Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Consider the plane $3x - 9y + 2z = 7$ and the line $\mathbf{r}(t) = \langle 1, 2, 1 \rangle + t\langle -2, 0, 1 \rangle$.

   (a) Find the point P where the plane intersects the line.

   (b) Find an equation for the plane passing through P that is perpendicular to the given line.

2. Find an equation for the plane of the figure:
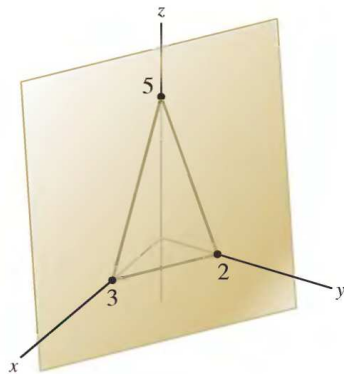
3. Find the vector function $\mathbf{r}(t)$ if it is given that $\mathbf{r}''(t) = \langle e^{2t-2}, t^2 - 1, 1 \rangle$ and $\mathbf{r}(1) = \langle 0, 0, 1 \rangle$, $\mathbf{r}'(1) = \langle 2, 0, 0 \rangle$.

4. Find an arc length parametrization of $\mathbf{r}(t) = \langle e^t \sin t, e^t \cos t, e^t \rangle$, on the interval $[0, 10]$.

5. Evaluate the curvature of $\mathbf{r}(t) = \langle 3 - t, e^{t-4}, 8t - t^2 \rangle$ at $t = 4$.