INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write (1) your name, (2) 1360/EXAM 2, (3) instructor’s name and (4) Summer 2014 on the front of your bluebook. Also make a grading table with room for 6 problems and a total score. Work all problems. Start each problem on a new page. Box your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

SHOW ALL WORK

1. (a) (12 pts) Let R be the region between the curve \( y = \sqrt{1-x} \), the x-axis and the y-axis. Determine the volume of the solid whose cross sections in R, perpendicular to the y axis, are squares. Be sure to evaluate the integral(s) involved.
   (b) (12 pts) A cup is formed by rotating the region between \( y = 0, y = 9, x = 0 \) and the line \( y = 2x - 1 \) about the y-axis. Using cylindrical shells, set up but do not evaluate the integral(s) representing the volume of the cup.

2. (10 pts) Find the surface area of the cup from 1(b). Make sure to evaluate the integral(s).

3. (a) (10 pts) A basic model for the temperature, \( T(t) \), of a delicious slice of toast with respect to time, \( t \), in a room of temperature 60°F was described by Newton, who was an avid toast enthusiast: \( \frac{dT}{dt} = -\frac{1}{2} (T - 60) \). If the toast is initially at a temperature of 300°F, determine the temperature of the toast as a function of time.
   (b) (5 pts) What happens to the toast as time goes on? Does this make sense?

4. (a) (10 pts) Does the sequence defined by \( a_n = n \sin(\frac{1}{n}) \) converge or diverge? If it converges, determine the limit.
   (b) (6 pts) Assuming the sequence defined by \( a_{n+1} = 1 + \frac{1}{1 + a_n} \) is convergent, what is the limit?

5. We can model [a picture of] Jabba the Hutt using the functions given in the graph below.

   (a) (8 pts) What is the total mass of Jabba the Hutt, given \( \rho = 1 \)?
   (b) (12 pts) Set up the calculations but DO NOT SOLVE for the coordinates of Jabba’s center of mass.

EXAM CONTINUED AND FORMULAS ON THE OTHER SIDE.

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1 Maybe?
6. (3 pts ea.) **Always true or false?** You do NOT need to justify your answer.
(a) For any constant $c$ and any sequence $a_n$, $\lim_{n \to \infty} (c \ a_n) = c \ \lim_{n \to \infty} a_n$.
(b) The center of mass of a 2-dimensional region will always lie on the boundary or the inside of the region.
(c) If $\lim_{n \to \infty} |a_n| = L$ for some number $L$, then $\lim_{n \to \infty} a_n = L$.
(d) The integral $\int_0^2 2\pi(x-5)e^x \,dx$ represents the volume of the region between the curve $y = e^x$ and the lines $x = 0$, $x = 2$ and $y = 0$ rotated about the line $x = 5$, using the cylindrical shell method.
(e) $x(t) = \sin(2t)$ is a solution to the differential equation $\frac{d^2x}{dt^2} + x = 0$.

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A NOT-SO-GENEROUS FORMULA SHEET/Exam 2 (1360 Summer 2014)

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\bar{x} = \frac{M_y}{M} = \frac{\int_a^b \rho x f(x) \,dx}{\int_a^b \rho f(x) \,dx}
\]

\[
\bar{y} = \frac{M_x}{M} = \frac{\int_a^b \rho \frac{1}{2} [f(x)]^2 \,dx}{\int_a^b \rho f(x) \,dx}
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