AM2060 Assignment 2

NOTE: this assignment is worth 25% of your final grade in this module.

Write a console app (program) in C# which solves the following integral using Simpsons method. The integral to be solved is

$$\int_a^b \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} dx$$

Details of the requirements:

1. Look up and understand Simpsons method.
2. Create a class named Simpson.
3. Create the following methods:
   (a) public void SetParameters(double a, double b, double sigma, double mu);
   Make sure that $b > a$. Make sure that sigma $\neq 0$.
   (b) public void SetNumIntervals(int numint);
   Make sure numint is an even number and greate than or equal to 10.
   (c) public double CalcIntegral();
   returns the value of the integral for the assigned parameter values.
   (d) public double GetError();
   estimates the error by finding the difference between the integral for numints intervals and 2 * numints intervals.
   (e) private double f(double x);
   evaluates the function $\frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$ at the value x.
4. You may include other helper methods if you so wish.
5. Provide test code in the main function which creates an instance of the Simpson class and evaluates the integral for the following parameter values: $a = 0$, $b = 1$, $\sigma = 1$, $\mu = 0.5$. Evaluate the integral for 10, 20, 30 and 40 intervals. Provide formatted output giving the number of intervals, the answer and the approximate error in each case.
6. Submit your answer by putting all code into a single file with an extension .cs. Check that your code runs and works before submitting. There will be marks allocated for tidy, readable and commented code.