

**SCHOOL OF ADVANCED TECHNOLOGY**

ICT - Applications & Programming

Computer Engineering Technology – Computing Science

**Numerical Computing – CST8233**

# Lab #6 – Solving Ordinary Differential Equations (ODE)

In this lab, you will write a script to solve ODE using Euler’s method.

You will need to show your lab professor to get your grades.

## Grades:

**2%** of your final course mark

## Deadline

During the lab period of Week 14

## Steps

### Step 1. Ordinary Differentiation Equations (ODE)

ODEs are equations that involve some ordinary derivatives, as opposed to partial derivatives of a function. First order ODEs are considered in this course. ODEs arise in many contexts of mathematics and natural sciences. Solving an ODE means finding the equation of the dependent variable as a function of the independent variable.

The algorithms used in this course to solve ODEs require two conditions:

1. The ODE can be written in the form of , and
2. The initial value of is given.

In this lab, you will use **Euler’s Method** to solve a given ODE. Using this method, you can find successive values of given a step size . This step size defines the difference between two values. The formula used to find values is given as:

Before applying this formula, the given ODE must be re-written in the form of .

### Step 2. Exercise

The motion of a mass is modelled using the following ODE:

where is the displacement and is the time. The initial value of is .

1. Write R program that finds the values of displacement between for the following step sizes, and . Plot the displacement for each case.
2. The solution of this ODE is:

Plot the displacement for the same range mentioned in part A using this solution and find the absolute and relative errors when

**Hint**: All angle values must be in radians.

You need to demo this to your lab professor.