115. #60. Determine if, or neither.

Plane 1: \(3x + 2y - z = 7\) normal \(\mathbf{n}_1 = \langle 3, 2, -1 \rangle\)

Plane 2: \(x - 4y + 2z = 0\) normal \(\mathbf{n}_2 = \langle 1, -4, 2 \rangle\)

\(\mathbf{n}_1, \mathbf{n}_2\) are not parallel.

\[\mathbf{n}_1 \cdot \mathbf{n}_2 = 3 - 8 - 2 = -7 \neq 0\]  
Not orthogonal.

\[\cos \theta = \frac{\mathbf{n}_1 \cdot \mathbf{n}_2}{\|\mathbf{n}_1\| \|\mathbf{n}_2\|} = \frac{-7}{\sqrt{14} \cdot \sqrt{30}} = \frac{-1}{\sqrt{6}}\]

\[\theta = \cos^{-1} \left( \frac{-1}{\sqrt{6}} \right) \approx 114^\circ\]

#82. Intersection of \(6x - 3y + 2 = 5\) and \(-x + y + 5z = 5\)

Direction of the line of intersection: cross product of normals \(
\mathbf{n}_1 = \langle 6, -3, 0 \rangle, \mathbf{n}_2 = \langle -1, 1, 5 \rangle
\)

\[\mathbf{n}_1 \times \mathbf{n}_2 = \langle -15, -30, 9 \rangle\]

To find a point in the intersection set \(z = 0\) in both equations.

\[\begin{align*}
6x - 3y &= 5 \\
-x + y &= 5
\end{align*}\]

\[y = 3, x = \frac{20}{3} \Rightarrow \left( \frac{20}{3}, \frac{35}{3}, 0 \right) \text{ on the line.}\]

#84. \(2x + 3y = -5\)

\[x = \frac{1}{2} (y + 3) \Rightarrow x = 4t + 1, y = 2t \Rightarrow 2t = 6 + 3t \\
2 \text{ (plug in } t = \frac{1}{2} \text{ in plane equation) on the plane 6c if it were the solution would be all points on the line. The line is not parallel.}\]

#90. Distance from \((3, 2, 1)\) to \(x - y + 2z = 4\) using the formula we derived in class.

\[\frac{|3 - 2 + 2 - 4|}{\sqrt{1^2 + (-1)^2 + 2^2}} = \frac{1}{\sqrt{6}}\]

#92. \(4x - 4y + 9z = 7\)

\(4x - 4y + 9z = 18\)

Normals are the same so parallel.

Distance pick a point on one of the planes and find its distance to the other one. Let \(x = 0, y = 0\) in the second plane equation. Then \(z = 2\).

Distance from \((0, 0, 2)\) to the first plane is:

\[\frac{|0 - 0 + 18 - 7|}{\sqrt{16 + 16 + 81}} = \frac{11}{\sqrt{113}}\]