The University of Zambia
Department of Mathematics and Statistics
MAT 4119 - Engineering Mathematics III
Tutorial Sheet 7

2024

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 α if the Composite Trapezoidal rule with $n = 4$ gives the value 1.75 for $\int_{0}^{1} f(x)$.