INSTRUCTIONS: This is a practice exam for the second midterm. Warning: It does not cover all the material that will be covered on the exam! If you only study the material on this practice exam, you could be in serious trouble for the actual exam. There will NOT be a solution key posted for this practice exam. This should take you no more than an hour to complete!

1. Let $F(t) = ti + \frac{1}{2}t^2j$. (a) Express the curvature in terms of $t$. (b) What is the radius of curvature when $t = 1$? (c) What is the length of the curve from $t = 1$ to $t = 2$?

2. (a) Find the line of intersection for the following two planes $P_1: -2x + 3y + 7z + 2 = 0$ and $P_2: x + 2y - 3z + 5 = 0$. (b) Find the point at which the line $\frac{z-12}{3} = -y - 6 = z - 2$ intersects $P_1$. (c) What is the relationship of the line in (a) and the line in (b)? (Parallel? Intersecting? Skew?)

3. A curve in space is parametrized by $F(t) = (t, 2t^2, 3t^3 + 1)$. Find the equation of the tangent line and normal plane at $P(1, 2, 4)$. Find the unit tangent vector at $P$.

4. Find the area inside both of the curves $r = \cos \theta$ and $r = 1 - \cos \theta$. 
5. A curve is parametrized by \( \mathbf{r}(t) = (\sin t - t \cos t)i + \cos t + t \sin t)j, \ 0 \leq t \leq \pi/2 \). Find the length of this curve.

6. Convert from polar to rectangular form:
   (a) \( \theta = \pi/3 \)

   (b) \( r = 4 \sin(\theta + \pi) \)

7. Convert from rectangular to polar form:
   (a) \( y = 3 - 2x \)

   (b) \( x^2 + y^2 + x = \sqrt{x^2 + y^2} \)

8. Graph \( r = \cos 4\theta \) on both the \( r - \theta \) plane and the \( x - y \) plane.