Numerical Analysis Course (Spring 1402)

Sympy Assignment

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1. Question Number 1: Symbolic Differentiation

   Find the derivative of the following functions using Sympy:

   (a) $f(x) = x^3 - 2x^2 + 5x - 7$

   (b) $g(x) = \frac{1}{x^2+1}$

   (c) $h(x) = e^{2x}\cos(x)$

2. Question Number 2 : Symbolic Integration

   Find the indefinite integral of the following functions using Sympy:

   (a) $f(x) = 2x + 5$

   (b) $g(x) = \frac{1}{x^2+1}$

   (c) $h(x) = \frac{x^3}{3} - 2x^2 + 5x - 7$

3. Question Number 3 : Solving Equations

   Solve the following equations using Sympy:

   (a) $x^2 - 3x + 2 = 0$

   (b) $e^x + x - 1 = 0$

   (c) $\cos(x) = \frac{1}{2}$

4. Question Number 4 : Advanced Sympy

   Use Sympy to find the first 10 terms of the Fourier series of the following function over the interval $[-\pi, \pi]$:

$$f(x) = \begin{cases} 0, & -\pi \leq x < 0 \\ 1, & 0 \leq x < \pi \end{cases}$$

5. Question Number 5 : Application of Sympy (Bonus Question)

   Use Sympy to solve the following problem:

   A particle moves along the x-axis according to the equation $x = 3\sin(t) - 4\sin(2t)$, where t is time. Find the velocity and acceleration of the particle as functions of time.

Good Luck, Have Fun, Code a Lot !