MTH 253
Mini Test 1

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(8) 1. Use a linear approximation for $f(x) = \frac{1}{x}$ at $a = 2$ to approximate $\frac{1}{1.998}$. Round your conclusion to the nearest ten-thousandth.

(8) 2. The equation $x^5 + x^3 + 6 = 3x^4 + x^2 + x$ has 3 real roots. Use Newton's method to approximate these roots with x_3. Make initial approximations of $x_1 = -1, 1, 3$. Show all work to support your conclusions, and round your conclusions to the nearest hundredth.

(4) 3. Suppose a population is modeled by the differential equation $\dfrac{dP}{dt} = 1.01P\left(1 - \frac{P}{253}\right)$.

   (a) What is the carrying capacity for this population?

   (b) If the initial population is $P = 100$, is this population going to grow or decay? What tells you this?

   (c) If the initial population is $P = 300$, is this population going to grow or decay? What tells you this?

(5) 4. Show that $y = \dfrac{e^x + e^{-x}}{2}$ is a solution to the second-order differential equation below.

$$y'' - y' + 2y - 2e^{-x} = e^x$$