

# Exercise Sheet: Base R Concepts

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This exercise sheet is designed to help you understand the key concepts that are essential to learning and using R. The key requirement is to have R installed. Follow the instructions below to learn more. Have fun!

**Be Brave and Experiment.** Making mistakes and experimenting is an essential part of learning R. You can recover from most mistakes (e.g. by restarting R). To do this “safely” start with a *fresh* R session without any other data loaded (otherwise you could lose it).

**Start R.** Double click in the R (or RStudio) icon to start it.

**Warning.** If an R command is not complete then R will show a plus sign (+) prompt on second and subsequent lines until the command syntax is correct.

```
+
```

To break out this, press the escape key (ESC).

**Exercises: The following are exercises for you try with R..**

## 1. Assign Values to an Object

**Assign numbers to objects:.**

```
year <- 1995
cases <- 523
year
cases
```

**Assign characters to objects:.**

```
country <- "Portugal"
country
```

**Warning: R is case sensitive.**

```
city <- "Coimbra"
CITY <- "Porto"
city
CITY
```

## 2. R as a Calculator

**You can use R as a basic calculator.**

```
72 + (34*51 - 4982)/(18*45)
sqrt(81)
9**2
```

**Trigonometric and logarithmic functions.**

```
# pi is a stored value
pi
sin(pi/3)
tan(pi/3)
log10(1000)
log(5.2)
exp(1)
```

**Rounding & combining.**

```
signif(1512337, 2)
round(16.15643, 2)
round(exp(sqrt(log(514))), 2)
```

## 3. Some More R Concepts

You can do some clever and useful things with using the assignment operator <-:

```
price <- 412.65
tax <- 94.91
total <- price + tax
total
```

**Vectors.** The objects presented so far have all been scalars (single values). Working with vectors is where R shines best as they are the basic building blocks of datasets. To create a vector we can use the `c()` (combine values into a vector) function.

```
vYear <- c(1995, 2000, 2005, 2010, 2015)
vCases <- c(523, 489, 511, 472, 439)
vCountry <- rep("Portugal", 5)
vYear
vCases
vCountry
```

**Vector operations.**

```
# Calculate the total by adding the tax to net
net <- c(108.99, 291.42, 16.28, 62.29, 31.77)
tax <- c(22.89, 17.49, 0.98, 13.08, 6.67)
total <- net + tax
total

# Convert from degrees centigrade to fahrenheit
tempC <- seq(-40, 40, 10)
tempF <- (9*tempC)/5 + 32
tempC
tempF
```

**Missing Values.** Missing values are coded as NA in R.

```
height <- c(NA, 1.73, 1.53, 1.67, 1.66, 1.81)
weight <- c(63, 70, 95, 63, NA, 77)
bmi <- weight/(height**2)
height
weight
round(bmi, 1)
```

**Comments.** It is useful to put human readable comments in your programs. These comments could help the future you when you go back to your program. R comments start with a hash sign (#). Everything after the hash to the end of the line will be ignored by R.

```
# This comment line will be ignored when run.
weight # Weight in kg
height # Height in metres
```

```
# bmi - Body Mass Index
signif(bmi, 3)
```

**Managing Objects.** Use function `ls()` to list the objects in your workspace. The `rm()` function removes (deletes) them.

```
ls()
rm(cases, city, CITY, country, year, tempF, tempC)
ls()
```

**R Functions.** What do the following functions do?

```
myNums <- c(454, 939, 740, 701, 394, 79, 30)
sort(myNums)
sort(myNums, decreasing = TRUE)
rank(myNums)
rev(myNums)
```

```
# With missing values
naNums <- c(105, 81, 17, NA, 52, 394)
mean(naNums)
mean(naNums, na.rm = TRUE)
sd(naNums, na.rm = TRUE)
```

**The useful `summary()` function.**

```
summary(naNums)
```

**Pasting text and numbers.**

```
Names <- c("Leo", "Iris")
Age <- c(4, 5)
Text <- paste0(Names, " is ", Age, " years old,")
Text
toupper(Text)
tolower(Text)
```

## 4. Additional Materials

**Selecting elements from a vector.**

```
colour <- c("red", "blue", "pink", "cyan", "gray")
colour[4]
colour[3:5]
colour[c(5, 1, 3)]
```

**Evaluating logical expressions.**

```
xscale <- c(7, 10, 9, 6, 1, 8, 2)
xscale > 8
xscale[xscale > 8 | xscale <= 2]
```

## 5. Summary

With these exercises you now have the building blocks to learn more.

**Acknowledgments.** The R project (<https://www.r-project.org>) for a great product.