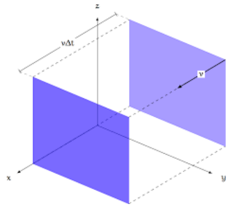
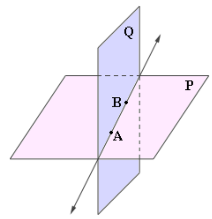
Thursday, October 25, 2018

9.3 The Intersection of Two Planes & 9.6 The Distance from a Point to a Plane

1) The Intersection of Two Planes

There are three ways that two planes can intersect. Using what you know, make an educated guess at these three possibilities.





What is different about the intersection of planes from that of lines?

Identify the type of intersection that occurs between the pairs of planes provided below, and explain how you reached your conclusion.

a) $2x - y + z = 4$
$4x - 2y + 2z = 8$

b) $6x + 4y - 2z = 8$
$3x + 2y - z = 8$

Now let's solve to find the equation of the line of intersection for two planes. We can do this using matrices, or using a series of substitution/elimination steps like we saw yesterday. The key thing to remember is that you need to introduce parameters so that we can develop an equation for a line! There is not a single unique solution.

Example: Determine the solution to $x - y + z = 3$ and $2x + 2y - 2z = 3$.

2) <u>The Distance from a Point to a Plane</u>

As long as you have the Cartesian equation for the plane that you are finding the distance to (if you don't have it, you can always find it!), we simply need to adjust the formula to find the distance from a point to a line in R^2.

Distance from a Point $P_0(x_0, y_0, z_0)$ to the Plane with Equation $Ax + By + Cz + D = 0$

In R^3, $d = \dfrac{|Ax_0 + By_0 + Cz_0 + D|}{\sqrt{A^2 + B^2 + C^2}}$, where d is the required distance between the point and the plane.

What is different in this formula?

Example: Find the distance from (-5, 2, 8) to the plane 3x - 4y + z - 2 = 0.

<u>A trickier example:</u>

Determine the distance between two parallel planes, 2x - y + 2z + 4 = 0 and 2x - y + 2z + 16 = 0.