Test 2 **MATH 129** **February 28, 2018**

Name: _____ **Signature:** _____

Show all your work!

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1. [20 points] Decide whether the following improper integrals convergent or divergent, set up the inequality that proves your answer.

   (a) $\displaystyle\int_3^\infty \frac{5+\sin x}{\sqrt{x-1}}\,dx$

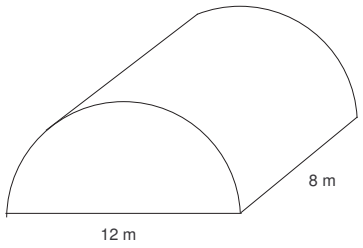
   (b) $\displaystyle\int_0^\infty \frac{dt}{e^t+2^t}$

2. [20 points] Evaluate the following improper integrals

   (a) $\displaystyle\int_0^\infty \frac{1}{1+x^2}\,dx$

   (b) $\displaystyle\int_1^2 \frac{1}{(x-1)^{0.1}}\,dx$

3. [15 points] Use horizontal slicing to set up the definite integral that represents the volume of the semi-cylinder below (do not evaluate the integral).



4. [15 points] A circular city of radius 3 miles, is densely populated near the center, and the population gradually thins out toward the city limits. The population density is $f(r) = 10,000(3 - r)$ people per square miles at radius r miles from the city center. Find the total population of the city (use slicing and show all of your work).

5. [30 points] Consider the region bounded by $y = e^x$, the x-axis and the lines $x = 0$ and $x = 1$. Draw cross sections and set up definite integrals to find the volume of the following solids (do not evaluate the integrals):

   (a) The solid obtained by rotating the region around the x-axis.

   (b) The solid obtained by rotating the region around the horizontal line $y = -2$.

   (c) The solid whose base is given by the region above, and whose cross sections perpendicular to the x-axis are semicircles.