Group members:

Warm-up: write the normal equations for a line in 2 dimensions and a plane in 3 dimensions. What information do you need to know in order to write each equation? What are the similarities and differences between your two equations?

Problem 1. Find at least four different normal vectors to the plane which has equation $z - 3 = 5(x - 4) - \frac{1}{2}y$, at least two of which point in opposite directions from each other.

Problem 2. In CW 4.1 & 4.2, we helped Gabby find an equation for the plane P passing through the points

$$A = (1, 3, 6) \qquad B = (5, 3, 4) \qquad C = (7, 5, 10).$$

Gabby does some more calculations and comes up with $\vec{n} = \langle 1, -7, 2\rangle$ as a normal vector to the plane. Separately, Ariel determines that $\vec{n}' = \left\langle -\frac{1}{2}, \frac{7}{2}, -1\right\rangle$ is a normal vector to P. Who is correct?

Problem 3. Compute the distance from the origin to the nearest point on the plane from Problem 1 with equation $z - 3 = 5(x - 4) - \frac{1}{2}y$.

Problem 4. (Lecture 5.3, Q30) Two planes are perpendicular if their normal vectors are orthogonal.

(a) Are $4x - 7y + z - 3 = 0$ and $5x + y + 13z + 25 = 0$ perpendicular?

(b) If two planes are perpendicular, is every vector in the first plane orthogonal to every vector in the second plane?

Problem 5. Determine if the plane $-x + 2z = 10$ is parallel or orthogonal to the line whose points are all of the form $(5, 2 - t, 10 + 4t)$, $-\infty < t < \infty$.

Problem 6. Find the angle between the planes $2x - y + z = 1$ and $x + z = -3$.

Problem 7. Find the shortest distance between the point $(1, 1, 1)$ and the tangent plane to $z = \ln(2x+y)$ at $(x, y) = (-1, 3)$. Is this point on the same side of the graph of $z = \ln(2x+y)$ as the origin?