

# Assignment #1

Course: Numerical methods of differential equation

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Date: May 23, 2023

**Problem 1.** Here is a question.

**Solution.** Here is the answer of the question.

**Problem 2.** Here is a proof question.

**Proof.** Here is the proof of the problem. □

A new box environment `hframe` has been defined here, which is not numbered.  
Users can write questions, answers, or any other thing.

1. item one
2. item two
3. item three

## Theorem

**Definition 1.** *This is a definition.*

**Proposition 1.** *This is a proposition.*

**Lemma 1** (Lemma). *This is a lemma.*

**Theorem 1** (Theorem). *This is a Theorem.*

**Proof.** This is the proof environment. □

**Corollary 1.** *This is a corollary.*

**Proposition 2** (Proposition). *This is a proposition.*

**Remark 1.** *This is a remark.*

**Example 1.** *This is an example.*

**Theorem A.1.** *This is a custom theorem.*

Table

This is an example of table, such as Table 1

| Table 1    Table name |         |         |         |         |          |          |
|-----------------------|---------|---------|---------|---------|----------|----------|
| A                     | $N = 3$ | $N = 5$ | $N = 7$ | $N = 9$ | $N = 11$ | $N = 13$ |
| B                     | 1.5789  | 1.3478  | 1.0645  | 0.8780  | 0.7222   | 0.5942   |
| C                     | 1.0000  | 1.0000  | 1.0000  | 1.0000  | 1.0000   | 1.0000   |
| D                     | 7.2632  | 14.3913 | 21.0323 | 27.3171 | 30.9630  | 34.0870  |

Figures

This is an example of figure, as shown in the Figure 2.

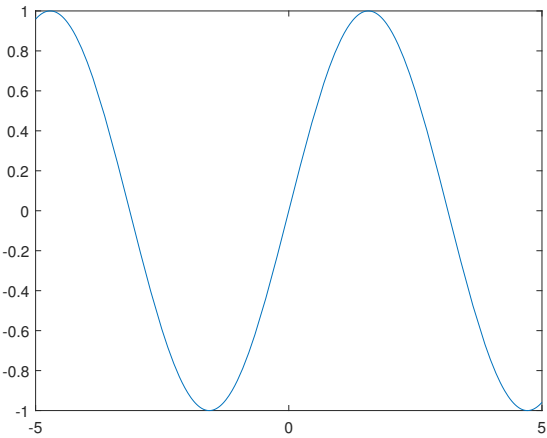


Figure 1    Image of function  $y = \sin(x)$

Two pictures placed side by side, as shown in Figure 2 and Figure 3.

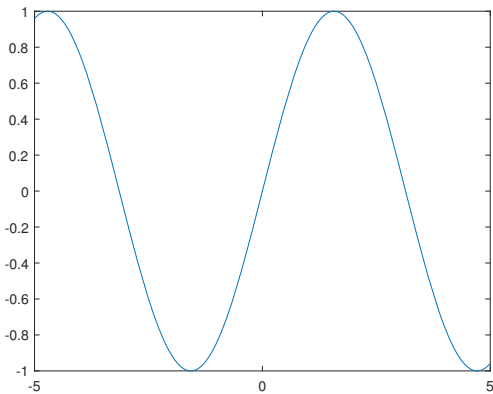


Figure 2    Description of image 1

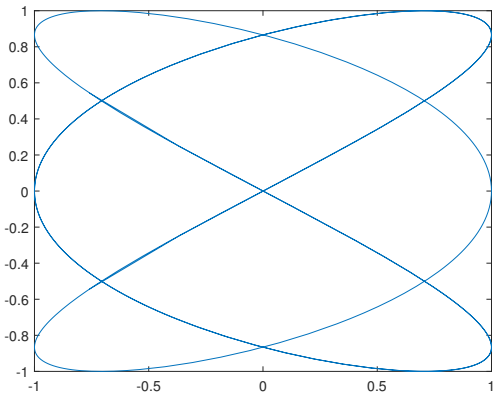


Figure 3    Description of image 2

## Code highlighting

This is MATLAB code highlighting environment

MATLAB code

```
1 % Euler method for the ODE model
2 % u'(x)=x^2+x-u, x in [0,1]
3 % Initial condition: u(0)=0.
4 clear all; clf
5 h=0.1;
6 x=0:h:1;
7 N=length(x)-1;
8 u(1)=0;
9 fun=@(t,u) t.^2+t-u; % RHS
10 for n=1:N
11     u(n+1)=u(n)+h.*fun(x(n),u(n));
12 end
13 ue=-exp(-x)+x.^2-x+1; % exact solution
14 plot(x,ue,'b-',x,u,'r+', 'LineWidth',1)
15 legend('Exact','Numerical','location','North')
16 xlabel('x'), ylabel('u')
```

This is Python code highlighting environment

Python code

```
1 #PythonDraw.py
2 import turtle as t
3 t.setup(650, 350, 200, 200)
4 t.penup()
5 t.fd(-250)
6 t.pendown()
7 t.pensize(25)
8 t.pencolor("purple color")
9 t.seth(-40)
10 for i in range(4):
11     t.circle(40, 80)
12     t.circle(-40, 80)
13 t.circle(40, 80/2)
14 t.fd(40)
15 t.circle(16, 180)
16 t.fd(40 * 2/3)
17 t.done()
```

## References

- [1] E. Tadmor. A review of numerical methods for nonlinear partial differential equations. *Bull. Amer. Math. Soc.*, 2012, 49(4): 507-554.
- [2] R. A. Adams, Fournier J J F. *Sobolev spaces*. Elsevier, 2003.
- [3] L. N. Trefethen, J. A. C. Weideman. The exponentially convergent trapezoidal rule. *SIAM Rev.*, 2014, 56(3): 385-458.
- [4] J. Shen. Efficient spectral-Galerkin method I. Direct solvers of second- and fourth-order equations using Legendre polynomials. *SIAM J. Sci. Comput.*, 1994, 15(6): 1489-1505.