Construction for Polygrams
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Step 1. Draw the circle with center O and radius OA,

Step 2. Use the protractor to measure the 6 central angle equal to 60°

Step 3. Label the intersection of the circle with the sides and the angles: Points E, F, G, H, and I.
Step 4. Draw lines AE, EF, FG, GH, HI, and IA to form regular hexagon AEFGHI
Step 5. Draw dashed lines through points A, E, F, G, H, and I.
Step 5. Label the dashed lines (previously shown) intersecting in points L, M, N, P, Q, and R, forming Reg Hex LMNPQR. (The dashed lines have been replaced with solid ones in the diagram.)

Step 6. Label points U, V, W, X, Y, and Z, the intersection of the sides of the 60° angle with Reg. Hex. LMNPQR.
Step 7. Through points L, M, N, P, Q, and R, you can draw addition lines.

These lines form a sequence of similar figures and cells which can be shaded to form interesting designs.
Step 8. The five diagrams we call hexagrams because all of them can be formed by creating cells within a regular hexagon.
Step 1. Draw the circle with center O and radius OA,

Step 2. Use the protractor to measure the 8 central angles equal to 45°
Or, measure 3 consecutive 45° and extend the sides.
Or, construct with compass 2 perpendicular lines and bisect the right angles.

Step 3. Label the intersection of the circle with the sides and the angles: Points A, B, C, D, E, F, G, H.
Step 4. Draw the dotted lines through points: A, B, C, D, E, F, G, and H to form a regular octagon.
Step 5. Draw more dashed lines through points to form a sequence of smaller octagons/8-sided stars. Use the intersection points to draw more lines.

If you create many sub level polygons or stars, you will need to draw a large circle at the beginning of your construction so that you will minimize the errors when you draw lines through the intersecting points.
Step 6. By shading in various cells, you can form different symmetrical patterns. Two of the examples are shown above. Many more examples are possible.

As a teacher, you can use the construction in a variety of ways to make your classes more interesting and teach fundamentals at the same time.

You can provide extra credit for each new pattern your students can create from the basic grid.

You can have a competition between groups to see which group can discover the most patterns.

You can decorate the room with the constructions made by the students, especially if they are colored.
Formula for Constructing Regular Polygons

Any regular polygon can be constructed using a compass, ruler, and protractor. Some are more difficult than others because of the angles you need to measure.

Regular polygons have two fundamental ideas:

(1) the sum of all of the central angles of any polygon inscribed in a circle is 360°;

(2) In a regular polygon, all of the central angles are equal.

Let: \( \Theta \) = the central angle of a regular polygon
\( n \) = the number of sides of a regular polygon.

Formula: \( \Theta = \frac{360°}{n} \)

Example 1: Regular Hexagon:
\( \Theta = \frac{360°}{6} = 60° \)

Example 2: Regular Octagon:
\( \Theta = \frac{360°}{8} = 45° \)

Example 3: Regular Pentagon:
\( \Theta = \frac{360°}{5} = 72° \)