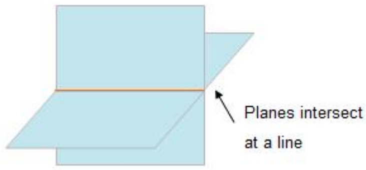
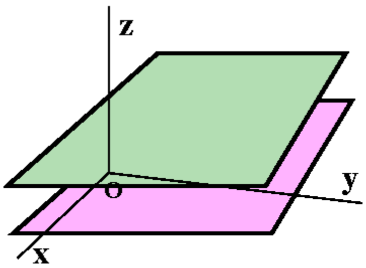
# L8(9.3) Intersections of Two Planes




1- If two planes intersect along a line,
***the system has an infinite number of solutions described by the parametric equations of the line.***

2- If two planes are co-incident,
***the system has an infinite number of solutions descirbed by one of the two given equations of the plane.***




3- If two planes are parallel and distinct,
**the system has no solution.**

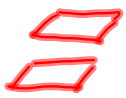
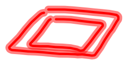
Example 1: Solve each system and give a geometric description of the planes.

a) $x + 4y - 3z + 6 = 0$
$2x + 8y - 6z + 11 = 0$

$\vec{n}_1 = (1, 4, -3)$

$\vec{n}_2 = (2, 8, -6)$

$2\vec{n}_1 = \vec{n}_2$

AT THIS TIME EITHER Parallel  OR COINCIDENT 

So check D values: $\because 2(6) \neq 11$ $\therefore$ The planes are parallel & distinct.

& No solutions.

b) $\pi_1$: 5x - y + 2z - 9 = 0

$\pi_2$: -25x +5y - 10z + 45 = 0

Since $-5\pi_1 = \pi_2 \Rightarrow$ Planes are coincident

$\therefore$ Infinite solutions

c) 4x + 7y - 33z + 17 = 0 ① × 2
8x + 5y - 3z + 7 = 0 − ②

Note: I made a mistake with this example - See example 3 on p.512 - You need to substitute a parameter in for z and solve the parametric equations for x and y (Observe below)

③ $9y - 63z + 27 = 0$ → ~~The equation of line of intersection.~~ oops

At this point, to determine the equation of the line of intersection, a parameter must be introduced. From equation 3 we let $z = s$

$$9y - 63(s) + 27 = 0$$
$$y = 7s - 3$$

At this point substitute $z = s$ and $y = 7s - 3$ into equation 1

$$4x + 7y - 33z + 17 = 0$$
$$4x + 7(7s - 3) - 33(s) + 17 = 0$$
$$4x + 49s - 21 - 33s + 17 = 0$$

and isolate for x

$$x = -4s + 1$$

Therefore the parametric equations of the line of intersection are

$$x = -4s + 1,\ \ y = 7s - 3,\ \text{and } z = s,\ \ s \in \mathbb{R}$$

I apologize.

# Assigned Work
# p.516 #6, 8