

➔ Q1

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains R code for creating and printing variables `a`, `b`, and `c`.
- Console:** Displays the output of the R script, showing the class of each variable and the values of `a`, `b`, and `c`.
- Environment:** Shows the current environment with variables `a`, `b`, and `c` and their values.
- Files:** Shows the file explorer with a list of files and folders.
- Plots:** Shows the plot viewer.
- Packages:** Shows the installed and available packages.
- Help:** Shows the help viewer.
- Viewer:** Shows the viewer pane.
- Presentation:** Shows the presentation pane.

Source Code:

```
1 a = (c(1,2,3))
2 b = (c("x","y","z"))
3 c = (c(T,F,T))
4 print(a)
5 print(class(a))
6
7 print(b)
8 print(class(b))
9
10 print(c)
11 print(class(c))
```

Console Output:

```
R 4.2.2 ~ /
> print(class(c))
[1] "character"
> a = (c(1,2,3))
> b = (c("x","y","z"))
> c = (c(T,F,T))
> print(a)
[1] 1 2 3
> print(class(a))
[1] "numeric"
>
> print(b)
[1] "x" "y" "z"
> print(class(b))
[1] "character"
>
> print(c)
[1] TRUE FALSE TRUE
> print(class(c))
[1] "logical"
> |
```

Environment:

Variable	Value
a	num [1:3] 1 2 3
b	chr [1:3] "x" "y" "z"
c	logi [1:3] TRUE FALSE TRUE

Files:

Name	Description	Version
base	The R Base Package	4.2.2
boot	Bootstrap Functions (Originally by Angelo Canty for S)	1.3-28
class	Functions for Classification	7.3-20
cluster	"Finding Groups in Data": Cluster Analysis Extended Rousseeuw et al.	2.1.4
codetools	Code Analysis Tools for R	0.2-18
compiler	The R Compiler Package	4.2.2
datasets	The R Datasets Package	4.2.2
foreign	Read Data Stored by 'Minitab', 'S', 'SAS', 'SPSS', 'Stata', 'Systat', 'Weka', 'dBase', ...	0.8-83
graphics	The R Graphics Package	4.2.2
grDevices	The R Graphics Devices and Support for Colours and Fonts	4.2.2
grid	The Grid Graphics Package	4.2.2
kernelSmooth	Functions for Kernel Smoothing Supporting Wand & Jones (1995)	2.23-20
lattice	Trellis Graphics for R	0.20-45
MASS	Support Functions and Datasets for Venables and Ripley's MASS	7.3-58.1
Matrix	Sparse and Dense Matrix Classes and Methods	1.5-1
methods	Formal Methods and Classes	4.2.2
mgcv	Mixed GAM Computation Vehicle with Automatic Smoothness Estimation	1.8-41
nls	Linear and Nonlinear Mixed Effects Models	3.1-180
nnet	Feed-Forward Neural Networks and Multinomial Log-Linear Models	7.3-18
parallel	Support for Parallel computation in R	4.2.2
rpart	Recursive Partitioning and Regression Trees	4.1-19
spatial	Functions for Kriging and Point Pattern Analysis	7.3-15

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Source Code:

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2 b = (c("x","y","z"))
3 c = (c(T,F,T))
4 print(a)
5 print(class(a))
6
7 print(b)
8 print(class(b))
9
10 print(c)
11 print(class(c))
```

Console Output:

```
R 4.2.2 ~ /
> print(class(c))
[1] "character"
> a = (c(1,2,3))
> b = (c("x","y","z"))
> c = (c(T,F,T))
> print(a)
[1] 1 2 3
> print(class(a))
[1] "numeric"
>
> print(b)
[1] "x" "y" "z"
> print(class(b))
[1] "character"
>
> print(c)
[1] TRUE FALSE TRUE
> print(class(c))
[1] "logical"
> |
```

Environment:

Variable	Value
a	num [1:3] 1 2 3
b	chr [1:3] "x" "y" "z"
c	logi [1:3] TRUE FALSE TRUE

Files:

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nls	Linear and Nonlinear Mixed Effects Models	3.1-180
nnet	Feed-Forward Neural Networks and Multinomial Log-Linear Models	7.3-18
parallel	Support for Parallel computation in R	4.2.2
rpart	Recursive Partitioning and Regression Trees	4.1-19
spatial	Functions for Kriging and Point Pattern Analysis	7.3-15

➔ Q2

```
m = matrix(c(1:20), nrow = 4, ncol = 5, byrow = T)
rownames(m) = c("a", "b", "c", "d")
colnames(m) = c("e", "f", "g", "h", "i")
m
```

```
n = matrix(c(21:26), nrow = 3, ncol = 2, byrow = T)
rownames(n) = c("x", "y", "z")
colnames(n) = c("j", "k")
n
```

```
p = matrix(c(55:58), nrow = 2, ncol = 2, byrow = T)
rownames(p) = c("aa", "bb")
colnames(p) = c("cc", "dd")
p
```

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains the R script code for creating matrices m, n, and p.
- Console:** Shows the execution output, including the dimensions and values of the matrices.
- Environment Pane:** Displays the objects in the global environment, including the matrices m, n, and p.
- Files Pane:** Shows the project files and folders.
- Plots Pane:** Displays any plots generated by the script.
- Packages Pane:** Lists the installed and available R packages.

Console Output:

```
R 4.2.2 > 
c 11 12 13 14 15
d 16 17 18 19 20
> 
> n = matrix(c(21:26), nrow = 3, ncol = 2, byrow = T)
> rownames(n) = c("x", "y", "z")
> colnames(n) = c("j", "k")
> n
      j k
x 21 22
y 23 24
z 25 26
> 
> p = matrix(c(55:58), nrow = 2, ncol = 2, byrow = T)
> rownames(p) = c("aa", "bb")
> colnames(p) = c("cc", "dd")
> p
      cc dd
aa 55 56
bb 57 58
> 
```

Environment Pane:

Object	Class	Attributes
m	matrix	int [1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
n	matrix	int [1:3, 1:2] 21 23 25 22 24 26
p	matrix	int [1:2, 1:2] 55 57 56 58

Files Pane:

Name	Description	Version
base	The R Base Package	4.2.2
boot	Bootstrap Functions (Originally by Angelo Canty for S)	1.3-28
class	Functions for Classification	7.3-20
cluster	"Finding Groups in Data": Cluster Analysis Extended Rousseeuw et al.	2.1.4
codetools	Code Analysis Tools for R	0.2-18
compiler	The R Compiler Package	4.2.2
datasets	The R Datasets Package	4.2.2
foreign	Read Data Stored by 'minitab', 'S', 'SAS', 'SPSS', 'Stata', 'Syntac', 'Weka', 'dBase', ...	0.8-83
graphics	The R Graphics Package	4.2.2
grDevices	The R Graphics Devices and Support for Colours and Fonts	4.2.2
grid	The Grid Graphics Package	4.2.2
krnamsmooth	Functions for Kernel Smoothing Supporting Wand & Jones (1995)	2.23-20
lattice	Trellis Graphics for R	0.20-45
MASS	Support Functions and Datasets for Venables and Ripley's MASS	7.3-58.1
Matrix	Sparse and Dense Matrix Classes and Methods	1.5-1
methods	Formal Methods and Classes	4.2.2
mgcv	Mixed GAM Computation Vehicle with Automatic Smoothness Estimation	1.8-41
nlme	Linear and Nonlinear Mixed Effects Models	3.1-160
nnet	Feed-Forward Neural Networks and Multinomial Log-Linear Models	7.3-18
parallel	Support for Parallel computation in R	4.2.2
rpart	Recursive Partitioning and Regression Trees	4.1-19
spatial	Functions for Kriging and Point Pattern Analysis	7.3-15

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains R code for creating matrices `m`, `n`, and `p` with row and column names.
- Console:** Displays the output of the executed code, showing the structure and content of the matrices.
- Environment:** Lists the objects in the global environment: `m` (integer matrix), `n` (integer matrix), `p` (integer matrix), `a` (numeric vector), `b` (character vector), and `c` (logical vector).
- Files:** Shows the project files and the R script being edited.
- Plots:** Empty panel for visualizing data.
- Packages:** Lists installed and available R packages, including the base package and various data analysis tools.

This screenshot is similar to the first one, showing the RStudio interface with the same R code and environment. The console output is slightly different, reflecting the execution of the code in this session.

➔ Q3

RStudio interface showing a script with the following code:

```
1 V = c(1:10)
2 print(V)
3
4 print("sum is :")
5 print(sum(V))
6
7 print("mean is :")
8 print(mean(V))
9
10 print("Product is :")
11 print(prod(V))
```

The console output is:

```
R 4.2.2 ~ /
[1] 2.432902e+18
> V = c(1:10)
> print(V)
[1] 1 2 3 4 5 6 7 8 9 10
>
> print("sum is :")
[1] "sum is : "
> print(sum(V))
[1] 55
>
> print("mean is :")
[1] "mean is : "
> print(mean(V))
[1] 5.5
>
> print("Product is :")
[1] "Product is : "
> print(prod(V))
[1] 3628800
>
```

The Environment pane shows the following objects:

Object	Class	Attributes
m	int	[1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
n	int	[1:3, 1:2] 21 23 25 22 24 26
p	int	[1:2, 1:2] 55 57 56 58
a	num	[1:3] 1 2 3
b	chr	[1:3] "x" "y" "z"
c	logi	[1:3] TRUE FALSE TRUE
V	int	[1:10] 1 2 3 4 5 6 7 8 9 10

The Packages pane shows the following installed packages:

Package	Version
base	4.2.2
boot	1.3-28
class	7.3-20
cluster	2.14
codetools	0.2-18
compiler	4.2.2
datasets	4.2.2
foreign	0.8-83
graphics	4.2.2
grDevices	4.2.2
grid	4.2.2
kernsmooth	2.23-20
lattice	0.20-45
MASS	7.3-58.1
Matrix	1.5-1
methods	4.2.2
mgcv	1.8-41
nime	3.1-160
nnet	7.3-18
parallel	4.2.2
rpart	4.1-19
spatial	7.3-15

RStudio interface showing a script with the following code:

```
1 V = c(1:20)
2 print(V)
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4 print("sum is :")
5 print(sum(V))
6
7 print("mean is :")
8 print(mean(V))
9
10 print("Product is :")
11 print(prod(V))
```

The console output is:

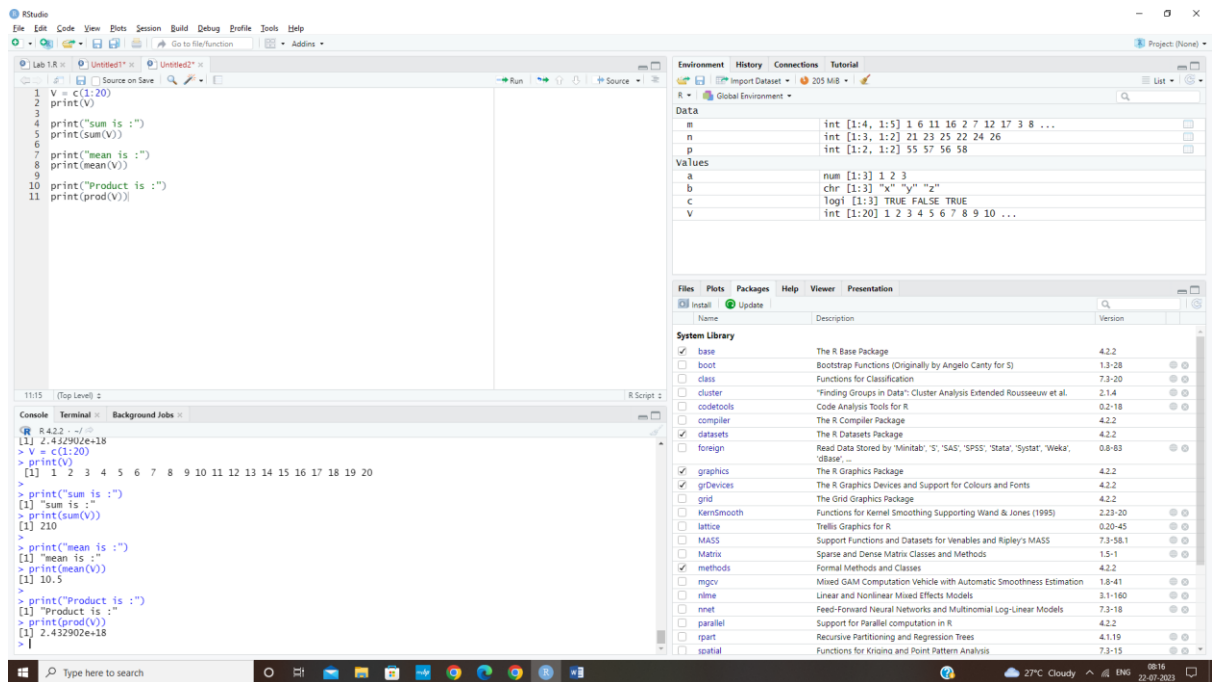
```
R 4.2.2 ~ /
[1] 2.432902e+18
> V = c(1:20)
> print(V)
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
>
> print("sum is :")
[1] "sum is : "
> print(sum(V))
[1] 210
>
> print("mean is :")
[1] "mean is : "
> print(mean(V))
[1] 10.5
>
> print("Product is :")
[1] "Product is : "
> print(prod(V))
[1] 2.432902e+18
>
```

The Environment pane shows the following objects:

Object	Class	Attributes
m	int	[1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
n	int	[1:3, 1:2] 21 23 25 22 24 26
p	int	[1:2, 1:2] 55 57 56 58
a	num	[1:3] 1 2 3
b	chr	[1:3] "x" "y" "z"
c	logi	[1:3] TRUE FALSE TRUE
V	int	[1:20] 1 2 3 4 5 6 7 8 9 10 ...

The Packages pane shows the following installed packages:

Package	Version
base	4.2.2
boot	1.3-28
class	7.3-20
cluster	2.14
codetools	0.2-18
compiler	4.2.2
datasets	4.2.2
foreign	0.8-83
graphics	4.2.2
grDevices	4.2.2
grid	4.2.2
kernsmooth	2.23-20
lattice	0.20-45
MASS	7.3-58.1
Matrix	1.5-1
methods	4.2.2
mgcv	1.8-41
nime	3.1-160
nnet	7.3-18
parallel	4.2.2
rpart	4.1-19
spatial	7.3-15



➔ Q4

```

data("iris")
head(iris, 4)
tail(iris)
dim(iris)

```

```

#The names of the columns
names(iris)

```

```

sort(colnames(df))

```

```

#The attributes of the dataframe
attributes(iris)

```

```

#Finally, if you want the descriptive statistics summary
summary(iris)

```

```

#Indexing the first 5 rows
iris[1:5,]

```

```

#Indexing the first 4 columns
iris[,1:4]

```

```

#If you want to explore the first 10 rows of a particular column, in this case, Sepal length
iris[1:10, "Sepal.Length"]

```

```

#Basic Visualizations with Base R

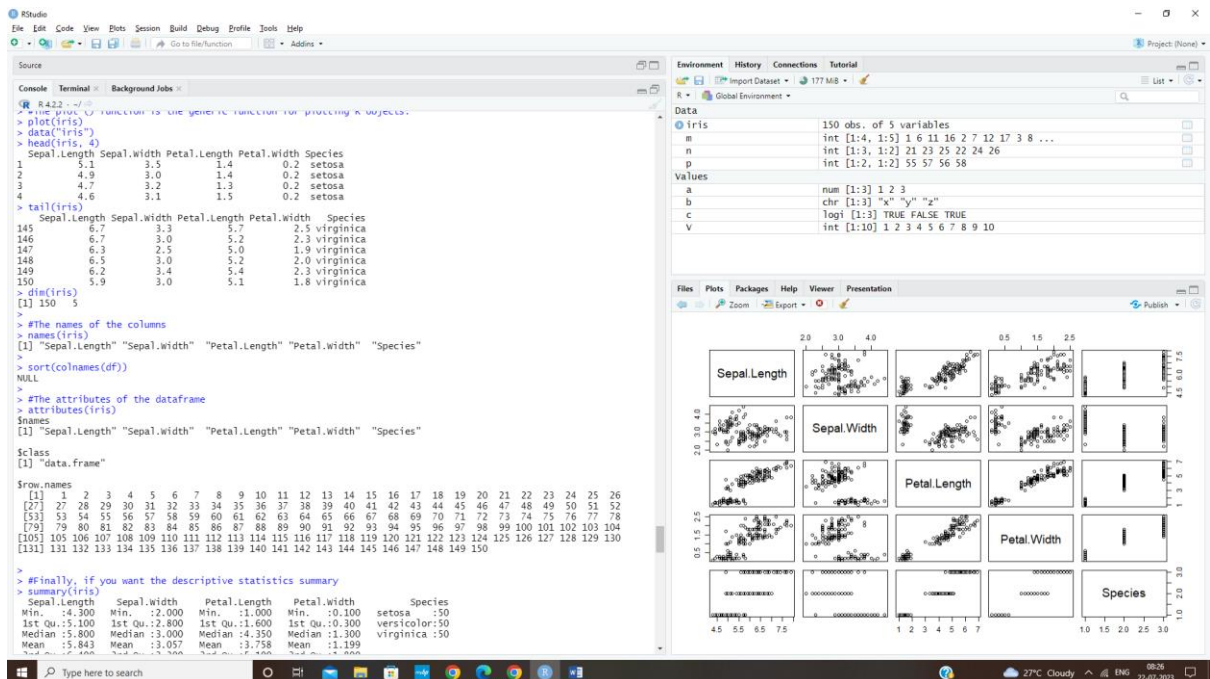
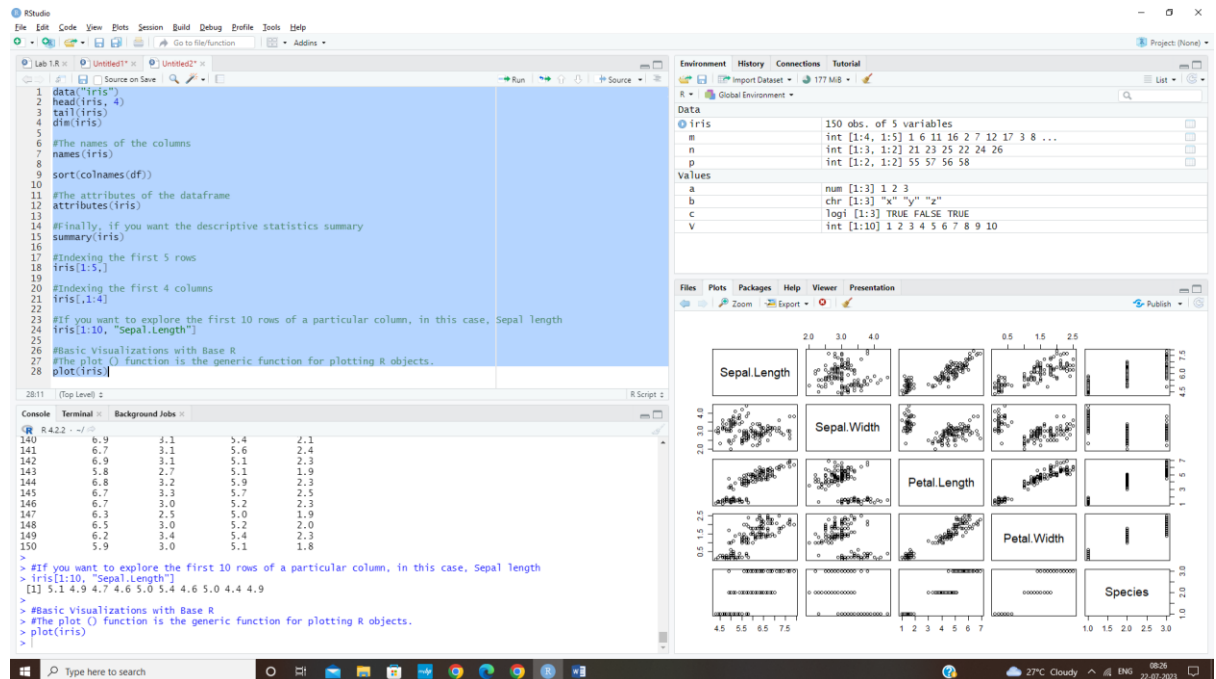
```

```

#The plot () function is the generic function for plotting R objects.

```

plot(iris)



➔ Q5

```
m1 = matrix(c(1, 2, 3, 4, 5, 6), nrow = 2, ncol = 3)
```

```
print("Matrix-1:")
```

```
print(m1)
```

```
m2 = matrix(c(0, 1, 2, 3, 0, 2), nrow = 2, ncol = 3)
```

```
print("Matrix-2:")
```

```
print(m2)
```

```
result = m1 + m2
```

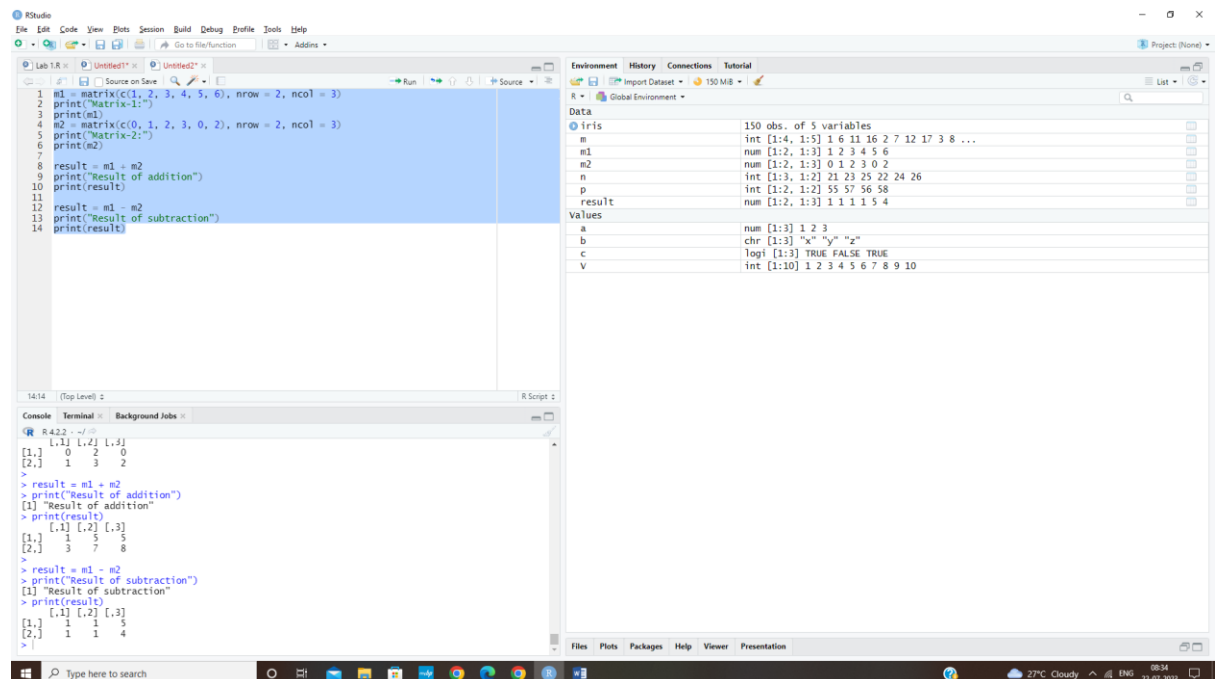
```
print("Result of addition")
```

```
print(result)
```

```
result = m1 - m2
```

```
print("Result of subtraction")
```

```
print(result)
```



The screenshot shows the RStudio interface with a script editor, environment pane, and console. The script defines two matrices, m1 and m2, and performs addition and subtraction. The console shows the output of these operations.

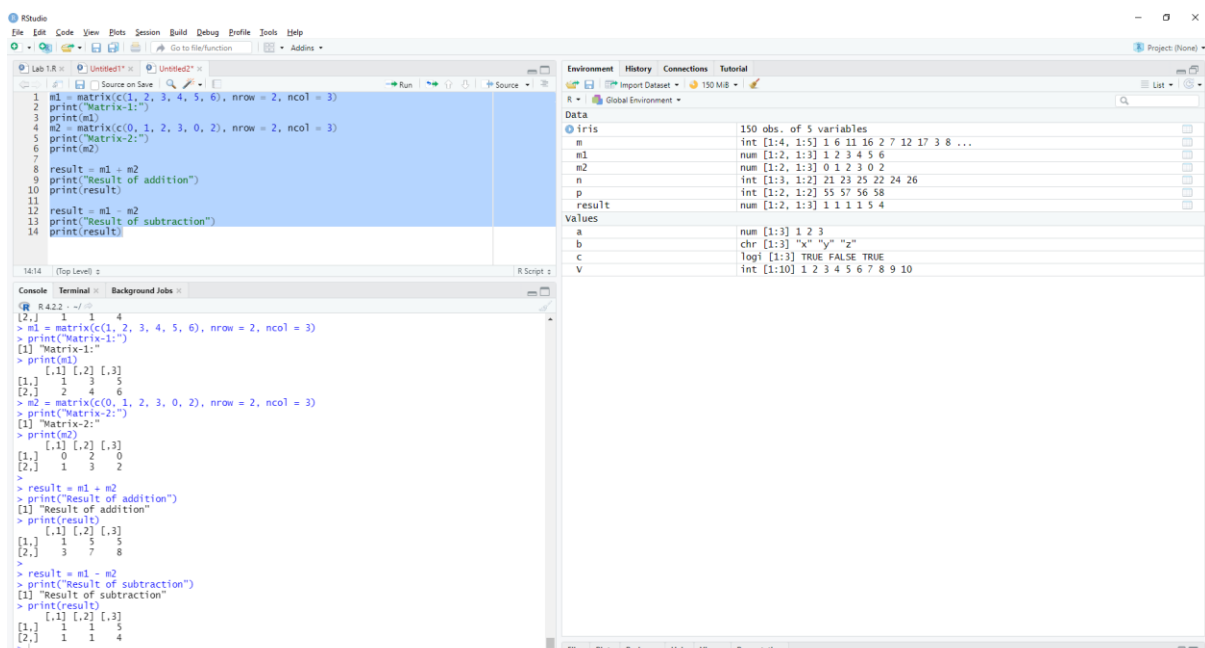
```
1 m1 = matrix(c(1, 2, 3, 4, 5, 6), nrow = 2, ncol = 3)
2 print("Matrix-1:")
3 print(m1)
4 m2 = matrix(c(0, 1, 2, 3, 0, 2), nrow = 2, ncol = 3)
5 print("Matrix-2:")
6 print(m2)
7
8 result = m1 + m2
9 print("Result of addition")
10 print(result)
11
12 result = m1 - m2
13 print("Result of subtraction")
14 print(result)
```

Environment pane:

Object	Class	Attributes
iris	data.frame	150 obs. of 5 variables
m	matrix	int [1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
m1	matrix	num [1:2, 1:3] 1 2 3 4 5 6
m2	matrix	num [1:2, 1:3] 0 1 2 3 0 2
n	matrix	int [1:3, 1:2] 21 23 25 22 24 26
p	matrix	int [1:2, 1:2] 55 57 56 58
result	matrix	num [1:2, 1:3] 1 1 1 5 4

Console:

```
R 4.2.2 - ~/R
> m1 = matrix(c(1, 2, 3, 4, 5, 6), nrow = 2, ncol = 3)
> print("Matrix-1:")
[1,] 1 2 3
[2,] 4 5 6
> m2 = matrix(c(0, 1, 2, 3, 0, 2), nrow = 2, ncol = 3)
> print("Matrix-2:")
[1,] 0 1 2
[2,] 3 0 2
> result = m1 + m2
> print("Result of addition")
[1,] 1 3 5
[2,] 7 5 8
> result = m1 - m2
> print("Result of subtraction")
[1,] 1 1 1
[2,] 1 5 4
```



The screenshot shows the RStudio interface with a script editor, environment pane, and console. The script defines two matrices, m1 and m2, and performs addition and subtraction. The console shows the output of these operations.

```
1 m1 = matrix(c(1, 2, 3, 4, 5, 6), nrow = 2, ncol = 3)
2 print("Matrix-1:")
3 print(m1)
4 m2 = matrix(c(0, 1, 2, 3, 0, 2), nrow = 2, ncol = 3)
5 print("Matrix-2:")
6 print(m2)
7
8 result = m1 + m2
9 print("Result of addition")
10 print(result)
11
12 result = m1 - m2
13 print("Result of subtraction")
14 print(result)
```

Environment pane:

Object	Class	Attributes
iris	data.frame	150 obs. of 5 variables
m	matrix	int [1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
m1	matrix	num [1:2, 1:3] 1 2 3 4 5 6
m2	matrix	num [1:2, 1:3] 0 1 2 3 0 2
n	matrix	int [1:3, 1:2] 21 23 25 22 24 26
p	matrix	int [1:2, 1:2] 55 57 56 58
result	matrix	num [1:2, 1:3] 1 1 1 5 4

Console:

```
R 4.2.2 - ~/R
> m1 = matrix(c(1, 2, 3, 4, 5, 6), nrow = 2, ncol = 3)
> print("Matrix-1:")
[1,] 1 2 3
[2,] 4 5 6
> m2 = matrix(c(0, 1, 2, 3, 0, 2), nrow = 2, ncol = 3)
> print("Matrix-2:")
[1,] 0 1 2
[2,] 3 0 2
> result = m1 + m2
> print("Result of addition")
[1,] 1 3 5
[2,] 7 5 8
> result = m1 - m2
> print("Result of subtraction")
[1,] 1 1 1
[2,] 1 5 4
```


→ Q6

```
list_data = list(c(21,32,11),matrix(c(1,3,5,7,9,11),nrow = 2, ncol = 3),  
                list(c(TRUE, 51.23, 119)))  
print(list_data)
```

```
print("Accessing the second element of list")  
print(list_data[2])
```

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains the R code from the previous blocks.
- Console:** Shows the output of the code execution, including the list structure and the second element of the list.
- Environment:** Displays the objects created in the global environment, including 'iris', 'list_data', 'm1', 'm2', 'n', 'p', and 'result'.

Console Output:

```
R 4.2.2 > list_data = list(c(21,32,11),matrix(c(1,3,5,7,9,11),nrow = 2, ncol = 3),  
+ list(c(TRUE, 51.23, 119)))  
> print(list_data)  
[[1]]  
[1] 21 32 11  
  
[[2]]  
[,1] [,2] [,3]  
[1,] 1 5 9  
[2,] 3 7 11  
  
[[3]]  
[[3]][1]  
[1] 1.00 51.23 119.00  
  
> print("Accessing the second element of list")  
[1] "Accessing the second element of list"  
> print(list_data[2])  
[[1]]  
[,1] [,2] [,3]  
[1,] 1 5 9  
[2,] 3 7 11  
> |
```

Environment:

Object	Class	Attributes
iris	data.frame	150 obs. of 5 variables
list_data	list	List of 3
m1	matrix	int [1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
m2	matrix	num [1:2, 1:3] 0 1 2 3 0 2
n	matrix	int [1:3, 1:2] 21 23 25 22 24 26
p	matrix	int [1:2, 1:2] 55 57 56 58
result	matrix	num [1:2, 1:3] 1 1 1 5 4

RStudio interface showing a script, console, and environment pane.

Script:

```
1 list_data = list(c(21,32,11),matrix(c(1,3,5,7,9,11),nrow = 2, ncol = 3),
2               list(c(TRUE, 51.23, 119)))
3
4 print(list_data)
5 print("Accessing the second element of list")
6 print(list_data[[2]])
```

Console:

```
R 4.2.2 >
> list_data = list(c(21,32,11),matrix(c(1,3,5,7,9,11),nrow = 2, ncol = 3),
+               list(c(TRUE, 51.23, 119)))
> print(list_data)
[[1]]
[1] 21 32 11

[[2]]
[,1] [,2] [,3]
[1,] 1 5 9
[2,] 3 7 11

[[3]]
[[3]][[1]]
[1] 1.00 51.23 119.00

> print("Accessing the second element of list")
[1] "Accessing the second element of list"
> print(list_data[[2]])
[[1]]
[,1] [,2] [,3]
[1,] 1 5 9
[2,] 3 7 11

> |
```

Environment:

Object	Class	Value
iris	data.frame	150 obs. of 5 variables
list_data	list	List of 3
m	matrix	int [1:4, 1:5] 1 6 11 16 2 7 12 17 3 8 ...
m1	matrix	num [1:2, 1:3] 1 2 3 4 5 6
m2	matrix	num [1:2, 1:3] 0 1 2 3 0 2
n	matrix	int [1:3, 1:2] 21 23 25 22 24 26
p	matrix	int [1:2, 1:2] 55 57 56 58
result	matrix	num [1:2, 1:3] 1 1 1 1 5 4
a	numeric	num [1:3] 1 2 3
b	character	chr [1:3] "x" "y" "z"
c	logical	logi [1:3] TRUE FALSE TRUE
v	integer	int [1:10] 1 2 3 4 5 6 7 8 9 10