Hexagons/Circles Stretch

Hexagons appear in beehives, tile patterns, quilts, games and elsewhere. They have many unique properties, some of which are explored here. For the problems in this stretch we will be using regular hexagon ABCDEF, shown in problem #1, the sides of which are each one unit long.

1. _______ diagn How many diagonals does hexagon ABCDEF have?

2. _______ units The three main diagonals of hexagon ABCDEF meet at point G, the center of the hexagon. What is the length of segment GB?

3. _______ degrees What is the measure of each interior angle of hexagon ABCDEF?

4. _______ lines Segment BE is a line of symmetry for hexagon ABCDEF. How many additional lines of symmetry does the hexagon have?

5. _______ sq units What is the area of hexagon ABCDEF? Express your answer as a common fraction in simplest radical form.

6. _______ units A circle with center G is inscribed in hexagon ABCDEF. What is the circumference of this circle? Express your answer in simplest radical form in terms of π.

7. _______ sq units A circle with center G is circumscribed about hexagon ABCDEF. What is the area of this circle? Express your answer in terms of π.

8. _______ Sides AB and DC are extended to meet at point H. What is the ratio of the area of triangle BCG to the area of triangle BCH? Express your answer in simplest form.
9. ______ sq units The extension of other pairs of sides, in the manner used in the previous problem, results in a six-point star, as shown. What is the total area of the shaded regions? Express your answer as a common fraction in simplest radical form.

10. ______ units A circle with radius GH is drawn to circumscribe the six-point star. How long is the radius of this new circle? Express your answer in simplest radical form.

11. ______ sq units What is the difference between the area of the circle circumscribed about the six-point star and the area of the circle inscribed in the original hexagon? Express your answer as a common fraction in terms of π.

12. ______ sq units Segment GB is extended to point V such that GB = BV. Likewise, GC, GD, GE, etc. are extended such that GC = CW; GD = DX; GE = EY, etc. What is the area of trapezoid BCWV? Express your answer as a common fraction in simplest radical form.

13. ______ What is the ratio of the length of a side of hexagon ABCDEF to the length of a side of hexagon UVWXYZ? Express your answer as a common fraction.

14. ______ What is the ratio of the area of hexagon ABCDEF to the area of hexagon UVWXYZ? Express your answer as a common fraction.

15. ______ deg If point G is held fixed and hexagon ABCDEF is rotated 60 degrees clockwise (shown below in four steps) such that point A moves to the previous location of point B, the resulting hexagon has the exact same orientation. What is the maximum number of degrees less than 500 degrees that this figure can be rotated clockwise and maintain its exact same orientation?
Fellowship of 9 Rings Stretch

In the figure below, a circle with center $G$ goes through points $S$, $C$, $Y$, $Q$, $L$ and $N$ (which are equally spaced around circle $G$) and has a radius of 1 unit. These six points also are centers of circles of radius 1 unit. Express all answers as a decimal to the nearest tenth unless otherwise instructed.

1. ______ units  What is the circumference of the circle with center $G$ that goes through $S$ and $C$?

2. ______ units  What is the perimeter of quadrilateral $SGNE$? Express your answer as a whole number.

3. ______ What is the ratio of the area of circle $G$ through $N$ and $S$ to the area of circle $G$ through $E$ and $A$? Express your answer as a common fraction.

4. ______ units  What is the length of the minor arc with endpoints $S$ and $N$?

5. ______ sq units  What is the area of the circle with center $G$ that goes through points $O$, $Z$ and $K$?

6. ______ sq units  What is the area of the triangle with vertices at $A$, $F$ and $J$?

7. ______ sq units  What is the area of the triangle with vertices at $J$, $A$ and $G$?

8. ______ units  What is the perimeter of the triangle with vertices at $O$, $K$ and $I$?

9. ______ units  What is the circumference of the circle with center $G$ that goes through points $E$, $A$ and $B$?

10. ______ sq units  What is the area of the quadrilateral with vertices at $A$, $B$, $H$ and $J$?