## Operators

### Arithmetic

| | |
|---|---|
| + | Addition |
| - | Subtraction, sign |
| * | Multiplication |
| / | Division |
| ^ | Raise to power (exponentiation) |
| %/% | Integer division |
| %% | Remainder from integer division |

### Logical and relational

| | |
|---|---|
| == | Equal to |
| See Help > FAQ on R question 7.31 for more on "==" | |
| != | Not equal to |
| < | Less than |
| > | Greater than |
| <= | Less than or equal to |
| >= | Greater than or equal to |
| is.na(x) | Missing data? |
| & | Element-wise AND |
| \| | Element-wise OR |
| ! | Logical NOT |

## Vectors and data types

### Generating

| | |
|---|---|
| numeric(5) | 5 zeros |
| character(5) | 5 spaces |
| logical(5) | 5 x FALSE |
| seq(-2,2,0.5) | Sequence -2.0, -1.5,…, 1.5, 2.0 |
| 2:6 | 2, 3, 4, 5, 6 |
| c(1,3,5,7,11) | Concatenation: 1,3,5,7,11 |
| rep(3, 5) | Repetition: 3,3,3,3,3 |
| gl(3,2,12) | Factor length 12, with 3 levels, in pairs: 1,1,2,2,3,3,1,1,2,2,3,3 |

### Coercion / conversion

| | |
|---|---|
| as.numeric(x) | Convert to numeric |
| as.character(x) | Convert to a character string |
| as.logical(x) | Convert to logical |
| factor(x) | Create a factor from vector x |
| round(x,n) | Round to n decimal places |
| floor, ceiling | Round down or up to integer |

### Data frames

| | |
|---|---|
| data.frame(height, weight) | Data frame with two vectors |
| mydf$var | Column var in data frame mydf |
| attach(mydf) | Put data frame into the search path, so R can 'see' the columns |
| detach() | Remove last data frame from path |

## Numerical functions

### Mathematical

| | |
|---|---|
| log(x) | Natural log of x (base *e*) |
| log10(x) | Base-10 logarithm |
| exp(x) | $e^x$ |
| sin(x), cos(x), tan(x) | Sine, Cosine, Tangent |
| asin(x), acos(x), atan(x) | Arcsin (inverse sine), etc |
| min(x), max(x) | Smallest/largest value in x |
| range(x) | Smallest and largest values |
| pmin(x1,x2,x3,…), pmax(xq,x2,x3,…) | Element-wise minimum/ maximum of vectors |
| length(x) | Number of elements in vector |
| sqrt(x) | Square root of x |
| abs(x) | Absolute value of x (ignores sign) |

### Statistical

| | |
|---|---|
| mean(x) | Arithmetic mean |
| sd(x) | Sample standard deviation |
| var(x) | Sample variance |
| median(x) | Median |
| quantile(x, p) | Quantiles |
| cor(x,y) | Correlation |

## Indexing

### Vectors

| | |
|---|---|
| x[2] | Second element of x |
| x[2:6] | Elements 2 to 6 of x |
| x[-(2:6)] | All elements except 2 to 6 |
| L <- y < 20 ; x[L] x[y < 20] | Elements of x which correspond to elements of y < 20 |

### Matrices and data frames

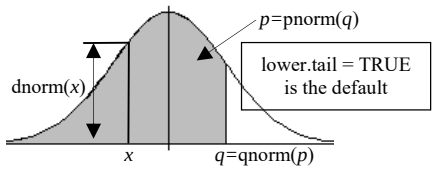
| | |
|---|---|
| m[4,] | Fourth row |
| m[,5] | Fifth column |
| mydf[mydf$y < 20,] subset(mydf, y<20) | Partial data frame, only with rows where y < 20 |

## Data input/output

| | |
|---|---|
| read.table("fn") | Read data from file named "fn" |
| read.csv("fn") | Comma separated data |
| read.delim("fn") | Tab separated data |
| write.table(x,"fn") write.csv(x,"fn") | Write data frame x to "fn" as space or comma delimited text. |
| save(x, "fn") load("fn") | Save/load x to a .Rdata file |

## Statistical distributions

### Normal distribution




| | |
|---|---|
| dnorm(x, mean, sd) | Density |
| pnorm(x,mean, sd) | Cumulative distribution |
| qnorm(p, mean, sd) | x value corresponding to p |
| rnorm(n, mean, sd) | n random values |

### Other distributions (all have d- q- and r- variants)

| | |
|---|---|
| plnorm(…) | Lognormal |
| pt(…) | Student's t |
| pf(…) | F distribution |
| pchisq(…) | Chi-squared distribution |
| pbinom(…) | Binomial distribution |
| ppois(…) | Poisson distribution |
| punif(…) | Uniform distribution |
| pexp(…) | Exponential distribution |
| pgamma(…) | Gamma distribution |
| pbeta(…) | Beta distribution |

See help pages for details

## Statistical tests

| | |
|---|---|
| t.test | t test (1 or 2 samples) |
| pairwise.t.test | Pairwise comparisons |
| wilcox.test | Wilcoxon test |
| kruskal.test | Kruskal-Wallis test |
| binom.test | Binomial test / sign test |
| prop.test | Comparison of proportions |
| fisher.test | Exact test in small tables |
| chisq.test | Chi-squared test |

## Linear models

| | |
|---|---|
| lm.o <- lm(y ~ x) | Fit linear model |
| summary(lm.o) | Basic output of lm |
| anova(lm.o) | ANOVA table |
| fitted(lm.o) | Fitted values |
| resid(lm.o) | Residuals |
| coef(lm.o) | Coefficients |
| update(lm.o, …) | Modify the model and fit again |
| confint(lm.o) | Confidence intervals |

## Graphics

### Standard plots

| | |
|---|---|
| plot() | Scatterplot, or whatever is appropriate for the data type |
| hist() | histogram |
| boxplot() | Box-and-whiskers plot |
| stripchart() | Strip chart |
| barplot() | Bar diagram |
| dotchart() | Dot diagram |
| pairs(mydf) | scatterplot matrix |
| stem() | Stem-and-leaf plot |
| curve() | plot of a function |

### Adding elements to plots

| | |
|---|---|
| lines() | Add lines |
| abline() | Horizontal, vertical or sloping straight lines |
| points() | Add points |
| segments() | Add line segments |
| legend() | Add a legend |
| text() | Add text in plot |
| mtext() | Add text in the margin |
| rug() | Add a floor covering |

### Common graphical parameters

| | |
|---|---|
| type | Plot type (points, lines, etc) |
| pch | Plotting character (see below) |
| lty, lwd | Line type, line width |
| col | Colour |
| ?plot.default, ?par | Help on graphical parameters |
| ?plotmath | Help on labels for graphics |

**plot symbols**