Computational Methods in Physics (PHY 365)

FA23

Dr. Muhammad Kamran

Department of Physics

COMSATS University Islamabad

Lab 23

Second order ODE

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x_i = 0;

x_f = 5 * pi;

x = [x_i , x_f];
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- The parameters a and b

```
a = 10  ^  -2;

b = 1;
```

Second order ODE

- Initial conditions

  IC = [0 , 1];

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  [X , Y] = ode45 (@ func_7 , x , IC);

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- Extracting y from Y

  y = Y(: , 1);

- Plotting the result

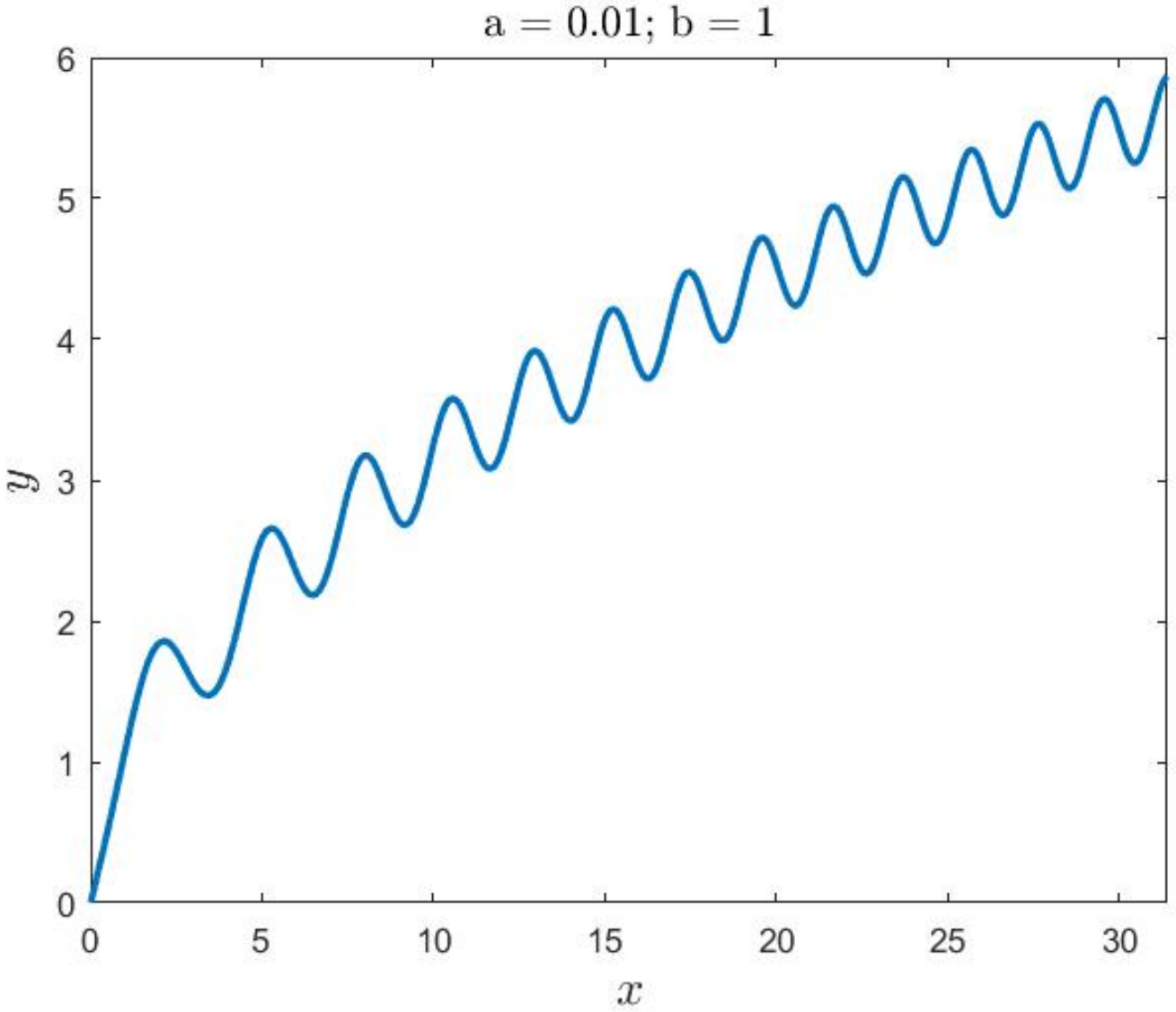
  plot(X , y)

Second order ODE

- The function file

```
function dy = func_7(x , y)
a = evalin('base' , 'a');
b = evalin('base' , 'b');
dy(1) = y(2);
dy(2) = x - a * y(2) - b * y(1) .^2;
dy = dy';
```

Second order ODE



MATLAB dsolve function

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- S = dsolve(eqn , cond) solves eqn with the initial or boundary condition "cond".
- S = dsolve(eqn , cond , Name , Value) uses additional options specified by one or more Name,Value pair arguments.
- [y1 , . . . , yN] = dsolve(___) assigns the solutions to the variables y1,. . . ,yN.

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- The differential equation

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my_eqn = diff(x , t) == 0;
```

- Initial condition

```
IC = x(0) == 2;
```

- Solving the equation

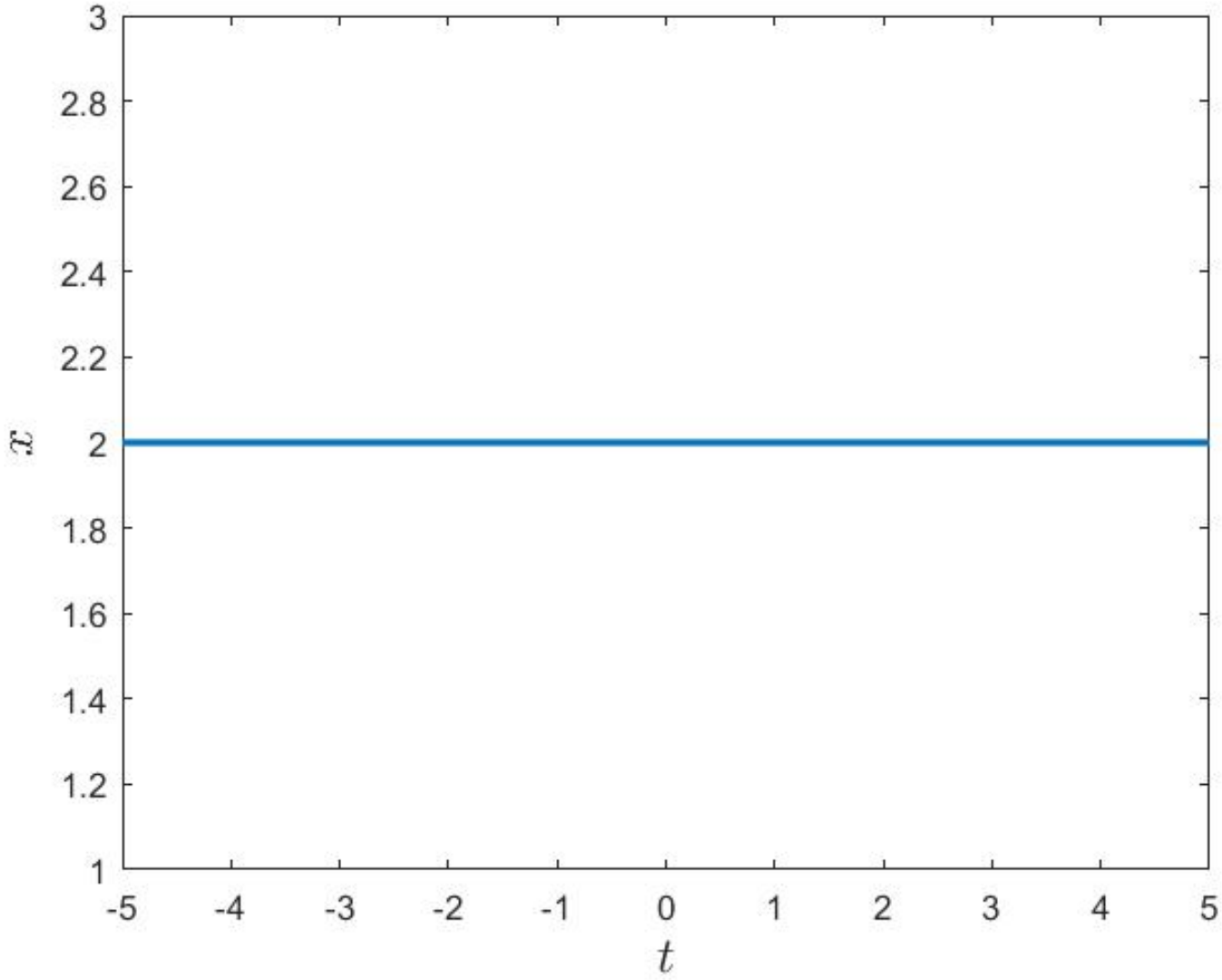
```
my_sol = dsolve(my_eqn , IC , 't');
```

First order ODE

- Plotting the result

```
fplot(my_sol)
```

First order ODE



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syms x(t);
my_eqn = diff(x , t) == sin (x);
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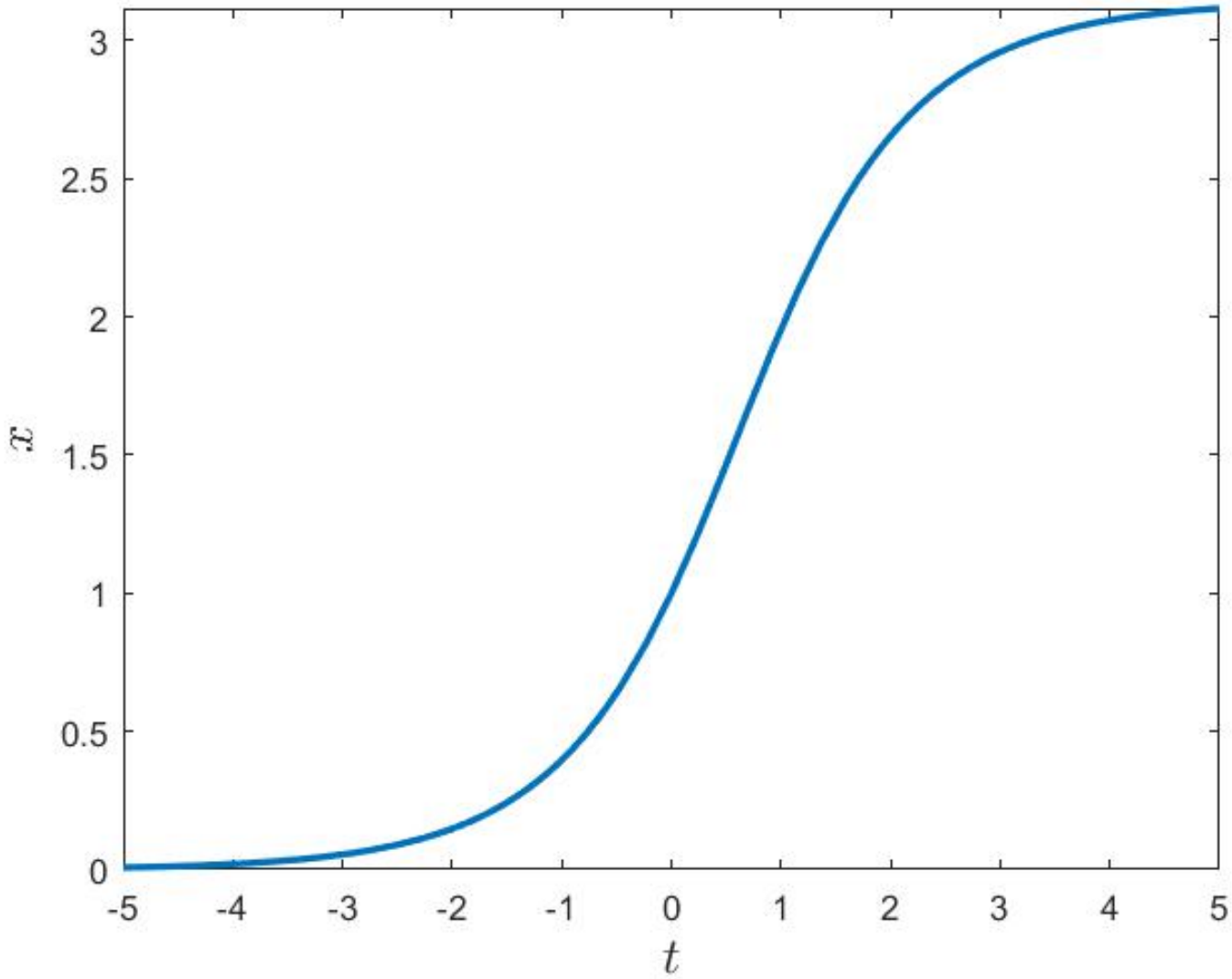

Second order ODE

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my_eqn = diff(x , t , 2) == t + exp(1 - t);
```

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- $\frac{d^2x}{dt^2} = t + \exp(1-t)$; $x(0) = 0, x'(0) = 1$.

- The differential equation

```
syms x(t);

my_eqn = diff(x , t , 2) == t + exp(1 - t);
```

- Initial conditions

```
Dx = diff(x , t);

IC = [x(0) == 0, Dx(0) == 1];
```

Second order ODE

- Solving the equation

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- Plotting the result

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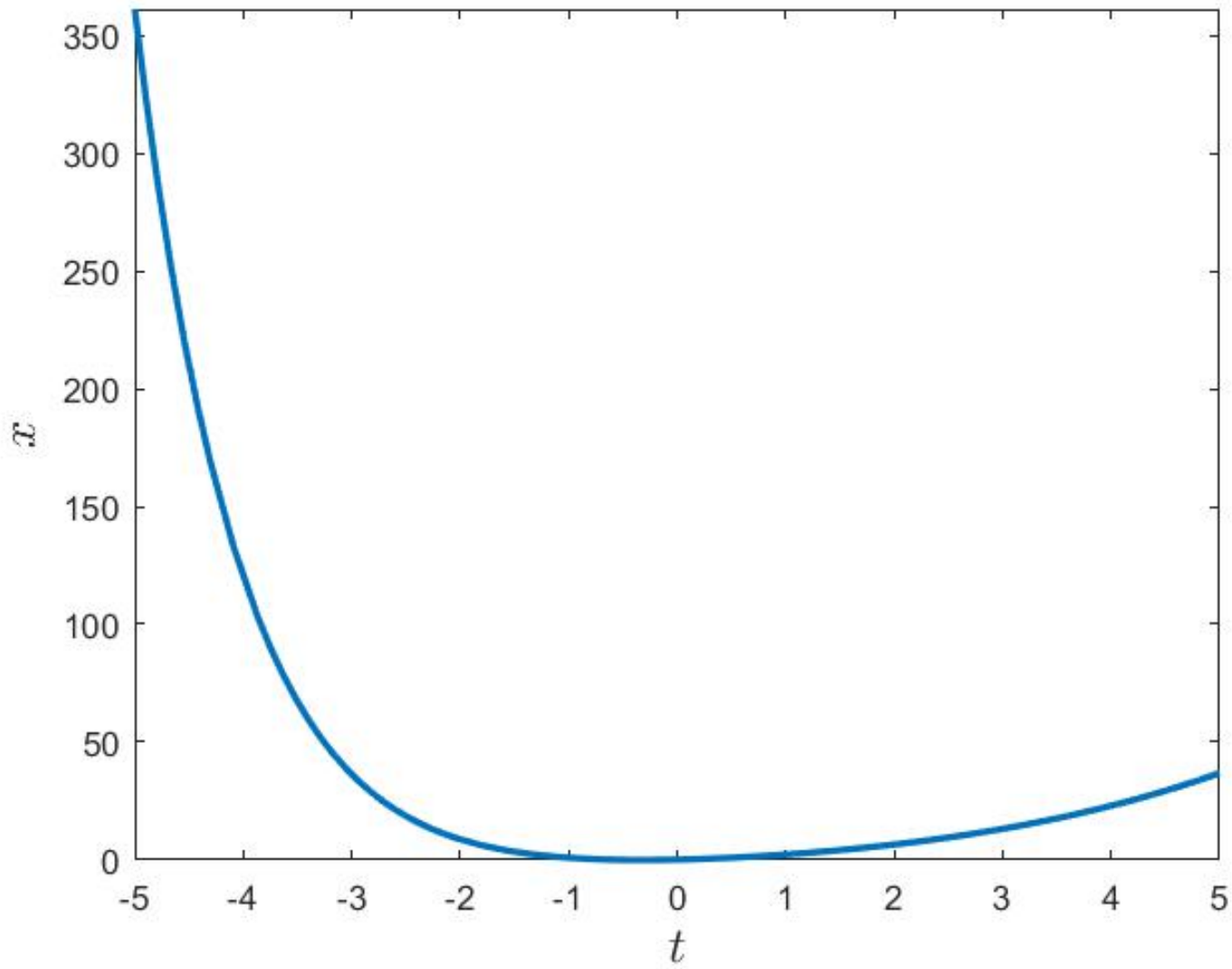

References

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