A totally optional addition to the *Angles* document: Creating the *Angles Table* in *Excel* by entering a few numbers and 2 equations

This will not help you understand **PwP** at all. It is provided to show how easy it is to produce a table such as the *Angles Table* using *Excel*. As you will see, the final table was created using a preliminary table showing which cells to include.

Excel is essentially a calculator that does repetitive calculations very easily. The next document is the *Excel* file used to create the table. The focus here is on how to create the table, not formatting it. The table was created in three steps.

1. Decide how large to make the table.
2. Determine which jump values should be included in the table.
3. Calculate the angle for those cells slated for inclusion in the table.

Once I decided to stop at ***n*** = 30, I knew that ***J*** = 14 was the largest ***J*** that was necessary (since ***J*** < ***n***/2).

Creating runners. There are numbers included in the first row and first column. To create the pattern, simply start the pattern then highlight the pattern, depress mouse, and drag the pattern as far as needed.

In the Excel file, ***n*** is started in cell A4 and A5 where 3 and 4 are entered. From there highlight A4:A5, then hold down mouse and drag down to A31 where 30 occurs. Start ***J*** in B3 with 1 and C3 with 2. Then drag B3:C3 to O3 where the number 14 occurs.

Creating cells to include (creating the preliminary table). Only include cells where ***J*** < ***n***/2 and GCD(***n***, ***J***) = 1.

In the Excel file, go to cell B4 and type (or notice it is already there): **=IF(B$3>$A4/2,"",IF(GCD(B$3,$A4)=1,1,""))**

This equation has been color-coded for explanatory purposes. Cells are excluded for two reasons:

1. If ***J*** > ***n***/2 (that is the **red IF** statement).
2. Cells are included if GCD(***J***, ***n***) = 1 (that is the **blue IF** statement).

Three things should be explained about the equation:

1. "" means put an empty cell in Excel if this condition holds.
2. A $ in front of a number (like the 3 in B$3) means hold the row at 3 even if the equation in B4 is dragged down to row 5 or beyond.
3. A $ in front of a letter (like the ***A*** in $A4) means hold the column to ***A*** even if the equation in B4 is dragged sideways to column C or beyond.

Once the equation in B4 is written click *Enter*. Then return your mouse to B4 and move to the bottom right corner. Once you see the open white ✚ sign turn into a black **+** sign, click and hold the mouse then drag the equation sideways to O4 and release the mouse. The entire row from B4:O4 will now be highlighted. Once again, find the black **+** sign, click and hold then drag this row of equations down to row 31.

Calculating the angles for included cells. The *Angles Table* is created to the right (from Q1:AE31) of the preliminary table. The labels are typed into cells and the runners are dragged sideways (in row 3) and down (in column R). The rest of the table is based on one equation. That equation is 180*(***n*** – 2***J***)/***n***.

In the Excel file, go to cell R4 and type (or notice it is already there): **=IF(B4=1,180*($A4-2*B$3)/$A4,"")**

There is a 1 in the first table everywhere that you want an angle. That is why the IF statement references B4=1.

Because B4 is referenced without $ signs, B4 turns into C4 if the equation in R4 is dragged to the right but it turns into B5 if the equation in R4 is dragged down.

The $ signs work the same as above. Drag this equation to AE4 and drag the set of equations down to row 31 and you are done.

This equation puts an angle value in each cell where there was a corresponding 1 in the first table but leaves all other cells blank.