Instruction:

1. Show complete and neat work for full credit.

2. This exam consists of (9) pages.
1. Sketch the curve with parametric equations

\[ x = \sin t, \quad y = \sin^2 t. \]

(Include all necessary details). (5 points)
2. Let \( r^2 = 4 \cos \theta \). Check symmetry of this curve about \( x \)-axis, \( y \)-axis and the origin. Show complete procedure to sketch this curve. (10 points)
3. Find area of the region that is inside the graph of $r = 3 + 2\sin \theta$ and outside the circle $r = 4$. (10 points)
4. For the curve $r = 2 + 2 \cos \theta$, find points at which the tangent line is vertical.
   
   (5 points)
5. Find area of: (10 points)

(a) curve \( r^2 = 3 \sin 2\theta \)

(b) one petal of the rose \( r = 3 \cos 6\theta \).
6. (a) Describe the set of points in space whose coordinates satisfy

\[ x^2 + y^2 + z^2 - 2x - 6y - 8z \leq -1. \]  

(3 points)

(b) For \( \vec{a} = \langle 3, -7, 2 \rangle \) and \( \vec{b} = \langle 1, 0, -2 \rangle \), compute \( \text{proj}_\vec{b} \vec{a} \).  

(2 points)
7. Find distance between the lines:

\[ L_1: \ x = 2 - t, \ y = 2t, \ z = 1 + t \]
\[ L_2: \ x = 1 + 2t, \ y = 3 - 4t, \ z = 5 - 2t. \]
8. For the planes,

\[ P_1 : -2x + 3y + 7z + 2 = 0 \]
\[ P_2 : x + 2y - 3z + 5 = 0, \]

find (10 points)

(a) parametric equations of the line of intersection of \( P_1 \) and \( P_2 \),

(b) angle between \( P_1 \) and \( P_2 \).