Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name: _____

1. To answer the following questions use the function given in parametric form

$$x = 3\cos(t),\ y = 6\sin(t)$$

(a) Graph.

(b) Find the tangent line to the function at $t = \pi/3$.

2. Consider equations of the plane and the line below.

$$P : \{x - y + 2z = 5 \qquad \text{and} \qquad L : \begin{cases} x = & -1 & +t \\ x = & 0 & +3t \\ z = & 1 \end{cases}$$

(a) At what point do the plane and line intersect?

(b) Find the parametric equation of the plane.

(c) At what angle do the plane and line intersect?

3. Let $\mathbf{r}(t) = \langle 4\cos(3t), 6\sin(3t) \rangle$.

    (a) What is the velocity, acceleration of this particle.

    (b) Compute $\mathbf{T}(t)$.

    (c) Graph $\mathbf{v}(\pi/4)$, and $\mathbf{a}(\pi/4)$ coming out from the point $\mathbf{r}(\pi/4)$.

4. Let $\mathbf{r}(t) = \langle 3\cos(t), 5\sin(t), 4\cos(t) \rangle$. Compute $\mathbf{v}(t)$, $\mathbf{T}(t)$, and $\mathbf{N}(t)$. Also compute $\mathbf{T}(t) \times \mathbf{N}(t)$.

5. For the equation $z^2 = x^2 + y^2$, graph the traces at $z = -1, 0, 1, 2, 3$ and at $x = 0$. Then graph the equation.

6. Compute (using polar) $\displaystyle\lim_{(x,y)\to(0,0)} \frac{1 - e^{x^2+y^2}}{x^2 + y^2}$

7. Let $f(x, y, z) = 7xyz^2 - 5yz^3$. Let $\nabla = \langle \frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z} \rangle$. Compute the following.

   (a) Compute $f_x(x, y, z)$ and $f_y(x, y, z)$.

   (b) Compute

$$\nabla f(x, y, z)$$

   (c) Compute

$$\nabla \cdot \langle xz^2, \sin(y^2), 4 - y^3 \rangle.$$