## The University of Zambia Department of Mathematics and Statistics MAT 4119 - Engineering Mathematics III Tutorial Sheet 6

1. Use the Trapezoidal and Simpson's rules to approximate the following integrals. Compare the approximations to the actual value and find a bound for the error in each case, if possible.

(a) 
$$\int_{1}^{2} \ln x \, dx$$
 (b)  $\int_{0}^{\frac{\pi}{3}} \cos^2 x \, dx$  (c)  $\int_{0}^{\frac{\pi}{4}} e^{3x} \sin 2x \, dx$  (d)  $\int_{1}^{1.5} x^2 \ln x \, dx$ 

2. Use the table below to find an approximation to  $\int_{1.1}^{1.5} e^x dx$ , using:

- (a) the Trapezoidal rule with  $x_0 = 1.1$  and  $x_1 = 1.5$ ;
- (b) Simpson's rule with  $x_0 = 1.1$ ,  $x_1 = 1.3$ , and  $x_2 = 1.5$ .

x	1.1	1.3	1.5
$e^x$	3.0042	3.6693	4.4817

3. Approximate the following integrals using Composite Trapezoidal rule:

(a) 
$$\int_{0}^{2} \frac{2}{x^{2}+4} dx; n = 6$$
 (b)  $\int_{0}^{\frac{3\pi}{8}} \tan x \, dx; n = 8$  (c)  $\int_{e}^{e+1} \frac{1}{x \ln x} \, dx; n = 8.$ 

- (d) Determine the value of n and of h required to approximate the integrals in (a) to (c) to within  $10^{-5}$
- 4. Approximate the following integrals using Composite Simpson's rule:

(a) 
$$\int_{3}^{5} \frac{2}{\sqrt{x^2-4}} dx$$
;  $n = 8$  (b)  $\int_{0}^{\pi} x^2 \cos x dx$ ;  $n = 6$  (c)  $\int_{0.75}^{1.75} (\sin^2 x - 2x \sin x + 1) dx$ ;  $n = 8$ .

- (d) Determine the value of n and of h required to approximate the integrals in (a) to (c) to within  $10^{-5}$
- 5. Suppose that f(0) = 1, f(0.5) = 2.5, f(1) = 2 and  $f(0.25) = f(0.75) = \alpha$ . Find  $\alpha$  if the Composite Trapezoidal rule with n = 4 gives the value 1.75 for  $\int_0^1 f(x)$ .