1. (5 minutes at start) Introductions. What are your goals for these PLTL sessions.

2. Use a sketch to calculate $\text{Proj}_{(1,-1)}(-1,0)$. Check your answer by using the formula for $\text{Proj}_u(v)$.

3. Sketch the curves in the $xy$-plane given by $4x^2 - y^2 = k$ for $k = -1, 0, 1, 2$.

4. Let $c$ be a non-zero real number. How is $\text{Proj}_{cu}(v)$ related to $\text{Proj}_u(v)$?

5. Why are the following formulae incorrect?

\[ \text{Proj}_u(v) = \frac{v \cdot u}{|v|} \frac{v}{|v|}, \quad \text{Proj}_u(v) = \frac{v \cdot u}{|u|} u, \quad \text{Proj}_u(v) = \frac{u \times v}{|u|} u \]

6. (From Exam 1, F11) Let $u$ be a unit vector in the $xy$-plane. Think of $u$ as a vector that starts at the origin. Let $v$ be the vector obtained by rotating $u$ clockwise about the origin by $60^\circ$. Let $w = v - u$.
   (a) Draw a sketch that illustrates how the vectors $u, v,$ and $w$ are related.
   (b) Use the physics (geometric) definitions of the dot product and cross product to find (i) $u \cdot v$, (ii) $u \cdot w$, and (iii) $u \times v$.

7. (From Exam 1, F11) Find a vector parametrization of the line obtained by intersecting the planes $x + 2y + 3z = 1$ and $x - y + z = 2$.

8. (Adapted from Exam 1, F11) Let $L_1$ and $L_2$ be lines in space with parametrizations

\[ x = 1 + 2t \quad y = 2 + t \quad z = -4 + t \]

and

\[ x = 1 + 5t \quad y = 2 + 2t \quad z = -4. \]
   (a) Using a schematic diagram and an English sentence, explain why $L_1$ and $L_2$ lie in a plane, $P$.
   (b) Find a vector parametrization of the plane $P$.
   (c) Find the (level set) equation of the plane $P$.
   (d) Find the points of intersection of $P$ with each of the three coordinate axes. Use this information to sketch $P$.

9. (From Exam 1, F11) Find the traces (i.e., slices) of the surface

\[ -x^2 + 4y^2 - 9z^2 = 4 \]

in the planes $x = 0$, $z = 0$, and $y = k$, for $k = 0, \pm 1, \pm 2$. Then sketch the surface.

10. (5 minutes at end) What is your study plan for MATH 2415 the next week? Specifically, how will you solidify your understanding of the theory we have covered so far in the course?