Instructions. Do all your work in your blue books. Write your solutions in your blue book. Show all work. Write your name on only the outside of your blue book. Write neatly, and use complete sentences when appropriate. My hope is that you do well on this exam. Good luck.

1. (5 points) Among the three points $(2, 4, 3)$, $(-2, 5, 6)$, and $(2, -3, -4)$ which is the closest to the $(xz)$-plane?

2. (5 points) Compute the equation of the sphere that has $(3, 2, 4)$ as its center and that has radius 6.

3. (10 points) Give the equation of the line in parametric form that passes through $P = (2, 1, 1)$ and $Q = (4, 2, 3)$. Find the points of intersection with the coordinate planes.

4. • (10 points) Give the equation of the plane that passess through $P = (1, 0, 0)$, $Q = (0, -2, 0)$, $R = (0, 0, -4)$.
   • (10 points) What is the area of the triangle that has these points as its vertices?
   • (10 points) What is the volume of the parallelipiped that has $(0, 0, 0)$, $P$, $Q$, and $R$ as vertices?
   • (5 points) What are the other 4 vertices of that parallelipiped?

5. (10 points) Compute the equation of the line of intersection between the planes $x + y + z = 6$ and $x - z = 2$.

6. (10 points) Find the equation of the plane that is perpendicular to the vector $(2, 3, -1)$, and that passes through the point $(1, 1, 1)$.

7. (10 points each) Complete the squares, Draw representative cross sections parallel to the coordinate planes, and classify the surfaces.
   
   (a) $z^2 = 9x^2 - 18x + 4y^2 + 36$
   
   (b) $4x - y^2 + 2y + 4z^2 = 0$

8. (10 points each) For the parametric curve $\vec{r}(t) = 3 \cos(t)i + 4 \sin(t)j$ Determine $\vec{r}'(t)$ and compute $\vec{r}(t) \cdot \vec{r}'(t)$. 