

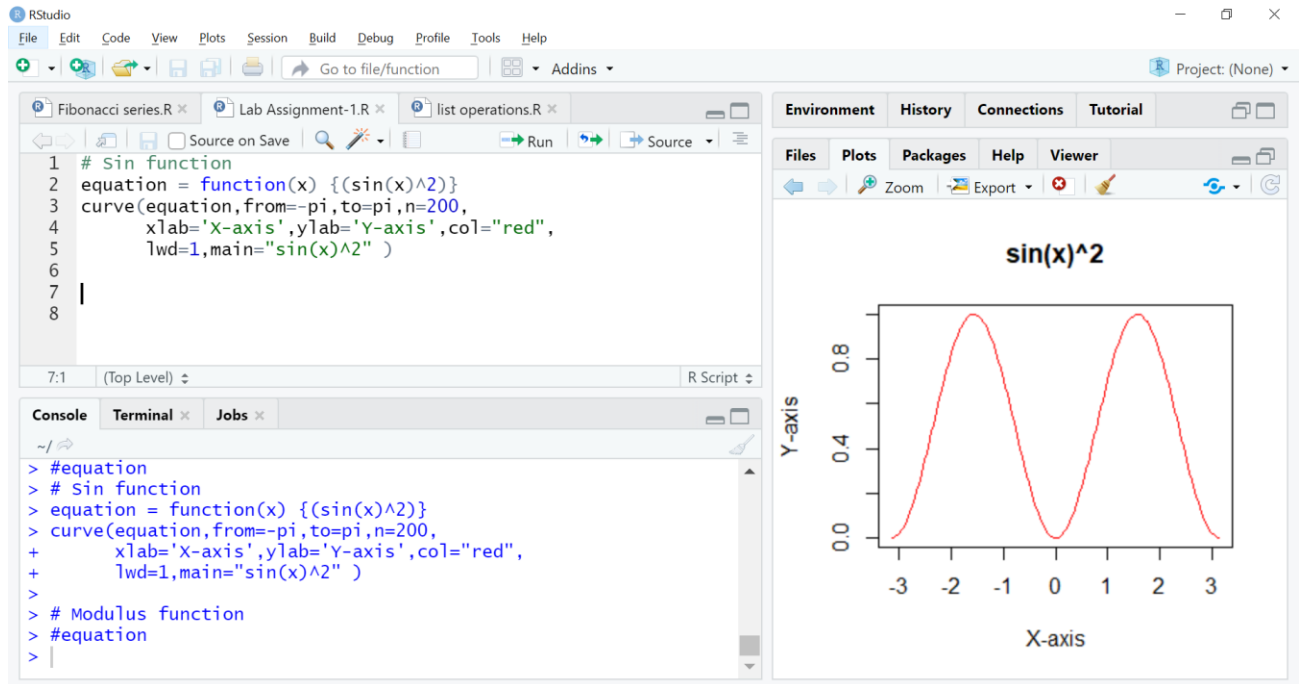
Statistics for Engineers

Lab assessment – 1

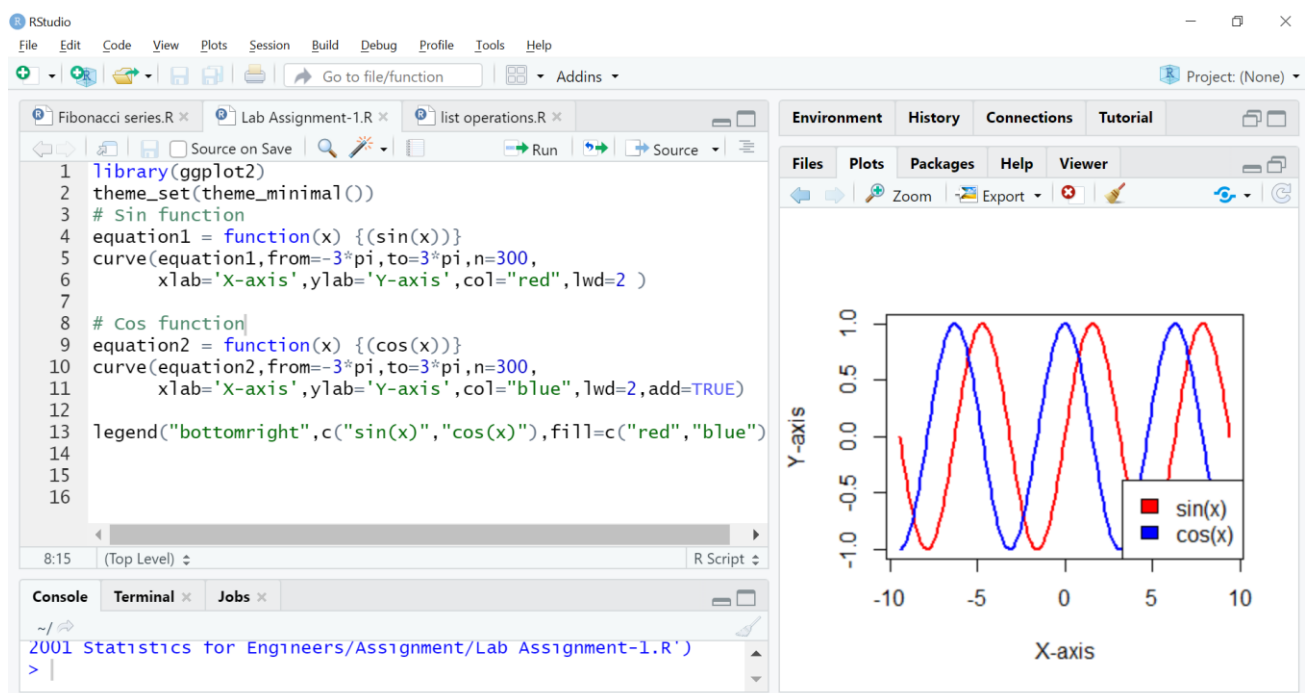
Prashanth.S

19MID0020

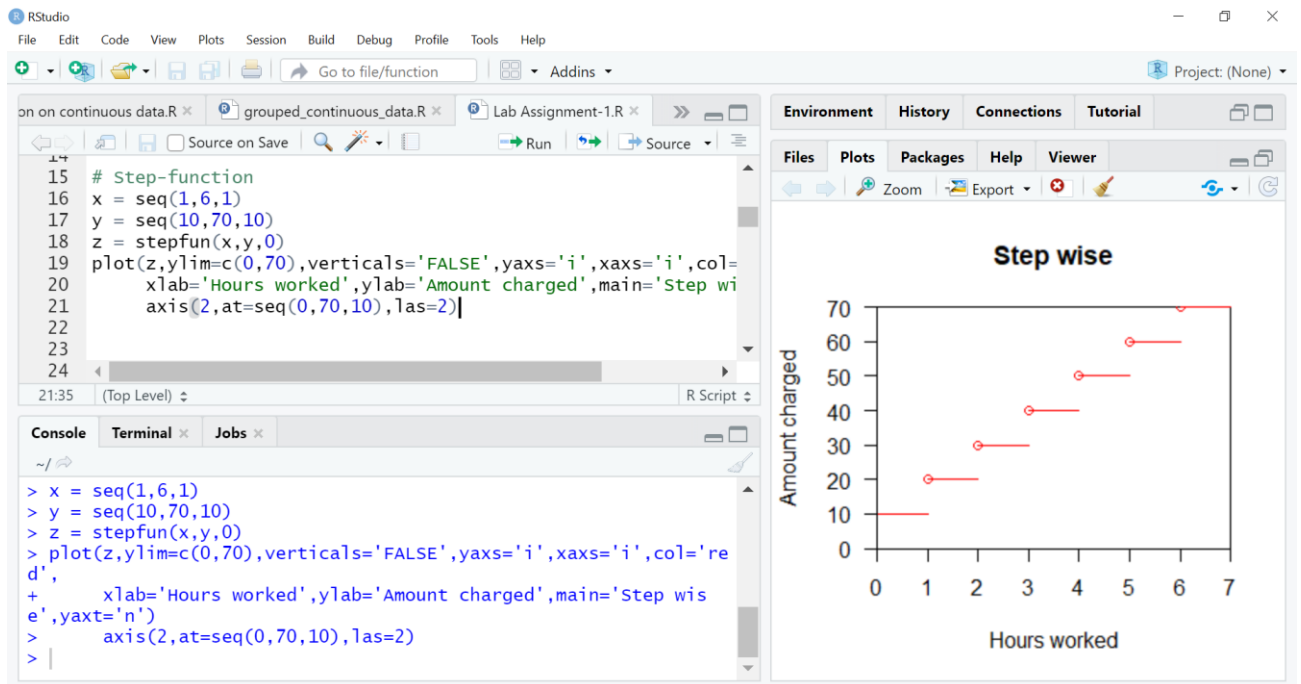
1) Sin function



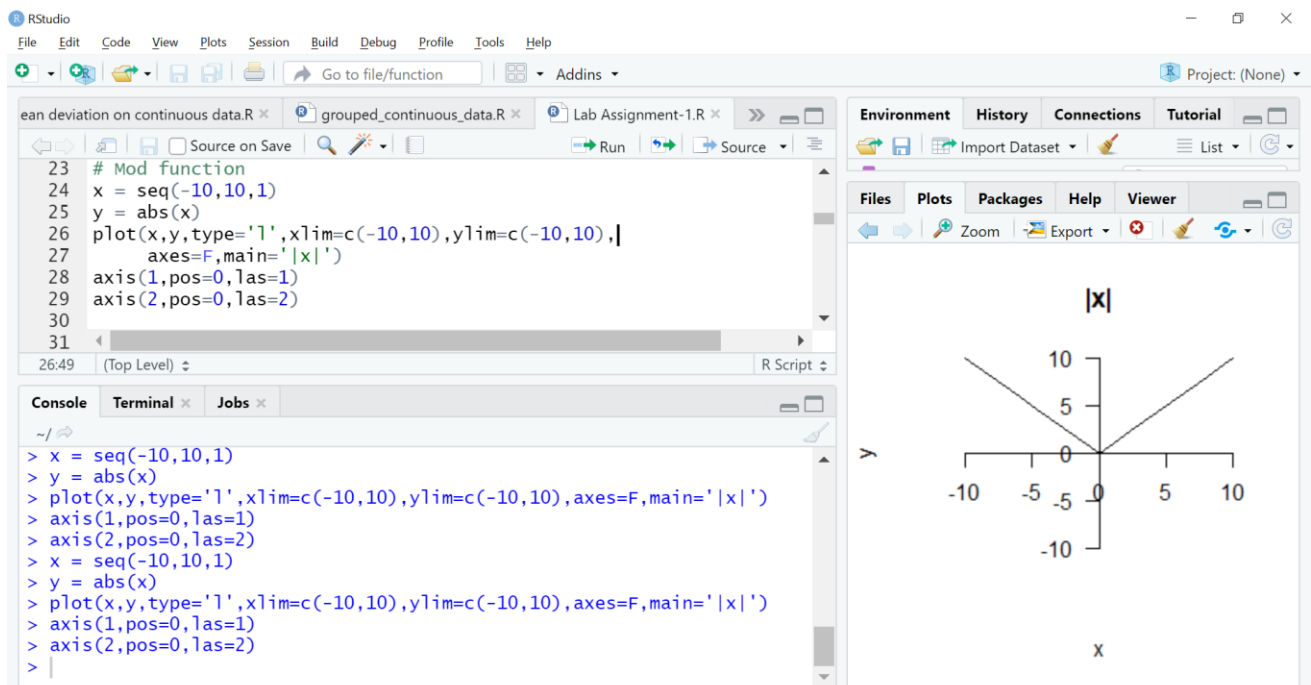
2) Sin and cos function



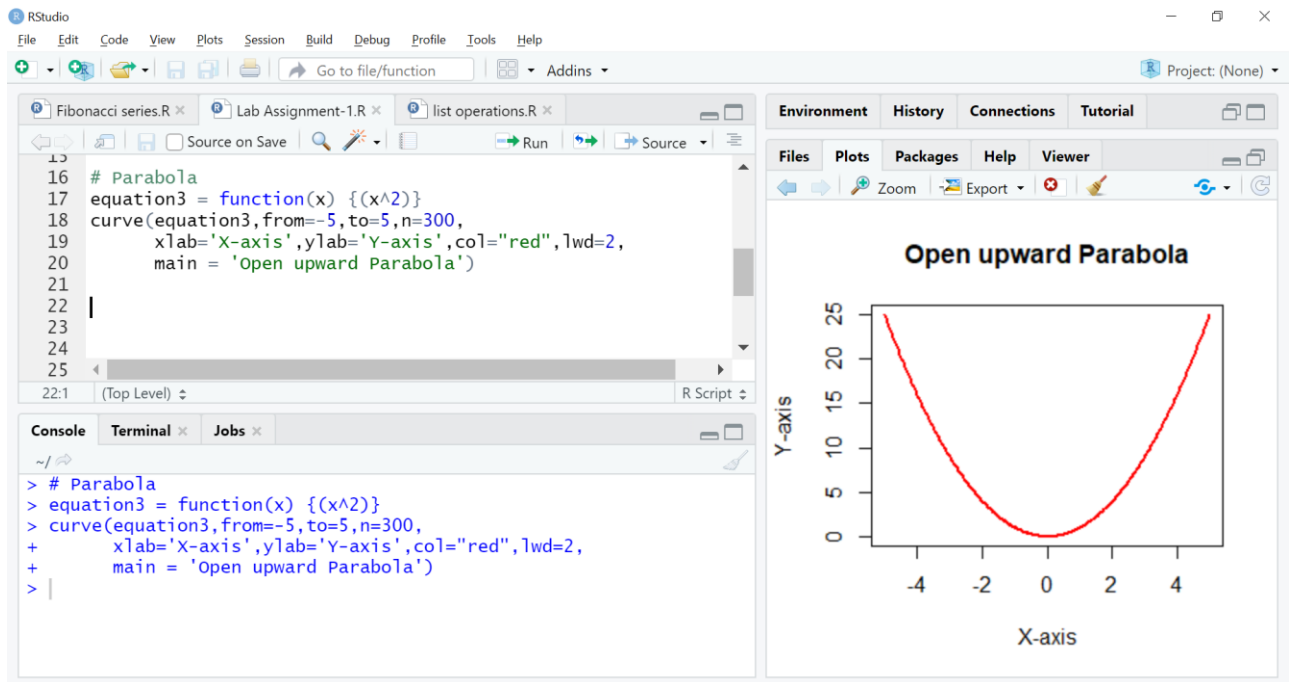
3)Step-function



3)Mod function



5) Parabola



3. If

$$A = \begin{bmatrix} 1 & 2 & -8 & 14 & 7 \\ 13 & 24 & 17 & 5 & 9 \\ 7 & 32 & 10 & 14 & 5 \\ 3 & 4 & 53 & 34 & 43 \\ 9 & 11 & 14 & -10 & 4 \end{bmatrix}$$

and

$$B = \begin{bmatrix} -10 & 12 & 11 & 4 & 2 \\ 9 & 21 & 7 & 13 & 8 \\ 17 & 2 & 1 & 17 & -19 \\ 2 & 7 & 5 & 3 & 4 \\ 15 & 1 & 4 & -31 & 14 \end{bmatrix}$$

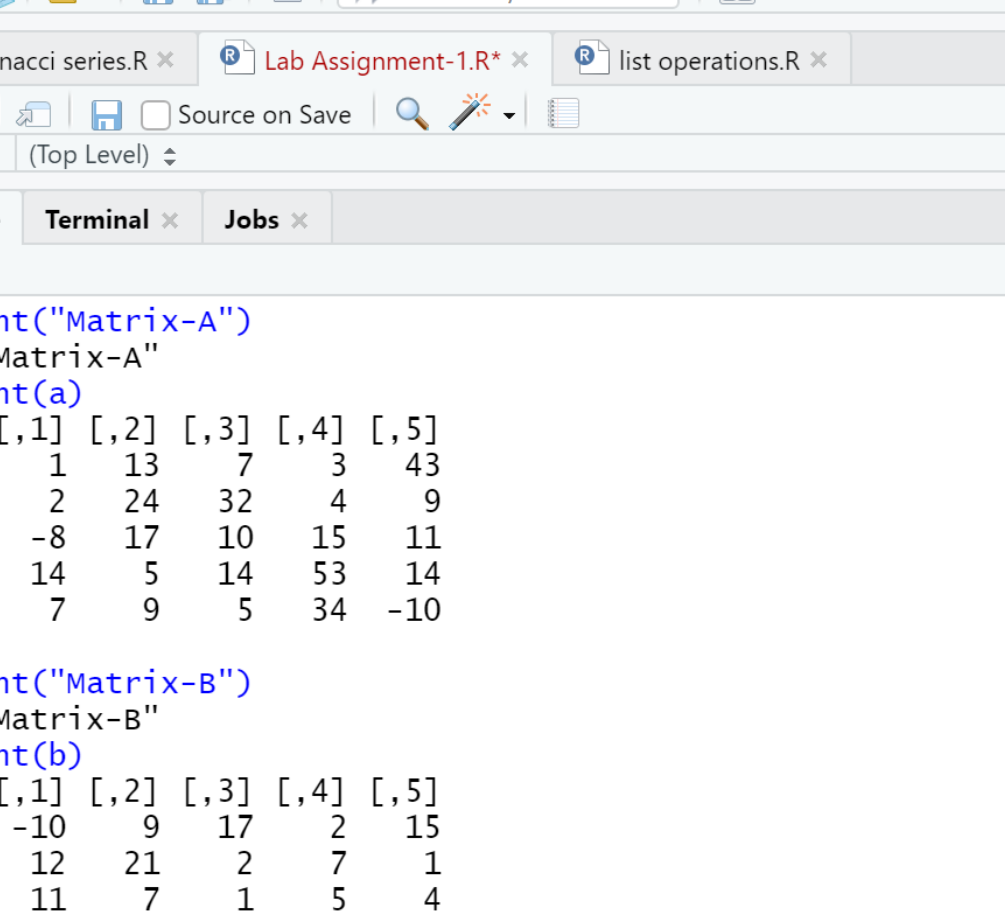
then write R code to find the following:

- (i) the eigenvalue and eigenvector of A and B .
- (ii) check whether $(AB)^{-1} = B^{-1}A^{-1}$
- (iii) dimension of $4 * A^5 - 5A^3 + A^2$
- (iv) replace 4th row of A by $(5 \ -4 \ 6 \ 3 \ 2)$ and 5th column of B by $(14 \ 9 \ 43 \ 24 \ 26)$.

Matrix-A and Matrix-B

The screenshot displays the RStudio environment with the following details:

- Menu Bar:** File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Help.
- Toolbar:** Includes icons for file operations (new, open, save, etc.) and a "Go to file/function" search bar.
- Project:** Project: (None)
- Open Files:** Fibonacci series.R, Lab Assignment-1.R* (active), list operations.R.
- Script Editor:**
 - Line 23: `## Eigen values and eigen vectors of a matrix`
 - Line 24: `a = matrix(nrow=5, ncol=5, c(1,2,-8,14,7,13,24,17,5,9,7,32,`
 - Line 25: `10,14,5,3,4,15,53,34,43,9,11,14,-10,4))`
 - Line 26: `b = matrix(nrow=5, ncol=5, c(-10,12,11,4,2,9,21,7,13,8,17,2,`
 - Line 27: `1,17,-19,2,7,5,3,4,15,1,4,-31,14))`
 - Line 29: `print("Matrix-A")`
 - Line 30: `print(a)`
 - Line 32: `print("Matrix-B")`
 - Line 33: `print(b)`
- Status Bar:** Shows "23:1 (Top Level)" and "R Script".



The screenshot shows the RStudio interface with the following components:

- Top Bar:** Contains menu items: File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Help.
- Toolbar:** Includes icons for file operations (new, open, save, print) and a search bar labeled "Go to file/function".
- Tab Bar:** Shows three open files: "Fibonacci series.R", "Lab Assignment-1.R*", and "list operations.R".
- Source Editor:** Displays the R code being executed. The code defines two matrices, A and B, and prints them. The output shows the dimensions and the values of the matrices.
- Console:** Displays the output of the R code. The output shows the dimensions and the values of the matrices.

```
> print("Matrix-A")
[1] "Matrix-A"
> print(a)
      [,1] [,2] [,3] [,4] [,5]
[1,]    1   13    7    3   43
[2,]    2   24   32    4    9
[3,]   -8   17   10   15   11
[4,]   14    5   14   53   14
[5,]    7    9    5   34  -10
>
> print("Matrix-B")
[1] "Matrix-B"
> print(b)
      [,1] [,2] [,3] [,4] [,5]
[1,]  -10    9   17    2   15
[2,]   12   21    2    7    1
[3,]   11    7    1    5    4
[4,]    4   13   17    3  -31
[5,]    2    8  -19    4   14
>
```

i) Eigen values and eigen vectors of A and B

The screenshot shows the RStudio interface with the 'Lab Assignment-1.R' file open. The code in the editor calculates the eigenvalues and eigenvectors of matrix 'a'. The console output shows the eigen decomposition of matrix 'a'.

```
36 print("Eigen values and eig vectors of Matrix-A and Matrix-B")
37 print(eigen(a))
38
```

37:16 (Top Level) ↕

Console Terminal Jobs

```
~/
> print("Eigen values and eig vectors of Matrix-A and Matrix-B")
[1] "Eigen values and eig vectors of Matrix-A and Matrix-B"
> print(eigen(a))
eigen() decomposition
$values
[1] 74.034746+0.00000i 30.587818+0.00000i -18.028751+9.26952i -18.028751-9.26952i 9.434938+0.00000i

$vectors
      [,1]      [,2]      [,3]      [,4]      [,5]
[1,] -0.3396031+0i -0.23810103+0i 0.6832276+0.0000000i 0.6832276+0.0000000i -0.75848469+0i
[2,] -0.3228409+0i -0.83596120+0i -0.2027045-0.2969969i -0.2027045+0.2969969i -0.54023956+0i
[3,] -0.2832544+0i -0.23760693+0i 0.4098647+0.2874886i 0.4098647-0.2874886i 0.27750911+0i
[4,] -0.7449540+0i 0.42236719+0i -0.1303642-0.0915333i -0.1303642+0.0915333i 0.23160620+0i
[5,] -0.3811221+0i 0.09811052+0i -0.2986923+0.1966589i -0.2986923-0.1966589i -0.04679162+0i
```

The screenshot shows the RStudio interface with the 'Lab Assignment-1.R' file open. The code attempts to calculate the inverse of matrix 'A' and the eigenvalues and eigenvectors of matrix 'B'. An error occurs when trying to calculate the inverse of matrix 'A'.

```
37 print(eigen(a))
38
39 print(eigen(b))
```

39:1 (Top Level) ↕

Console Terminal Jobs

```
~/
> inv(A*B)
Error in inv(A * B) : could not find function "inv"
> print(eigen(b))
eigen() decomposition
$values
[1] 32.70316+ 0.00000i -21.55109+ 0.00000i 6.55190+10.80064i 6.55190-10.80064i 4.74412+ 0.00000i

$vectors
      [,1]      [,2]      [,3]      [,4]      [,5]
[1,] -0.34436533+0i -0.89762345+0i 0.34269723+0.02492796i 0.34269723-0.02492796i 0.21479221+0i
[2,] -0.71239171+0i 0.23111639+0i 0.07119562+0.01549784i 0.07119562-0.01549784i 0.22966375+0i
[3,] -0.36309551+0i 0.33204798+0i 0.15409365-0.02198836i 0.15409365+0.02198836i 0.01253631+0i
[4,] -0.48600546+0i 0.01410987+0i -0.83875175+0.00000000i -0.83875175+0.00000000i -0.93132345+0i
[5,] -0.07662189+0i 0.17436283+0i 0.25468027+0.28988503i 0.25468027-0.28988503i 0.18329853+0i
```

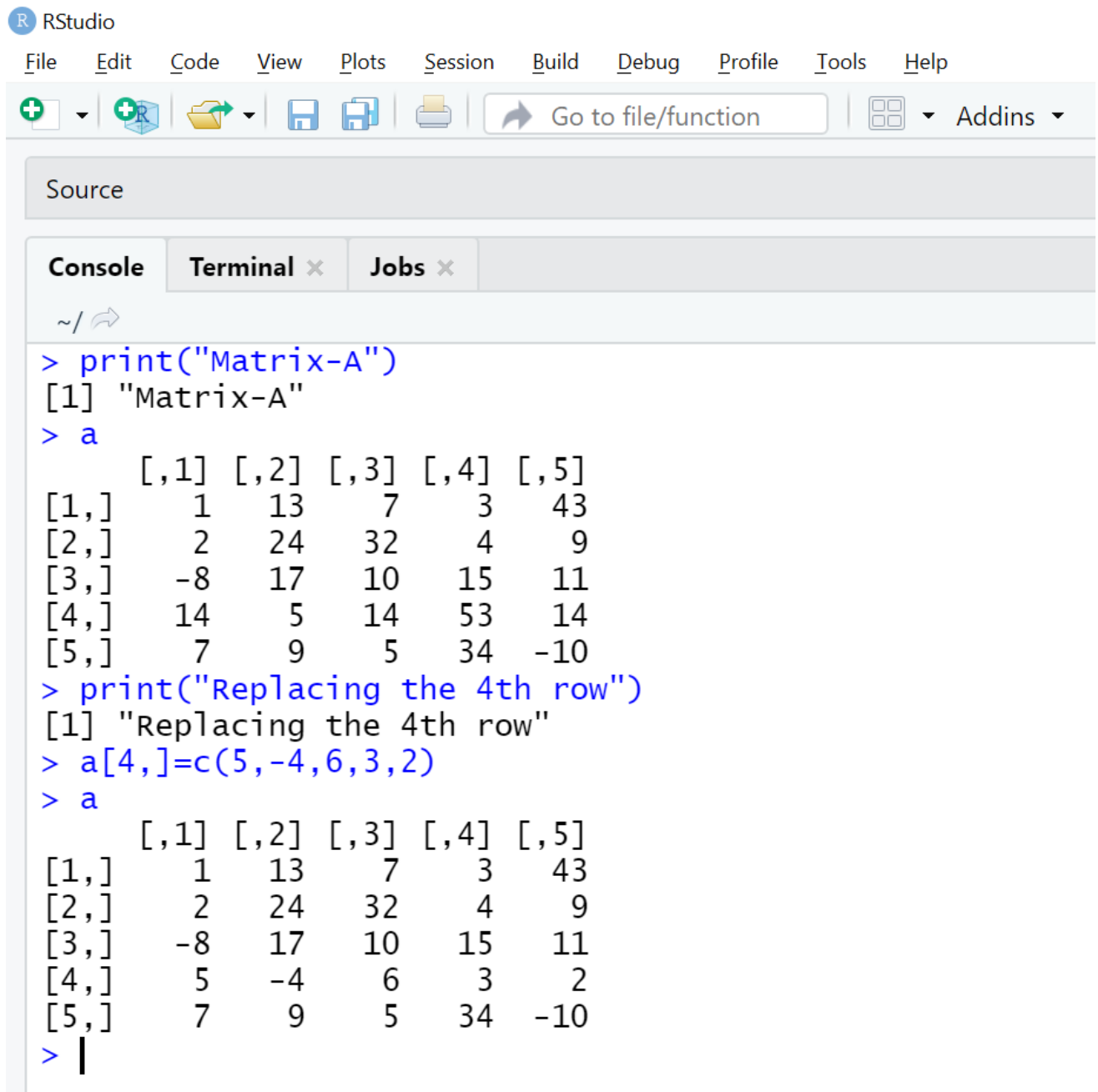
ii) Check whether $(AB)^{-1} = B^{-1} * A^{-1}$

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
+ [Go to file/function] [Addins]
Fibonacci series.R Lab Assignment-1.R* list operations.R
Source on Save
40
41 print(solve(a%*%b)) # Inverse of products of matrix
42 print(solve(b)%*%solve(a)) # Product of Inverses
43
42:1 (Top Level)
Console Terminal Jobs
~/
> print(solve(a%*%b)) # Inverse of products of matrix
      [,1]      [,2]      [,3]      [,4]      [,5]
[1,] 0.0009991762 0.0006741243 0.001396953 -0.0055926531 0.0063613895
[2,] 0.0096564386 -0.0025929168 -0.003265485 -0.0130533269 0.0203309385
[3,] -0.0005346298 0.0013542584 -0.001718808 -0.0001489988 0.0007218626
[4,] -0.0246980016 0.0069865809 0.006206058 0.0409153435 -0.0595342923
[5,] 0.0018291237 0.0007889277 -0.002239300 -0.0028924021 0.0041675288
>
> print(solve(b)%*%solve(a)) # Product of Inverses
      [,1]      [,2]      [,3]      [,4]      [,5]
[1,] 0.0009991762 0.0006741243 0.001396953 -0.0055926531 0.0063613895
[2,] 0.0096564386 -0.0025929168 -0.003265485 -0.0130533269 0.0203309385
[3,] -0.0005346298 0.0013542584 -0.001718808 -0.0001489988 0.0007218626
[4,] -0.0246980016 0.0069865809 0.006206058 0.0409153435 -0.0595342923
[5,] 0.0018291237 0.0007889277 -0.002239300 -0.0028924021 0.0041675288
> |
```

iii) Dimension of $4*A^5 - 5A^3 + A^2$

```
> matrix1 = 4*(a^5)-5*(a^3) + (a^2)
> print(dim(matrix1))
[1] 5 5
> |
```

iv) Replacing 4th row of A by (5 -4 6 3 2) and 5th column of B by (14 9 43 24 26)



The image shows the RStudio interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu bar is a toolbar with icons for creating a new file, opening a file, saving, printing, and navigating. The main workspace is divided into three panes: Source, Console, and Terminal. The Console pane is active, showing the following R code and its output:

```
> print("Matrix-A")
[1] "Matrix-A"
> a
      [,1] [,2] [,3] [,4] [,5]
[1,]     1  13   7   3  43
[2,]     2  24  32   4   9
[3,]    -8  17  10  15  11
[4,]    14   5  14  53  14
[5,]     7   9   5  34 -10
> print("Replacing the 4th row")
[1] "Replacing the 4th row"
> a[4,]=c(5,-4,6,3,2)
> a
      [,1] [,2] [,3] [,4] [,5]
[1,]     1  13   7   3  43
[2,]     2  24  32   4   9
[3,]    -8  17  10  15  11
[4,]     5  -4   6   3   2
[5,]     7   9   5  34 -10
> |
```

Source

Console

Terminal x

Jobs x

~/

```
> print("Matrix-B")
```

```
[1] "Matrix-B"
```

```
> b
```

	[,1]	[,2]	[,3]	[,4]	[,5]
[1,]	-10	9	17	2	15
[2,]	12	21	2	7	1
[3,]	11	7	1	5	4
[4,]	4	13	17	3	-31
[5,]	2	8	-19	4	14

```
> print("Replacing the 5th column")
```

```
[1] "Replacing the 5th column"
```

```
> b[,5] = c(14,9,43,24,26)
```

```
> b
```

	[,1]	[,2]	[,3]	[,4]	[,5]
[1,]	-10	9	17	2	14
[2,]	12	21	2	7	9
[3,]	11	7	1	5	43
[4,]	4	13	17	3	24
[5,]	2	8	-19	4	26

```
>
```