Further Automating the Functional Relation *n*(*k*) = *ak* + *b*

Explainer 11.5a showed how to connect ***n*** to ***k*** via an equation in cell B1. This explainer provides a quick way to automate that equation so that you can easily adjust it and see the results.

We consider here a general relation ***n***(***k***) = ***ak*** + ***b*** where ***a*** and ***b*** are whole numbers (which can be negative or positive). (A negative value of ***n*** simply means counting around the circle in a counterclockwise direction.)

Automating *n*(*k*). Instead of clicking on cell B1 and changing the equation each time you want to consider a new functional relation between ***n*** and ***k***, we can use the unprotected green cells starting in P1 to help simplify equation adjustments. The idea is to put ***a*** and ***b*** in cells (P12 and P13) then link the equation for ***n*** (in B1) to BOTH ***k*** in D1 and ***a*** and ***b*** in P12 and P13. (The equation to type in B1 is shown in cell P14 below.)

Column		•••	P	Q
Row	•••	•••	•••	•••
•••	•••	•••	•••	•••
11	•••	•••	Equation for cell B1: ***n*** = ***ak***+***b***	
12	•••	•••	**3**	***a*** (in cell P12)
13	•••	•••	**3**	***b*** (in cell P13)
14	•••	•••	In B1 type: **=P12*D1+P13** enter.	
15	•••	•••	Then use ***k*** arrows in C1:C2.	

Once you type in this equation in B1, all you do is change ***a*** or ***b*** to order to test a new relation. Consider the three functions examined in 11.5a, ***n*** = ***k***, ***n*** = 2***k***, and ***n*** = 2***k*** + 1. The first require 1 in P12 and 0 P13. Change P12 to 2 and you see the second. Change P13 to 1 and see the third … all without touching B1.

The images below show the ***a*** and ***b*** suggested above, ***n*** = 3***k***+3 for ***k*** = 6 and ***k*** = 7. As ***k*** changes, one still sees only equilateral triangles, but other patterns emerge as well. In particular, see if you can identify different patterns based on the remainder of ***k*** once ***k*** is divided by 6. The two images below show remainder 0 and 1. For example, when ***k*** is one more than a multiple of 6 (like the right image below) one can see regular hexagons). Every other version will show 6 pie pieces (like below). but ***k*** = 13 has no such inner pie pieces (however ***k*** = 19 once again looks like an extended version of ***k*** = 7 below).