The problems on this worksheet are for in-class practice during tutorial. You are free to collaborate and to ask for help. They don't count for course credit, but it's a good idea to make sure you know how to do everything before you leave tutorial – similar problems may show up on a test or assignment.

1. Eliminate the parameter to obtain an equation for the curve involving only x and y:

   (a) $x = \sec t$, $y = \tan t$

   (b) $x = 4\sin t + 1$, $y = 3\cos t - 2$ (Hint: first solve for $\cos t$ and $\sin t$.)

   (c) $x = \dfrac{1}{t+1}$, $y = \dfrac{3t+5}{t+1}$. (Hint: try doing long division on the expression for y.)

   (d) $x = \cosh t, y = \sinh t$

2. Find the length of the parametric curve:

   (a) $x = -3\sin(2t)$, $y = 3\cos(2t)$, $t \in [0, \pi]$.

   (b) $x = e^{t/10}\cos t, y = e^{t/10}\sin t$, $t \in [0, 2\pi]$.

3. Find the area enclosed by the astroid $x = \cos^3 t, y = \sin^3 t$, $t \in [0, 2\pi]$. (There is some work involved here to evaluate the integral.)

4. Find the area enclosed by the loop of the "teardrop" curve $x = t(t^2 - 1), y = t^2 - 1$. (See Figure 5.34 in the text.)

5. Verify that $x = Ce^{-t} + De^{2t}$ is a solution to $x'' - x' - 2x = 0$.

6. Find the solution from Problem 5 that satisfies $x(0) = 3$ and $x'(0) = -2$.

7. Solve $y' = y^3$ when $y(0) = 1$. (Hint: $\dfrac{1}{y'} = \dfrac{dx}{dy}$.)

8. Solve $\dfrac{dx}{dt} = x\sin(t)$ for $x(0) = 1$.