(7) Let m and n be integers with $m < n$ and let r be any number other than 1. Simplify the sum

$$\sum_{i=m}^{n} r^i = r^m + r^{m+1} + r^{m+2} + \cdots + r^{n-2} + r^{n-1} + r^n.$$

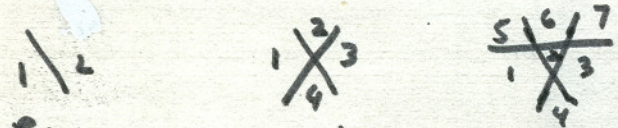
Let S = sum

$$(1-r)S = r^m + r^{m+1} + \cdots + r^{n-1} + r^n$$
$$- r^{m+1} - \cdots - r^{n-1} - r^n - r^{n+1}$$
$$= r^m - r^{n+1}$$

$$\therefore \boxed{S = \frac{r^m - r^{n+1}}{1-r}}$$

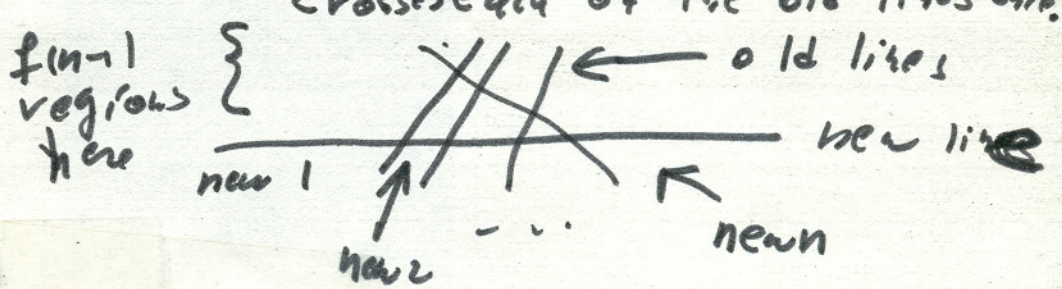
(8) Suppose that n lines are drawn in the plane in "general position" (That is, no two lines are parallel and no three lines intersect at a point.) Into how many regions do these lines divide the plane? (Your final answer should be a function of n.)

Let $f(n)$ = # of regions when there are n lines



Suppose $f(n-1)$ is known.

Draw one more line. It crosses each of the old lines once.



$\therefore f(n) = f(n-1) + n$

$f(n) = n + f(n-1) = n + (n-1) + f(n-2) = n + (n-1) + (n-2) + f(n-3)$

$= n + (n-1) + (n-2) + \cdots + 2 + f(1) = (n + (n-1) + \cdots + 1) + 1 = \boxed{\frac{n(n+1)}{2} + 1}$