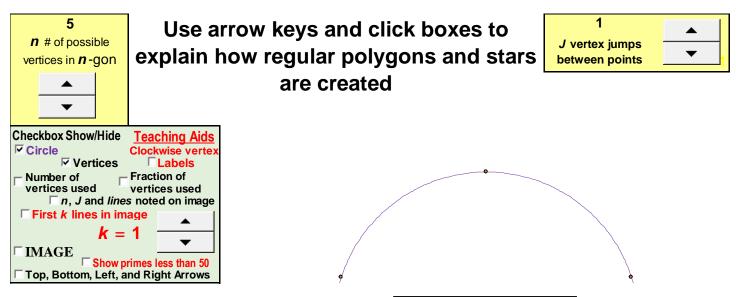# A Quick-Start Guide to Using the Teacher File

The P & S teacher file allows you to quickly show how polygons and stars are made using just two numbers. The dashboard is shown below, but you should really have the file open as you read this.

This file has a number of **Show/Hide** toggle switches in the boxed green **Teaching Aids** area and one additional set of Up/Down ⬍ arrows that allows you to show the first *k* line segments from the image.

These modifications allow you to create your own interactive teaching materials. The way to use the file depends on the grade level of students as well as what you are trying to teach in the specific session. The following are six suggestive ideas, just to get you comfortable with using the file as a teaching tool.

1. Showing the vertices of a regular polygon as points on a circle

Click **Circle** and **Vertices** on, turn all other toggles off. Increase *n* and watch what happens.

To see these vertices as vertices of a polygon, click **Circle** off, **IMAGE** on, set *J* = 1, *n* = 3 then increase *n*.

> To show that the polygon gets closer and closer to the circle as *n* increases, click **Vertices** off and scroll *n* up to 50. Once *n* is near 50, click **Circle** on and off to show the images are close to each other.

2. To investigate patterns in vertices of regular polygons

The 10 questions on the Polygons sheet can be asked here as well by clicking **Top, Bottom, Left, and Right Arrows** on. These arrows can examine even/odd patterns as well as patterns that occur every fourth value of *n*. (Note that **Labels** should be turned off in this instance (since they are superimposed on the arrows.)

3. Showing how *continuously-drawn* stars are created from regular polygonal vertices by varying *J*

Click **Image, Vertices** and **Labels** on, turn all other toggles off.

Set *n* = 12. There is only one distinct continuously drawn 12 point star.

> (*J* = 5 and *J* = 7 produce stars that look the same but are drawn in a different order).

Set *n* = 11. There are 4 distinct continuously drawn 11 point stars (and *n* = 13 has 5).

These comparisons provide a direct visual entry into discussing prime and composite numbers.

4. Showing inside/outside issues with *continuously-drawn* stars

Turn all but **Vertices** and **First *k* lines in image** off, set *k* = **1** and *n* > 20 and *J* > 1 but less than *n*. For younger children *J* should initially be set at a small number such as 2 or 3 (2 works well in kindergarten).

Click *k* from **1** to **2** then ask: *Once we have a completed image, will all vertices be included in the image or will some be left out?*

The answer, of course, is: *It depends*. If *n* and *J* have a common factor (greater than 1) then the answer is **NO**, otherwise the answer is **YES**.

Whatever the answer was, manipulate *n* so that the reverse answer occurs and use this as a springboard to composite numbers and GCD (if you want to go there).

In the event you want to discuss this further, click **Number of vertices used** and **Fraction of vertices used** on and vary *n* and *J* and watch what happens. If doing this, I suggest turning **First *k* lines in image** off and **IMAGE** on.

5. Examining prime versus composite numbers

The **Show primes less than 50** box provides one additional way to visually examine composites versus primes.

Have a student choose a prime number from the list. Set *n* to that number. Start with *J* = 1 and set **IMAGE** on.

Increase *J* from 1 to *n*-1. Every value of *J* will use all vertices.

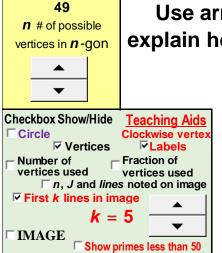(NOTE: If *J* = *n* then there is no image visible as the starting point and ending point coincide.)

Next, return *J* to 1 and increase or decrease *n* by 1 from the prime number chosen (ask someone whether you should go up or down).

Increase *J* from 1 to the *new n*-1. Now AT LEAST every other *J* uses half the vertices (or less).

To emphasize what is happening, click **Number of vertices used** and **Fraction of vertices used** on when you do this exercise.
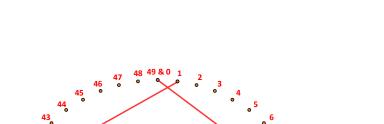
6. Examining stars as rotating polygons (based on Explainer 1.4. *Stars as Rotating Polygons*)

The values below produce a 49-point star created as a *clockwise rotating pentagon*. Since *k* = **5**, the 50th endpoint is as vertex 1 (since *n* = 49). Increase *k* to 10 then 15 and notice that the vertices move from 2 to 3 and so on. (Change *J* = 12 and the 49-point star is created as a *counterclockwise rotating square*.)