

## **Assignment 4: Numerical Integration**

Find the following definite integral analytically and numerically:

$$\int_0^1 \sqrt{x^2 + 4} dx.$$

### **Hand in:**

1. Analytical method: Calculate the integral using the following formula. The result is used as the “accurate” value for calculating relative deviations. **(10%)**

$$\int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \ln(x + \sqrt{x^2 + a^2})$$

2. Numerical method: Find the integral by the Simpson’s rule using  $n=10$ , and calculate the relative deviation. Show necessary process. **(20%)**

### **Demonstration:**

1. Numerical method — by the trapezoidal rule: Write a program using a language of your choice to calculate the integral at any given value for  $n$ . Display the results, both integral and relative deviation, for  $n=5$ , 10, and 15, respectively. A table format is preferred. **(40%)**

2. At demonstration, you will run your program to find the integral and the relative deviation for another  $n$  value to be provided. **(30%)**

### **Requirements**

- Both hand in and demonstration are due November 22, 2012.
- The following rule applies to late hand in and demonstration: One day delay results in 20% mark deduction; two day delay results in 40% mark deduction; three day delay results in 60% mark deduction; a delay of more than three days results in 0 mark.
- Results for definite integral should use 6 decimal places, and results for relative deviation should use scientific notation with 2 decimal places.