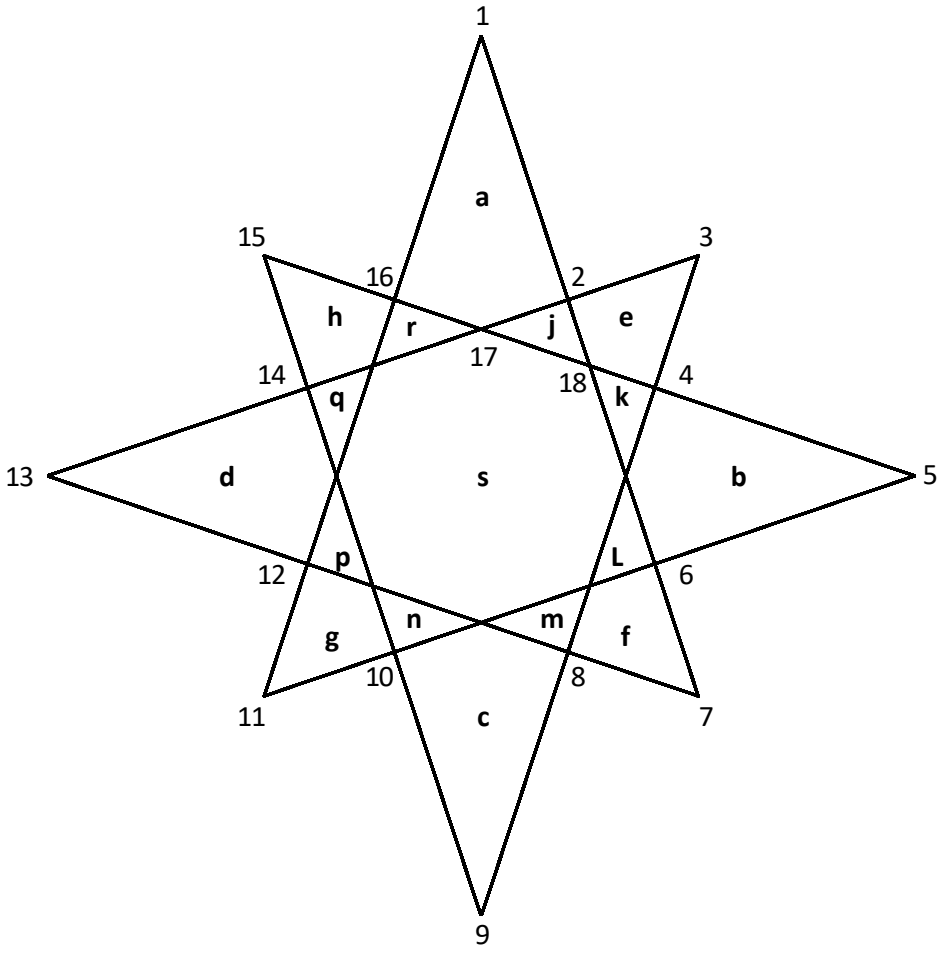
Brunes Star Challenge Questions

(Created from ***S*** = 2, ***P*** = 3, ***J*** = 1 and ***n*** = 4)

This 8-point star provides a wealth of opportunities to explore mathematical issues. Indeed, entire articles are written about this image (click here to see one). Consider the image below which is annotated in the following way.

Vertices are numbered starting at 1 and going to 18 in order to be able to talk about various parts of the star. (Don't worry, not all vertices are labelled but enough are so that we can ask questions.) Areas are labelled with lower case letters.



1. Some of the angles appear to be right angles. Explain why this must be the case.

FACT: Each of the triangles in the image are 3-4-5 right triangles.

2. Choose one of these triangles (such as the triangle with vertices 1, 7, 12) and show that this is such a triangle. Vertex 1 is at (0, 1) and 7 is at (1/2, -1/2).

HINT: To do this you will have to determine the coordinates of vertex 12 (at the intersection of line (1,11) and (13,7)). Next, use the Pythagorean Theorem to show that the sides are in the ratio 3-4-5.

3. Suppose the smallest triangle, for example triangle **j**, has length 3, 4, 5 (i.e., (2,18) is 3, (2,17) is 4, and (17,18) is 5). What is the area of the Brunes Star?

HINT: Add up areas and make sure to not double-count. Also, try to do it more than one way as a check on your answer.