Assignment #1

Course: Numerical methods of differential equation

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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.

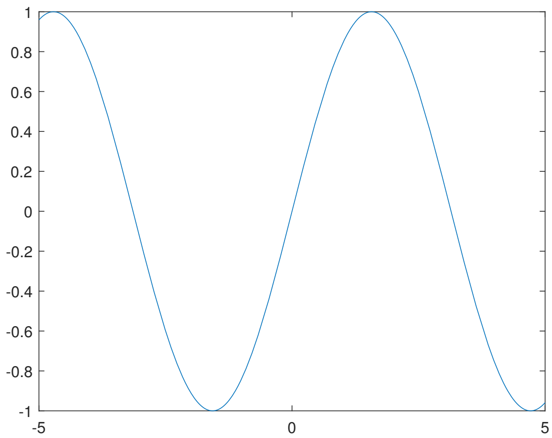

Figure 1 Image of function $y = \sin(x)$

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

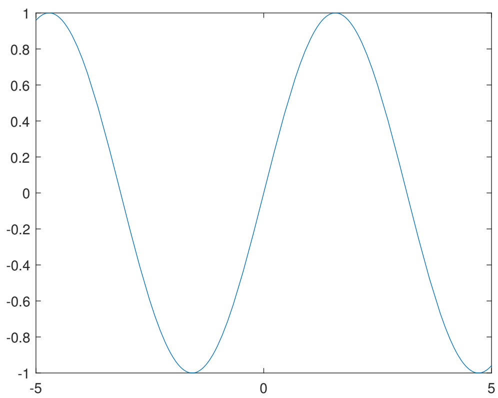

Figure 2 Description of image 1

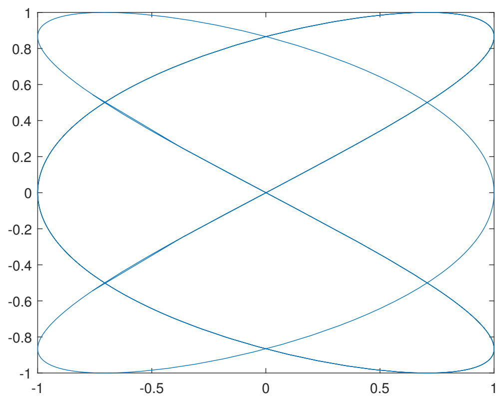

Figure 3 Description of image 2

Code highlighting

This is MATLAB code highlighting environment

MATLAB code

```matlab
% Euler method for the ODE model
% u'(x)=x^2+x-u, x in [0,1]
% Initial condition: u(0)=0.
clear all;  clf
h=0.1;
x=0:h:1;
N=length(x)-1;
u(1)=0;
fun=@(t,u) t.^2+t-u;   % RHS
for n=1:N
    u(n+1)=u(n)+h.*fun(x(n),u(n));
end
ue=-exp(-x)+x.^2-x+1;  % exact solution
plot(x,ue,'b-',x,u,'r+','LineWidth',1)
legend('Exact','Numerical','location','North')
xlabel('x'), ylabel('u')
```

This is Python code highlighting environment

Python code

```python
#PythonDraw.py
import turtle as t
t.setup(650, 350, 200, 200)
t.penup()
t.fd(-250)
t.pendown()
t.pensize(25)
t.pencolor("purple color")
t.seth(-40)
for i in range(4):
    t.circle(40, 80)
    t.circle(-40, 80)
t.circle(40, 80/2)
t.fd(40)
t.circle(16, 180)
t.fd(40 * 2/3)
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.