Here are a set of problems for my Calculus I notes. These problems do not have any solutions available on this site. These are intended mostly for instructors who might want a set of problems to assign for turning in. I try to put up both practice problems (with solutions available) and these problems at the same time so that both will be available to anyone who wishes to use them.

**Arc Length with Parametric Equations**

For all the problems in this section you should only use the given parametric equations to determine the answer.

For problems 1 – 5 determine the length of the parametric curve given by the set of parametric equations. For these problems you may assume that the curve traces out exactly once for the given range of t’s.

1. \( x = 3 + 9t \quad y = 10 - 15t \quad -5 \leq t \leq 8 \)
2. \( x = 6(3 + t)^{\frac{3}{2}} \quad y = -3t^{\frac{3}{2}} \quad -2 \leq t \leq 1 \)
3. \( x = 4t^2 - 3 \quad y = 3t \quad 0 \leq t \leq 5 \)
4. \( x = 3 + t \quad y = 6 + (t - 1)^2 \quad 1 \leq t \leq 3 \)
5. \( x = t^2 - 1 \quad y = t^4 + 5 \quad 0 \leq t \leq 1 \)

For problems 6 and 7 a particle travels along a path defined by the following set of parametric equations. Determine the total distance the particle travels and compare this to the length of the parametric curve itself.

6. \( x = 6 \cos^2(3t) \quad y = 2 - 3 \sin^2(3t) \quad -\frac{31}{4} \pi \leq t \leq \frac{43}{5} \pi \)
7. \( x = 3 + \cos\left(\frac{1}{6}t\right) \quad y = 4 + \cos^2\left(\frac{1}{6}t\right) \quad -\frac{21}{2} \pi \leq t \leq \frac{17}{2} \pi \)

For problems 8 – 10 set up, but do not evaluate, an integral that gives the length of the parametric curve given by the set of parametric equations. For these problems you may assume that the curve traces out exactly once for the given range of t’s.

8. \( x = t \cos(2t) \quad y = \sin(3t) \quad 2 \leq t \leq 3 \)
9. \( x = 1 - \sin\left(1 + \sqrt{t}\right) \quad y = \sin\left(e^{-t}\right) \quad 1 \leq t \leq 4 \)
10. \[ x = \ln(t + 2) \quad \frac{1}{t + 7} \quad -1 \leq t \leq 2 \]