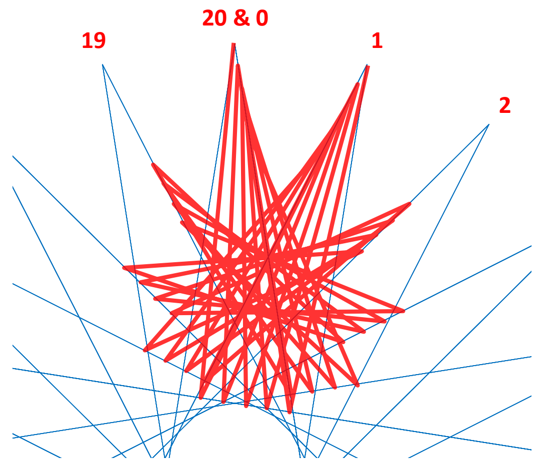
Using Cycles to Understand Images

The Extra Materials For Instructors includes a version of File 2 that allows you to create materials suitable for classroom presentation, but the file can also be used to help understand the underlying aspects of a given image.



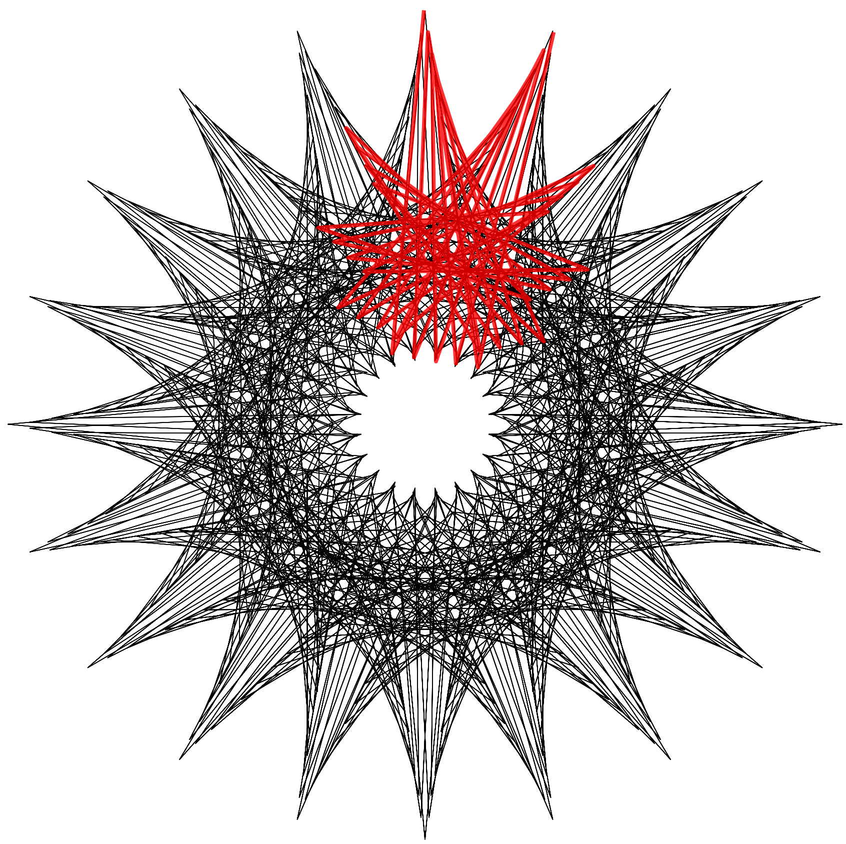
One toggle in particular helps to show how the image was created by letting the user scroll through the first ***k*** lines in the image (cell B10). The value of ***k*** can be set by typing a number in cell C11, using the up/down arrow keys in C10:12, or by linking C11 to a specific cell.

A useful cell to link ***k*** to is ***S*** (type =C1 in cell C11) because this shows the first cycle as long as ***S*** and ***P*** have no factors in common. (If the Equations toggle in cell C6 is clicked on, then you could alternatively type =M9 in C11.)

The image to the right shows the first cycle, the vertex frame, and labels. The first cycle ends at vertex 1 and has 38 lines. The endpoints of these 38 lines are subdivision points on 9 of the 20 lines on the vertex frame. The used vertex frame lines can be seen as the lines from: 12-1, 13-2, 14-3, 15-4, 16-5, 17-6, 18-7, 19-8, and 20&0-9.

The image below shows how 20 such cycles create the full image, one cycle spanning each pair of successive vertices.

(n,S,P,J)=(20,38,169,9) 760 lines



Click here then click *Toggle Drawing* to see this drawn. It is worth noting a couple of things about nearby images.

1. If you change ***S*** with fixed ***n***, ***P***, ***J*** and GCD(***S, P***) = 1 then the first cycle will continue to end at 1; the image remains a one-time-around image. ***S*** = 34 looks like a pulsing square and ***S*** = 31 is a 20-point spinning needle star.
2. If you change ***P*** for fixed ***n***, ***S***, and ***J*** the images produced are no longer necessarily one-time-around. For example, P = 167 looks very similar to ***P*** = 169 but it is a 3 time around image because the first cycle ends at vertex 3.