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Linear Systems and Signals Lab

Laboratory 1: Introduction to MATLAB

1. Compute the outcome of the expression $2cos(\pi) + \sqrt{4sin(\pi/2)} - e^2$

```
Command Window
>> lab1_e1

ans =

   -3.3891

fx >>
```

2. Create a row vector *a* with elements [1 2 ... 5], and row vector *b* with elements $[2^{-1}...2^{-5}]$.

2.1 Concatenate row vector *a* and *b* and compute the length of the new vector.

2.2 Compute the product of *a* and *b*.

2.3 Convert vector *b* into a column vector and store the column vector into a new vec *c*.

2.4 Create a row vector x =[0, 1, . . . , 100] and a row vector y =[0, 0.01, . . . , 1].

2.5 Compute the dot product of *x* and *y*.

2.6 Calculate the sum of the elements of x.

```
>> lab1_e2
a =
     1     2     3     4     5

b =
    0.5000    0.2500    0.1250    0.0625    0.0312

ans =
    1.0000    2.0000    3.0000    4.0000    5.0000    0.5000    0.2500    0.1250    0.0625    0.0312

ans =
    10

ans =
    0.5000    0.5000    0.3750    0.2500    0.1562

c =
    0.5000
    0.2500
    0.1250
    0.0625
    0.0312

ans =
        5050
```

3 Create the matrices A =[[12 3 −6],[2 8 11],[2 1 1]] and B = [[1 2 3],[4 5 6]].

3.1 Compute the sizes of each matrix.

3.2 Find the transpose matrix of B. Store the transpose matrix into a matrix C.

3.3 Create a matrix D by placing the elements of C next to the elements of A.

3.4 Export the second row of A.

3.5 Export the first and the third columns of A.

3.6 Export the second and the third rows of A.

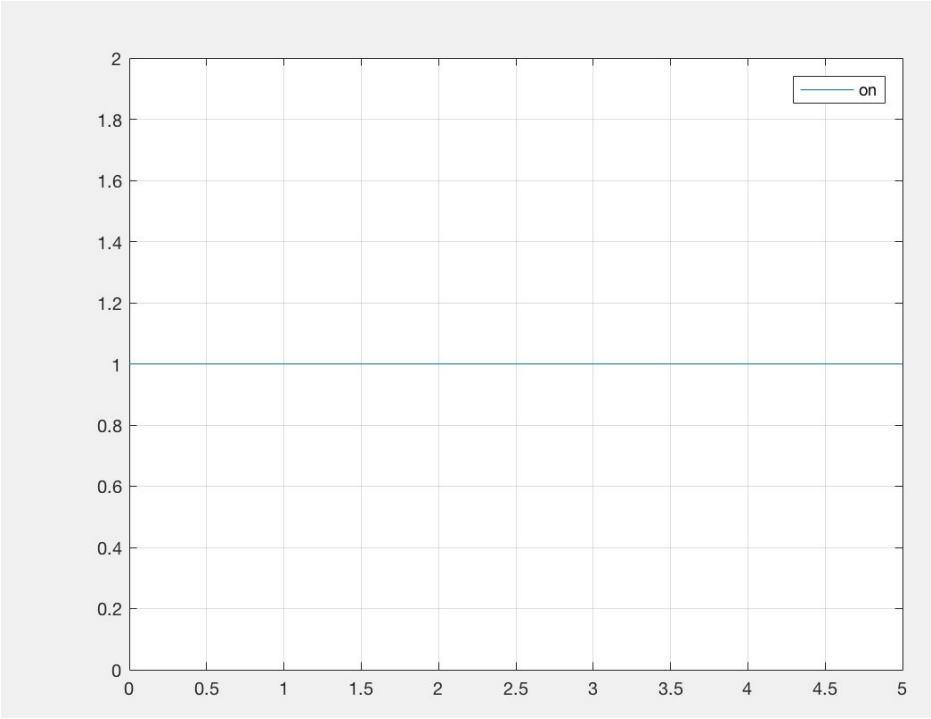
3.7 Compute the element per element product between A and the inverse matrix of A.

3.8 Find A^2

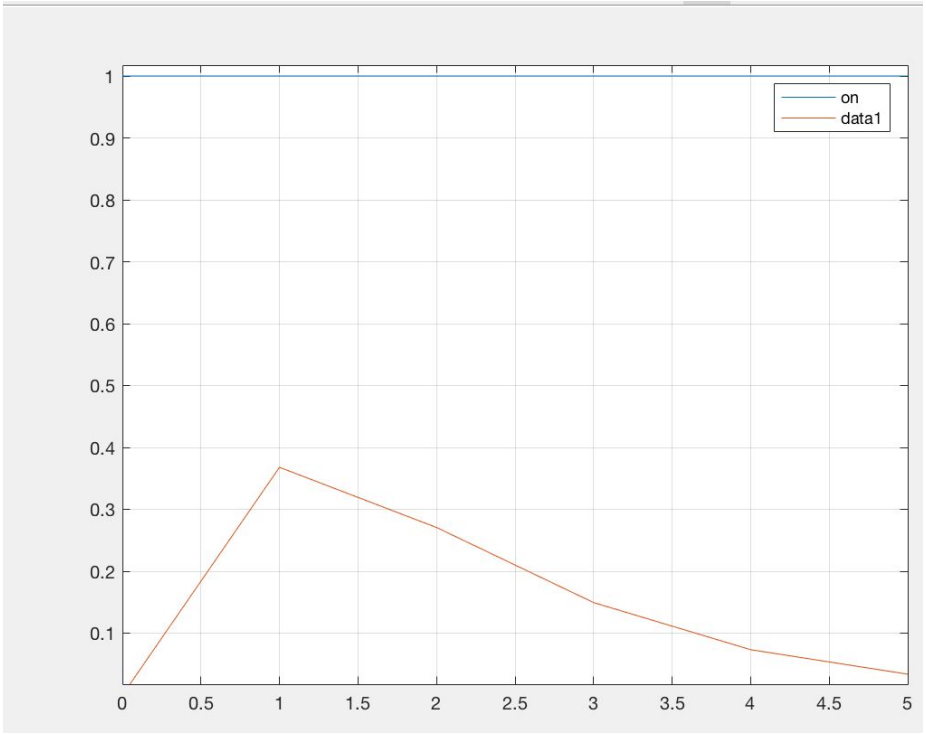
```
>> lab1_e3

A =

     1     3    -6
     2     8    11
     2     1     1


B =

     1     2     3
     4     5     6


ans =

     3     3


ans =

     2     3


C =

     1     4
     2     5
     3     6


D =

     1     3    -6     1     4
     2     8    11     2     5
     2     1     1     3     6
```

```
ans =

     2     8    11


ans =

     1
     2
     2


ans =

    -6
    11
     1


ans =

     2     8    11


ans =

     2     1     1


ans =

    1.0000   -0.0000    0.0000
   -0.0000    1.0000   -0.0000
    0.0000    0.0000    1.0000


ans =

    -5    21    21
    40    81    87
```

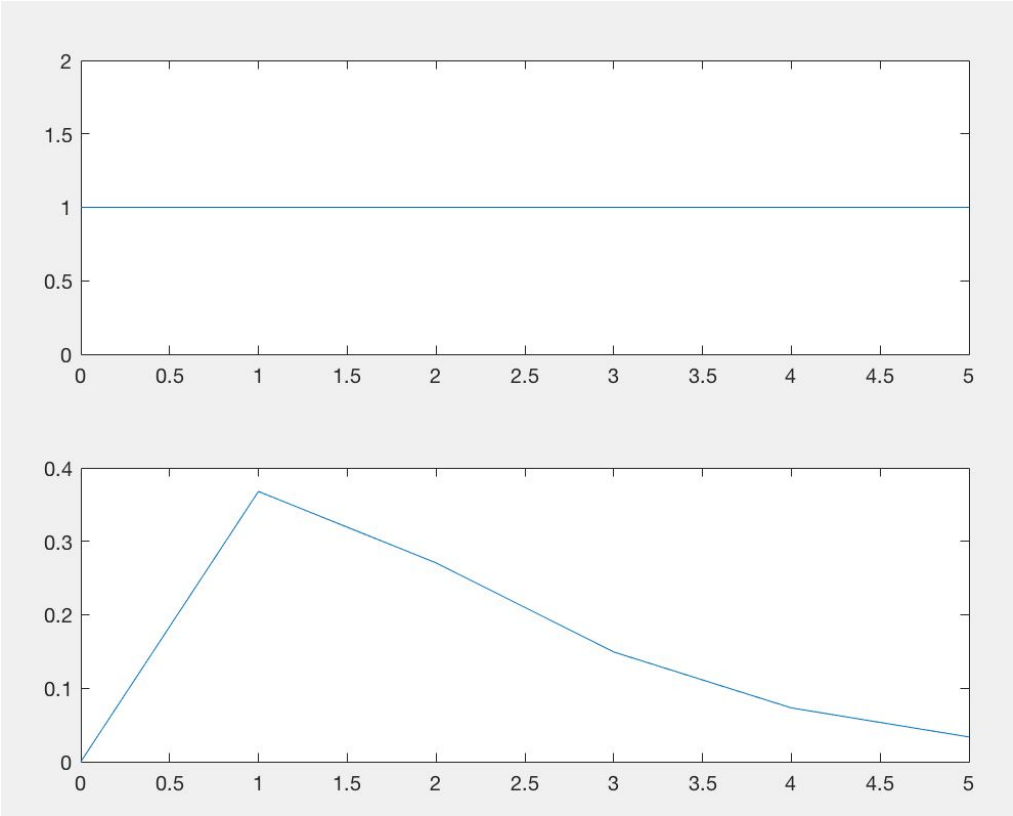
4. Plot the function $f(x) = cos(2\pi x)$, $0 \leq x \leq 5$. 4.1 Insert title, grid, and legend in the graph.



4.2 Plot in the same figure the function $g(x) = xe^{-x}$, $0 \leq x \leq 5$.



4.3 Plot again the same functions, but this time in two different subfigures of the same figure.



5. Create a script (M-File) that computes the sum of the squares of numbers 1 through 10.

```
>> lab1_e5

x =

     1     2     3     4     5     6     7     8     9    10


ans =

   385
```

6. Create a function that accepts a number b as input argument and generates the graph of the function $(t) = te^{-bt}$, $0 \leq t \leq 5$. Vector y must be returned as an output from the function.

```
>> lab1_e6

f =

         0    2.7183   14.7781   60.2566  218.3926  742.0658
```

7. Compute the first and the second derivative of $x(t) = cos(t)$ at $t = 0$, and $t = \pi$.

```
>> lab1_e7

ans =

-sin(t)


ans =

0


ans =

0
```

```
ans =

-cos(t)


ans =

-1


ans =

1
```

8. Calculate the integrals $\int_{-1}^{1} t^3 dt$, and $\int_{-\infty}^{\infty} e^{-t^2} dt$.

```
>> lab1_e8

ans =

0


ans =

pi^(1/2)

>>
```