Problem 1. Find an equation of the tangent to the curve at the given point by two methods:
(a) without eliminating the parameter. (b) by first eliminating the parameter.

1. $x = 1 + \ln(t)$ $\quad y = t^2 + 2,$ $\quad (1, 3)$
2. $x = 1 + \sqrt{t}$ $\quad y = e^{t^2},$ $\quad (2, e)$

Problem 2. Find the area of the region enclosed by the following parametric equations.

1. $x = a\cos^3(\theta)$ $\quad y = a\sin^3(\theta)$
2. $x = t^2 - 2t$ $\quad y = \sqrt{t},$ $\quad y$-axis
3. $x = 1 + e^t$ $\quad y = t - t^2,$ $\quad x$-axis

Problem 3. Find the exact length of each curve.

1. $x = 1 + 3t^2$ $\quad y = 4 + 2t^3,$ $\quad 0 \leq t \leq 1$
2. $x = e^t + e^{-t}$ $\quad y = 5 - 2t,$ $\quad 0 \leq t \leq 3$
3. $x = t\sin(t)$ $\quad y = t\cos(t),$ $\quad 0 \leq t \leq 1$
4. $x = 3\cos(t) - \cos(3t)$ $\quad y = 3\sin(t) - \sin(3t),$ $\quad 0 \leq t \leq \pi$

Problem 4. Find the exact area of surface obtained by rotating given curve about the given axis.

1. $x = t^3$ $\quad y = t^2$ $\quad 0 \leq t \leq 1$ $\quad x$-axis
2. $x = a\cos^3(\theta)$ $\quad y = a\sin^3(\theta)$ $\quad 0 \leq \theta \leq \frac{\pi}{2}$ $\quad x$-axis.
3. $x = 3t^2$ $\quad y = 2t^3$ $\quad 0 \leq t \leq 5$ $\quad y$-axis.
4. $x = e^t - t$ $\quad y = 4e^{\frac{t}{2}}$ $\quad 0 \leq t \leq 1$ $\quad y$-axis