Toronto Metropolitan University

Department of Electrical, Computer, & Biomedical Engineering
Faculty of Engineering & Architectural Science

Course Number	ELE 532
Course Title	Signals and Systems I
Semester/Year	Fall 2025
Instructor	Beheshti, Soosan
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Lab/Tutorial Report No.	01
Report Title	Working with MATLAB, Visualization of Signals

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PROBLEM A:

A.1:

Figure 1.46:

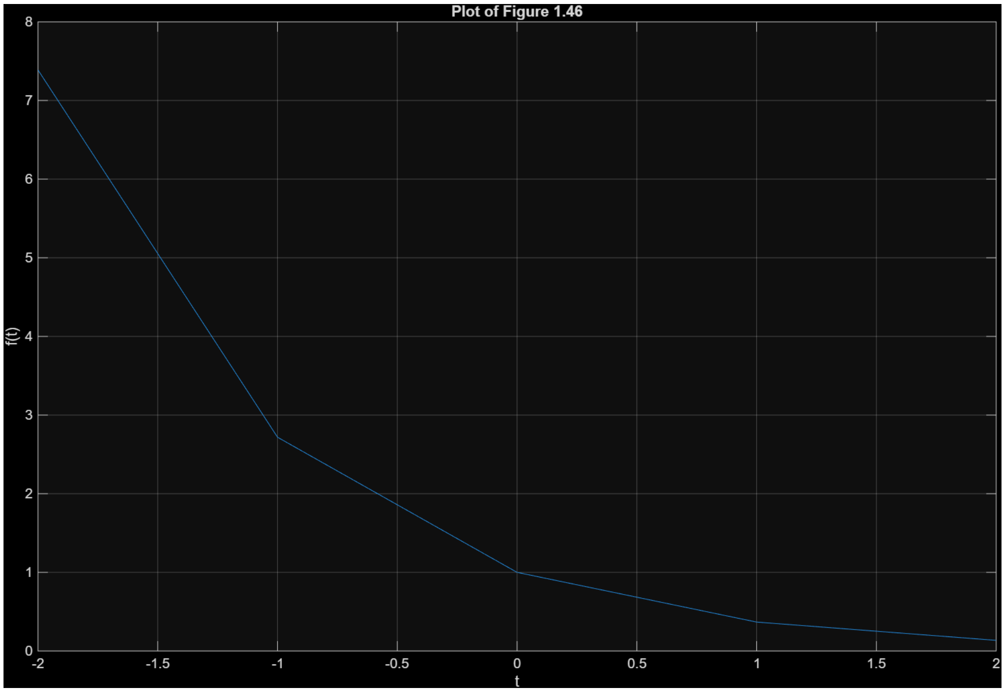
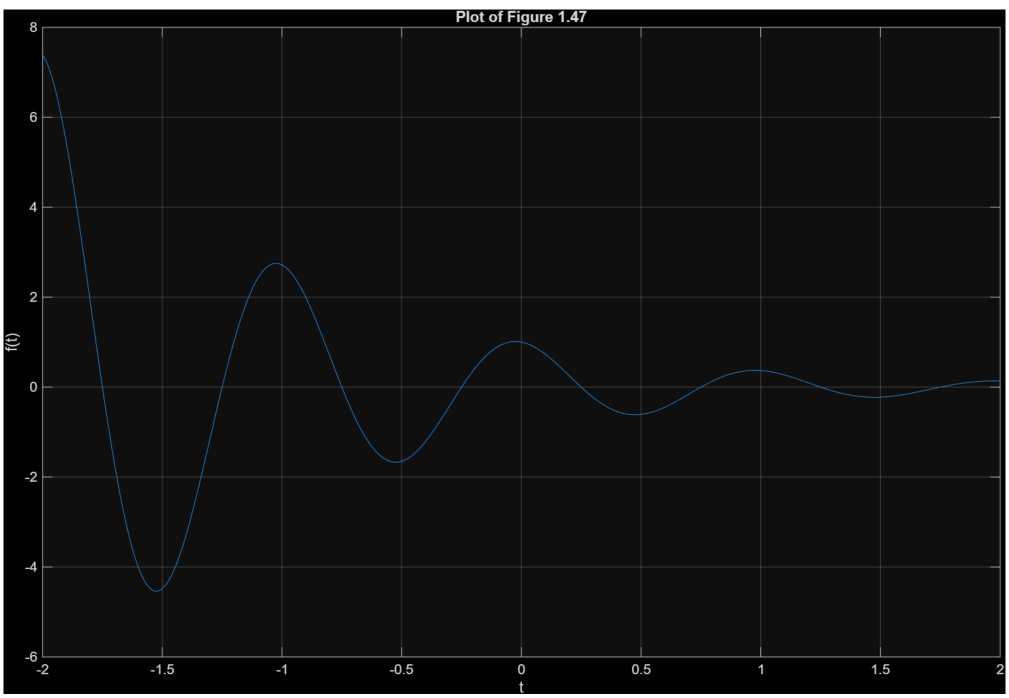
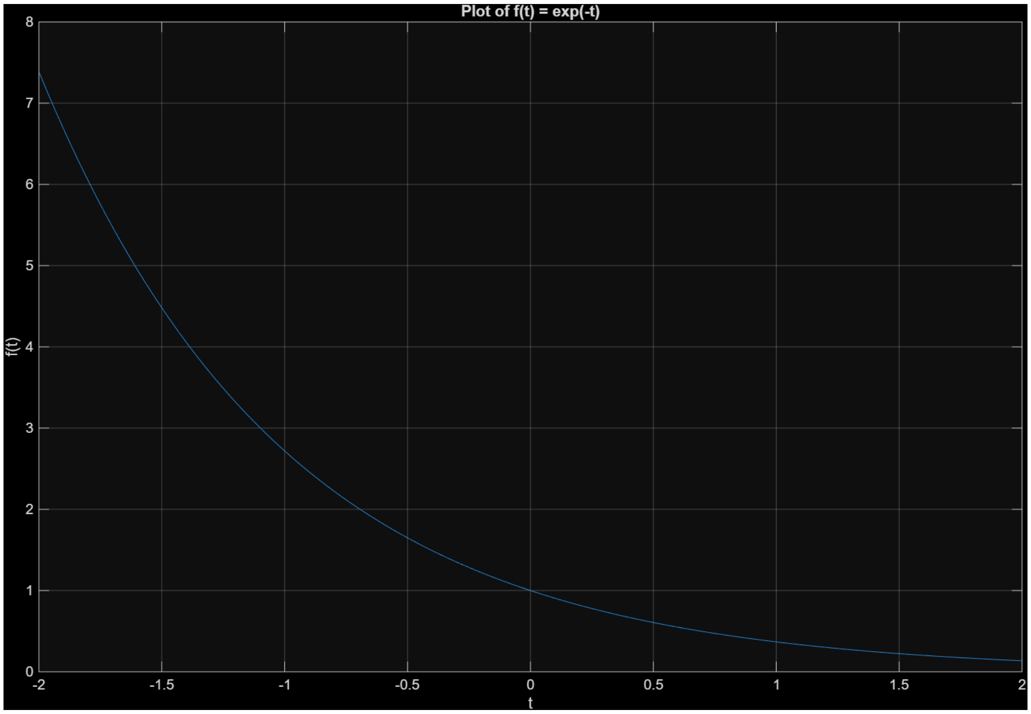


Figure 1.47:



A.2:

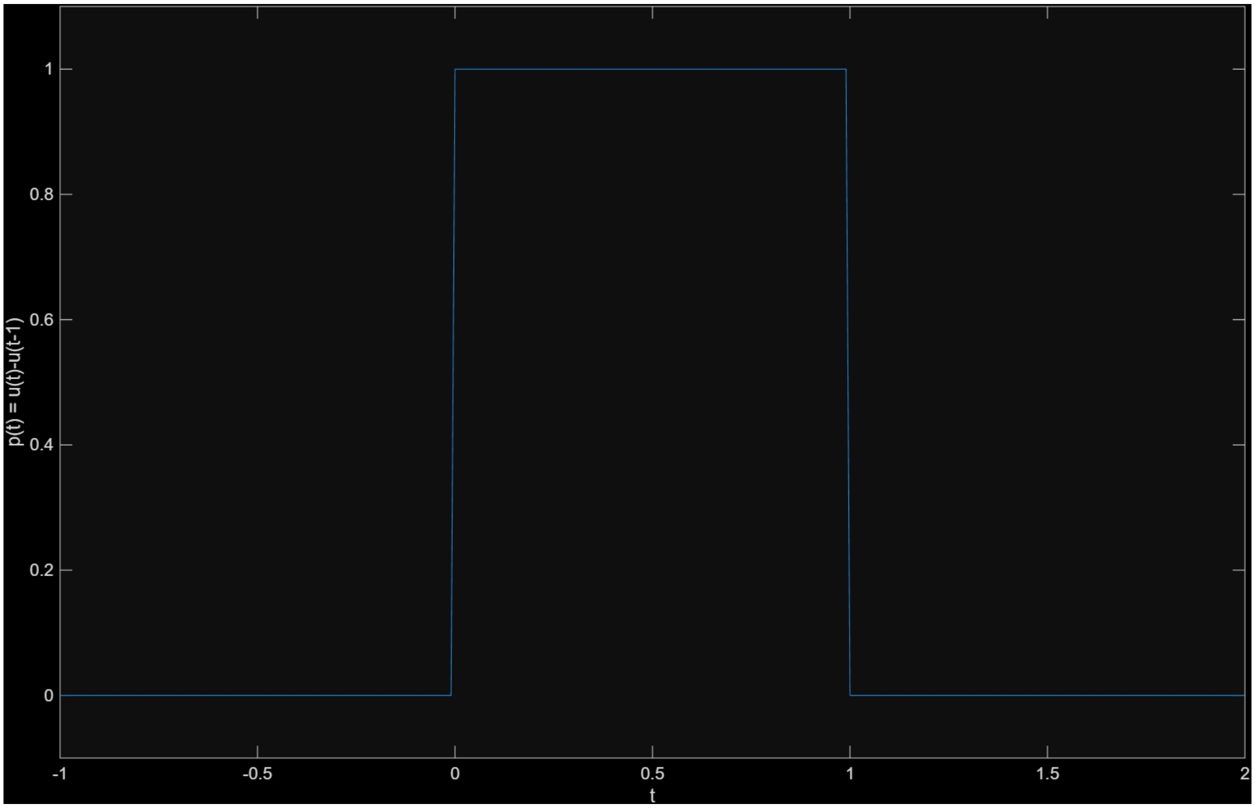


For Problem A.3: Comparison of Plots

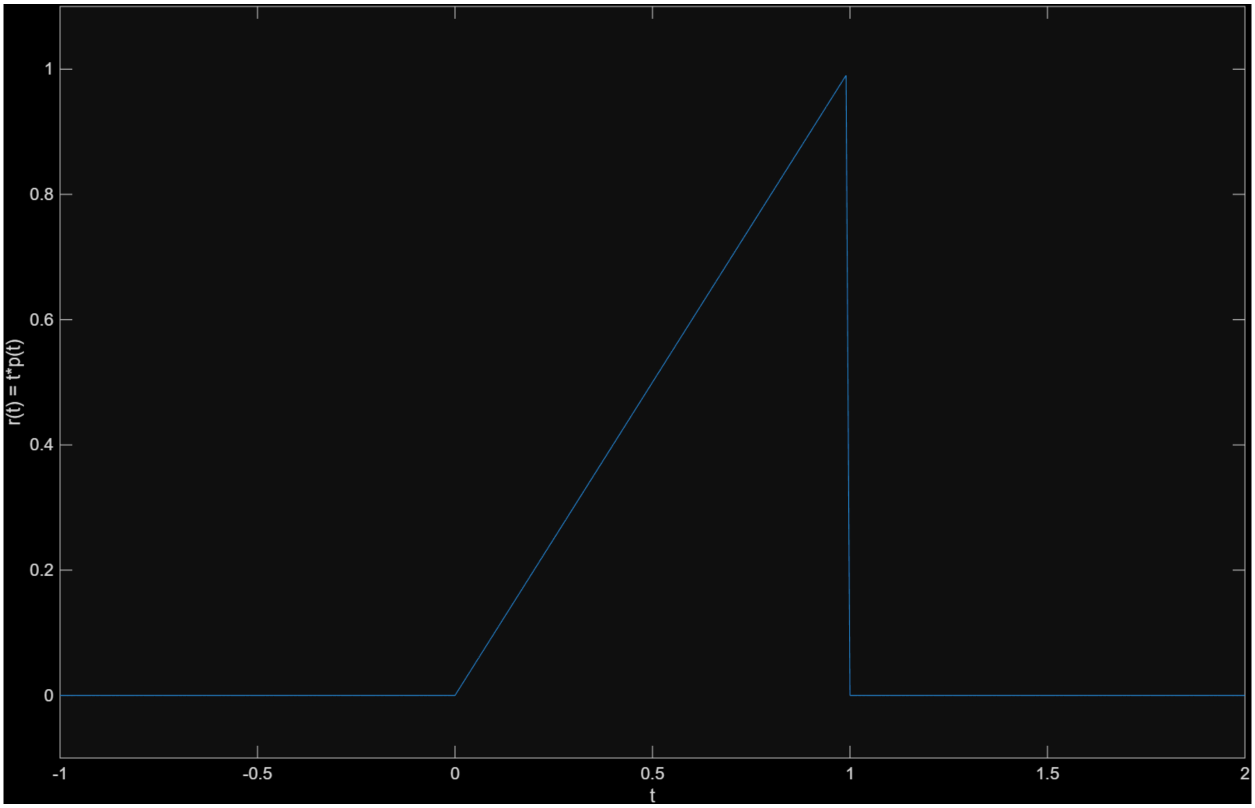
The plot generated in Problem A.1 appears as a smooth, continuous function because the time vector t = [-2:0.01:2] has a very high resolution with many points. In contrast, the plot in Problem A.2, which uses the vector t = [-2:1:2] , only shows five discrete points. This comparison demonstrates that the visual representation of a function in MATLAB is highly dependent on the resolution of its independent variable vector.

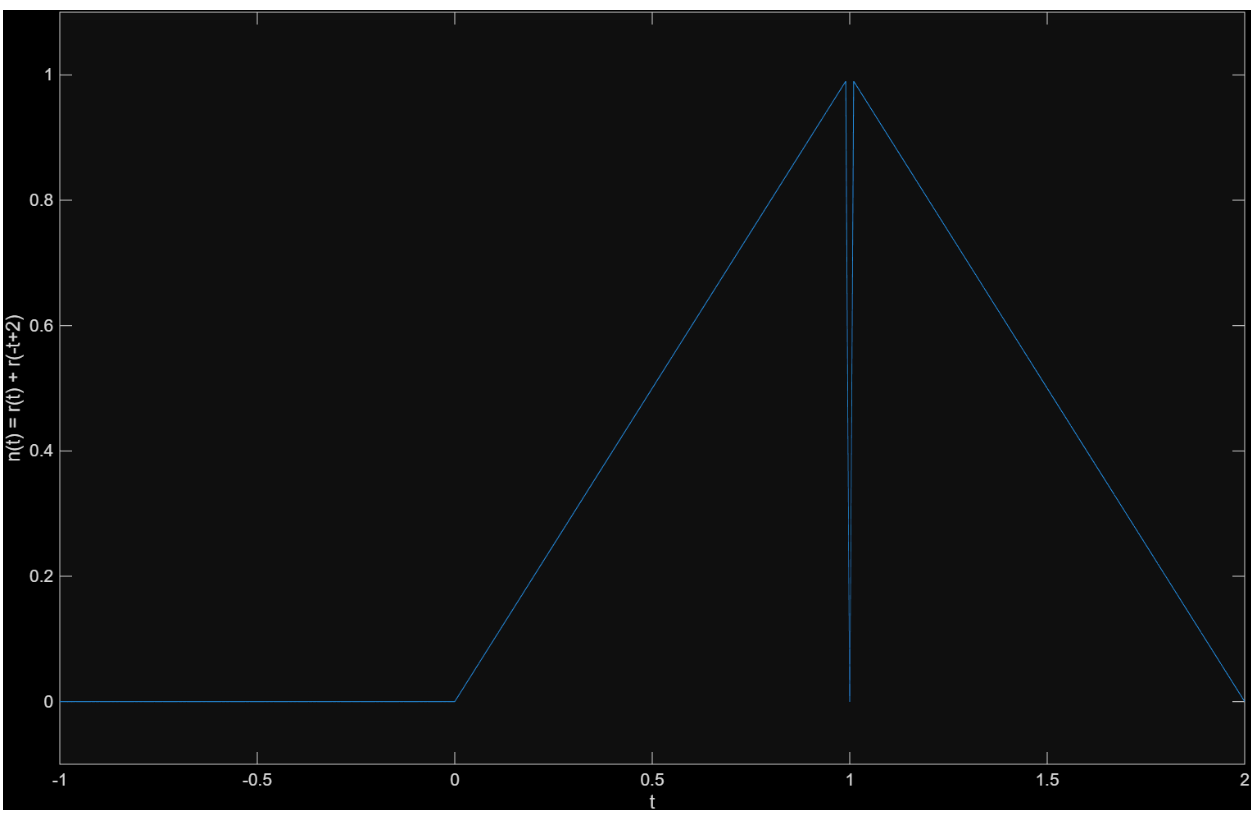
PROBLEM B:

B.1

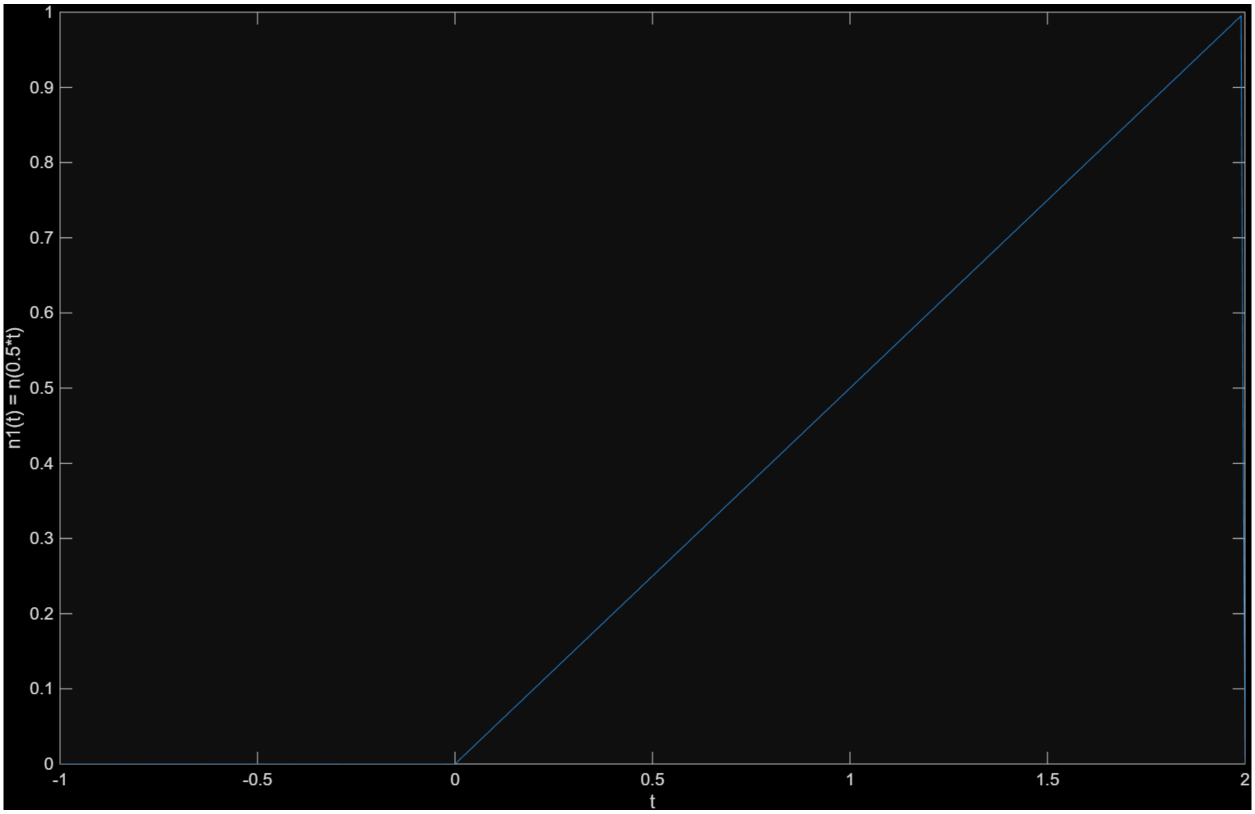


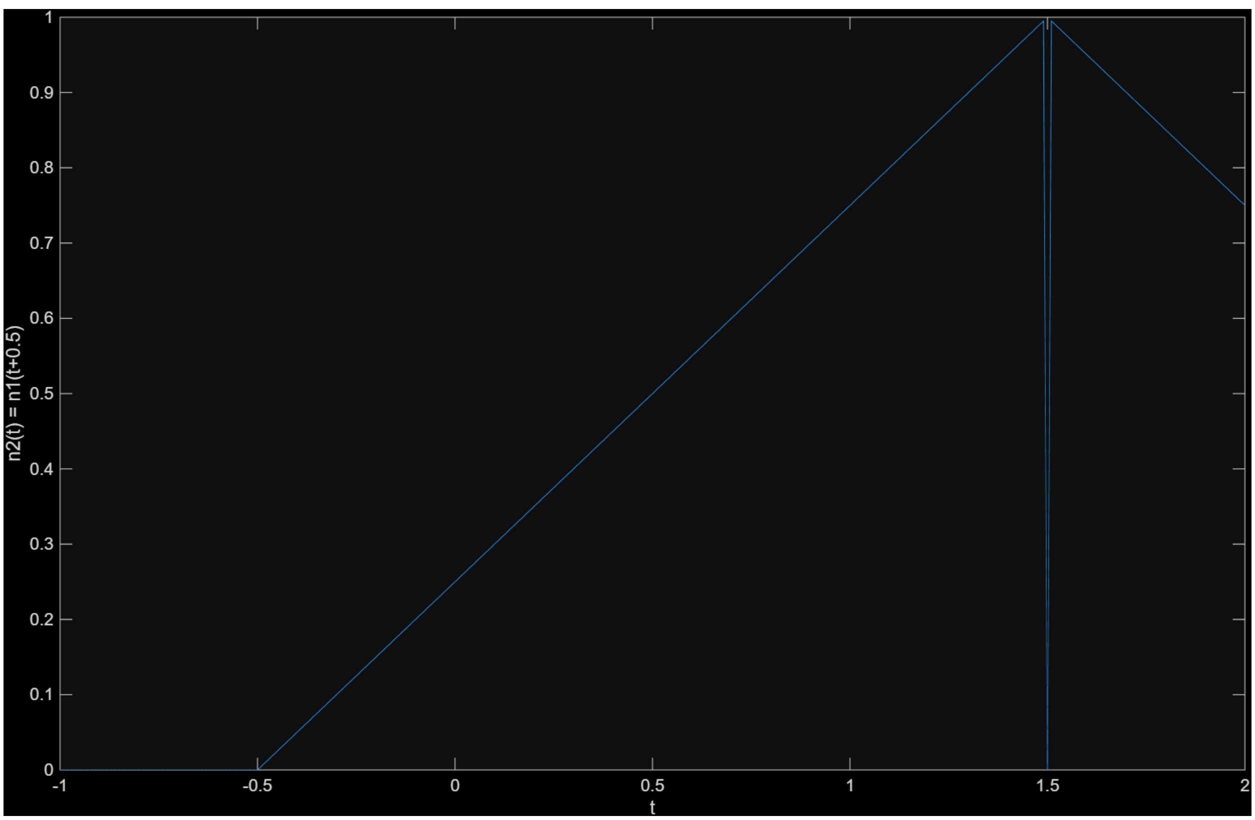
B.2


r(t) = t*p(t)
1
0.8
0.6
0.4
0.2
0
-1
-0.5
0
0.5
1
1.5
2
t

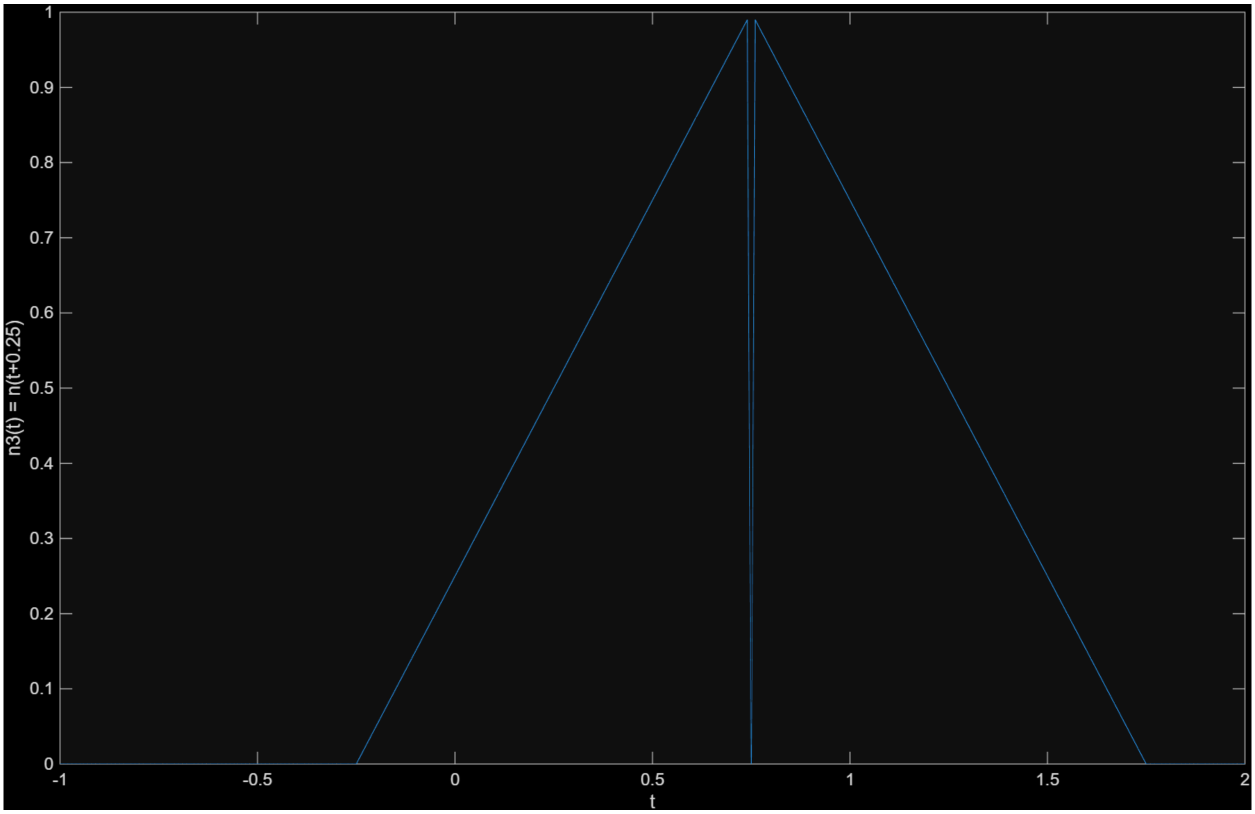

n(t) = r(t) + r(-t+2)
1
0.8
0.6
0.4
0.2
0
-1
-0.5
0
0.5
1
1.5
2
t

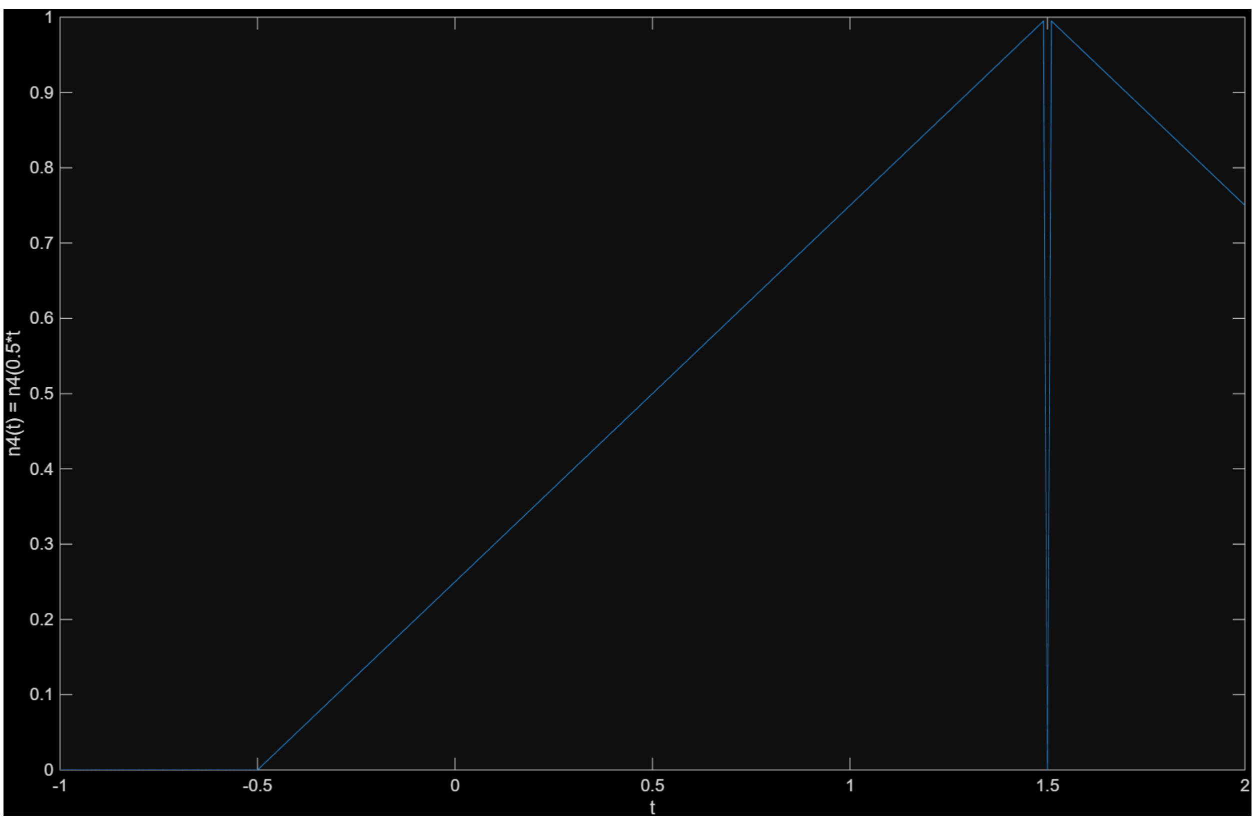
B.3





B.4


n3(t) = n(t+0.25)
t
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1
-0.5
0
0.5
1
1.5
2


n4(t) = n4(0.5*t
t
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1
-0.5
0
0.5
1
1.5
2

B.5

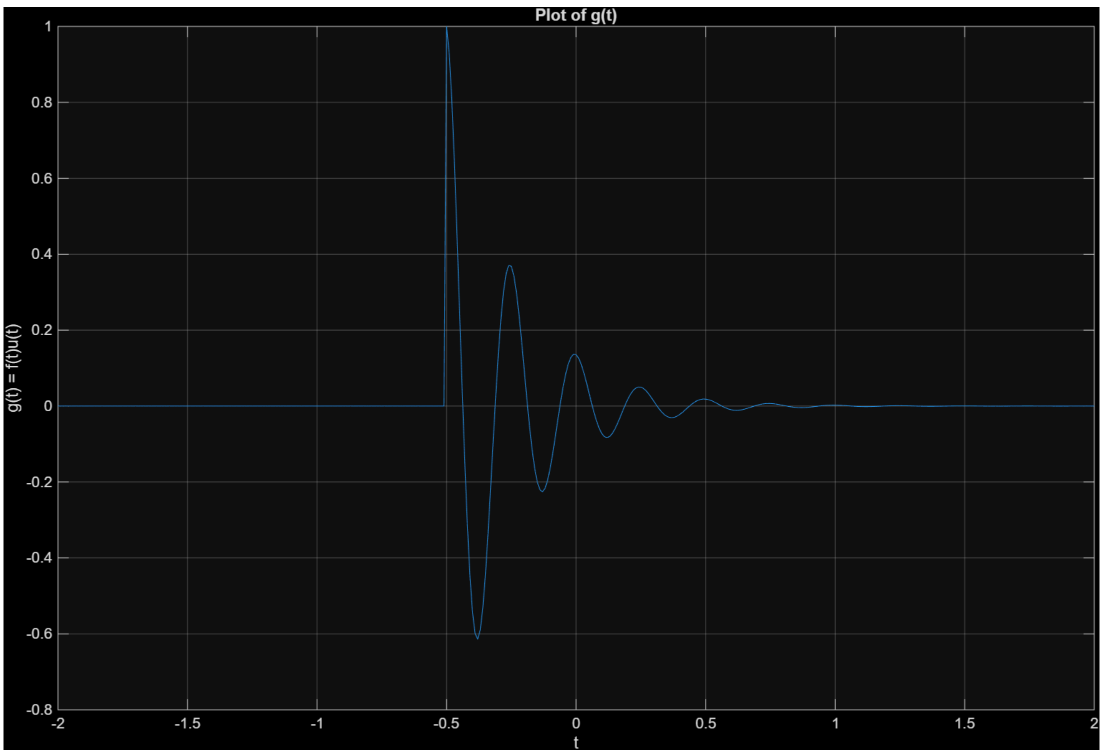
The plots for n2(t) and n4(t) are identical because, despite the different order of operations, they both simplify to the same mathematical expression.

- **For n2(t)**, the process is time scaling followed by a time shift: $n(t) \rightarrow n(0.5t) \rightarrow n(0.5(t+0.5)) = n(0.5t+0.25)$
- **For n4(t)**, the process is a time shift followed by time scaling: $n(t) \rightarrow n(t+0.25) \rightarrow n((0.5t)+0.25) = n(0.5t+0.25)$

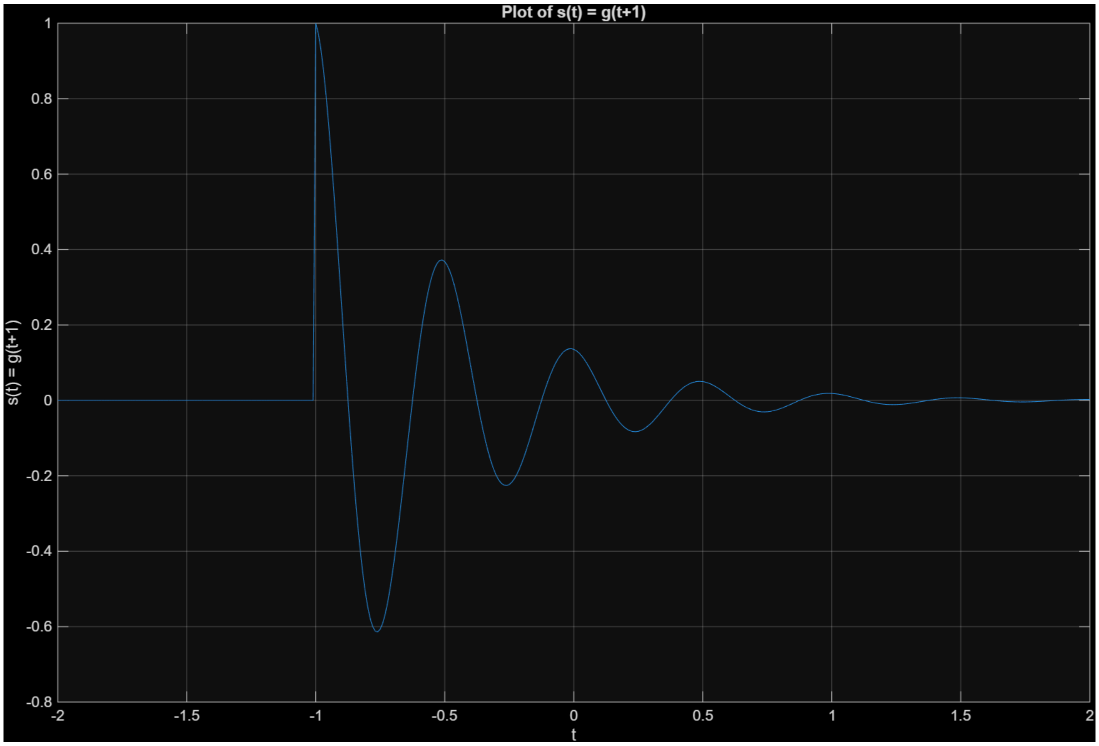
Since both operations result in the same final function, their plots are identical. This exercise highlights the importance of the order of operations in signal transformation.

PROBLEM C:

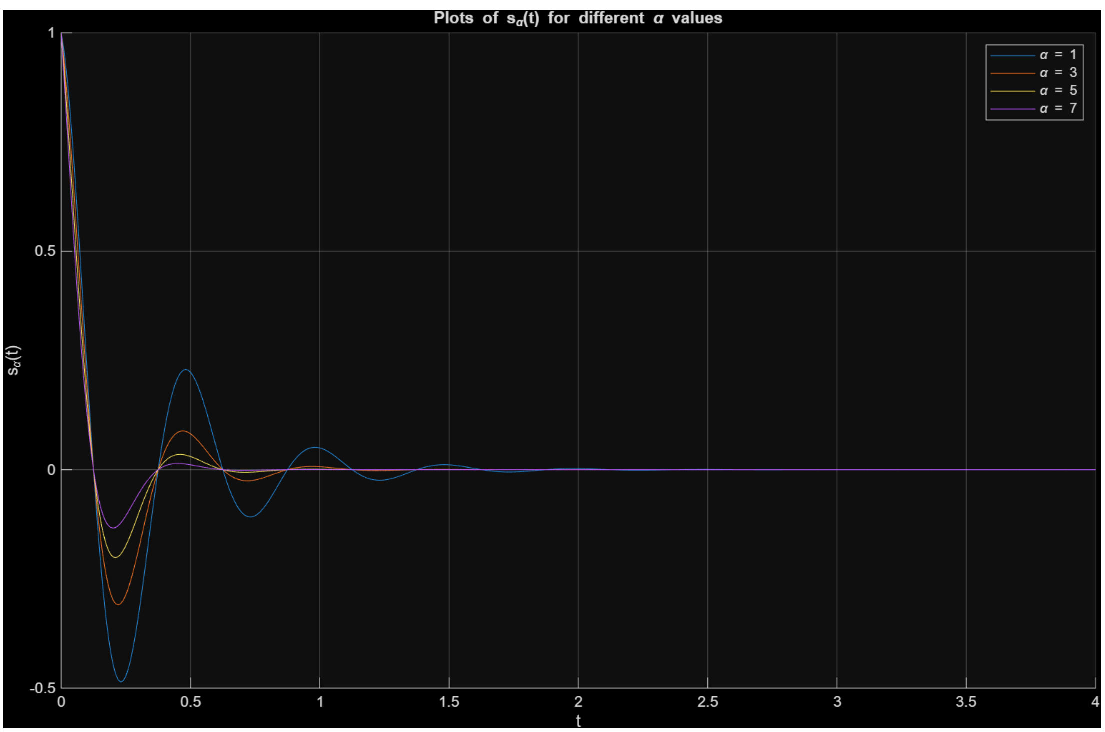
C.1:



C.2:


Plot of s(t) = g(t+1)
s(t) = g(t+1)
t
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

C.3:


Plots of $s_\alpha(t)$ for different α values
α = 1
α = 3
α = 5
α = 7
$s_\alpha(t)$
t
1
0.5
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4

C.4:
Using a built-in command from MatLab, the size of the matrix can be determined. After running this code, the size of the matrix is revealed to be 4 by 401.

PROBLEM D:

For Problem D.1: Operation Results and Descriptions

(a) A(:) *This operation reshapes the matrix A into a single column vector by stacking its columns.*

```
ans =
    0.5377
    1.8339
   -2.2588
    ...
```

(b) A([2 4 7]) *This operation extracts the 2nd, 4th, and 7th elements from the column vector created by linear indexing.*

```
ans =
    1.8339
    0.3426
   -0.4336
```

(c) [A >= 0.2] *This operation returns a logical matrix of the same size as A, with* `1` *(true) where the condition is met and* `0` *(false) otherwise.*

```
ans =
  5×4 logical array
   1   0   0   0
   1   0   1   0
   0   1   1   0
   1   1   0   1
   1   0   1   1
```

(d) A([A >= 0.2]) *This logical indexing operation extracts all elements from A that are greater than or equal to 0.2 and displays them as a column vector.*

```
ans =
   0.5377
   1.8339
   ...
```

(e) A([A >= 0.2]) = 0 *This operation finds all elements in A greater than or equal to 0.2 and sets their value to 0.*

```
A =
0         -1.3077   -1.3499    -0.2050
0         -0.4336   0          -0.1241
-2.2588   0         0          -0.0631
0         0         -0.0631    0
0         -0.4447   0          0
```

For Problem D.2: Execution Time Conclusion

After the `fprintf` outputs for D.2, add a concluding sentence:

The results clearly show that using MATLAB's logical indexing (~`0.0001` seconds) is significantly faster than using nested for-loops (~`0.002` seconds). This performance difference is because MATLAB is highly optimized for vectorized and matrix operations.