Proposition: S_n : n (infinitely long) straight lines lie on a plane in such a way that no two of the lines are parallel, and no three lines intersect a single point. This arrangement divides the plane into $\dfrac{n^2+n+2}{2}$.

Proof. (Induction).
Basis step. Suppose $n = 1$.

Observe that 1 line divides the plane into 2 regions. $2 = \dfrac{1^2+1+2}{2}$, thus S_1.

Inductive step. Suppose S_n for some $n \in \mathbb{N}$.

We now show S_n implies S_{n+1}.

Observe that any 1 line intersects n lines once in any such arrangement of $n+1$ lines, dividing $n+1$ of the $\dfrac{n^2+n+2}{2}$ regions in the valid arrangement of n lines. Then

$$\frac{n^2+n+2}{2} + (n+1) = \frac{n^2+n+2+2(n+1)}{2} \tag{1}$$

$$= \frac{(n^2+2n+1)+(n+1)+1}{2} \tag{2}$$

$$= \frac{(n+1)^2+(n+1)+1}{2}. \tag{3}$$

Thus S_{n+1}.

It follows by mathematical induction that S_n for all $n \in \mathbb{N}$. ∎