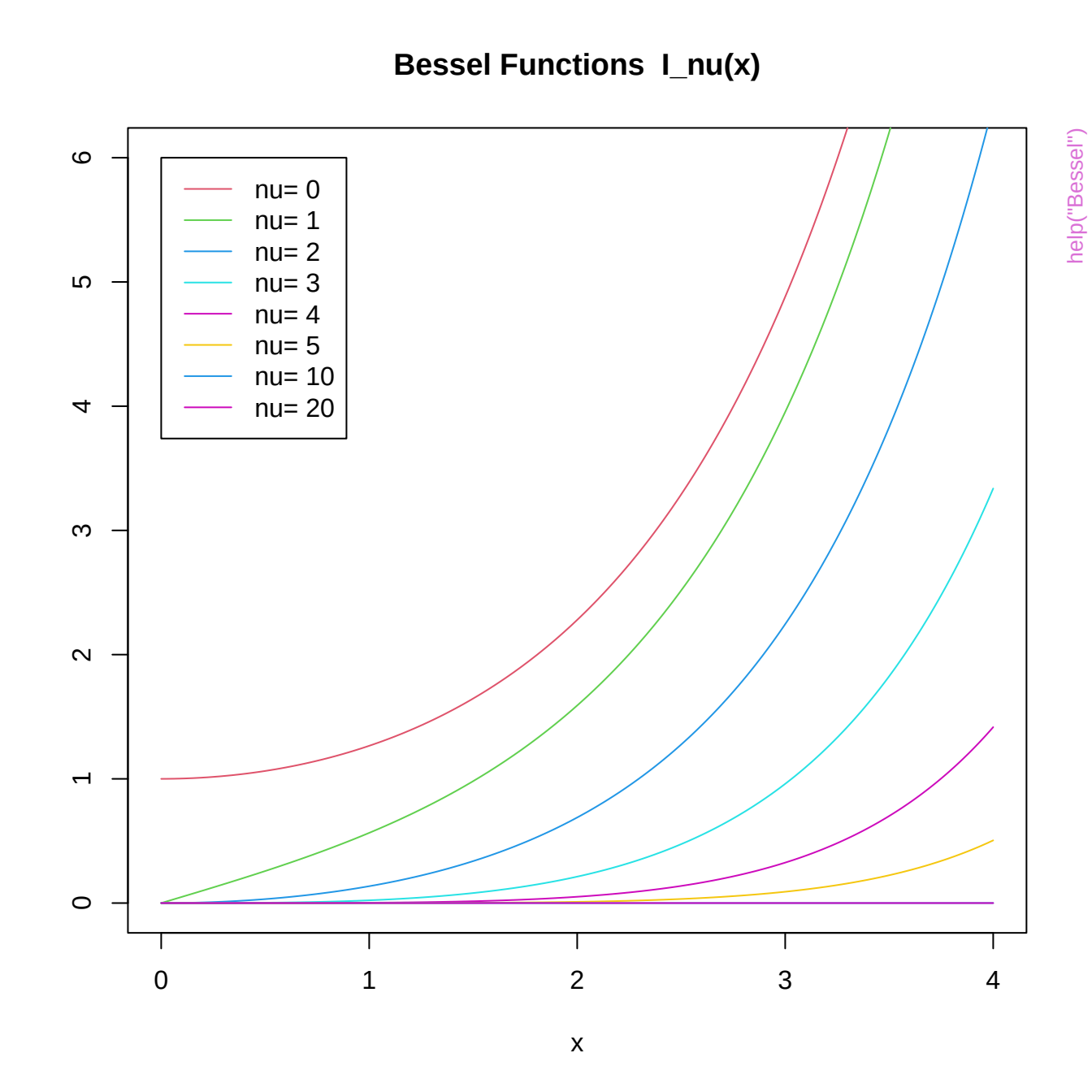
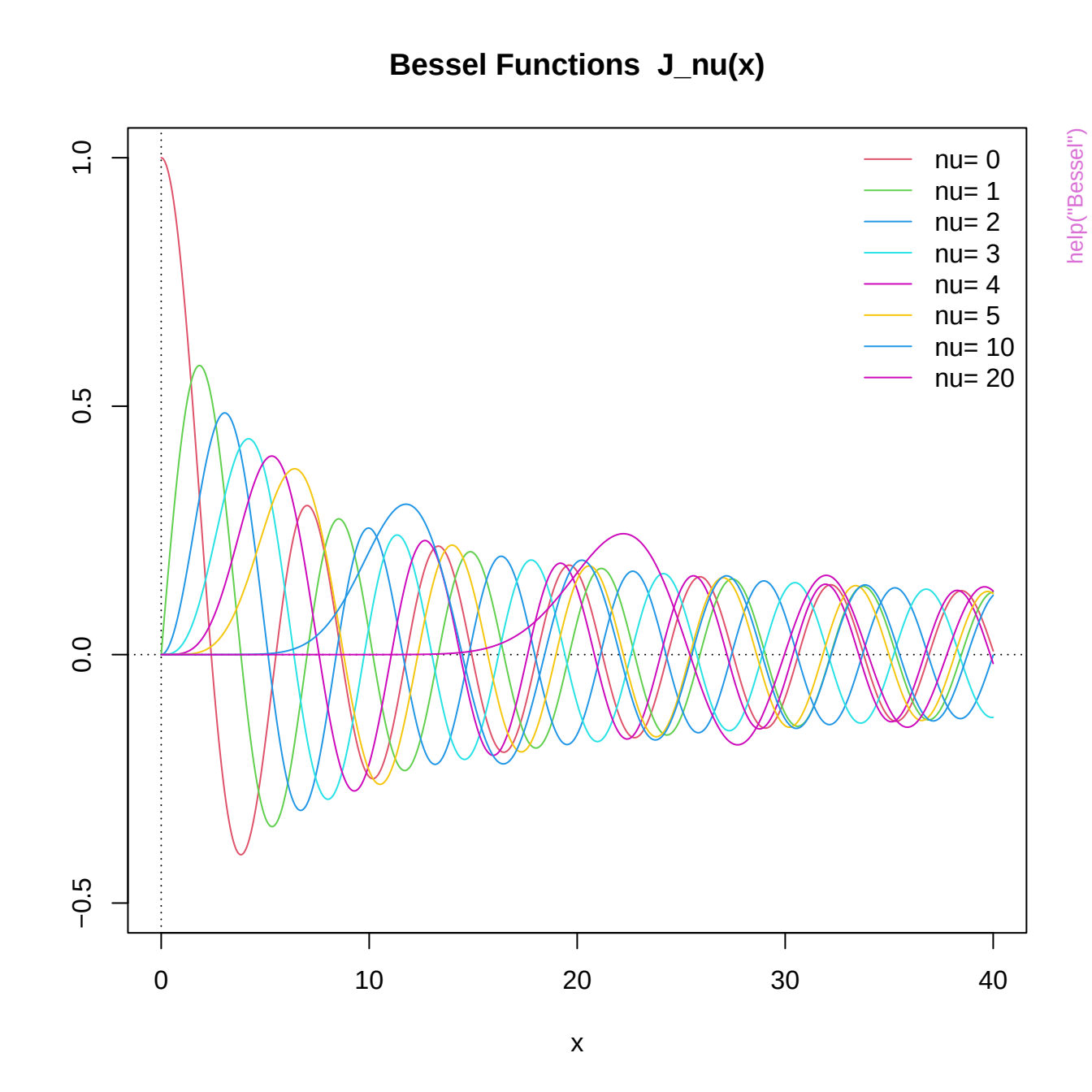
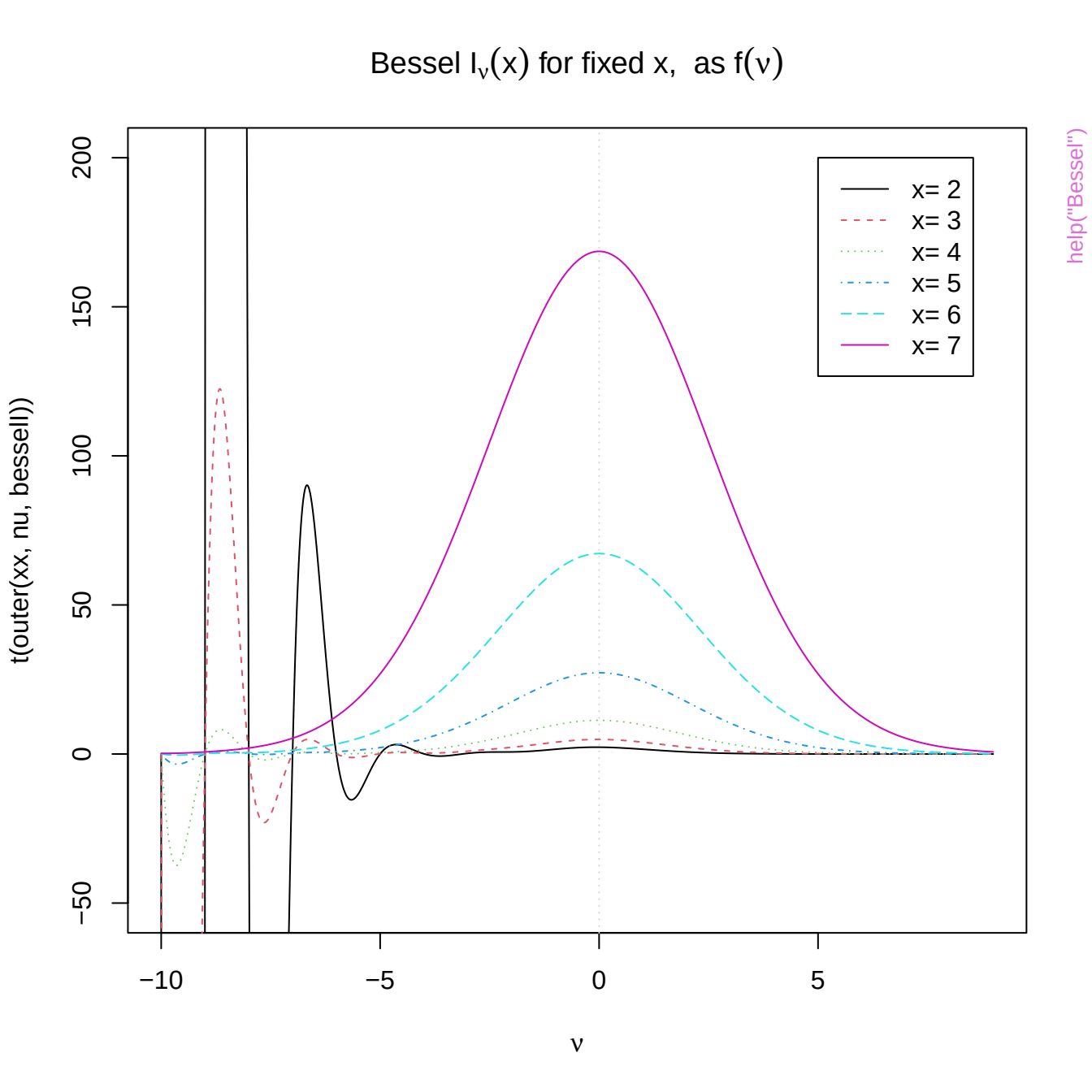
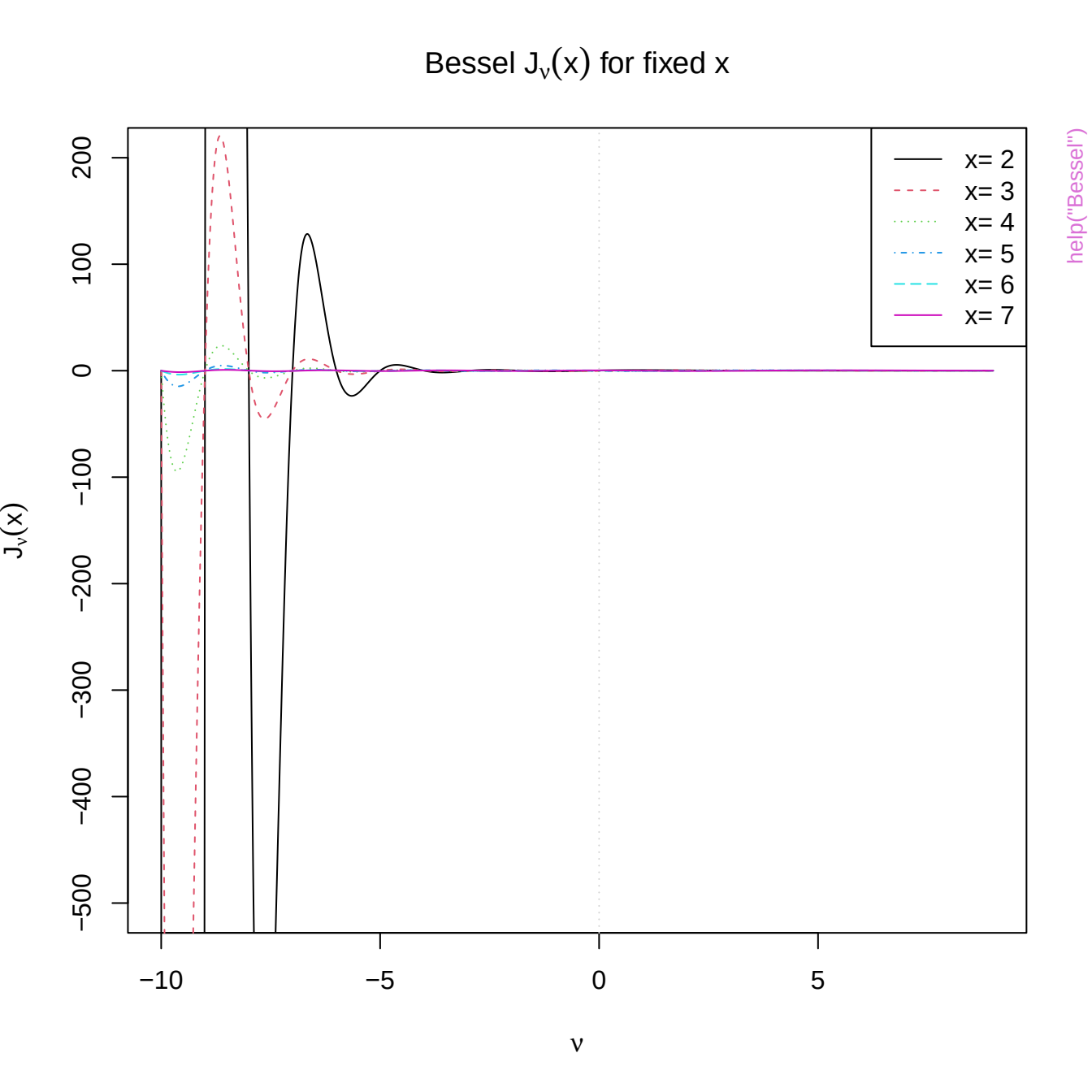
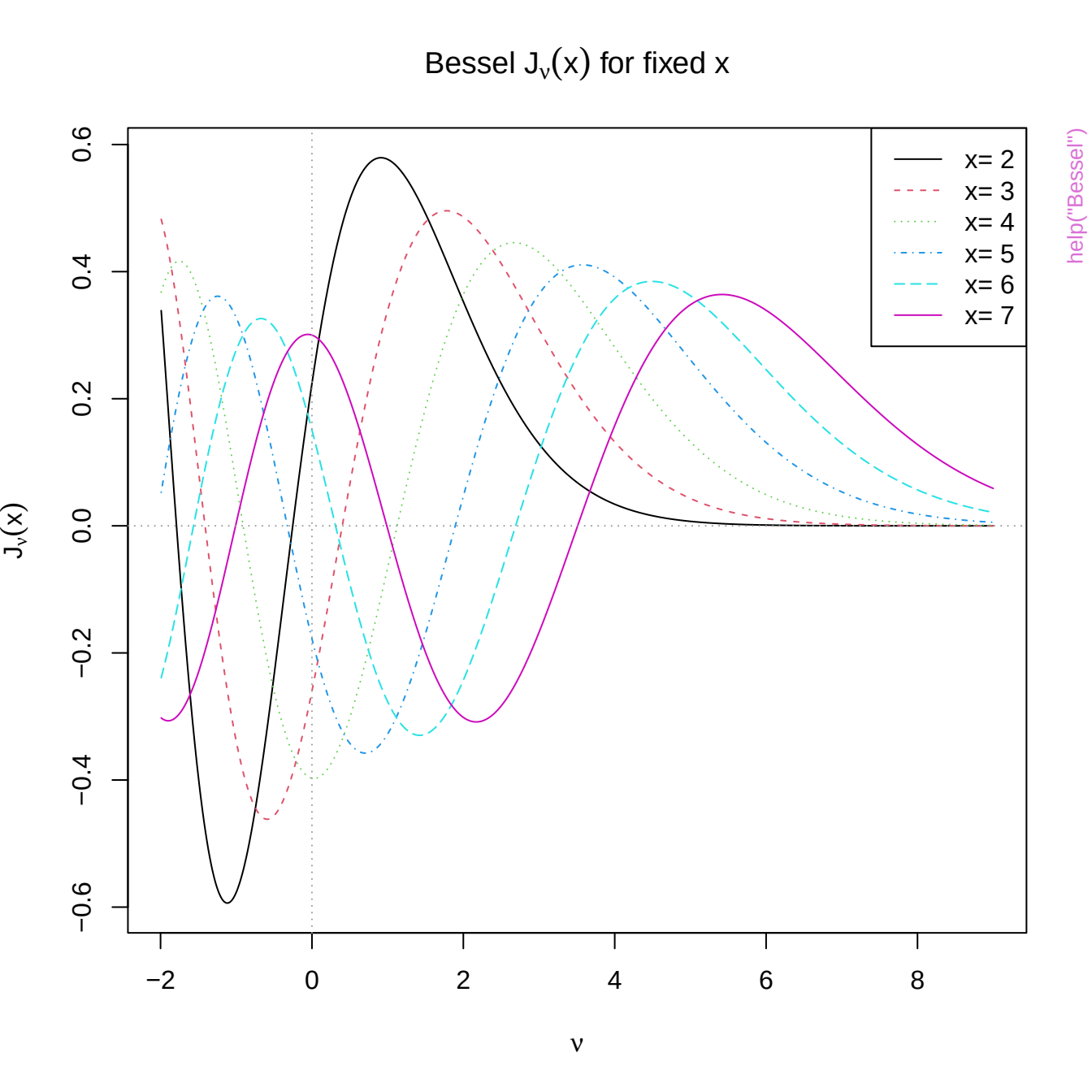
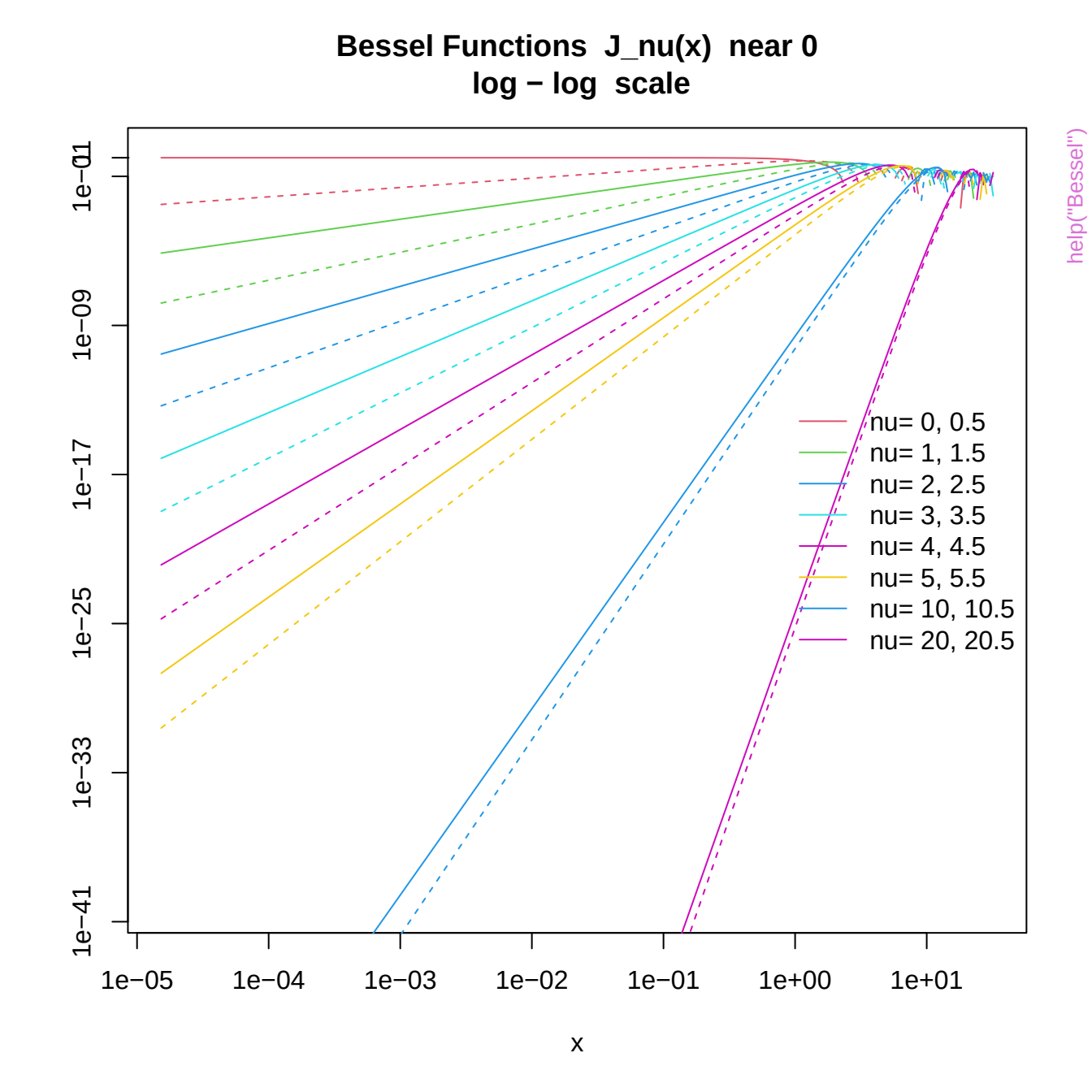

Bessel Functions I_nu(x)
nu= 0
nu= 1
nu= 2
nu= 3
nu= 4
nu= 5
nu= 10
nu= 20
0
1
2
3
4
5
6
0
1
2
3
4
x
help("Bessel")

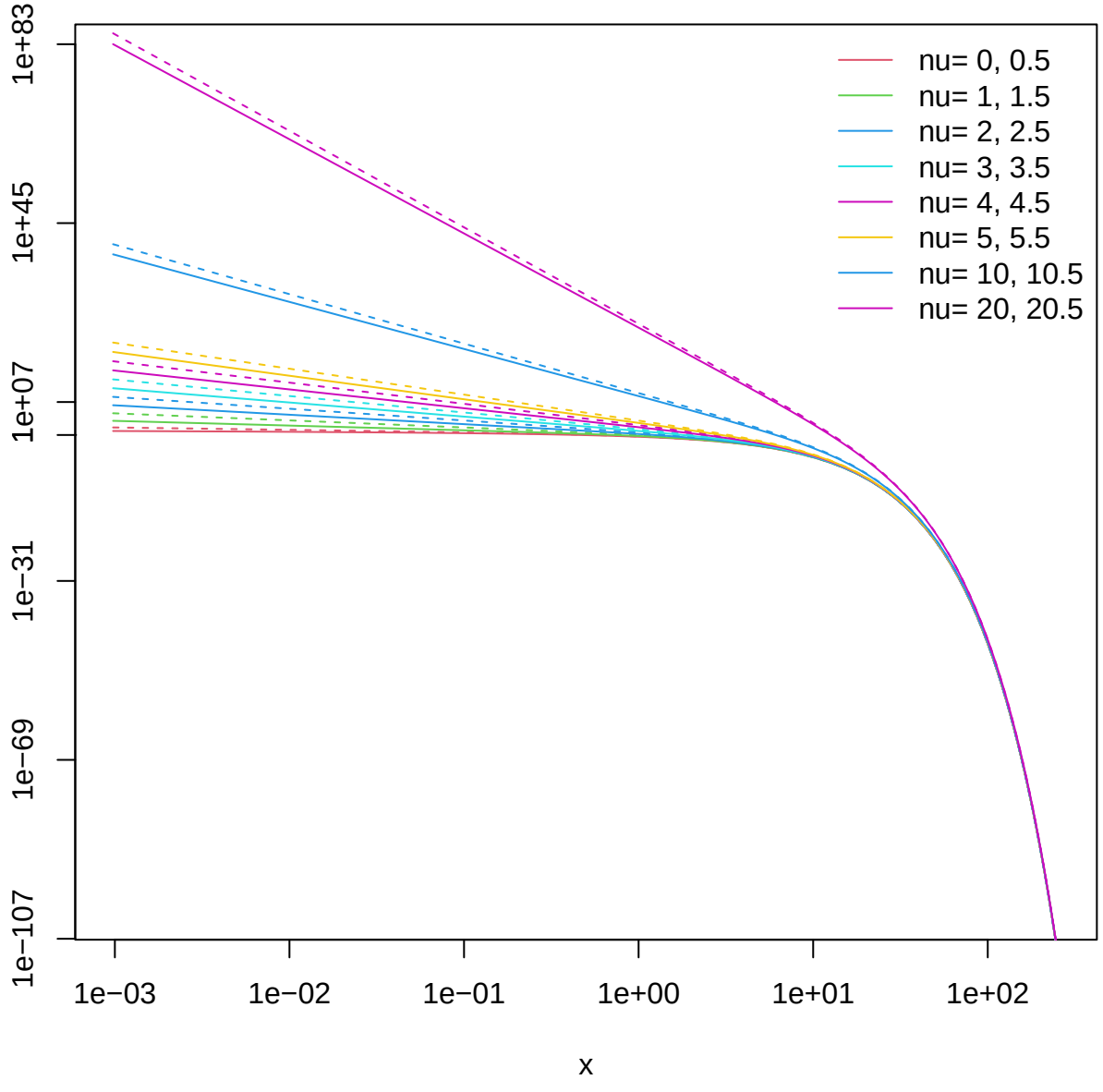

Bessel Functions J_nu(x)
nu= 0
nu= 1
nu= 2
nu= 3
nu= 4
nu= 5
nu= 10
nu= 20
1.0
0.5
0.0
−0.5
0
10
20
30
40
x
help("Bessel")


Bessel $I_\nu(x)$ for fixed x, as $f(\nu)$
t(outer(xx, nu, bessel))
ν
x= 2
x= 3
x= 4
x= 5
x= 6
x= 7
200
150
100
50
0
−50
−10
−5
0
5
help("Bessel")

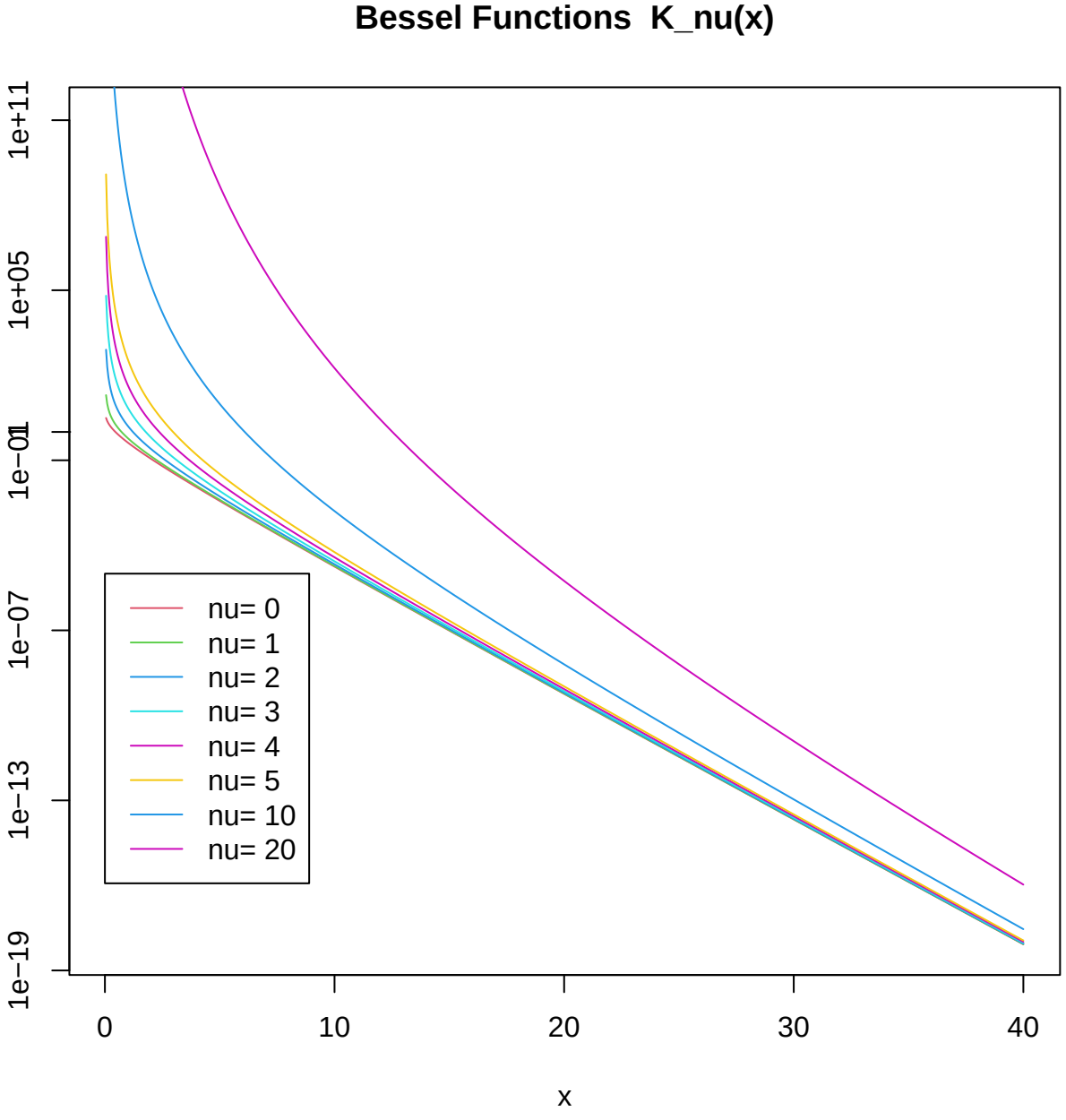

Bessel $J_\nu(x)$ for fixed x
x= 2
x= 3
x= 4
x= 5
x= 6
x= 7
$J_\nu(x)$
200
100
0
−100
−200
−300
−400
−500
−10
−5
0
5
ν
help("Bessel")

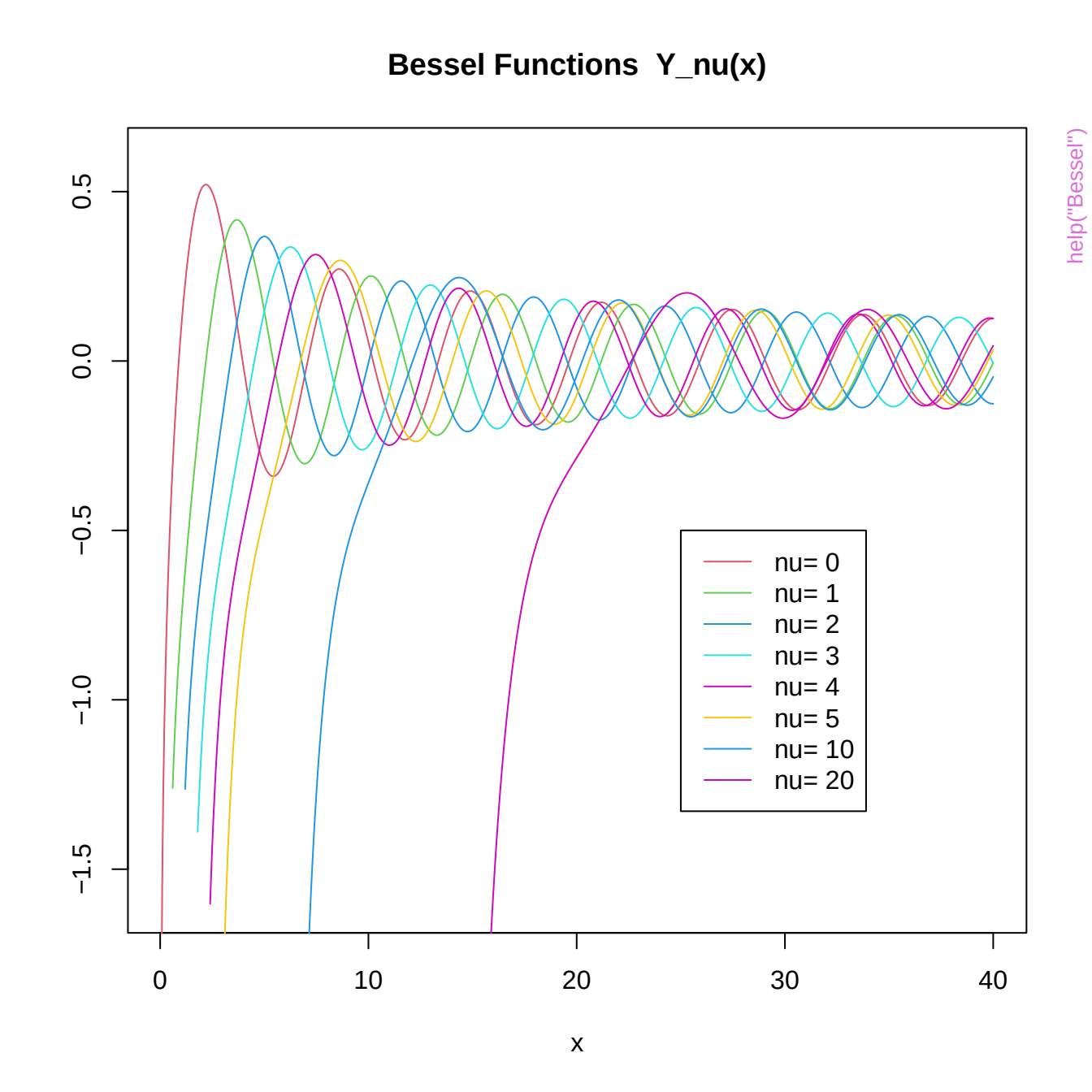

Bessel $J_\nu(x)$ for fixed x
x= 2
x= 3
x= 4
x= 5
x= 6
x= 7
$J_\nu(x)$
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−2
0
2
4
6
8
ν
help("Bessel")

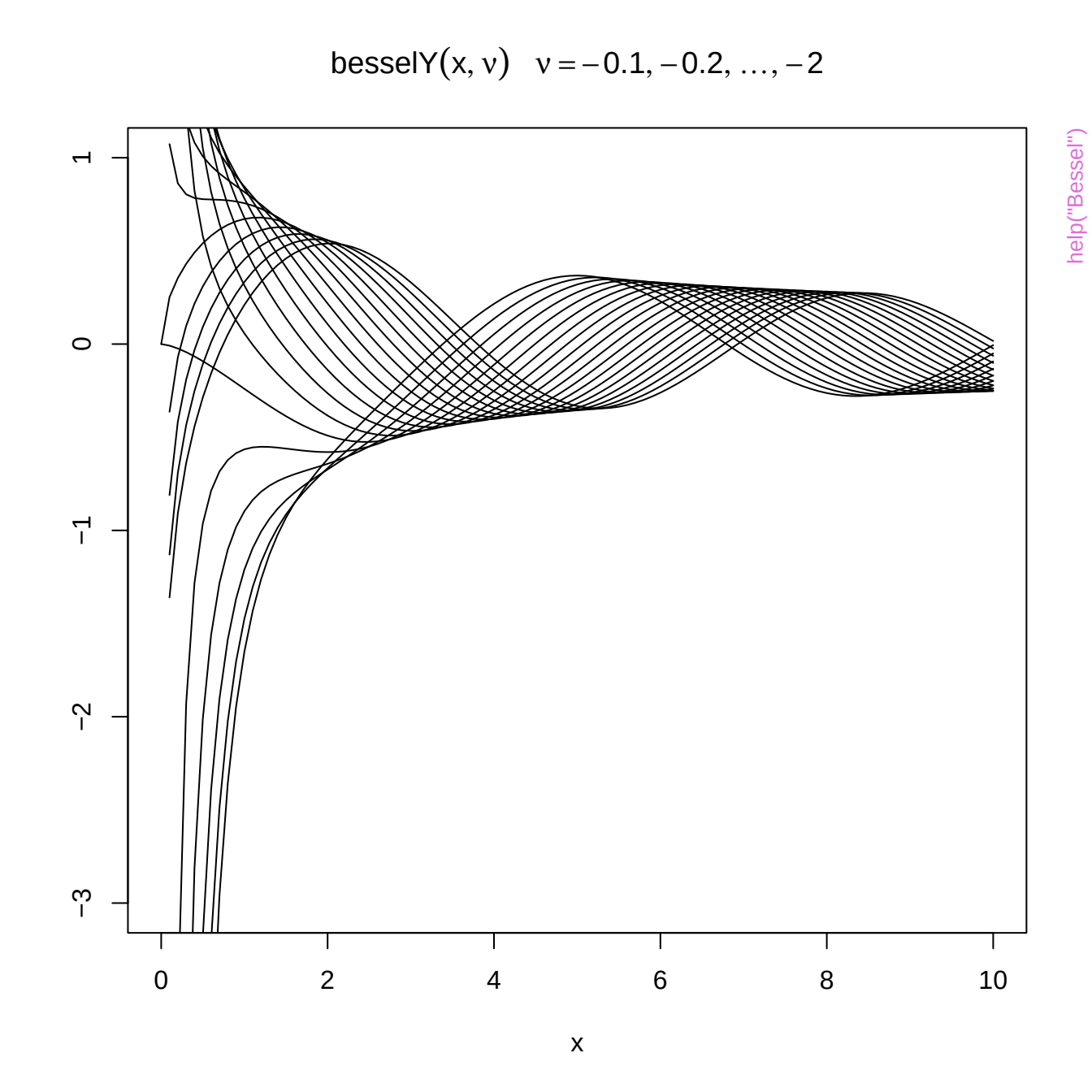

Bessel Functions J_nu(x) near 0
log − log scale
1e−01
1e−09
1e−17
1e−25
1e−33
1e−41
1e−05
1e−04
1e−03
1e−02
1e−01
1e+00
1e+01
x
nu= 0, 0.5
nu= 1, 1.5
nu= 2, 2.5
nu= 3, 3.5
nu= 4, 4.5
nu= 5, 5.5
nu= 10, 10.5
nu= 20, 20.5
help("Bessel")

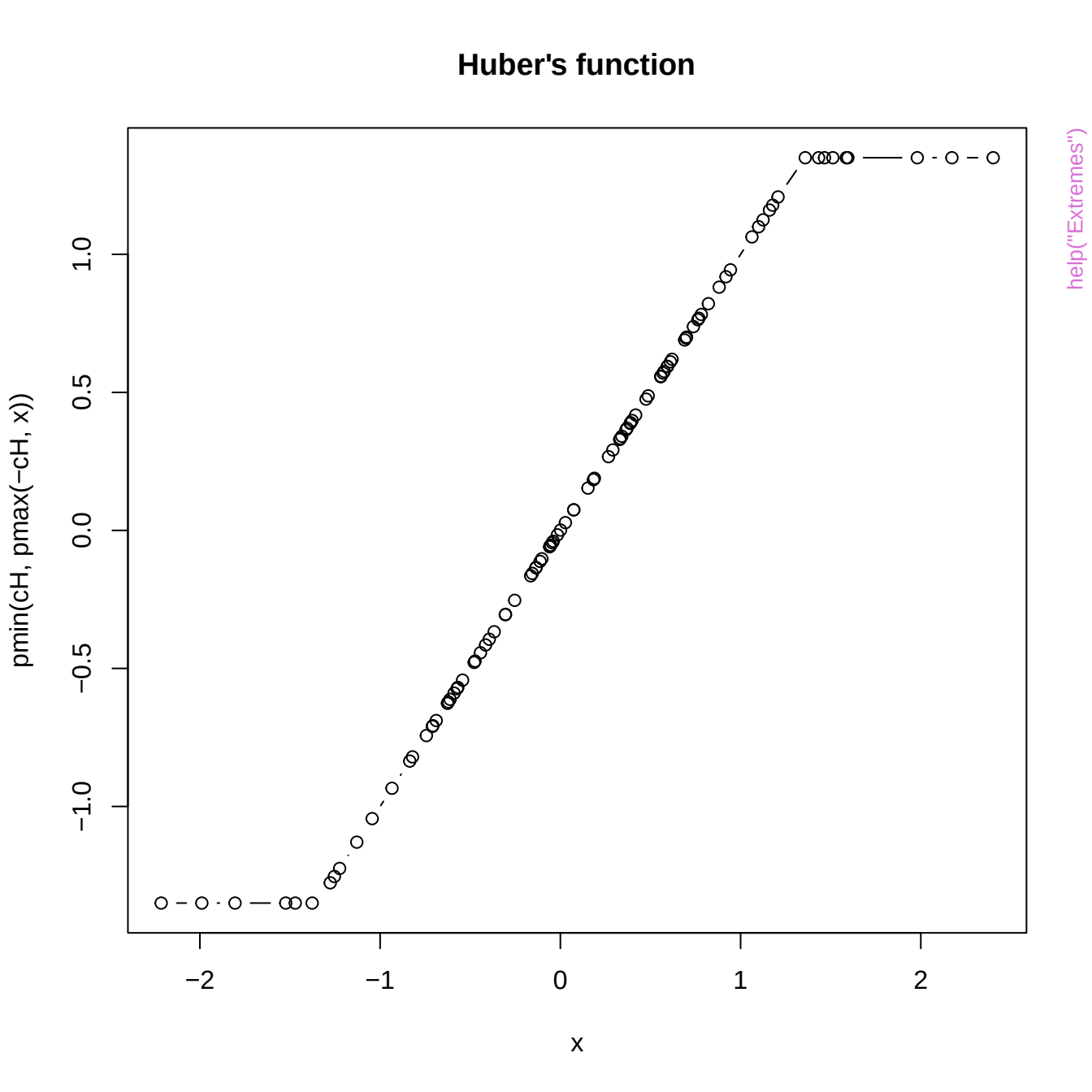

Bessel Functions K_nu(x) near 0
log − log scale
nu= 0, 0.5
nu= 1, 1.5
nu= 2, 2.5
nu= 3, 3.5
nu= 4, 4.5
nu= 5, 5.5
nu= 10, 10.5
nu= 20, 20.5
1e+83
1e+45
1e+07
1e−31
1e−69
1e−107
1e−03
1e−02
1e−01
1e+00
1e+01
1e+02
x

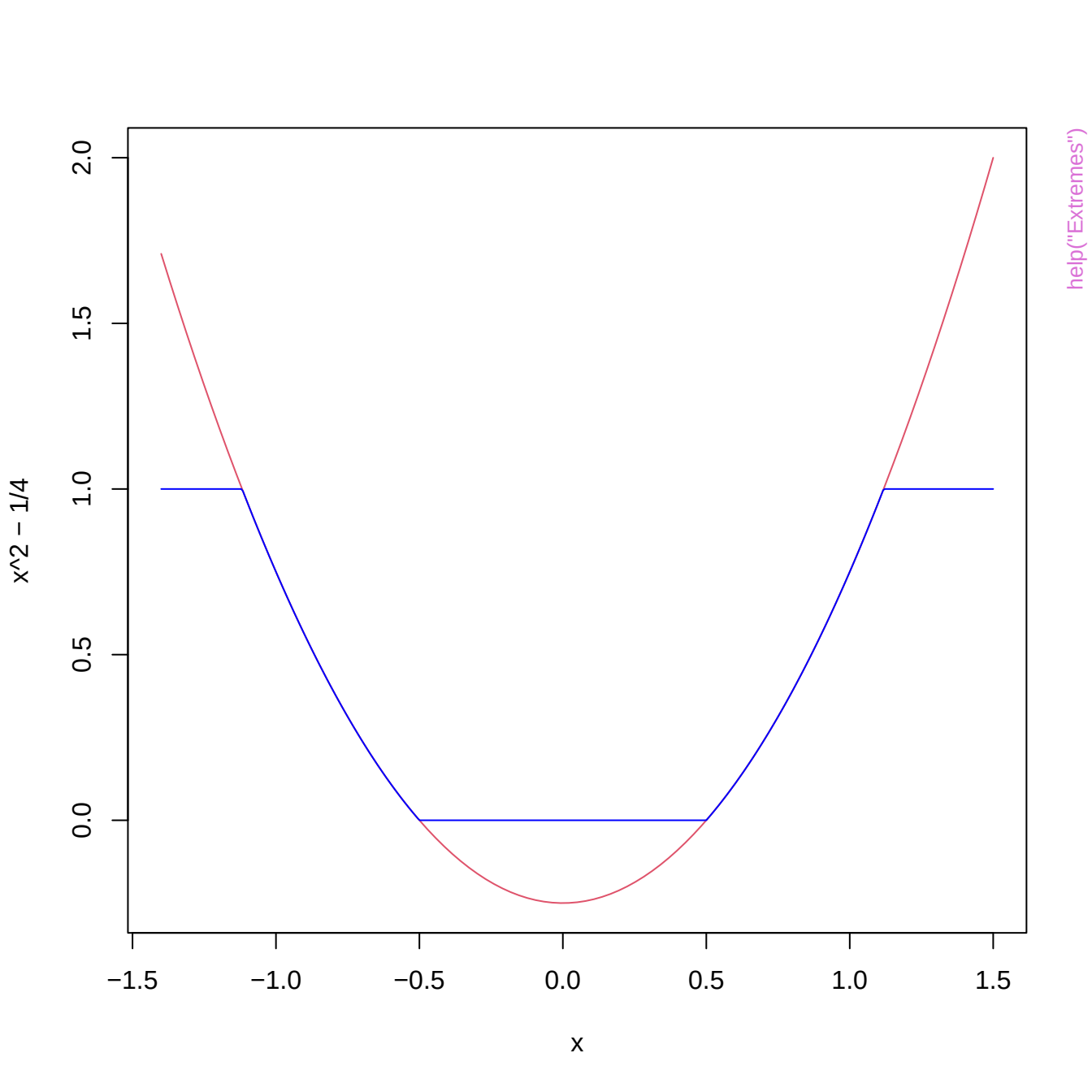
help("Bessel")

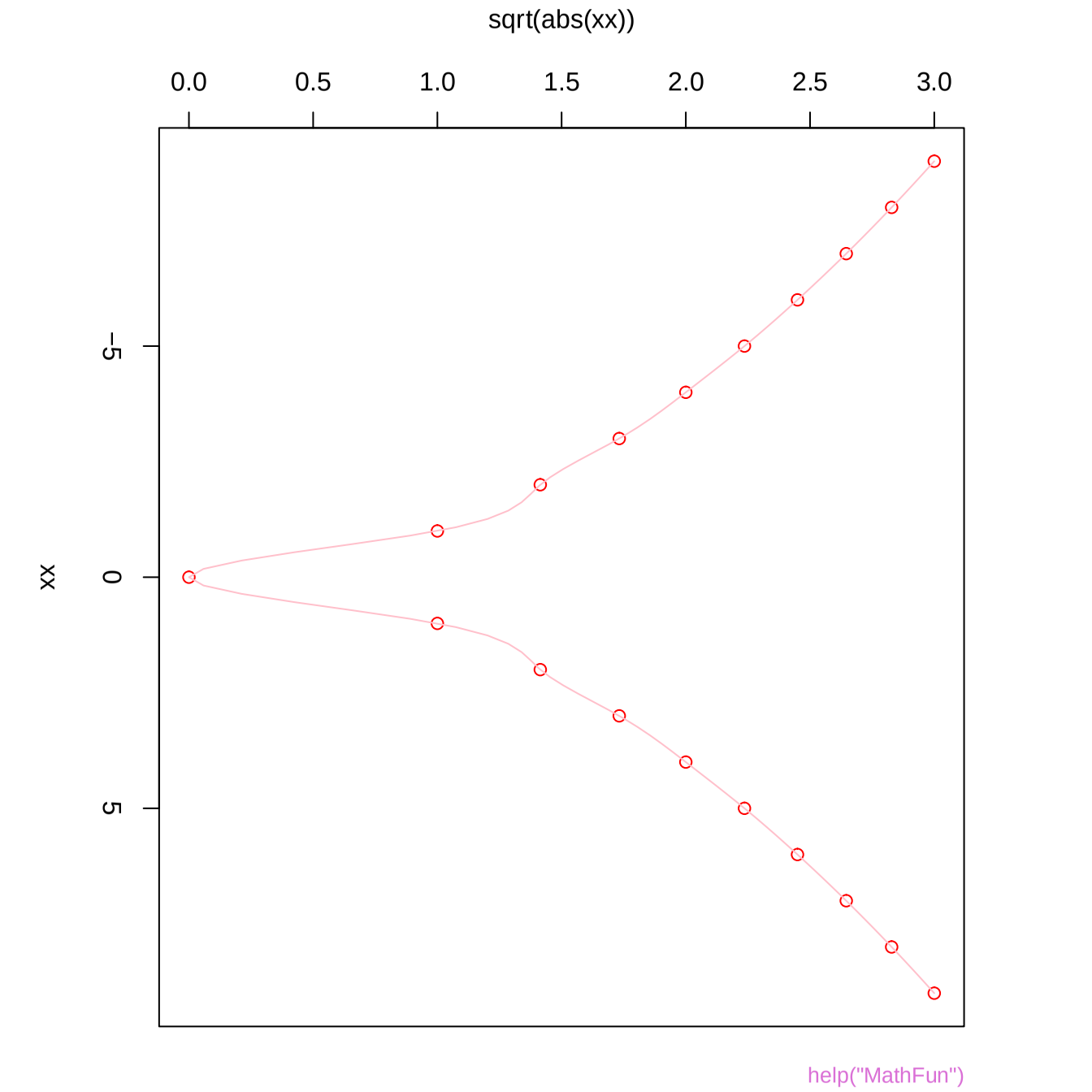

Bessel Functions K_nu(x)
1e+11
1e+05
1e−01
1e−07
1e−13
1e−19
0
10
20
30
40
x
nu= 0
nu= 1
nu= 2
nu= 3
nu= 4
nu= 5
nu= 10
nu= 20
help("Bessel")

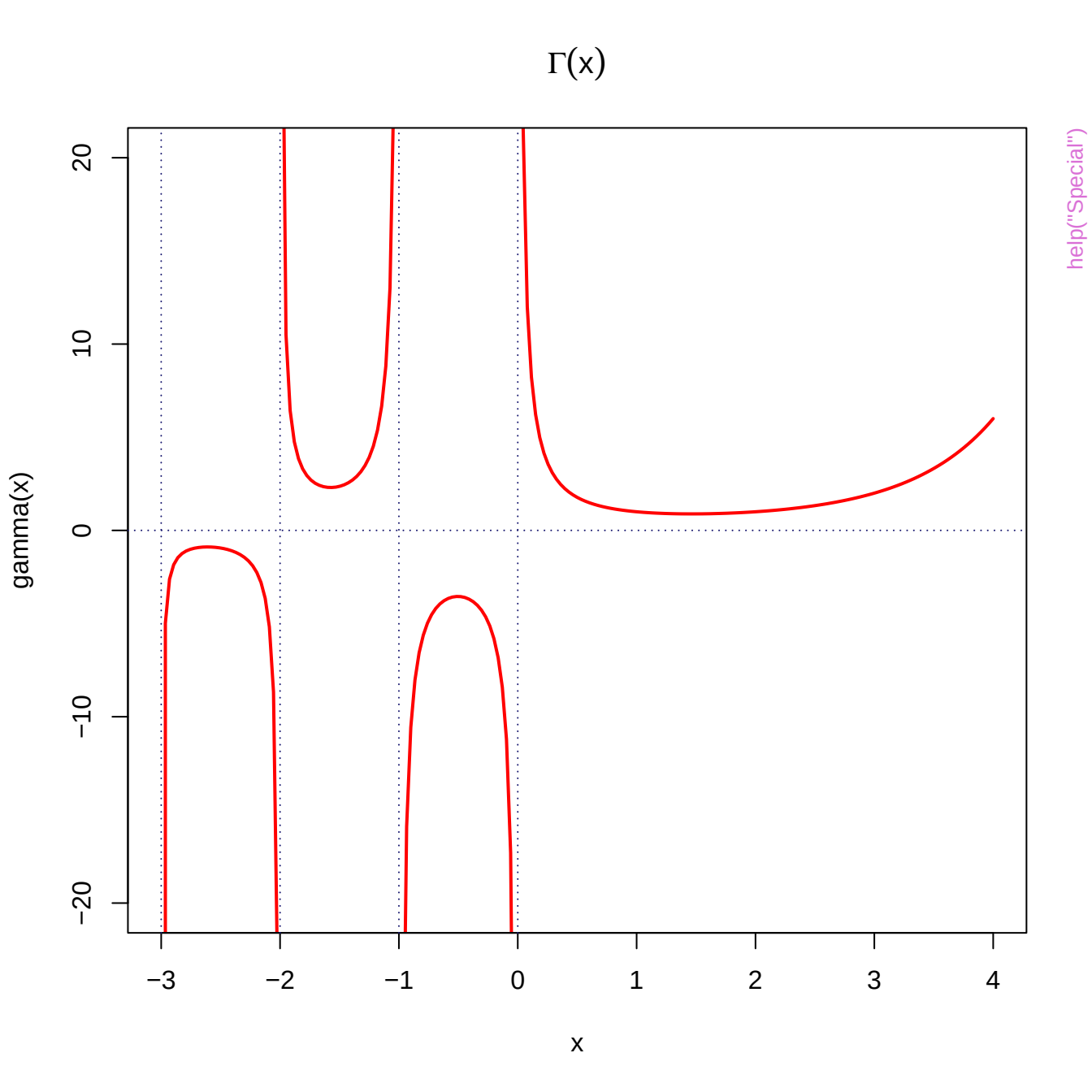

Bessel Functions Y_nu(x)
help("Bessel")
0.5
0.0
−0.5
−1.0
−1.5
0
10
20
30
40
x
nu= 0
nu= 1
nu= 2
nu= 3
nu= 4
nu= 5
nu= 10
nu= 20

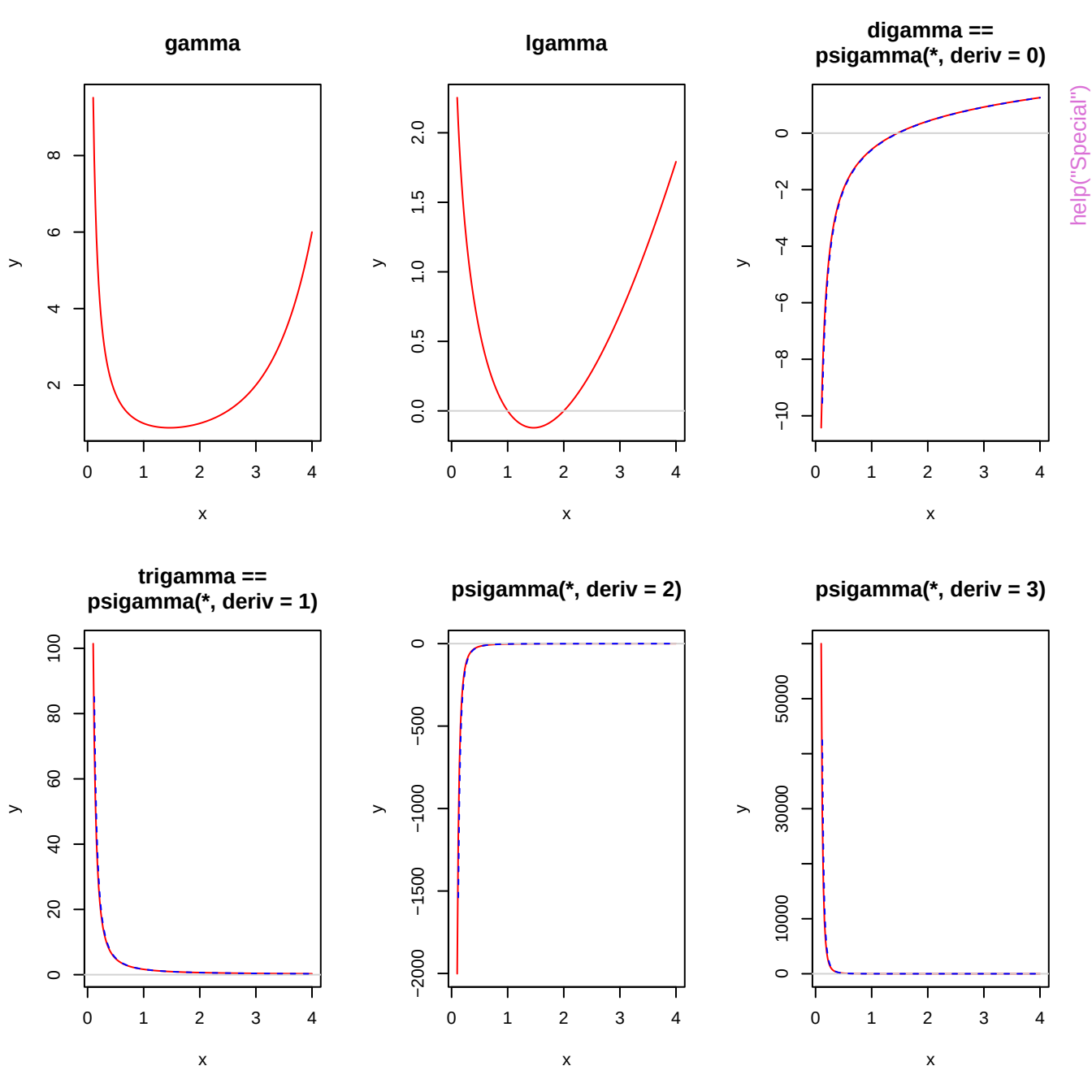

besselY(x, ν) ν = −0.1, −0.2, …, −2
help("Bessel")
1
0
−1
−2
−3
0
2
4
6
8
10
x

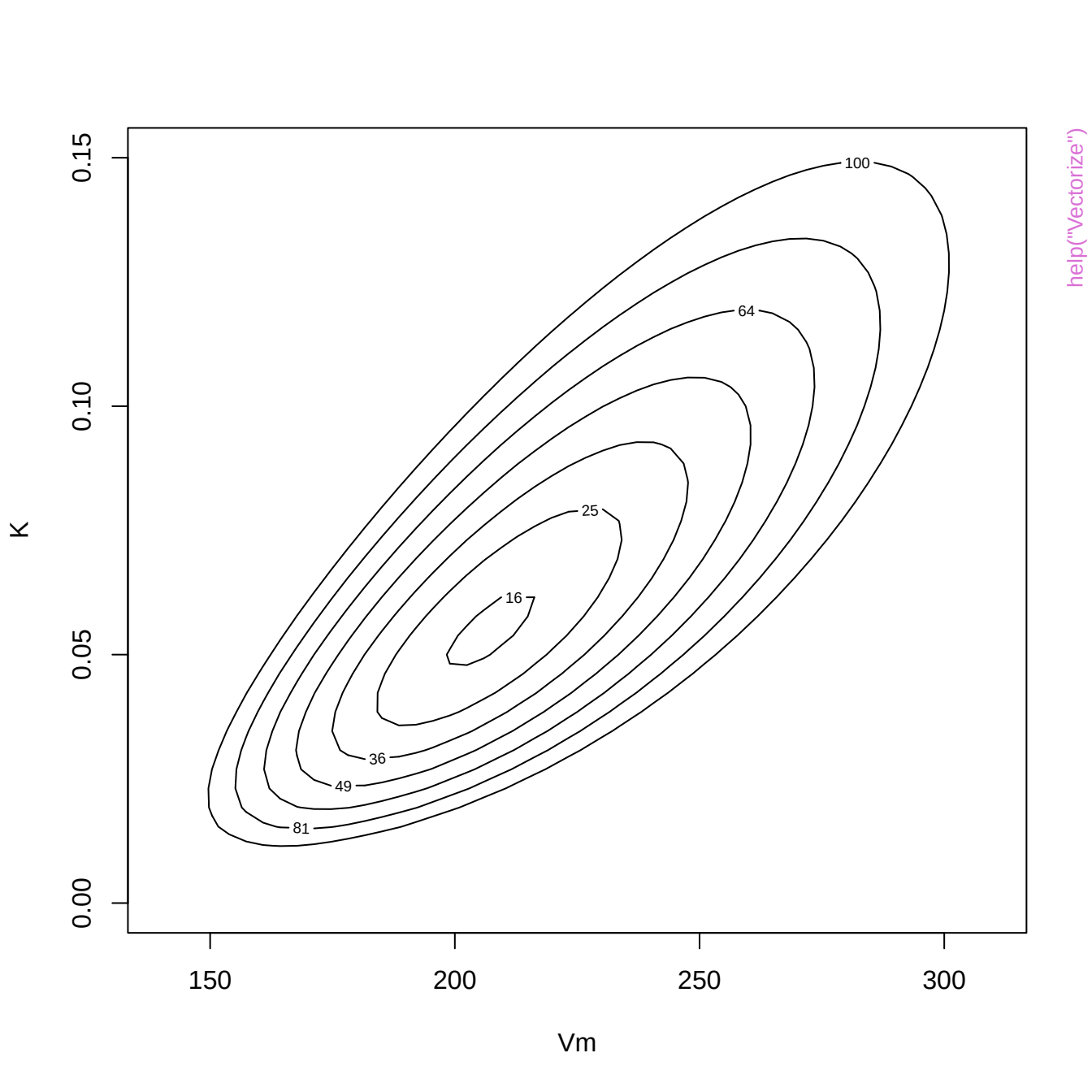

Huber's function
pmin(cH, pmax(−cH, x))
x
−2
−1
0
1
2
−1.0
−0.5
0.0
0.5
1.0
help("Extremes")

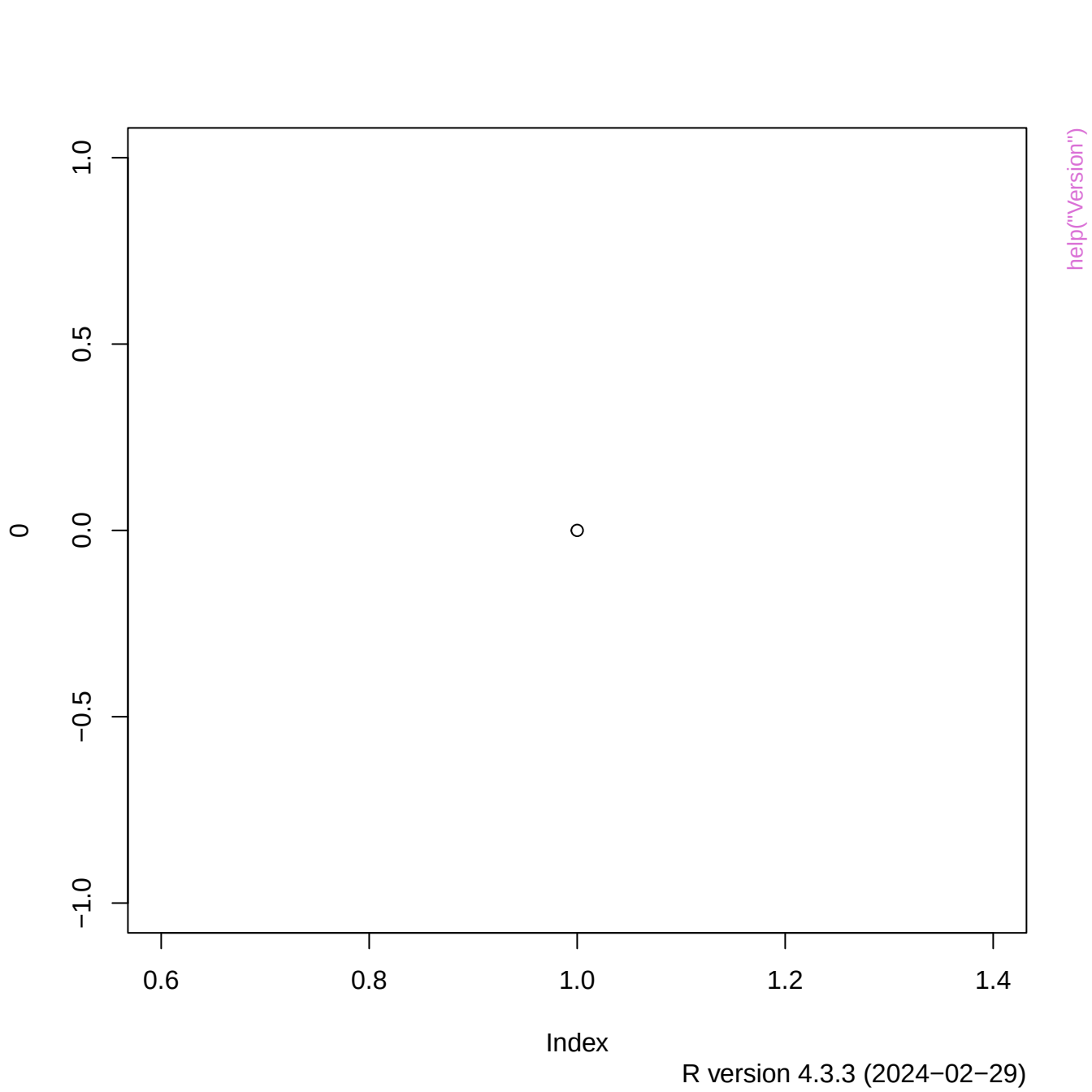

help("Extremes")
x^2 − 1/4
2.0
1.5
1.0
0.5
0.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
x

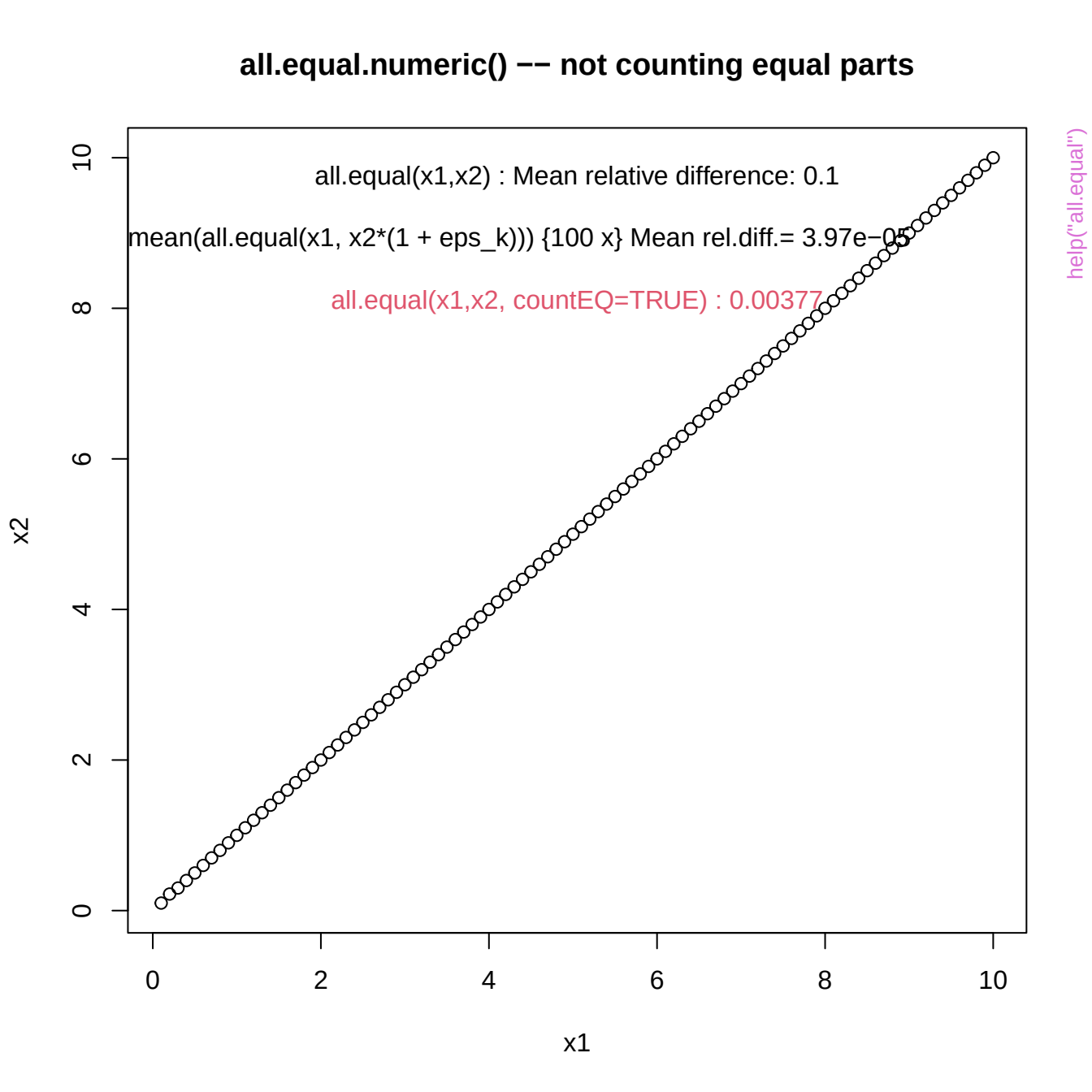

sqrt(abs(xx))
0.0
0.5
1.0
1.5
2.0
2.5
3.0
xx
−5
0
5
help("MathFun")

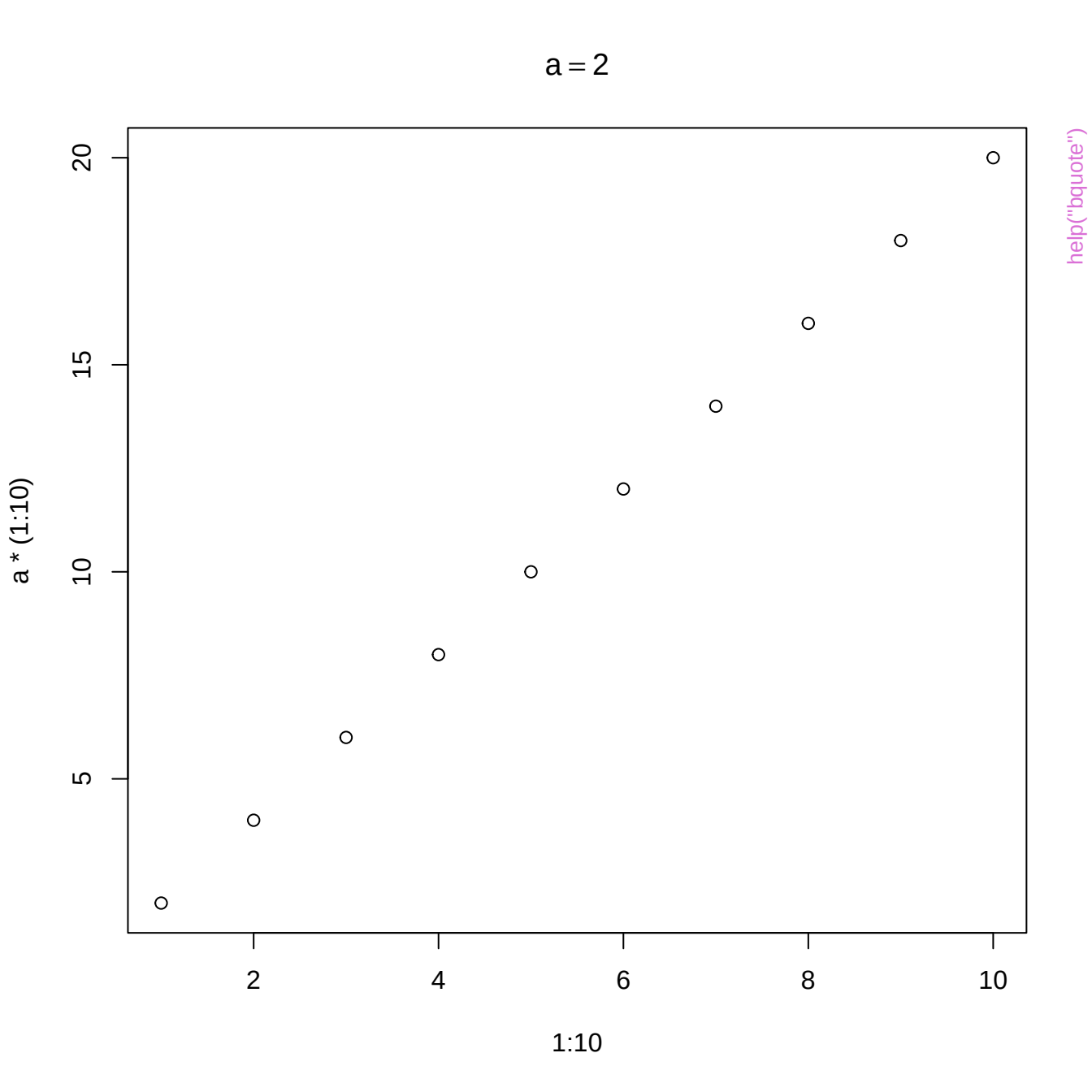

Γ(x)
gamma(x)
20
10
0
−10
−20
−3
−2
−1
0
1
2
3
4
x
help("Special")


gamma
lgamma
digamma ==
psigamma(*, deriv = 0)
trigamma ==
psigamma(*, deriv = 1)
psigamma(*, deriv = 2)
psigamma(*, deriv = 3)
x
y
help("Special")

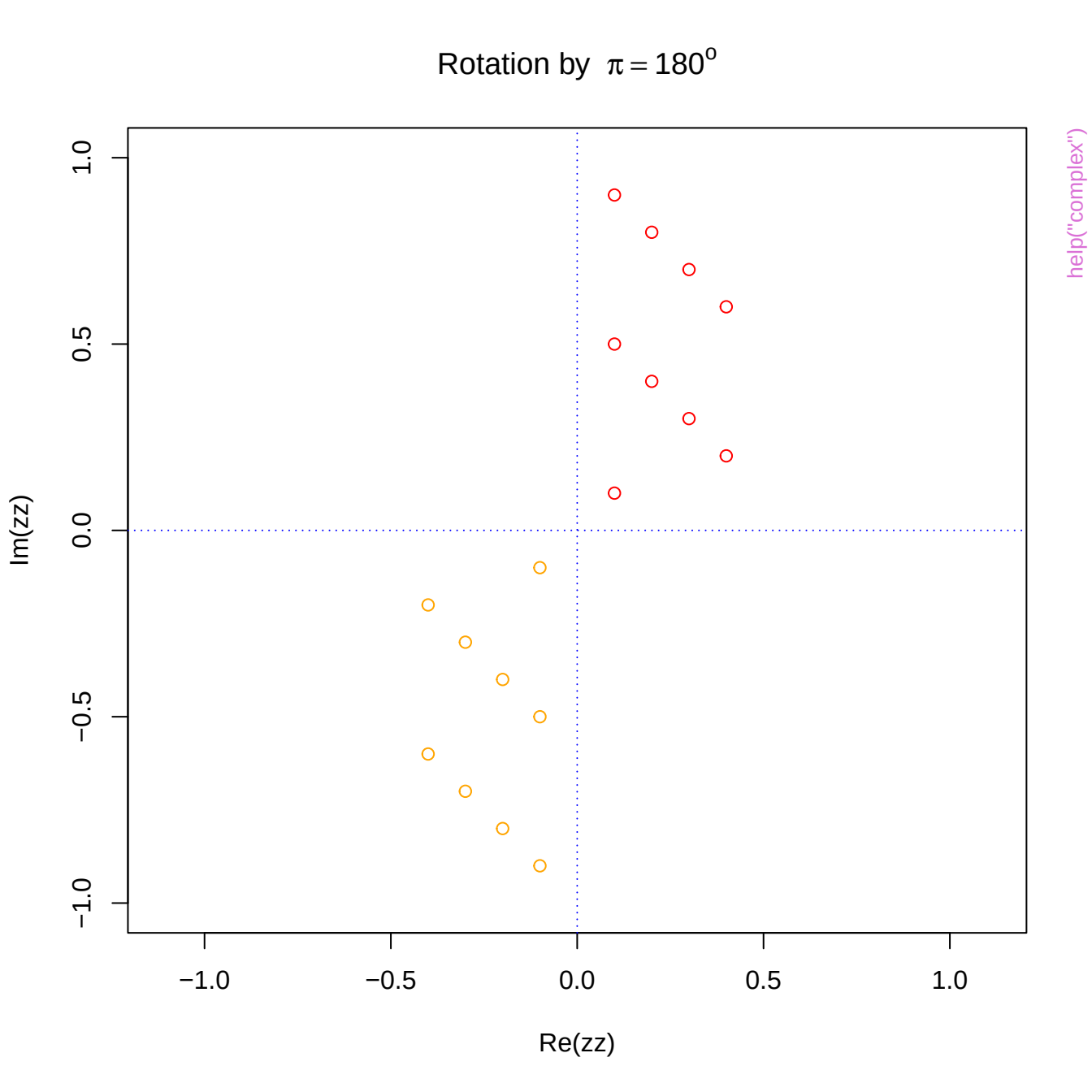

help("Vectorize")
0.15
0.10
0.05
0.00
K
100
64
25
16
36
49
81
150
200
250
300
Vm

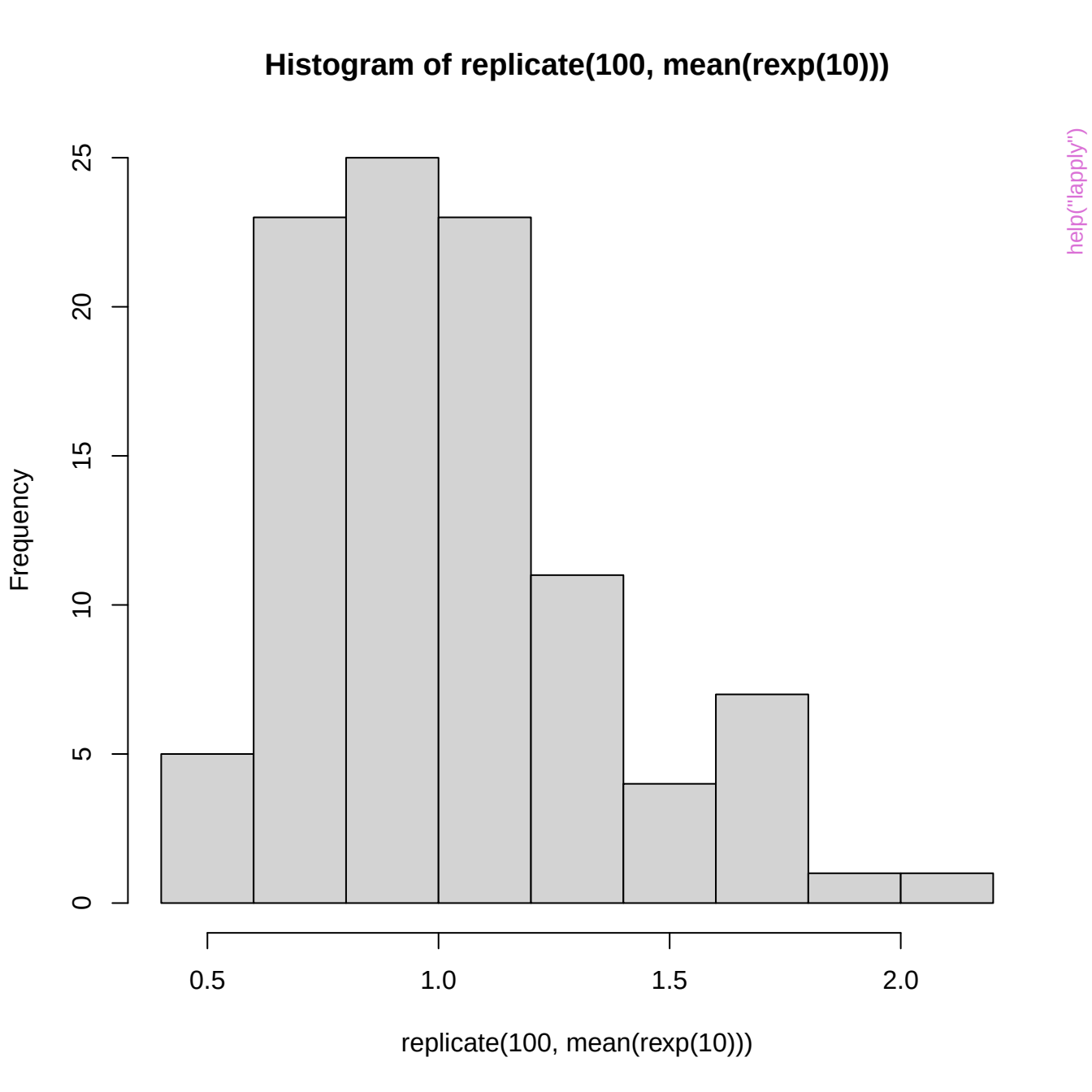

help("Version")
0
1.0
0.5
0.0
−0.5
−1.0
0.6
0.8
1.0
1.2
1.4
Index
R version 4.3.3 (2024−02−29)

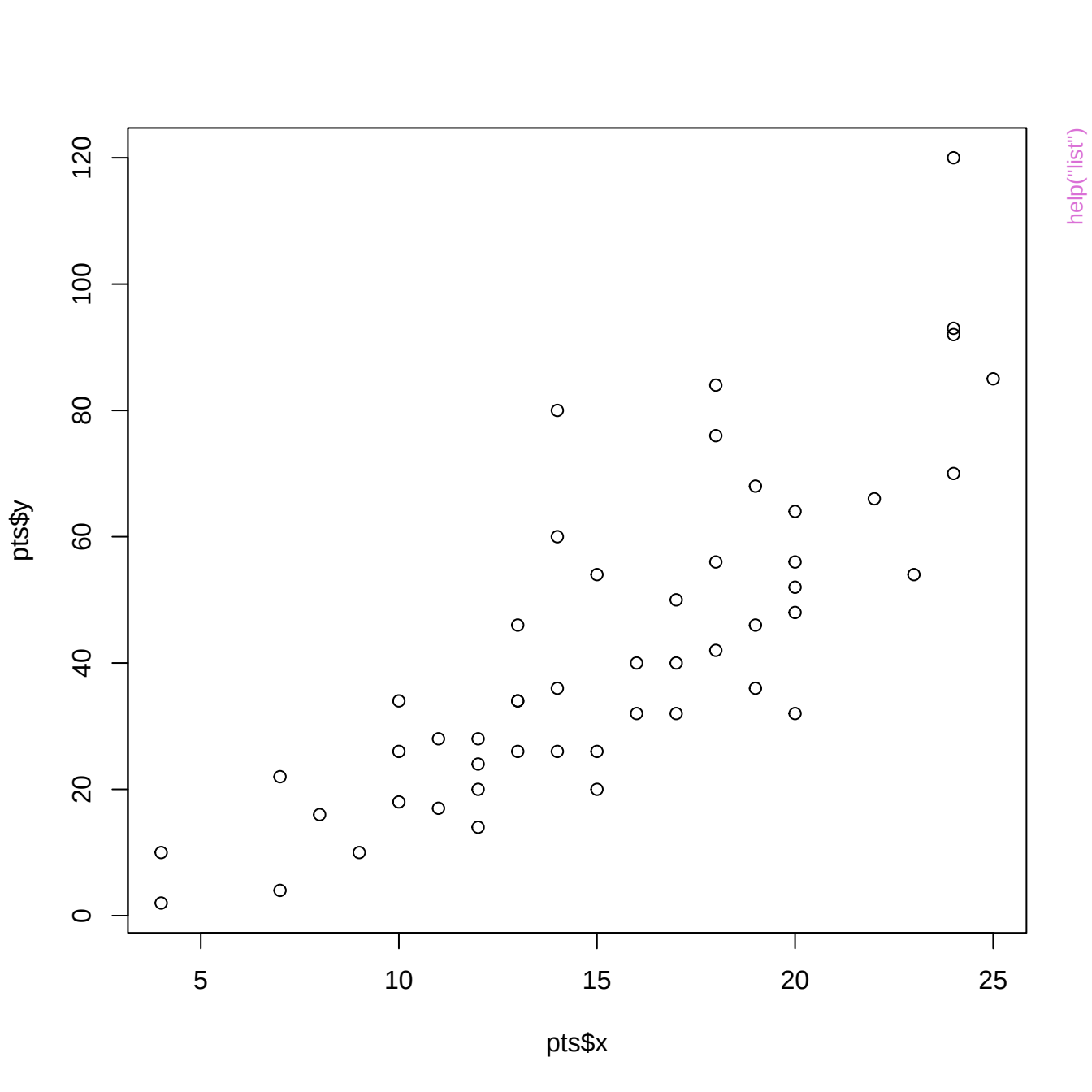

all.equal.numeric() −− not counting equal parts
all.equal(x1,x2) : Mean relative difference: 0.1
mean(all.equal(x1, x2*(1 + eps_k))) {100 x} Mean rel.diff.= 3.97e−05
all.equal(x1,x2, countEQ=TRUE) : 0.00377
help("all.equal")
x2
x1
0
2
4
6
8
10



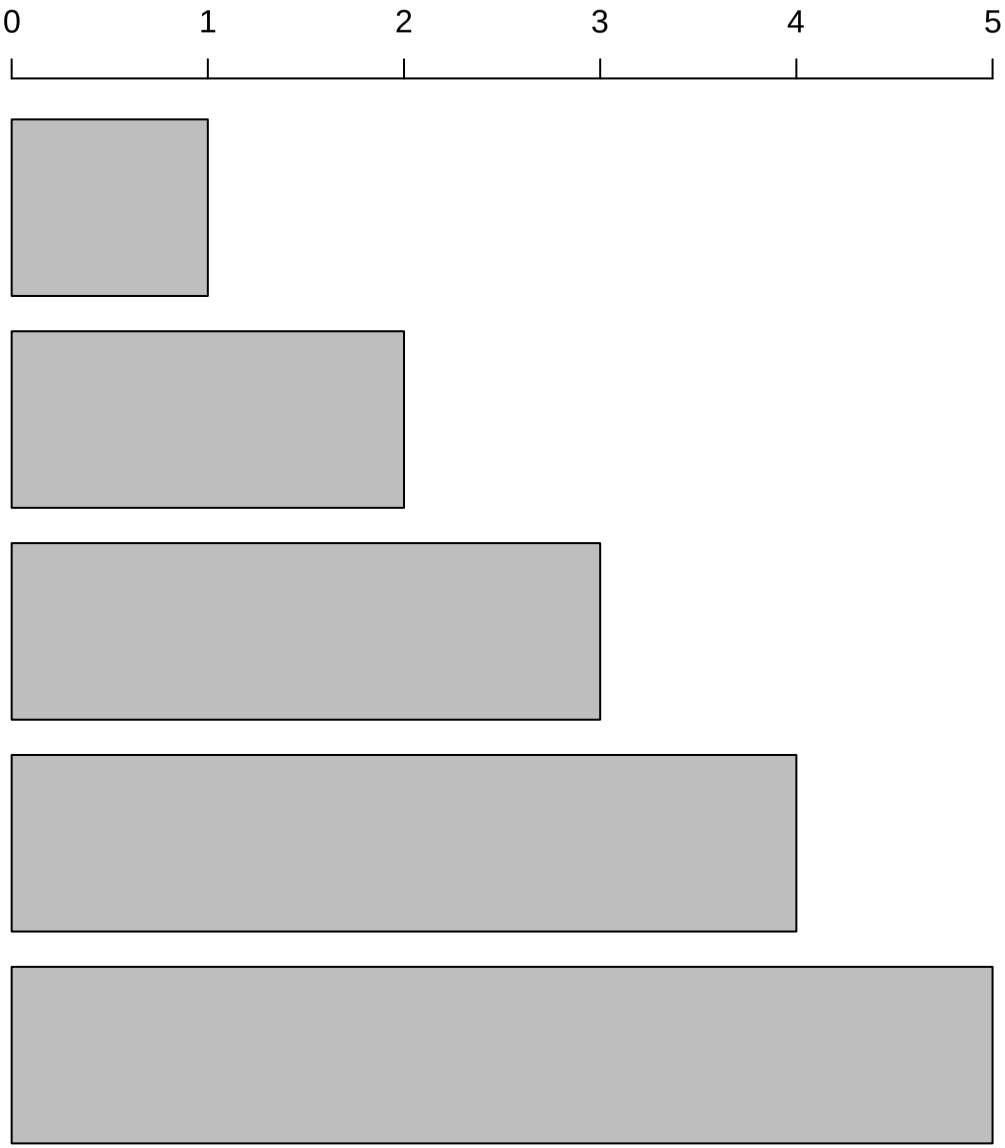
help("bquote")


Rotation by $\pi = 180^o$
Im(zz)
Re(zz)
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5
1.0
help("complex")

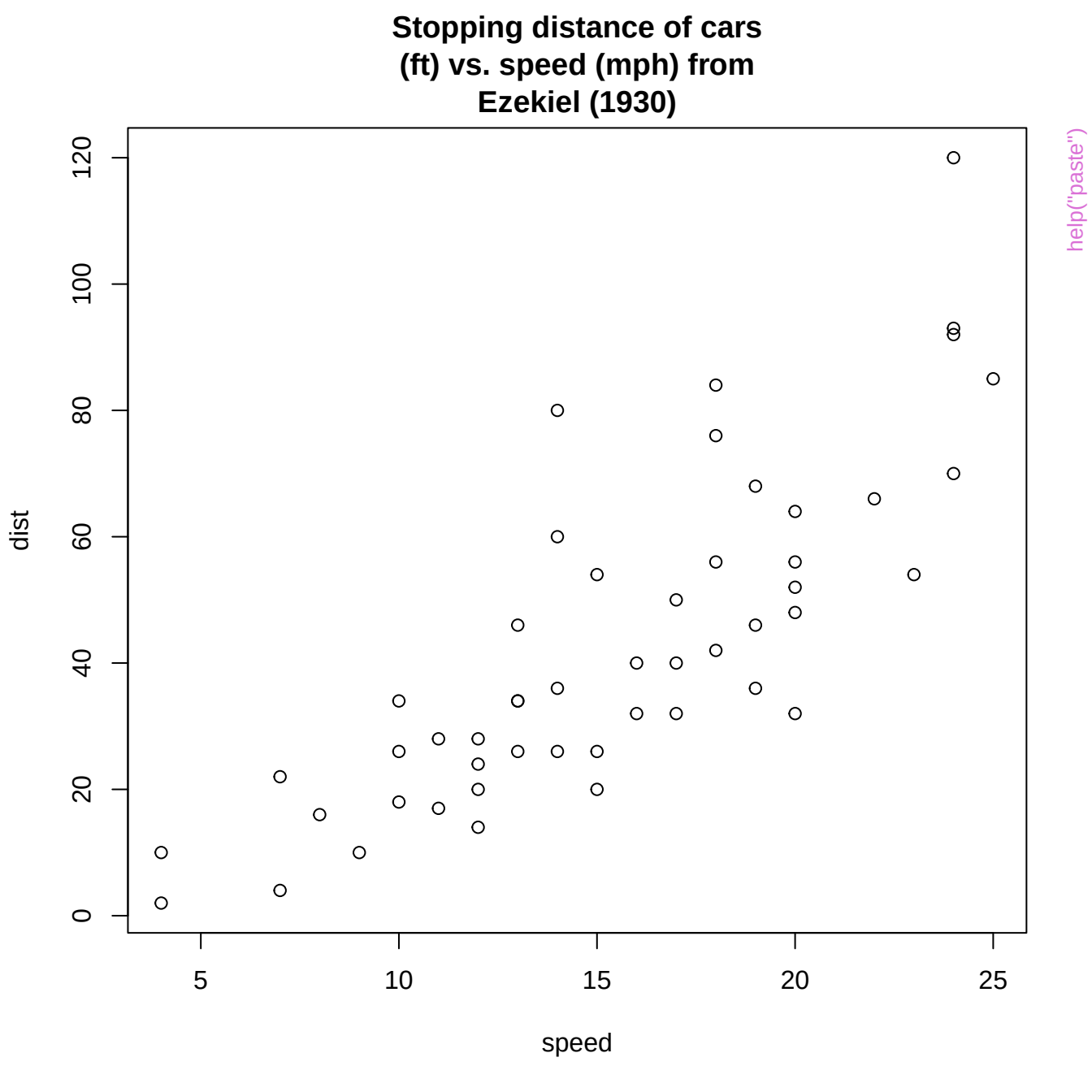

Histogram of replicate(100, mean(rexp(10)))
Frequency
0
5
10
15
20
25
0.5
1.0
1.5
2.0
replicate(100, mean(rexp(10)))
help("lapply")

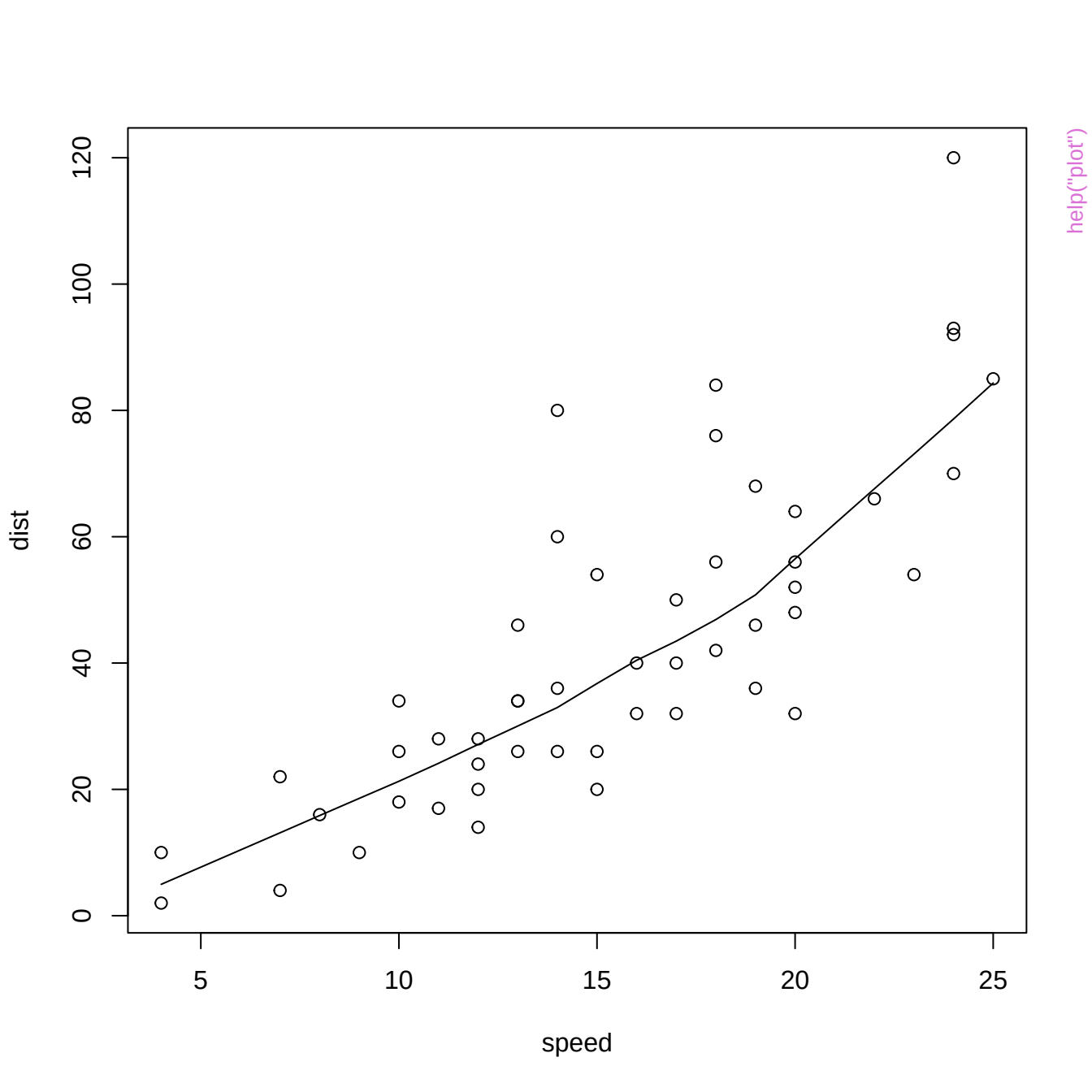


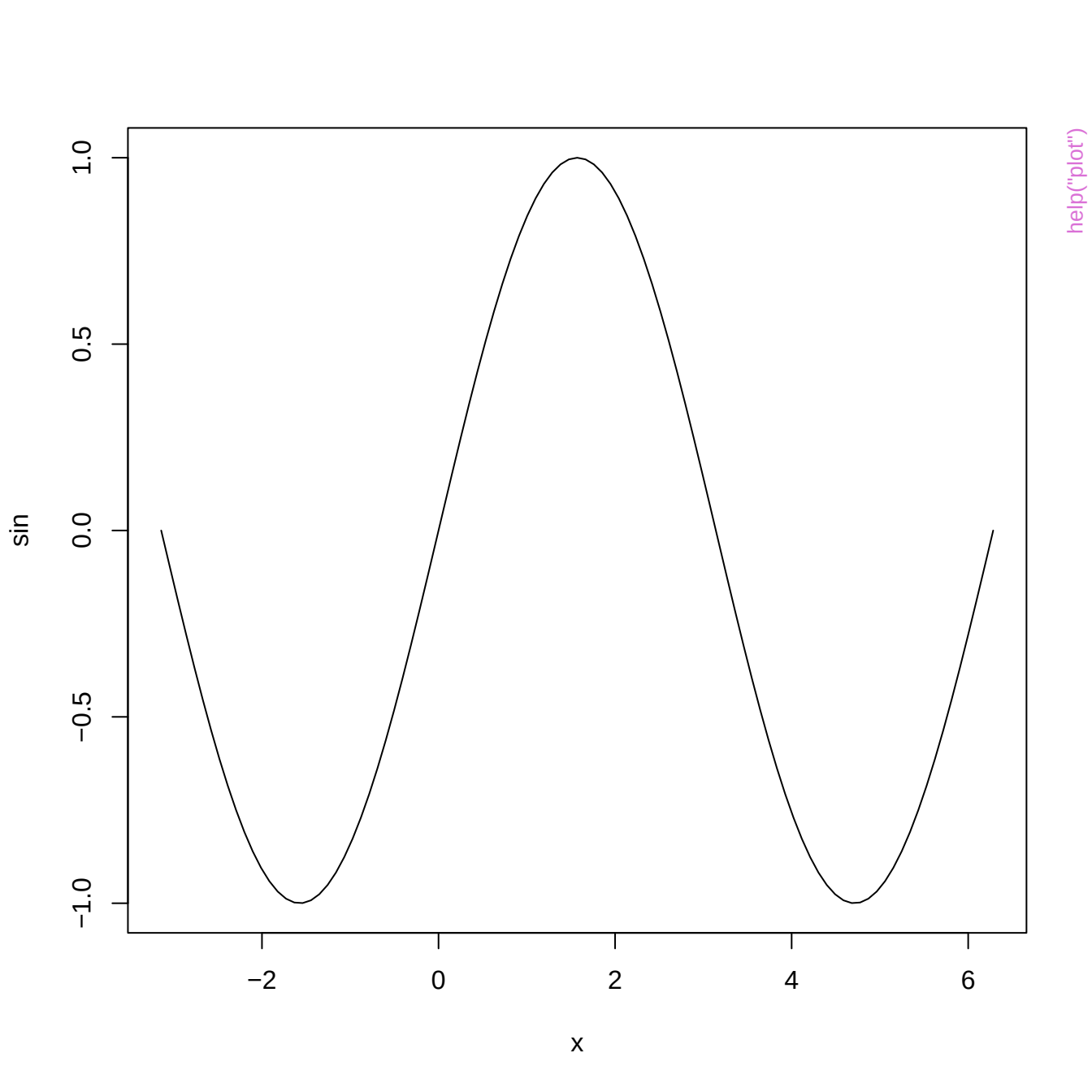
help("list")

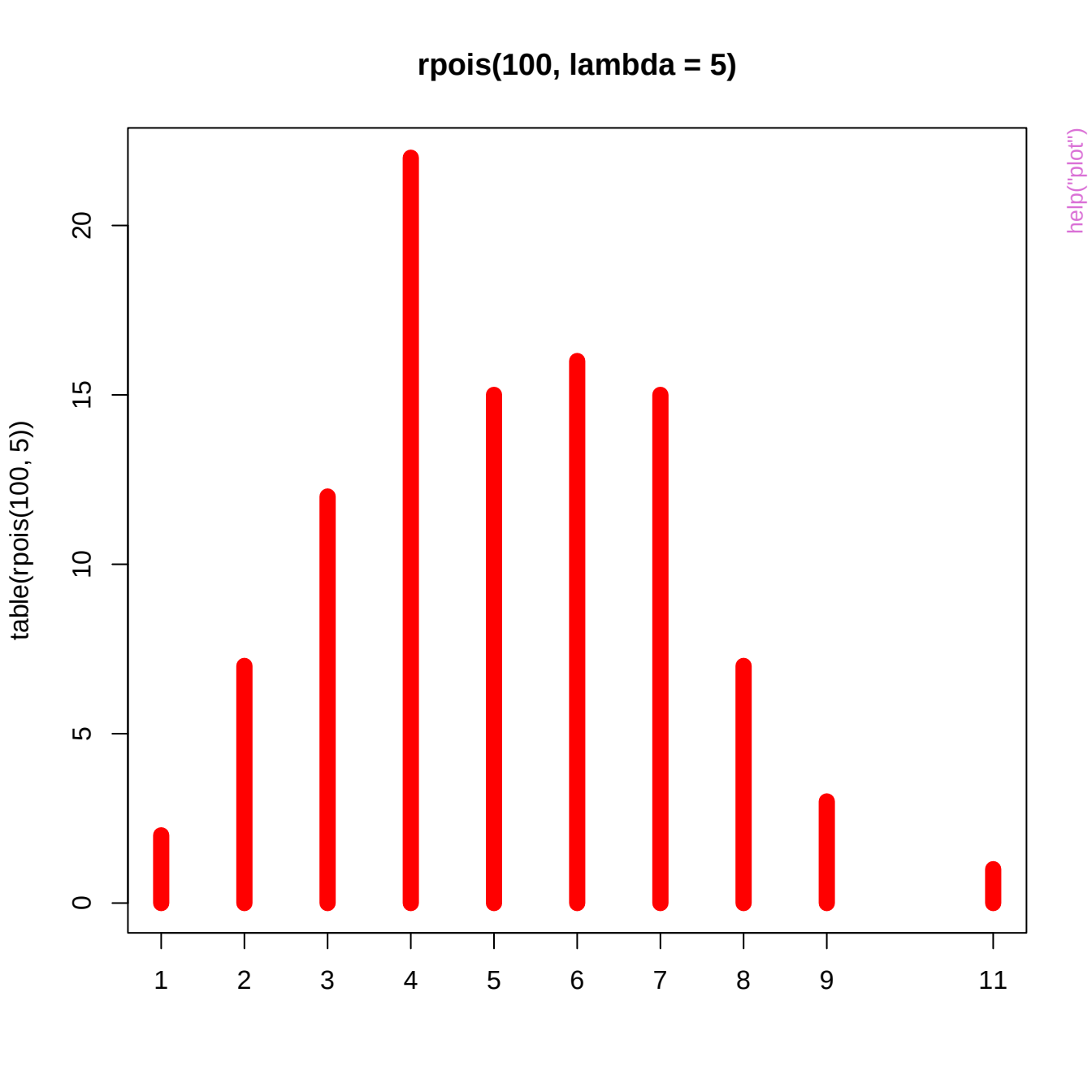


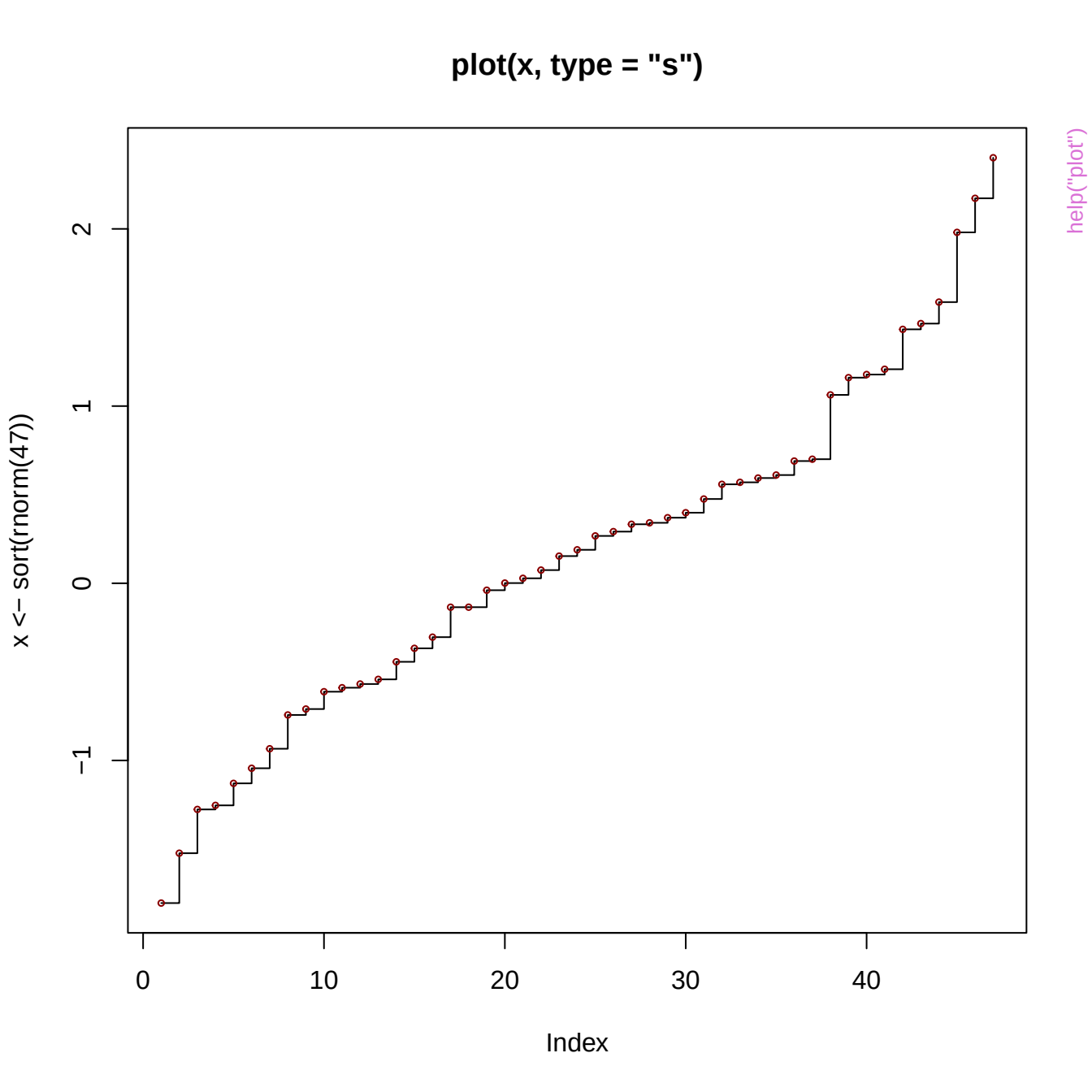
help("notyet")

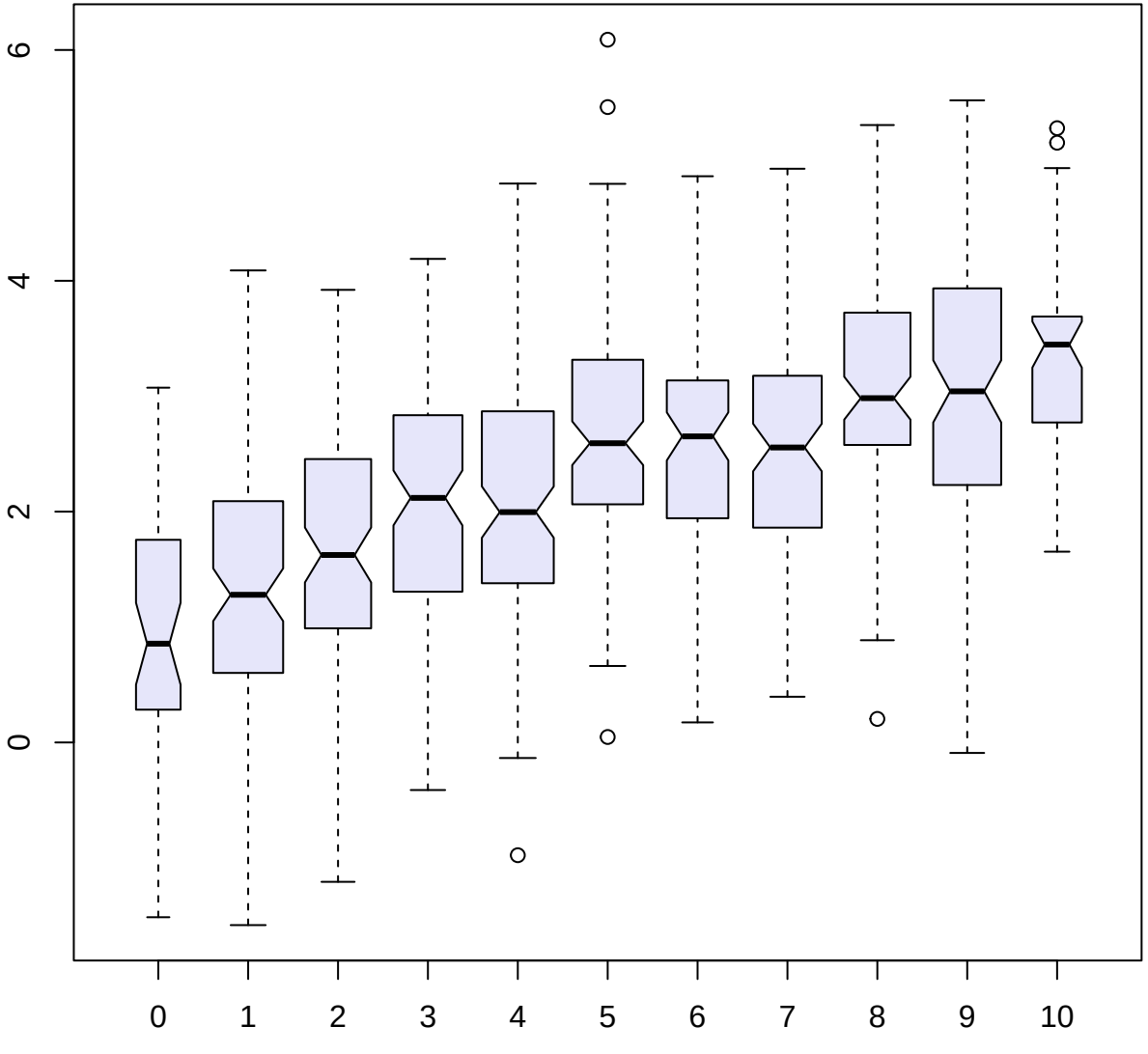

Stopping distance of cars
(ft) vs. speed (mph) from
Ezekiel (1930)
dist
speed
0
20
40
60
80
100
120
5
10
15
20
25
help("paste")


dist
0
20
40
60
80
100
120
5
10
15
20
25
speed
help("plot")

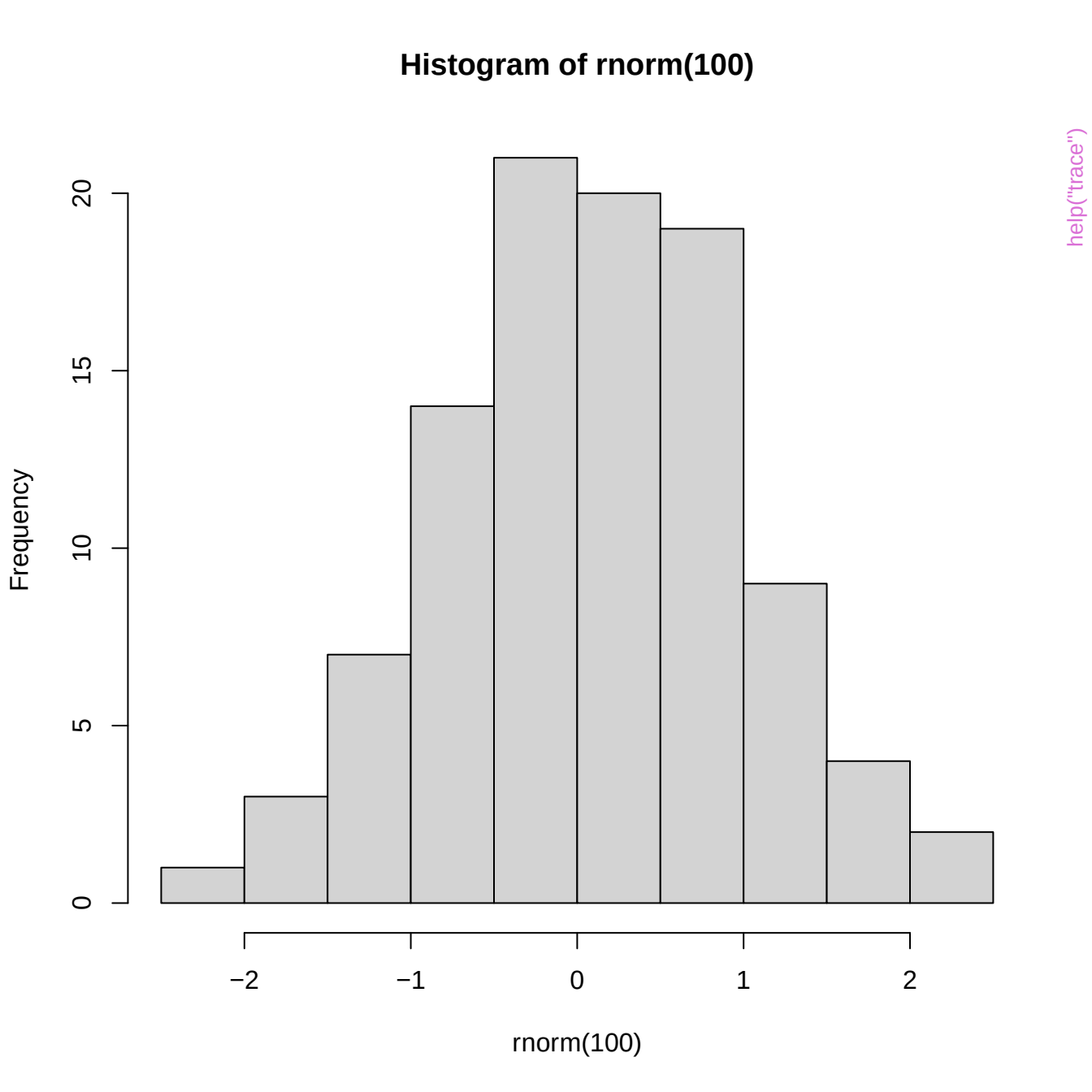

sin
1.0
0.5
0.0
−0.5
−1.0
−2
0
2
4
6
x
help("plot")

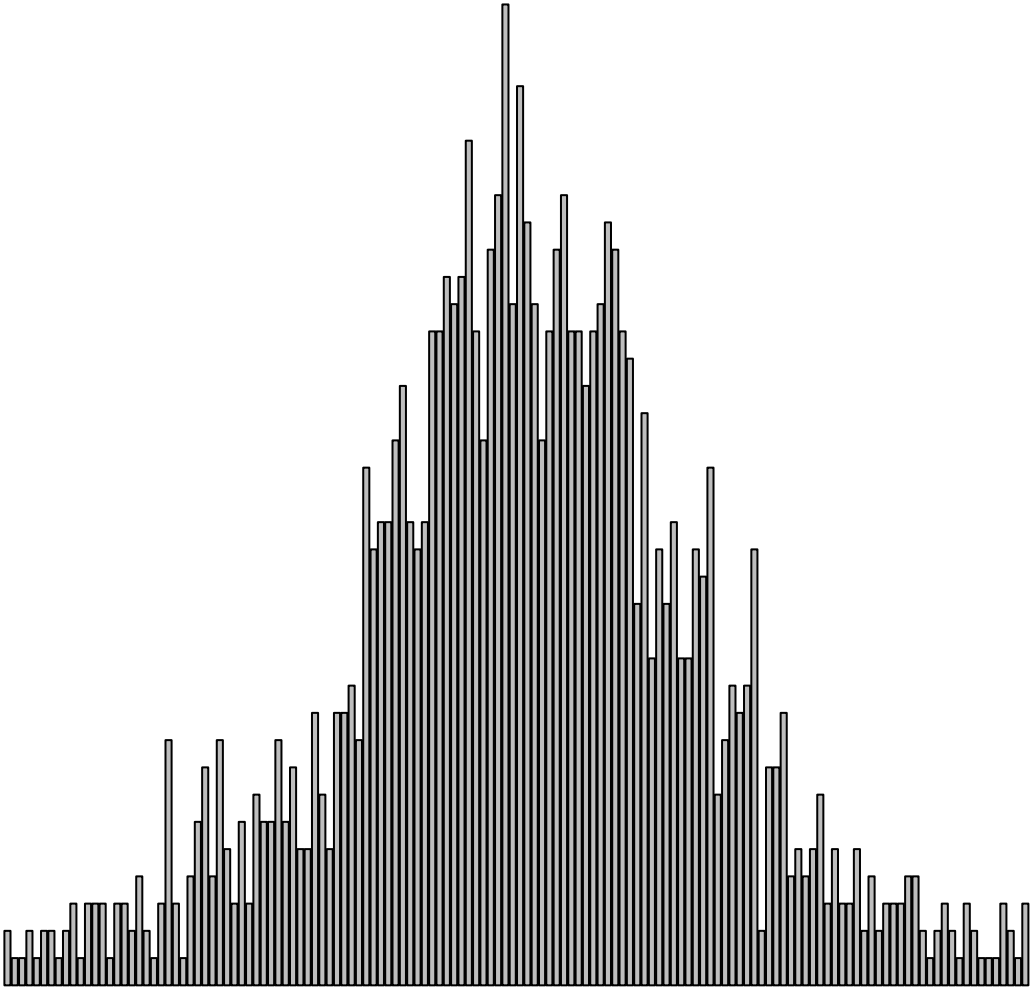

rpois(100, lambda = 5)
table(rpois(100, 5))
0
5
10
15
20
1
2
3
4
5
6
7
8
9
11
help("plot")


plot(x, type = "s")
x <- sort(rnorm(47))
help("plot")
Index
0
10
20
30
40
−1
0
1
2

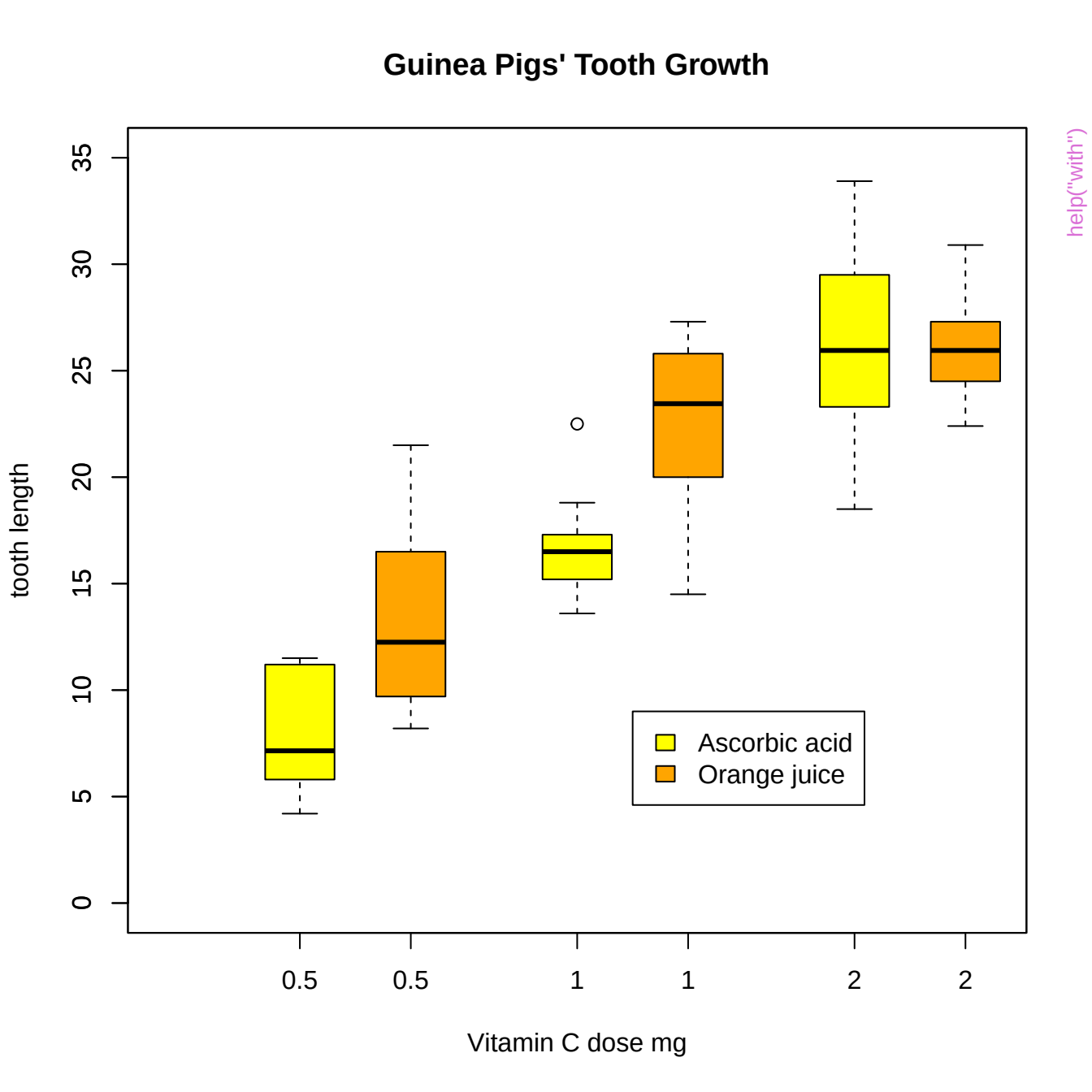


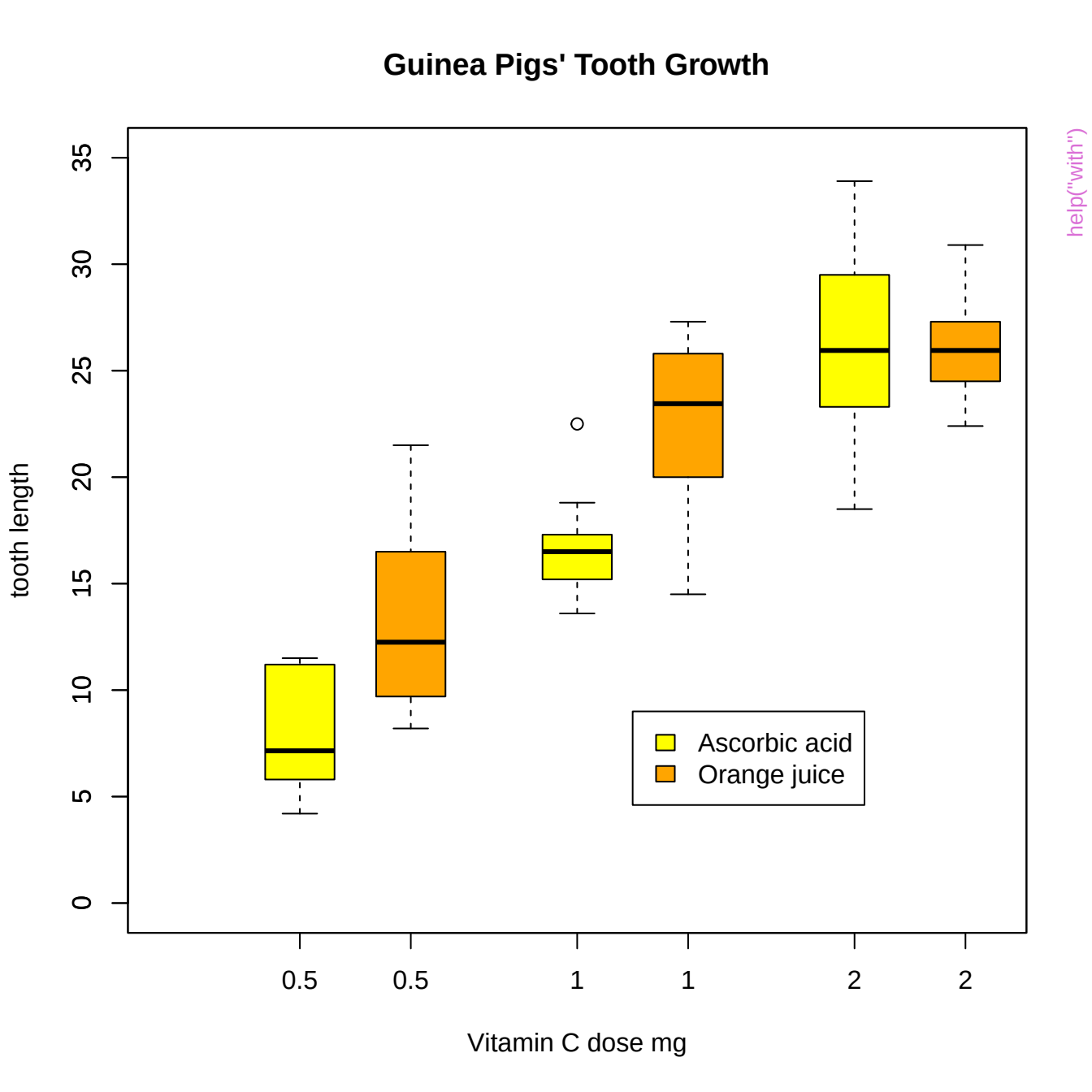
help("split")


Histogram of rnorm(100)
Frequency
0
5
10
15
20
−2
−1
0
1
2
rnorm(100)
help("trace")



help("unname")


Guinea Pigs' Tooth Growth
tooth length
0
5
10
15
20
25
30
35
0.5
0.5
1
1
2
2
Vitamin C dose mg
Ascorbic acid
Orange juice
help("with")


Guinea Pigs' Tooth Growth
tooth length
0
5
10
15
20
25
30
35
0.5
0.5
1
1
2
2
Vitamin C dose mg
Ascorbic acid
Orange juice
help("with")