1. Write your Name, PID, and Section on the front of your Blue Book.
2. Write the Version of your exam on the front of your Blue Book.
3. No calculators or other electronic devices are allowed during this exam.
4. You may use one page of notes, but no books or other assistance during this exam.
5. Read each question carefully, and answer each question completely.
6. Write your solutions clearly in your Blue Book
   (a) Carefully indicate the number and letter of each question.
   (b) Present your answers in the same order they appear in the exam.
   (c) Start each question on a new page.
7. Show all of your work; no credit will be given for unsupported answers.

1. Let $\mathbf{v} = \langle 3, 0, 4\rangle$ and $\mathbf{w} = \langle -1, \sqrt{2}, -1\rangle$.
   (a) (5 points) Find the cosine of the angle between $\mathbf{v}$ and $\mathbf{w}$.
   (b) (5 points) Find the projection of $\mathbf{v}$ along $\mathbf{w}$.
2. Let $\mathbf{v}_1 = \langle 1, 1, 1\rangle$, $\mathbf{v}_2 = \langle 1, 2, 0\rangle$ and $\mathbf{v}_3 = \langle 0, 1, 2\rangle$.
   (a) (6 points) Find the area of the parallelogram spanned by $\mathbf{v}_1$ and $\mathbf{v}_2$.
   (b) (4 points) Find the volume of the parallelepiped spanned by $\mathbf{v}_1$, $\mathbf{v}_2$, $\mathbf{v}_3$.
3. (10 points) Find the equation of the plane that contains both of the lines given by the vector parametrizations

$$\mathbf{r}_1(t) = \langle 1, 2, -1\rangle + t\langle 1, -1, 2\rangle, \text{ and } \mathbf{r}_2(t) = \langle 1, 2, -1\rangle + t\langle 2, -1, 1\rangle.$$

4. (5 points) Find a vector parametrization of the line tangent to the curve

$$\mathbf{r}(t) = \langle t, t^2, t^3\rangle$$

   at $\mathbf{r}(1) = \langle 1, 1, 1\rangle$.
5. (5 points) Find a vector parametrization of the curve of intersection of the cylinder $y^2 + z^2 = 1$ and the plane $x - y + z = 1$.

Good luck.