

Name: _____

Date: _____

- 1) Consider the region bounded by $y = 1$, $y = \sqrt{x+1}$, $x = 0$ and $x = 3$.
 - a) Find the volume of the resulting solid if the region is revolved about $y = -1$.
 - b) Find the volume of the resulting solid if the region is revolved about the y -axis.
- 2) A spring has a natural length of 10m. It takes 8N of force to keep it stretched out to 12m. How much work does it take to stretch the spring from 12m to 15m?
- 3) Find the center of mass of the following n -point system of masses:
 $m_1 = 2kg$ at $P_1(2,4)$ $m_2 = 6kg$ at $P_2(0,-2)$ $m_3 = 4kg$ at $P_3(1,1)$ $m_4 = 8kg$ at $P_4(-4,0)$
- 4) Find the centroid of the region bounded below by $y = \sec x$ and above by $y = 2$.
- 5) ***** DO NOT USE CALCULATOR ***** Bob's coffee has cooled down to 73 degrees. To warm up the coffee, he places it in an oven that is set to 100 degrees. If the coffee reaches 88 degrees after two minutes, what temperature will it reach after three minutes? How long will it take to reach $94\frac{2}{3}$ degrees?
- 6) A population of ants grows at a rate which is proportional to the size of the population. Assume the initial population size is 2500 ants and that its relative growth rate is 0.25 per year. Let y denote the population size at any given time t (in years).
 - a) Write a differential equation that describes the population growth.
 - b) Write the population size as a function of time.
 - c) How many ants will there be in 10 years?
- 7) Solve the following initial value problem: $\frac{dy}{dx} = 2xy^2$ subject to the initial condition $y(0) = \frac{1}{2}$.
- 8) Use an integrating factor to solve the following linear ODE: $xy' - y = 2x^3\sqrt{x^2 + 1}$
- 9) Solve: $\frac{dy}{dx} = 2xy + y$ subject to $y(0) = 6$.
- 10) Solve the initial value problem: $y'' - 6y' + 9y = 0$ where $y(0) = 2$ and $y'(0) = 3$
- 11) Solve the boundary value problem: $4y'' - y = 0$ where $y(0) = e + 2$ and $y(2) = 2e + 1$
- 12) Solve the initial value problem: $y'' - 4y' + 8y = 0$ where $y(0) = 3$ and $y'(0) = 4$