## Math 116 - Quiz 4

 Name: $\qquad$Answer the following questions showing all work. 5 points each.
For questions 1-4, consider the graph given by the parametric equations $x(t)=2 e^{t}-4$ and $y(t)=\frac{1}{2} e^{2 t}-t$.

1. Precisely one of the points $\left(2 e^{5}-4, \frac{1}{2} e^{5}-5\right)$ and $\left(2 e-4, \frac{e^{2}}{2}-1\right)$ is on the graph. Which one is?
2. Find the equation of the tangent line to the graph at the point you found in 1 .
3. Is the graph concave up or concave down at the point you found in 1 ?
4. Find length along the graph from $\left(4, \frac{1}{2}\right)$ to $\left(8 e^{2}-4, \frac{1}{2} e^{4}-1\right)$.
5. Suppose $r=f(\theta)$ satisfies the differential equation $\left(\frac{d r}{d \theta}\right)^{2}+r^{2}=\theta^{2}$. Compute the arc length of $f$ from $\theta=0$ to $\theta=2 \pi$.
6. In honor of St. Patricks Day, you decide to pick a shamrock. Unfortunately, you can't find any three leaf clovers, which makes you sad. Your friend offers to cheer you up by conjuring up one in the form of the polar equation $r=4 \cos (3 \theta)$. With that in mind, compute the area of a single leaf.
7. Also, write down (but do not evaluate) a definite integral to compute the perimiter of one leaf.
8. Consider the region, $\Omega$, in the first quadrant bounded by the x -axis, the y -axis, the line $x+y=10$, and the circle $x^{2}+y^{2}=4$. Give inequalities on $r$ and $\theta$ that describe $\Omega$.
