Calculus Field Day **Practice AB-Calculus Session 2 (Graphing Calculator permitted)**

School: _____

Team Members: _____

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Part II. (30 minutes; A graphing calculator is permitted.)

Each team has 30 minutes to answer three questions.

Each team submits one set of answers at the end of the thirty minutes. You must cross out (without penalty) whatever you do not wish to be considered.

You must show steps and reasoning. Partial credit will be given. Round off final answers to three decimal places, e.g., 1.8746 becomes 1.875. Remember to include units: feet/second, meters, etc.

Name: _____

1.) A particle moves along the x-axis. The velocity of the particle at time $t \geq 0$ is given by $v(t) = 2\cos\left(\frac{t}{3}\right) - \sqrt{t}$. The particle is at position $x = 3$ at time $t = 4$.

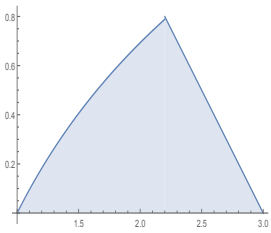
a.) At time $t = 2$, is the particle speeding up or slowing down?

b.) Find all times t in the interval $0 < t < 3$ when the particle changes direction. Justify your answer.

c.) Find the initial position of the particle at time $t = 0$.

d.) Find the total distance the particle travels from time $t = 0$ to time $t = 3$.

2.) Let R be the region in the first quadrant bounded by the x-axis and the graphs of $y = \ln x$ and $y = 3 - x$, as shown in the figure below.



a.) Find the area of R.

b.) Region R is the base of a solid. For the solid, each cross section perpendicular to the x-axis is a square.
Write, but do not evaluate, an expression involving one or more integrals that gives the volume of the solid.

c.) The horizontal line $y = k$ divides R into two regions of equal area. Write, but do not solve, an equation involving one or more integrals whose solution gives the value of k.

3.) There is no snow on Lily's driveway when snow begins to fall at midnight. From midnight to 9 A.M. next morning, snow accumulates on the driveway at a rate modeled by $F(t) = 3t\, e^{\cos t}$ cubic feet per hour, where t is measured in hours since midnight. Lily starts removing snow at 7 A.M. ($t = 7$). The rate $G(t)$, in cubic feet per hour, at which Lily removes snow from the driveway at time t hours after midnight is modeled by

$$G(t) = \begin{cases} 0, & 0 \le t < 7 \\ 82, & 7 \le t < 8 \\ 70, & 8 \le t < 9. \end{cases}$$

a.) How many cubic feet of snow have accumulated on the driveway by 7 A.M.?

b.) Find the rate of change of the volume of snow on the driveway at 8 A.M.

c.) Let $H(t)$ represent the total amount of snow, in cubic feet, that Lily has removed from the driveway at time t hours after midnight. Express H as a piecewise-defined function with domain $0 \le t \le 9$.

d.) How many cubic feet of snow are on the driveway at 9 A.M.?