Numerical Analysis 10E **Name (Print):** ______________________

Chapter 01 Sample Exam

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1. (10 points) Given the quadratic equation $0.987x^2 + 11.2x + 0.246 = 0$. Find the best approximation to each of the two solutions using 3 digit chopping arithmetic and the appropriate equations for x_1 and x_2.

2. (10 points) Given the quadratic equation $0.987x^2 - 11.2x - 0.246 = 0$. Find the best approximation to each of the two solutions using 3 digit rounding arithmetic and the appropriate formulas.

3. (15 points) Let $x_0 = 0.5$. Given

$$f(x) = -2e^{-x} + 1/4x^4 - \frac{1}{120}x^5 + 2x \qquad f'(x) = 2e^{-x} + x^3 - \frac{1}{24}x^4 + 2$$
$$f''(x) = -2e^{-x} + 3x^2 - \frac{1}{6}x^3 \qquad f'''(x) = 2e^{-x} + 6x - \frac{1}{2}x^2$$
$$f^{(4)}(x) = -2e^{-x} + 6 - x \qquad f^{(5)}(x) = 2e^{-x} - 1$$
$$f^{(6)}(x) = -2e^{-x}$$

   (a) (5 points) Find the Taylor Polynomial, $T_3(x)$, of degree at most 3 for $f(x)$ expanded about x_0.

   (b) (5 points) Give the general error formula for $f(x) - T_3(x)$ for any x.

   (c) (5 points) Find the absolute error in using $T_3(0.65)$ to approximate $f(0.65)$.

4. (10 points) Let $x_0 = 0$. Given

$$f(x) = -2e^{-x} + 1/4x^4 - \frac{1}{120}x^5 + 2x \qquad f'(x) = 2e^{-x} + x^3 - \frac{1}{24}x^4 + 2$$
$$f''(x) = -2e^{-x} + 3x^2 - \frac{1}{6}x^3 \qquad f'''(x) = 2e^{-x} + 6x - \frac{1}{2}x^2$$
$$f^{(4)}(x) = -2e^{-x} + 6 - x \qquad f^{(5)}(x) = 2e^{-x} - 1$$
$$f^{(6)}(x) = -2e^{-x}$$

   (a) (5 points) Find the Taylor Polynomial, $T_3(x)$, of degree at most 3 for $f(x)$ expanded about x_0.

   (b) (5 points) Use the error formula to find a bound for the absolute error in approximating $f(0.65)$ with $T_3(0.65)$.

5. (10 points) Let $f(x) = x^3 - e^{-x}, \quad x_0 = 0.5$.

   (a) (5 points) Find the Taylor Polynomial, $T_2(x)$, of degree at most 2 for $f(x)$ expanded about x_0.

   (b) (5 points) Evaluate $T_2(0.8)$ and compute the actual error $|f(0.8) - T_2(0.8)|$