

FALL 2019 PRACTICE TEST 2(2)

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Problem 1. Determine a function $p(h)$ to estimate the derivative of $\sin(x^2)$ at $x = 1$.

$$\left. \frac{df}{dx} \right|_{x=a} \approx p(h) = A_0 \cdot f(a - 4h) + A_1 \cdot f(a - h) + A_2 \cdot f(a) + A_3 \cdot f(a + h) + A_4 \cdot f(a + 5h)$$

Problem 2. For a queue of type M/M/ ∞ what is the average number in the queue with arrival rate α service rate σ ?

Problem 3. Suppose that you are determining the number of exchanges for a telephone system with 10,000 telephone lines. Suppose that each line makes five calls per day. Each call lasts an average of three minutes. How many exchanges would you calculate are needed. Explain.

Problem 4. Assume that the human blood contains 30×10^{12} erythrocytes. Suppose that each erythrocyte lives 100 days. How many erythrocytes are being produced each day by the bone marrow?

Problem 5. Approximate the following differential equation using the Picard method using five iterations.

$$\frac{d^2x}{dt^2} = -x$$

with the following initial conditions $x(0) = 1$ and $x'(0) = 1$.

Solve the same problem using **linearode** on the interval $[0, \pi]$ using ten steps. Determine the Taylor expansion up to ten terms.