1. Introduction to Numerical Methods

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1.1 Exercises

Exercises: Errors

Exercise 1.1 If $x = 2$ is approximated by $\bar{x} = 1.94$, find the true error and relative error. ■

Exercise 1.2 If $x = \pi$ is approximated by $\bar{x} = \frac{3}{7}$, find the actual error and the relative percent error. ■

Exercise 1.3 If $x = 0.76$ *inches* and the relative error of an approximation is known to be 0.04, find the possible values for $\bar{x}$. ■

Exercise 1.4 If $x = 186.4$ and the relative error of an approximation is known to be 0.0001, find the possible values for $\bar{x}$. ■

Exercises: Taylor's series

Exercise 1.5 Given a function $f(x) = \sin(x)$. Compute the following Taylor's polynomial at $x = 0$ by truncating

i. Second terms, third terms and fourth terms.

ii. If the above Taylor's polynomial is used to approximates $\sin(27^\circ)$, then find the true error E_t

of each of these approximations

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Exercise 1.6 Find the second and fourth order Taylor's polynomial by truncating the second and fifth terms, centered at $x = x_0$, for each of the following functions
i. $f(x) = e^x$, $x_0 = 1$
ii. $f(x) = x^{\frac{1}{3}}$, $x_0 = 5$

■

Exercise 1.7 Using the Maclaurin expansion of e^x and e^{-x}, find the second order Maclaurin expansion,$P_2(x)$ of
i. $\sinh(x)$ where $\sinh(x) = \frac{1}{2}(e^x - e^{-x})$
ii. $\cosh(x)$ where $\cosh(x) = \frac{1}{2}(e^x + e^{-x})$

■

Exercise 1.8 Show that the Taylor's expansion of $\ln(1-x)$ about $x = 0$ is $\sum_{n=1}^{\infty} \frac{(-1)^{n-1} - x^n}{n}$ ■

References 1. Chapra, C. S. & Canale, R. P. Numerical Methods for Engineers, Sixth Edition, McGraw–Hill, 2010.