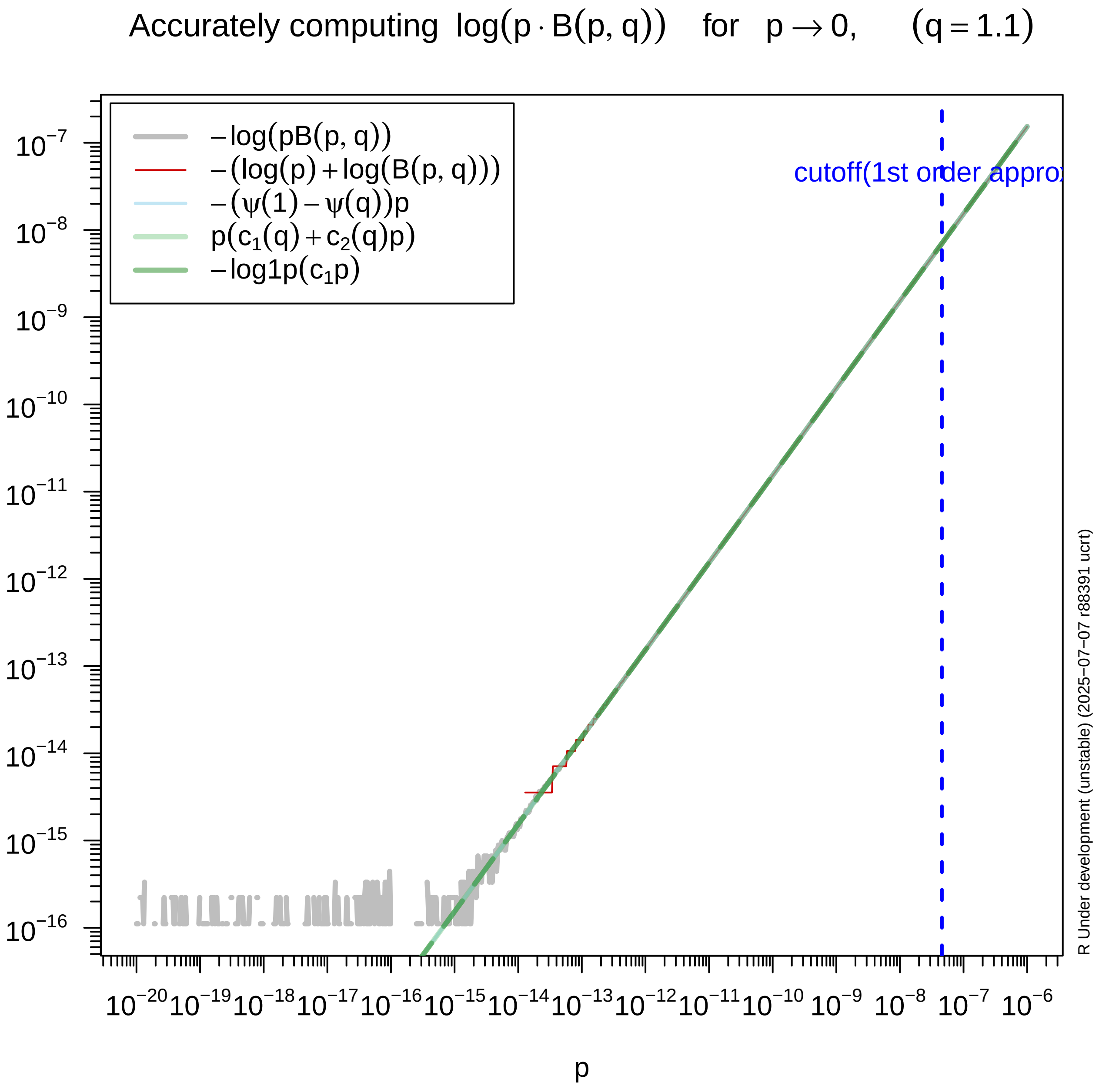
$c_2(q)$ from Beta expansion $pB(p, q) \approx 1 + c_1 p + c_2 p^2$
cutOff.q=0.0004
c12pBeta(x, TRUE)
−1.6438
−1.6439
−1.6440
−1.6441
−1.6442
3×10^{-4}
3.5×10^{-4}
4×10^{-4}
4.5×10^{-4}
5×10^{-4}
q



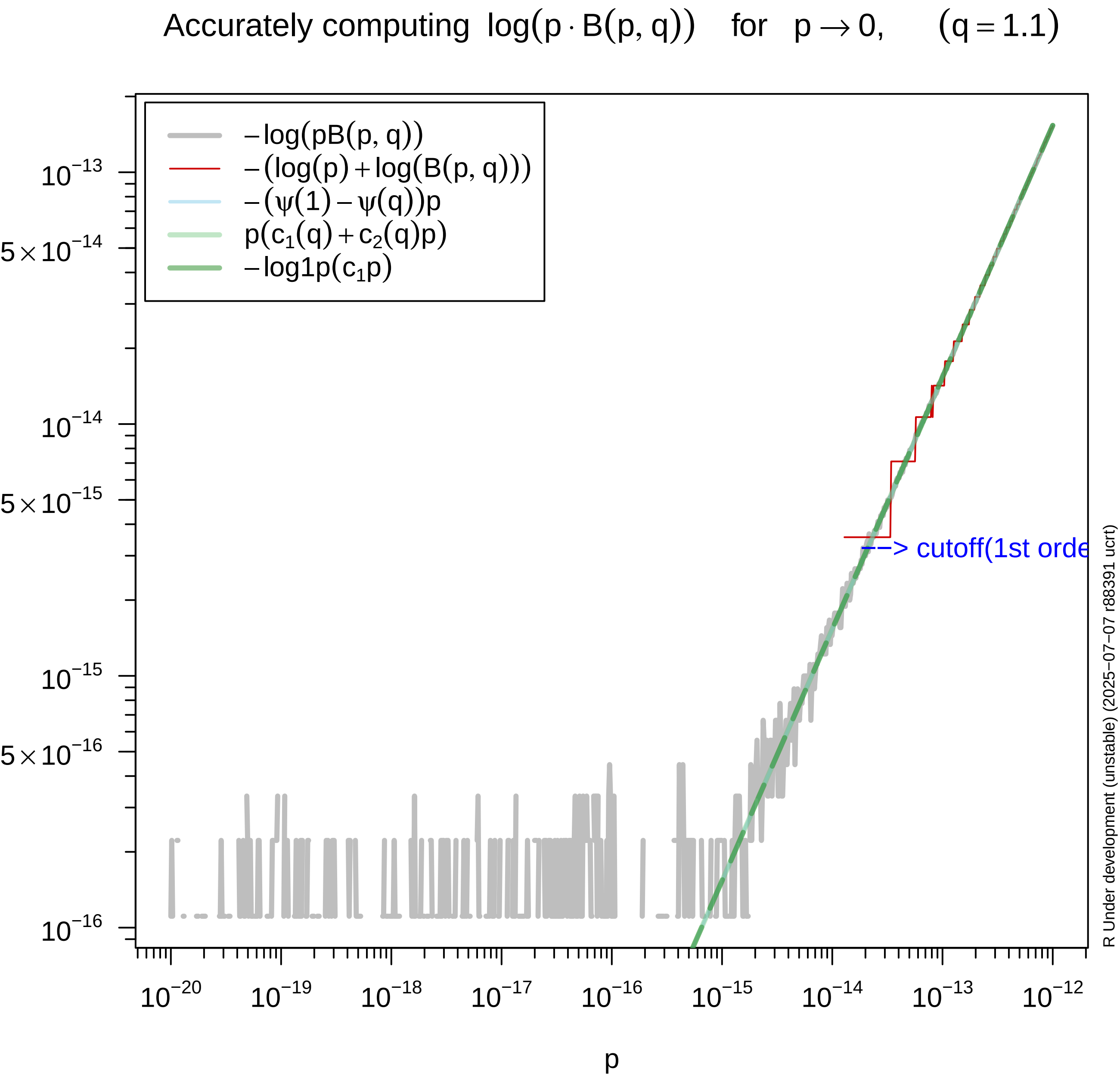
$c_2(q)$ from Beta expansion $pB(p, q) \approx 1 + c_1 p + c_2 p^2$
q = 1
cutOff.q=0.0004
c12pBeta(x, TRUE)
0
5000
10000
15000
20000
25000
30000
10^{-103} 10^{-85} 10^{-67} 10^{-49} 10^{-31} 10^{-13} 10^{5} 10^{23} 10^{41} 10^{59} 10^{77} 10^{95} 10^{113}
q



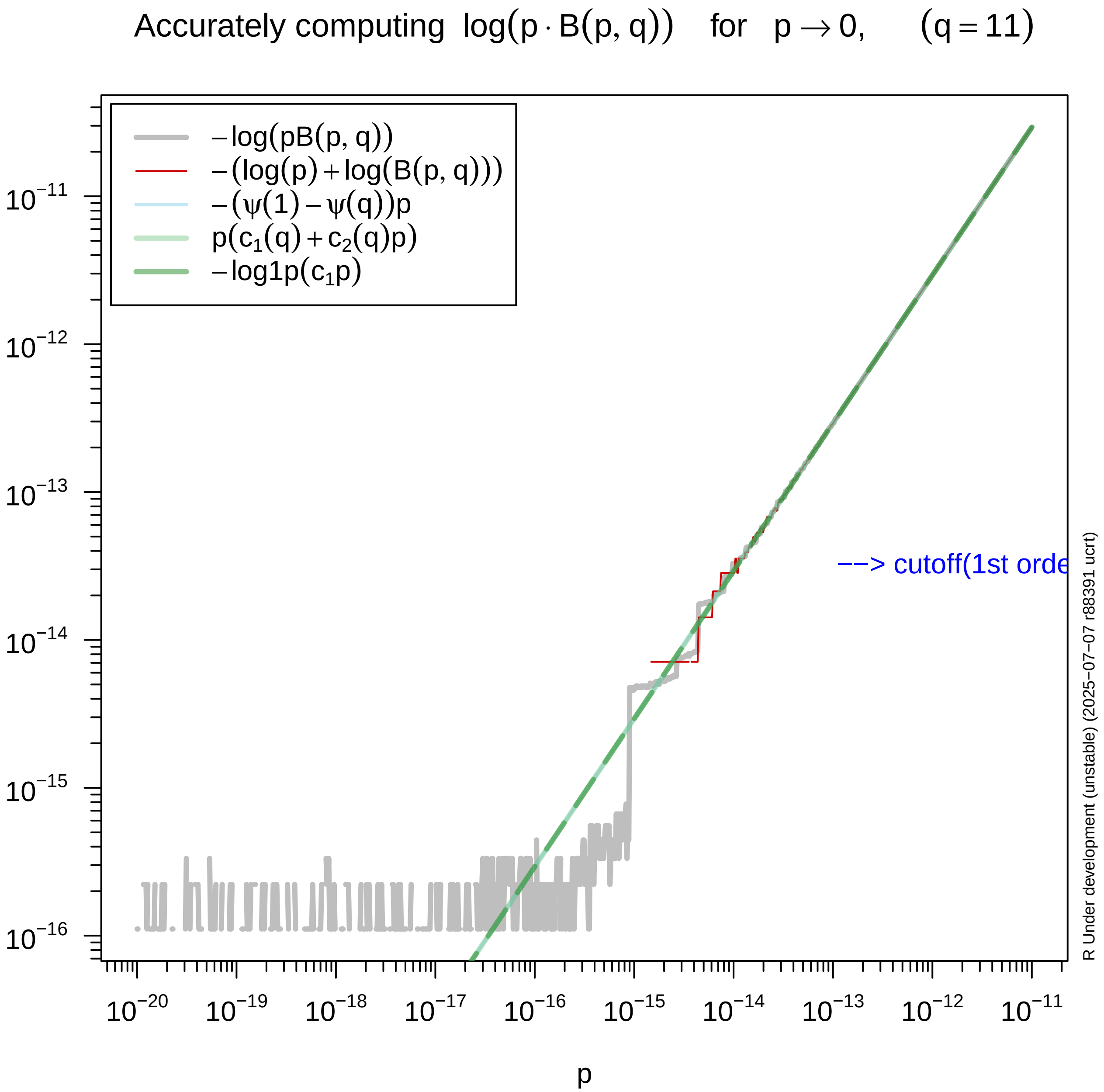
c2(q) from Beta expansion pB(p, q) ≈ 1 + c1p + c2p^2
q = 1
cutOff.q=0.0004
c12pBeta(x, TRUE)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
10^−103
10^−85
10^−67
10^−49
10^−31
10^−13
10^5
10^23
10^41
10^59
10^77
10^95
10^113
q

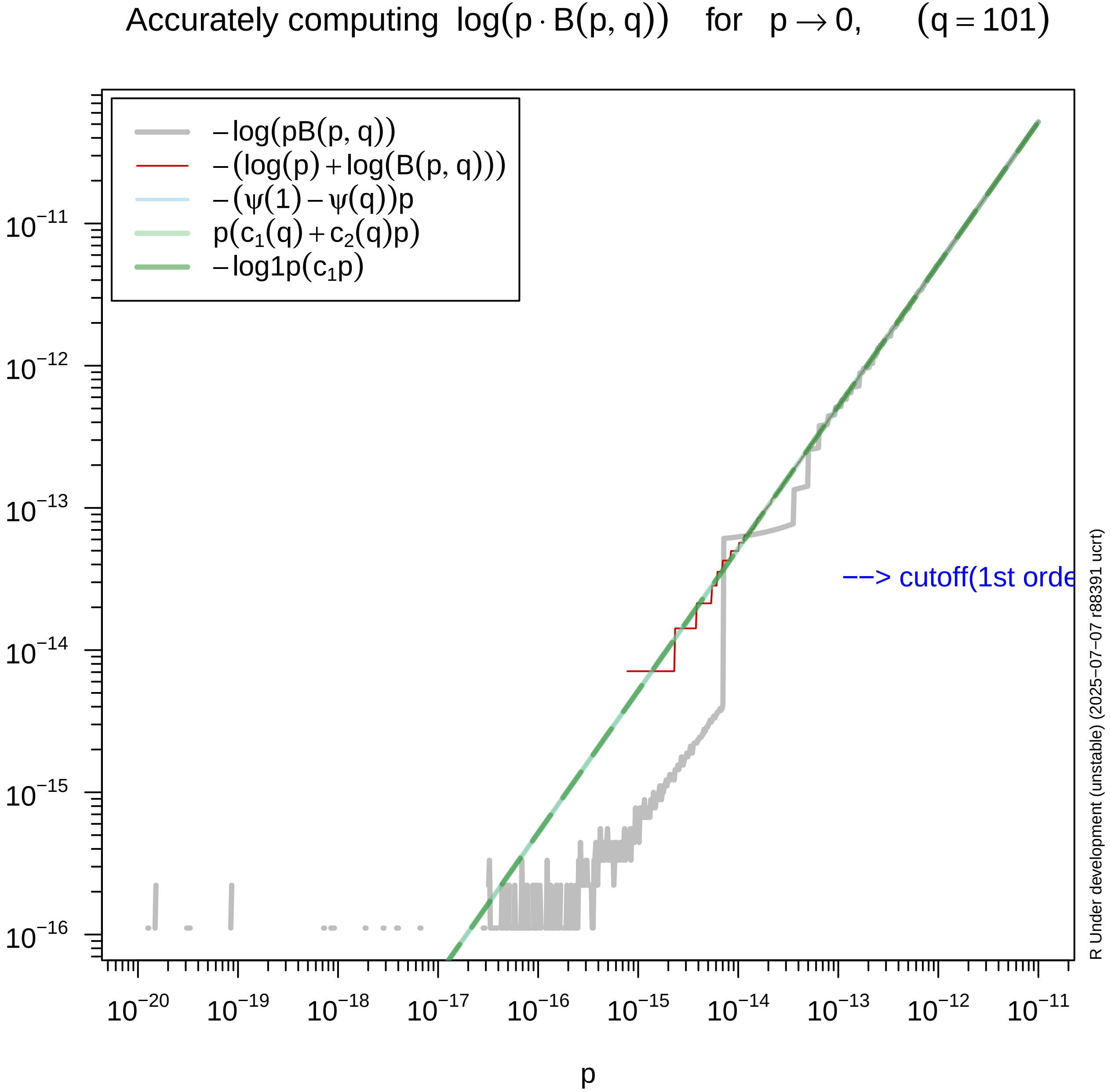


Accurately computing log(p · B(p, q)) for p → 0, (q = 1.1)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
cutoff(1st order approx
p
R Under development (unstable) (2025−07−07 r88391 ucrt)

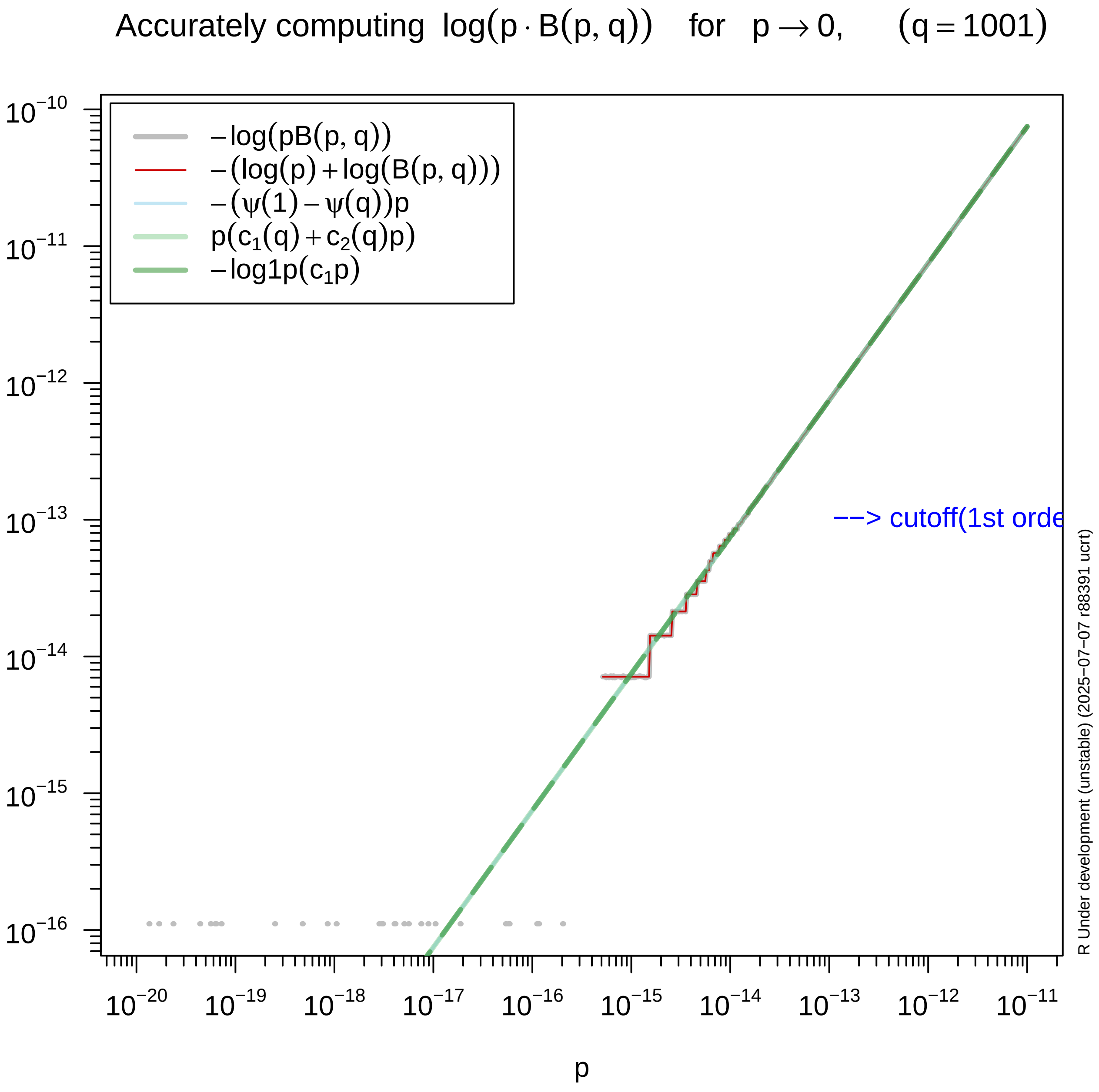


Accurately computing log(p · B(p, q)) for p → 0, (q = 1.1)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
--> cutoff(1st orde
10^−13
5 × 10^−14
10^−14
5 × 10^−15
10^−15
5 × 10^−16
10^−16
10^−20
10^−19
10^−18
10^−17
10^−16
10^−15
10^−14
10^−13
10^−12
p
R Under development (unstable) (2025−07−07 r88391 ucrt)

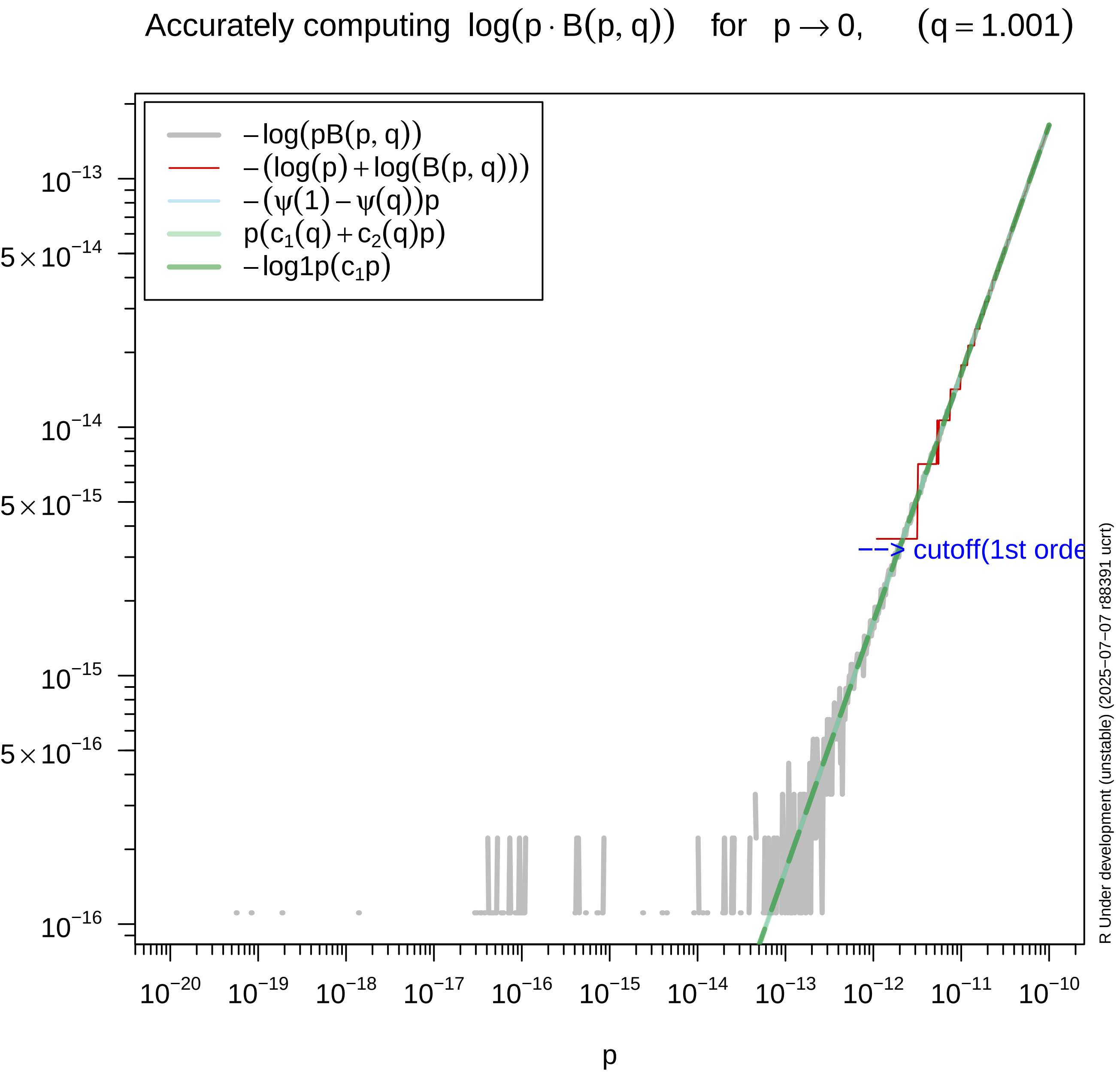

Accurately computing log(p · B(p, q)) for p → 0, (q = 11)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
--> cutoff(1st orde
10^−11
10^−12
10^−13
10^−14
10^−15
10^−16
10^−20
10^−19
10^−18
10^−17
10^−16
10^−15
10^−14
10^−13
10^−12
10^−11
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



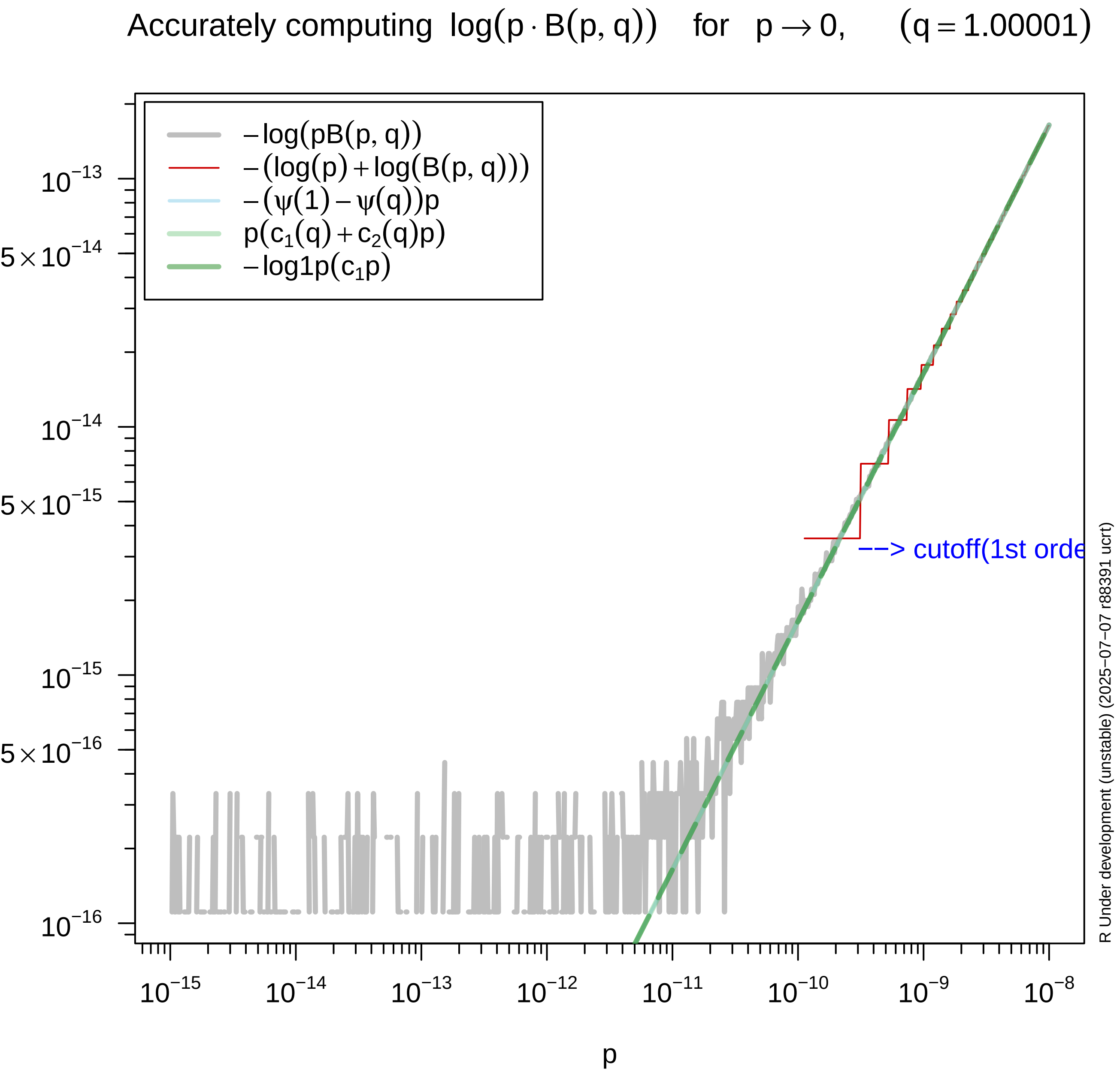
Accurately computing log(p · B(p, q)) for p → 0, (q = 101)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
−−> cutoff(1st orde
10^−11
10^−12
10^−13
10^−14
10^−15
10^−16
10^−20
10^−19
10^−18
10^−17
10^−16
10^−15
10^−14
10^−13
10^−12
10^−11
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



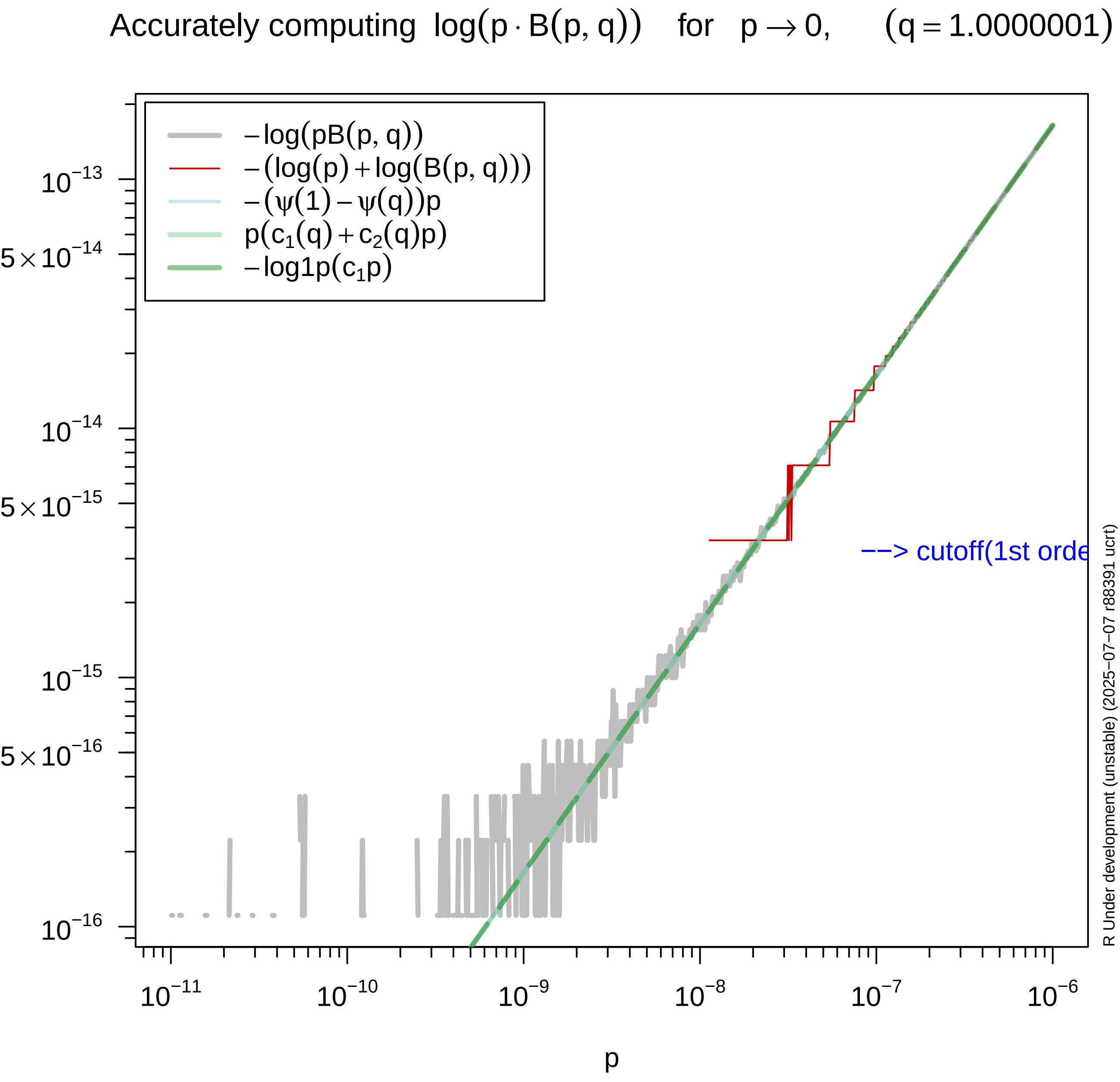
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 1001)$
$-\log(pB(p, q))$
$-(\log(p) + \log(B(p, q)))$
$-(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$-\text{log1p}(c_1 p)$
--> cutoff(1st orde
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-20}
10^{-19}
10^{-18}
10^{-17}
10^{-16}
10^{-15}
10^{-14}
10^{-13}
10^{-12}
10^{-11}
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



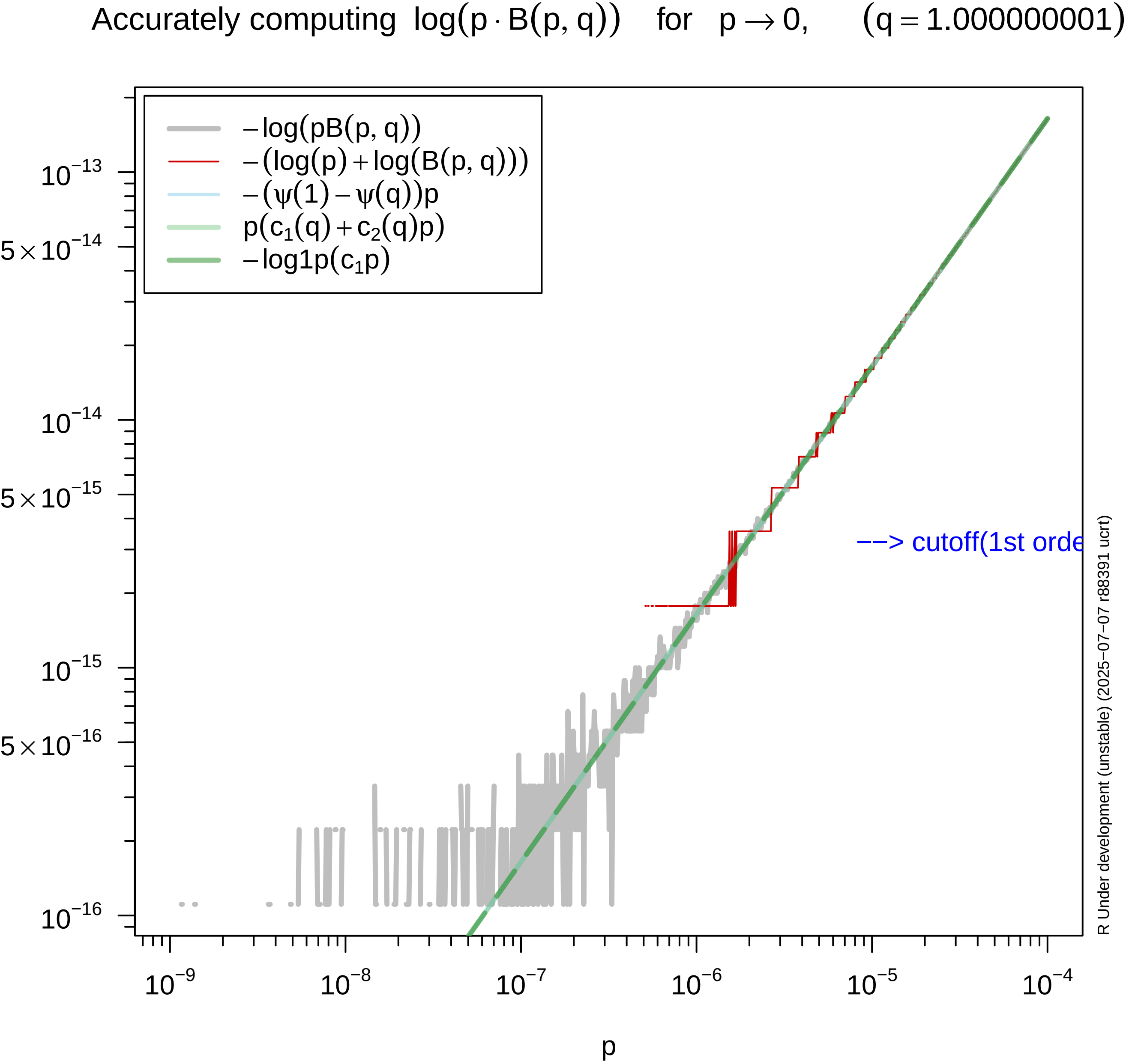
Accurately computing log(p · B(p, q)) for p → 0, (q = 1.001)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
--> cutoff(1st orde
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



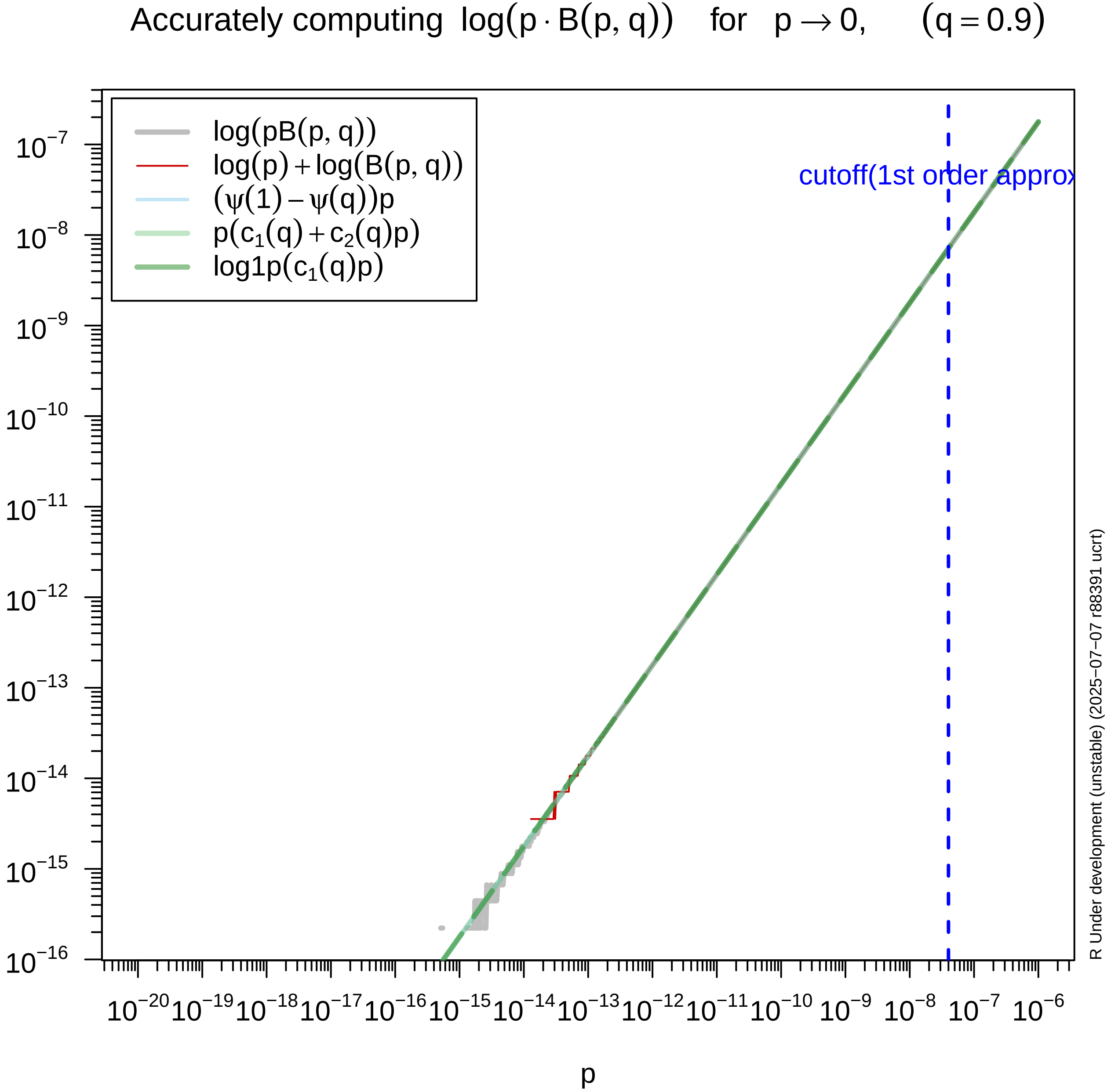
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 1.00001)$
$-\log(pB(p, q))$
$-(\log(p) + \log(B(p, q)))$
$-(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$-\mathrm{log1p}(c_1 p)$
--> cutoff(1st orde
10^{-13}
5×10^{-14}
10^{-14}
5×10^{-15}
10^{-15}
5×10^{-16}
10^{-16}
10^{-15} 10^{-14} 10^{-13} 10^{-12} 10^{-11} 10^{-10} 10^{-9} 10^{-8}
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



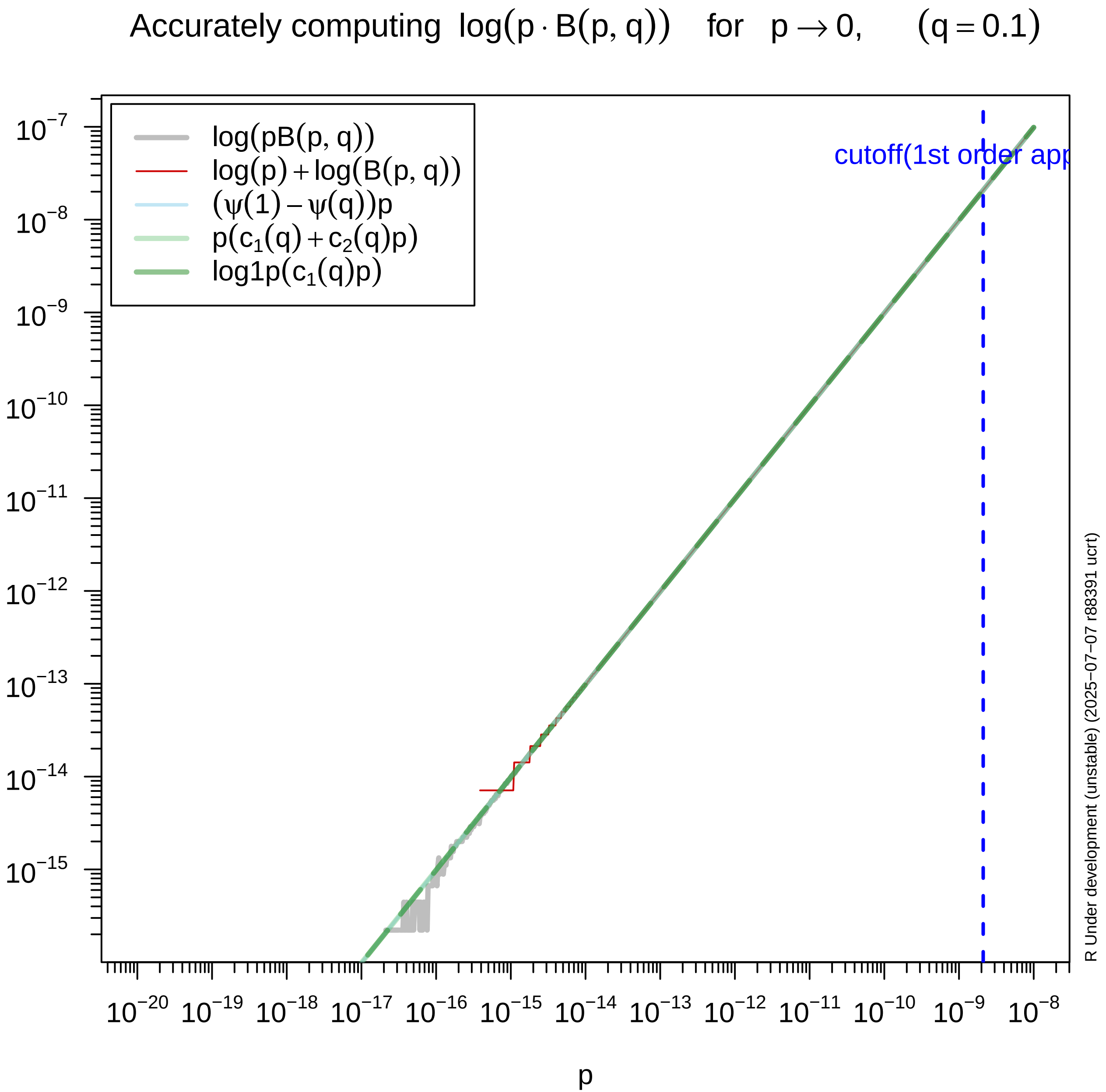
Accurately computing log(p · B(p, q)) for p → 0, (q = 1.0000001)
−log(pB(p, q))
−(log(p) + log(B(p, q)))
−(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
−log1p(c1p)
--> cutoff(1st orde
10^−13
5 × 10^−14
10^−14
5 × 10^−15
10^−15
5 × 10^−16
10^−16
10^−11
10^−10
10^−9
10^−8
10^−7
10^−6
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



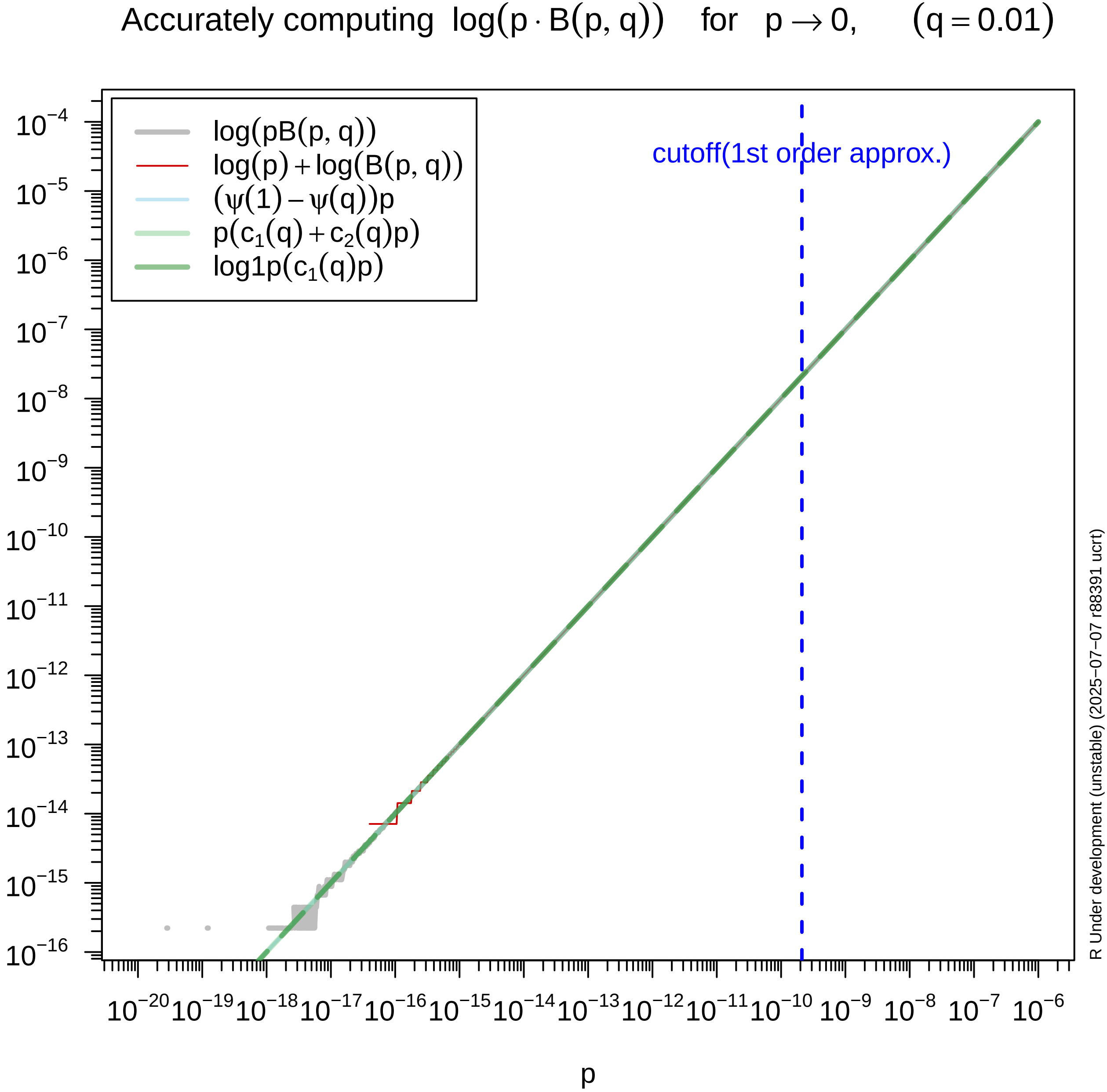
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 1.000000001)$
$-\log(pB(p, q))$
$-(\log(p) + \log(B(p, q)))$
$-(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$-\text{log1p}(c_1 p)$
--> cutoff(1st orde
R Under development (unstable) (2025−07−07 r88391 ucrt)
10^{-13}
5×10^{-14}
10^{-14}
5×10^{-15}
10^{-15}
5×10^{-16}
10^{-16}
10^{-9}
10^{-8}
10^{-7}
10^{-6}
10^{-5}
10^{-4}
p



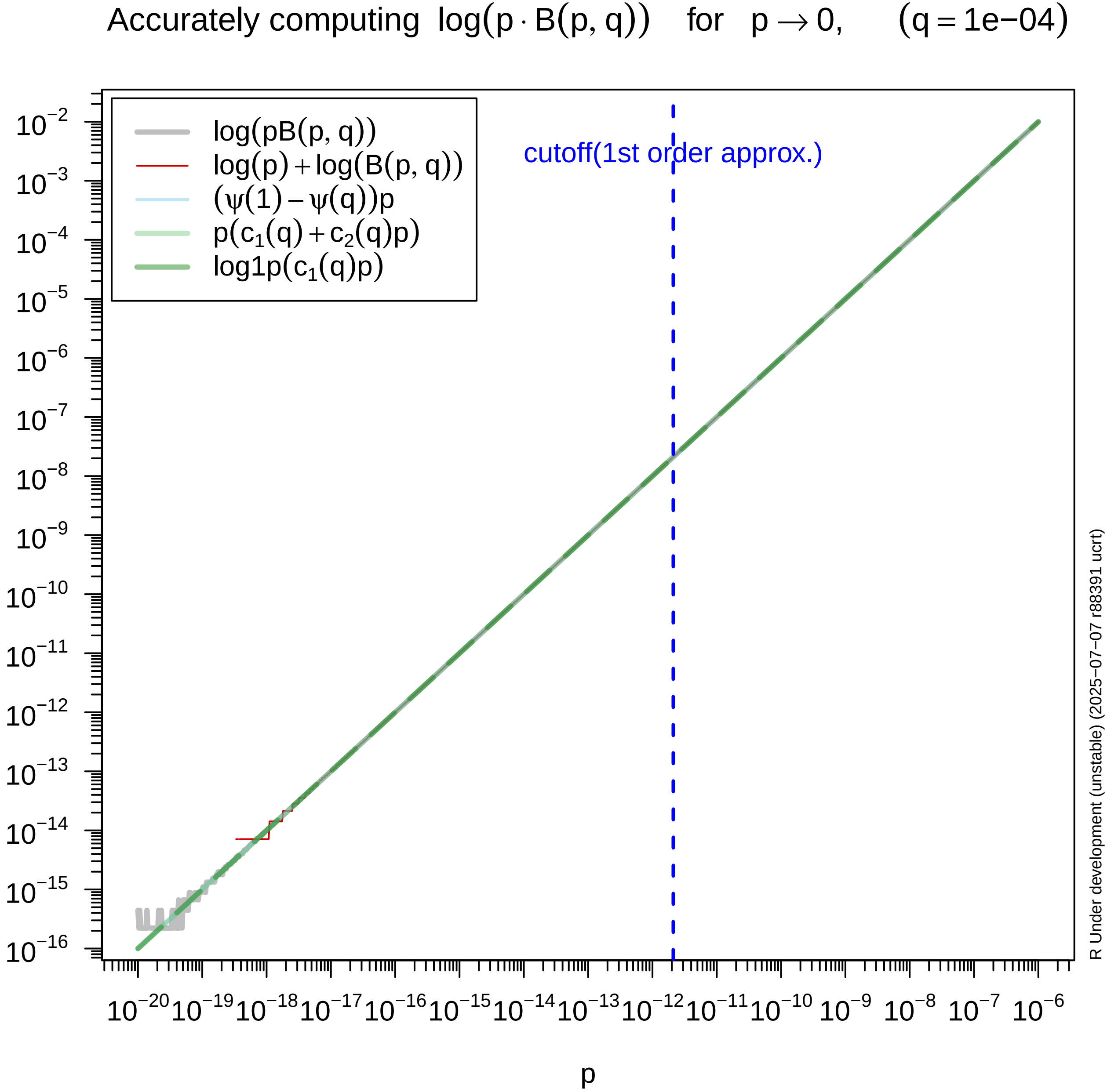
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 0.9)$
log(pB(p, q))
log(p) + log(B(p, q))
(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
log1p(c1(q)p)
cutoff(1st order approx
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



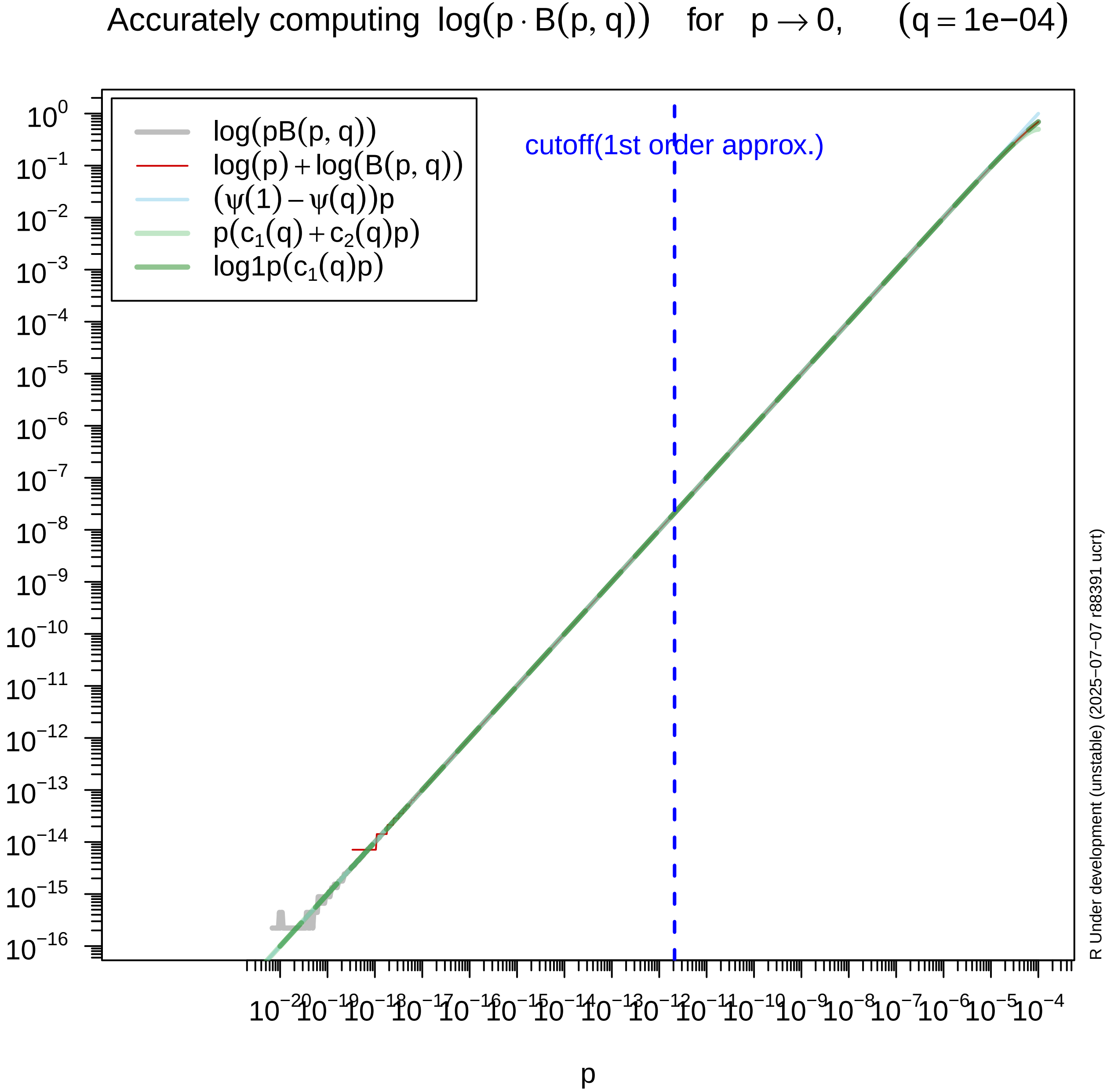
Accurately computing log(p · B(p, q)) for p → 0, (q = 0.1)
log(pB(p, q))
log(p) + log(B(p, q))
(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
log1p(c1(q)p)
cutoff(1st order app
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



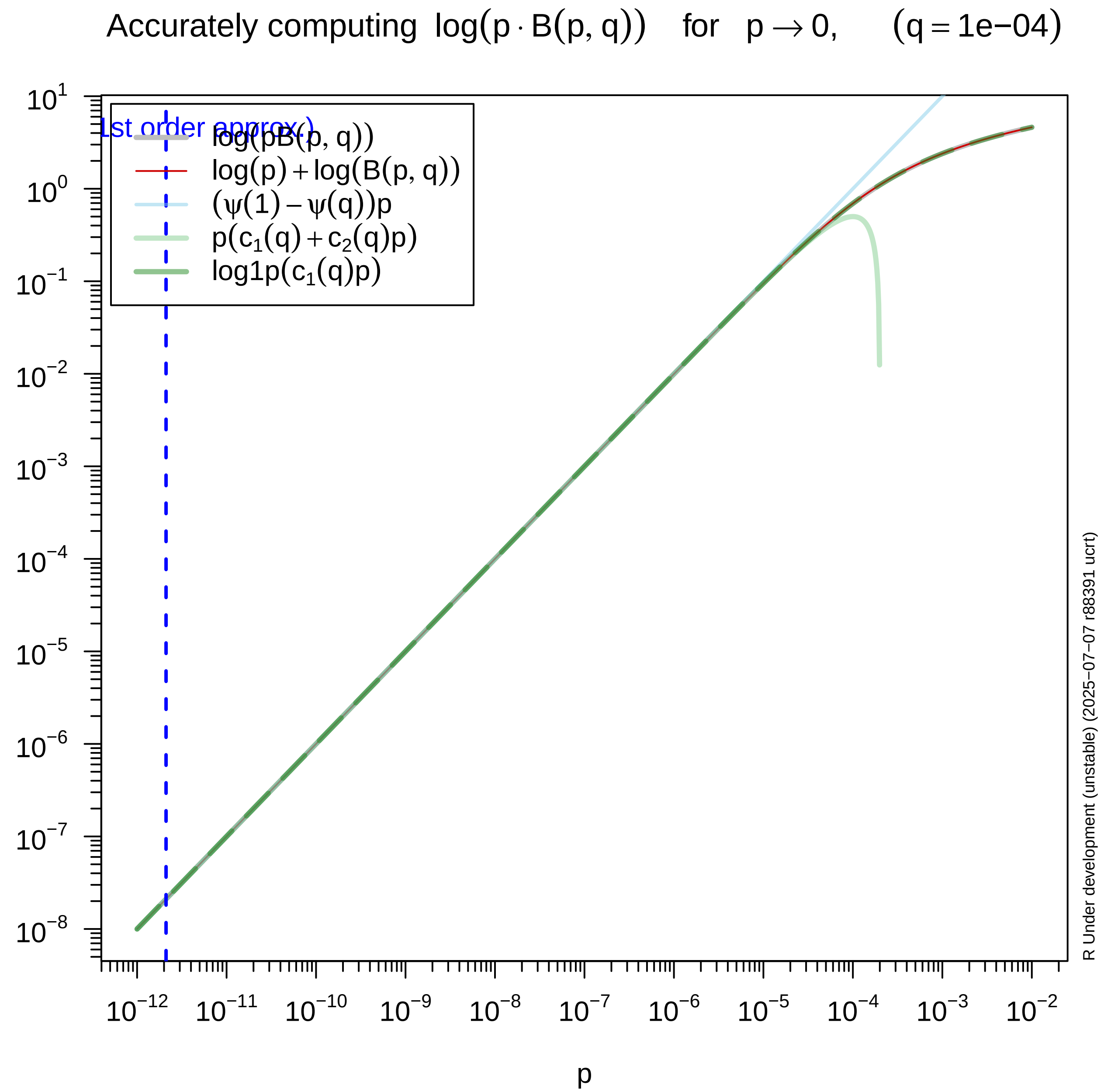
Accurately computing log(p · B(p, q)) for p → 0, (q = 0.01)
log(pB(p, q))
log(p) + log(B(p, q))
(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
log1p(c1(q)p)
cutoff(1st order approx.)
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



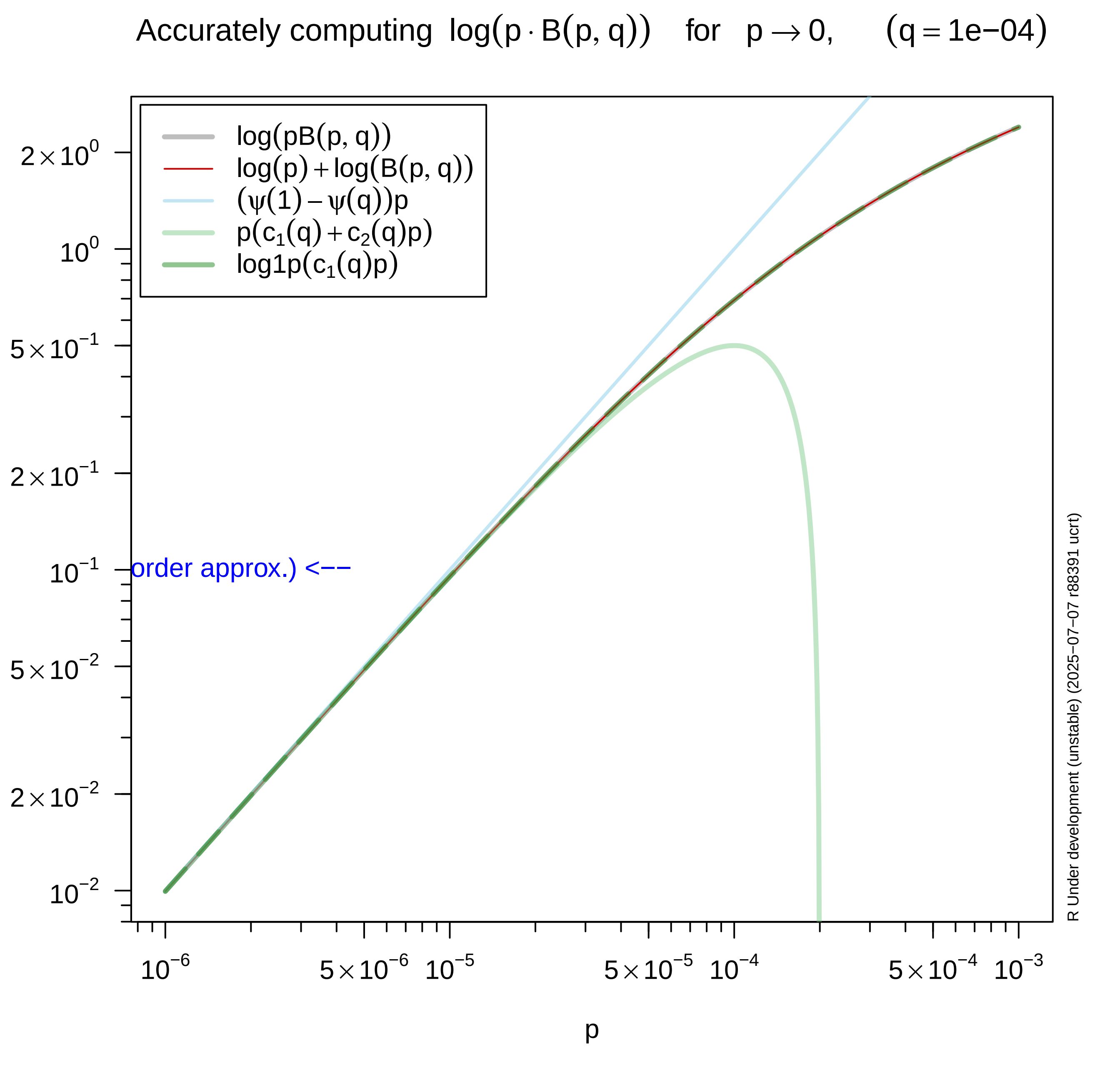
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 1e-04)$
$\log(pB(p, q))$
$\log(p) + \log(B(p, q))$
$(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$\text{log1p}(c_1(q)p)$
cutoff(1st order approx.)
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-20} 10^{-19} 10^{-18} 10^{-17} 10^{-16} 10^{-15} 10^{-14} 10^{-13} 10^{-12} 10^{-11} 10^{-10} 10^{-9} 10^{-8} 10^{-7} 10^{-6}
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



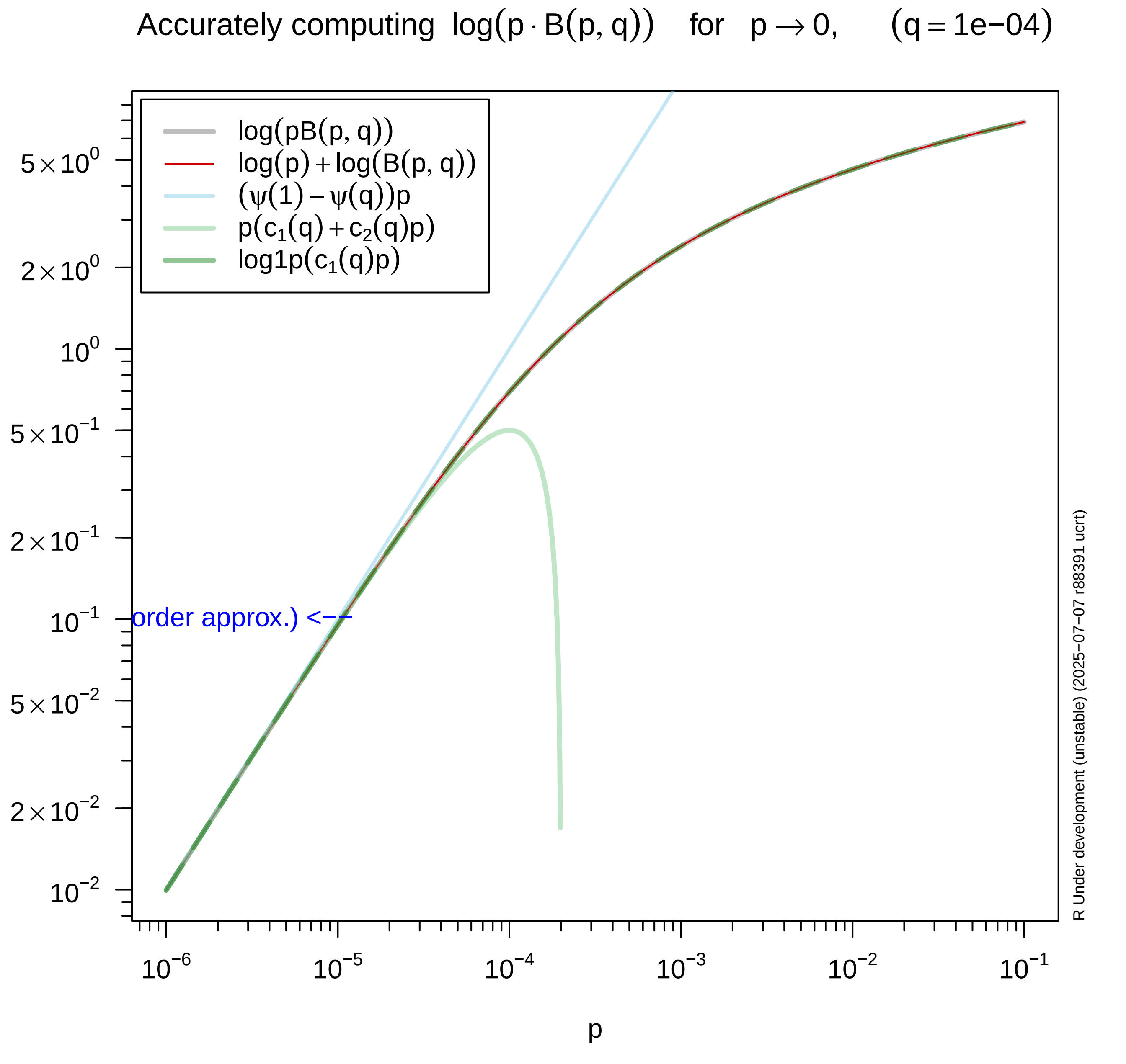
Accurately computing $\log(p \cdot B(p, q))$ for $p \to 0$, $(q = 1e-04)$
log(pB(p, q))
log(p) + log(B(p, q))
$(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$\text{log1p}(c_1(q)p)$
cutoff(1st order approx.)
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



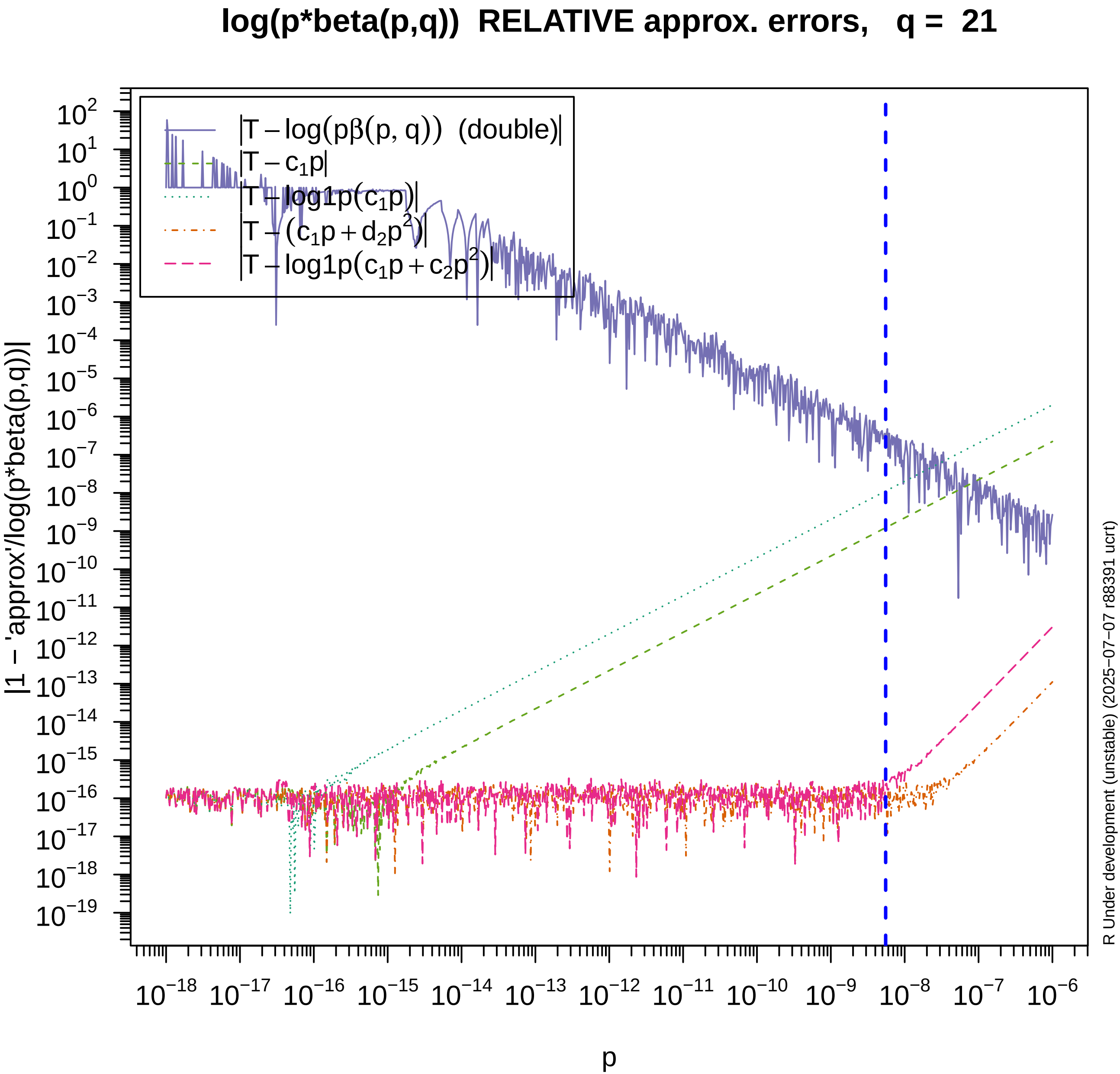
Accurately computing log(p · B(p, q)) for p → 0, (q = 1e−04)
1st order approx.)
log(pB(p, q))
log(p) + log(B(p, q))
(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
log1p(c1(q)p)
10^1
10^0
10^−1
10^−2
10^−3
10^−4
10^−5
10^−6
10^−7
10^−8
10^−12
10^−11
10^−10
10^−9
10^−8
10^−7
10^−6
10^−5
10^−4
10^−3
10^−2
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



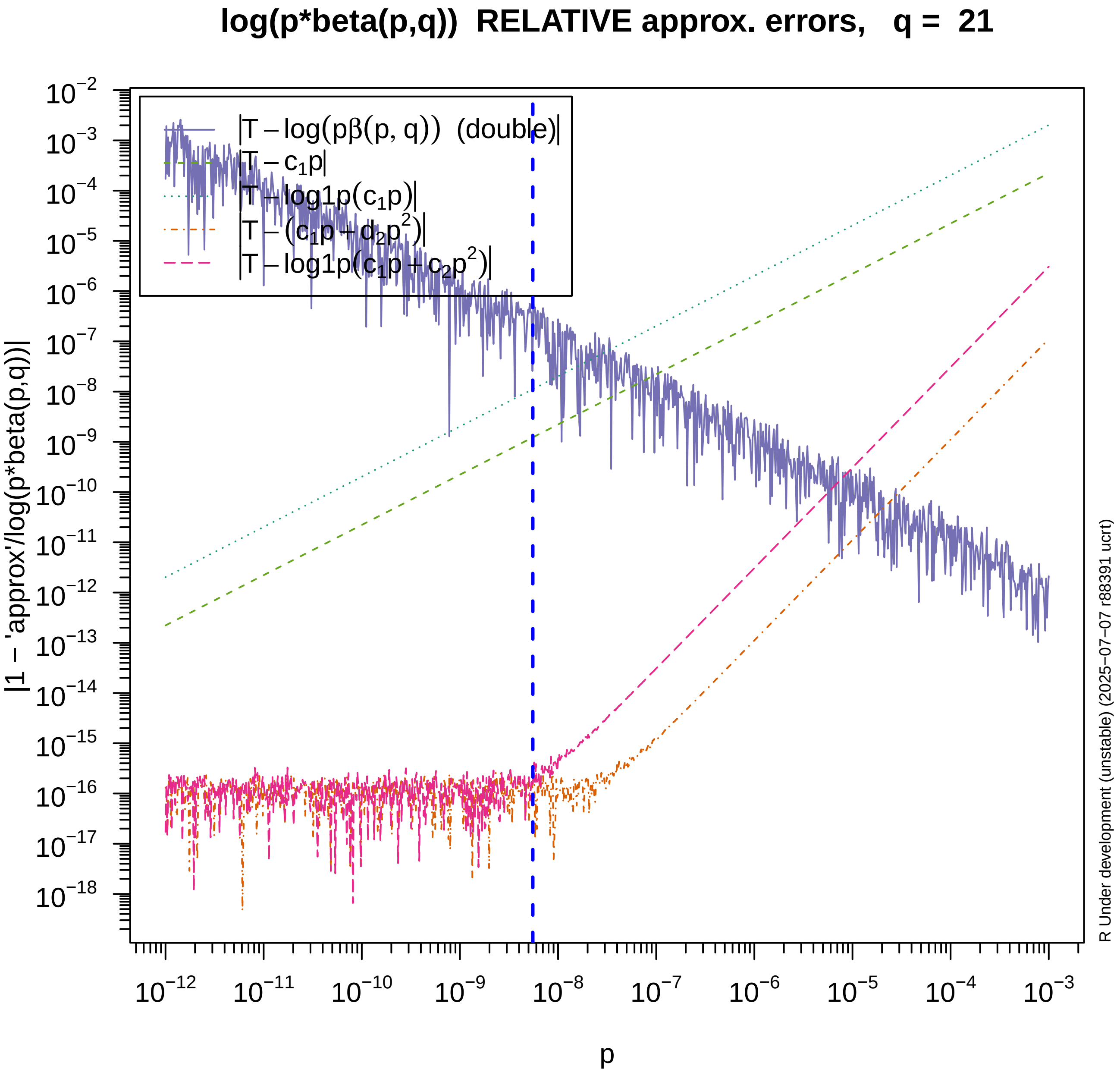
Accurately computing $\log(p \cdot B(p,q))$ for $p \to 0$, $(q = 1e-04)$
$\log(pB(p,q))$
$\log(p) + \log(B(p,q))$
$(\psi(1) - \psi(q))p$
$p(c_1(q) + c_2(q)p)$
$\mathrm{log1p}(c_1(q)p)$
order approx.) <--
2×10^0
10^0
5×10^{-1}
2×10^{-1}
10^{-1}
5×10^{-2}
2×10^{-2}
10^{-2}
10^{-6}
5×10^{-6}
10^{-5}
5×10^{-5}
10^{-4}
5×10^{-4}
10^{-3}
p
R Under development (unstable) (2025-07-07 r88391 ucrt)



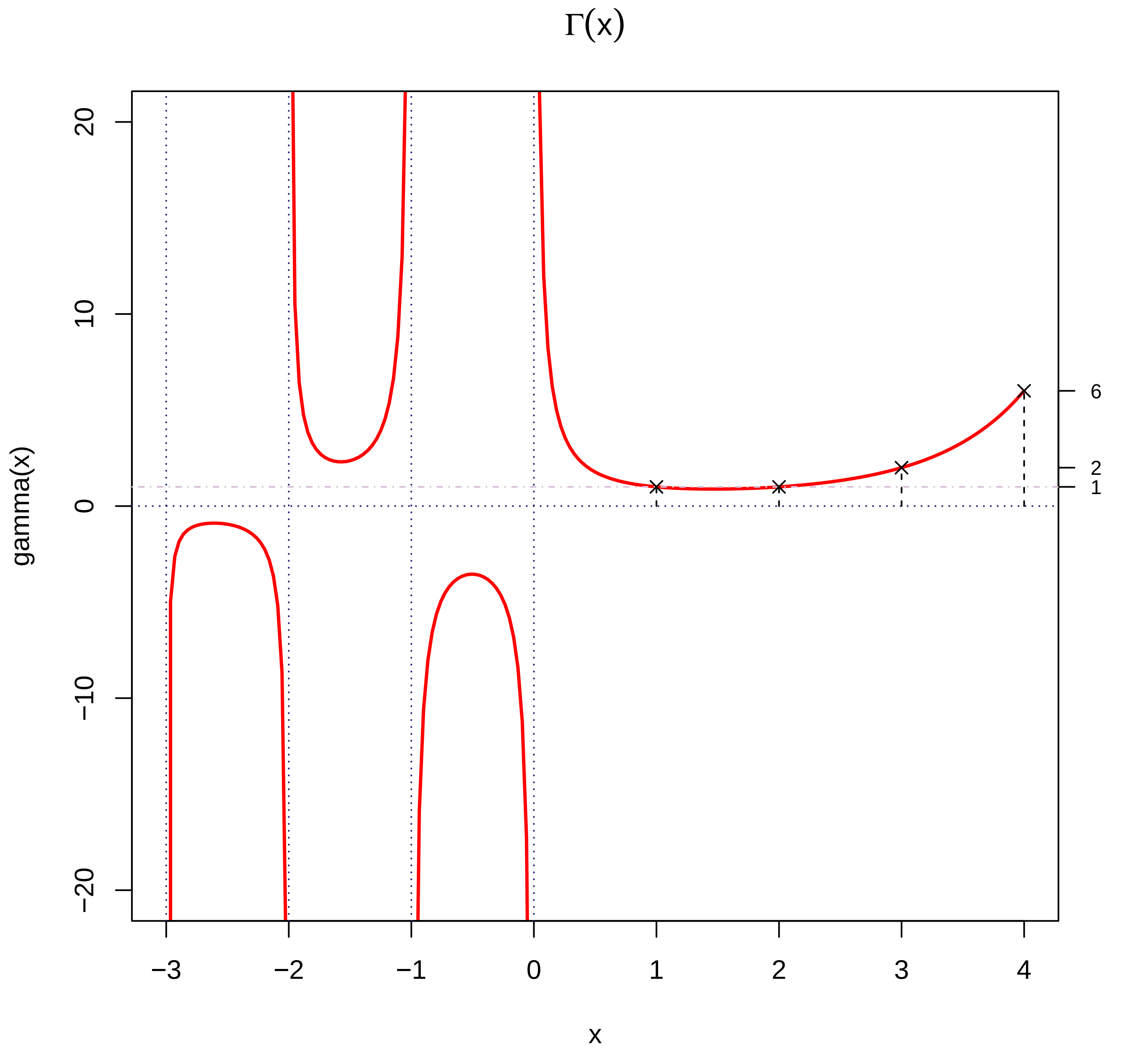
Accurately computing log(p · B(p, q)) for p → 0, (q = 1e−04)
log(pB(p, q))
log(p) + log(B(p, q))
(ψ(1) − ψ(q))p
p(c1(q) + c2(q)p)
log1p(c1(q)p)
order approx.) <−−
5 × 10^0
2 × 10^0
10^0
5 × 10^−1
2 × 10^−1
10^−1
5 × 10^−2
2 × 10^−2
10^−2
10^−6
10^−5
10^−4
10^−3
10^−2
10^−1
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



log(p*beta(p,q)) RELATIVE approx. errors, q = 21
|T − log(pβ(p, q)) (double)|
|T − c1p|
|T − log1p(c1p)|
|T − (c1p + d2p^2)|
|T − log1p(c1p + c2p^2)|
|1 − 'approx'/log(p*beta(p,q))|
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



log(p*beta(p,q)) RELATIVE approx. errors, q = 21
|T − log(pβ(p, q)) (double)|
|T − c_1p|
|T − log1p(c_1p)|
|T − (c_1p + $d_2$$p^2$)|
|T − log1p(c_1p + $c_2$$p^2$)|
|1 − 'approx'/log(p*beta(p,q))|
p
R Under development (unstable) (2025−07−07 r88391 ucrt)



Γ(x)
gamma(x)
x
20
10
0
−10
−20
−3
−2
−1
0
1
2
3
4
6
2
1