

Name: _____

Please show all work and justify your answers.

- (10 pts.) The probability that a computer running Megahard Windows 2003 will crash between a and b hours after power-on is modeled by

$$0.2 \int_a^b e^{-0.2t} dt$$

- According to this model, on average, how soon does such a computer crash?
 - At 9am workers arrive at the Drexxon Corp. cube farm and turn on their Megahard computers. By what time one half of the computers had been rebooted?
- (10 pts.) Find the second order Taylor approximation to $e^x/\sqrt{1-x}$ near $x = 0$. Sketch the given function and the approximation very close to $x = 0$ on the same graph.
 - (10 pts.) Find the first order Fourier approximation to $|x|$ on the interval $[-1, 1]$. Feel free to compute the required integrals numerically. Sketch $|x|$ and the approximation over the entire interval on the same graph.
 - (20 pts.) When a new anti-viral drug is administered, the viral load $P(t)$, measured in 10^4 virii, in a patient t days after treatment begins is modeled by the differential equation

$$\frac{dP}{dt} = 0.5(t + 3)^{-\frac{3}{2}}P$$

Assuming the initial load is 3 (in other words, 30000 virii), we would like to determine the predicted load after 2 days of treatment.

- Estimate $P(2)$ using Euler's method with step size $\Delta t = 1$.
- Solve the differential equation analytically, for example using separation of variables, and find $P(2)$.
- Sketch $P(t)$ over an extended course of treatment. How useful does the treatment seem? What is the long term prognosis for the patient?

| 1 | 2 | 3 | 4 | total (50) |
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Prelim. course grade: %