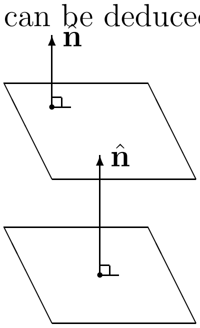
**Question**

Do the planes $x+2y+3z=6$ and $3x+6y+9z=12$ intersect? How about $x+2y+3z=6$ and $3x+6y+9z=18$?

**Answer**

$$\begin{aligned} x+2y+3z &= 6 \quad (1) \\ 3x+6y+9z &= 12 \quad (2) \end{aligned}$$

Consider $3\times(1)$: $3x+6y+9z+18$ (3)
Clearly the LHS of (3)=LHS of (2).
They can only now intersect if the RHS of (3) and (2) are also equal, which they're not. Thus the planes don't intersect. Actually they're parallel, as can be deduced from the vector form of the planes:




$\mathbf{r}\cdot(3\mathbf{i}+6\mathbf{j}+9\mathbf{k})=18$
$\mathbf{r}\cdot(3\mathbf{n}+6\mathbf{n}+9\mathbf{n})=12$
$\mathbf{r}=x\mathbf{i}+y\mathbf{j}+z\mathbf{k}$

Clearly they have a common normal vector $\mathbf{n}$. Hence they're parallel.
The two planes

$$\begin{aligned} x+2y+3z &= 6 \quad (4) \\ 3x+6y+9z &= 18 \quad (5) \end{aligned}$$

are coincident/identical as can be seen by multiplying (4) through by 3 to get (5).