# Mathematics and Art

Interactive GeoGebra Worksheet on Plane Tessellation - Triangular Basis

Goal: To enable Maths educators to construct and explore plane tessellation patterns dynamically and interactively with GeoGebra.

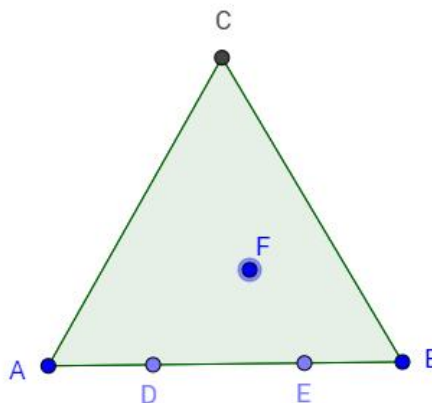**Relevant Maths Keywords and Concepts:**

Tessellation, Tiling, Equilateral Triangle, Symmetry, Regular Polygon, Vertices, Line Segment, Edge Rotation, Translation, Vector, Midpoint.
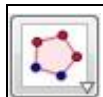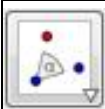
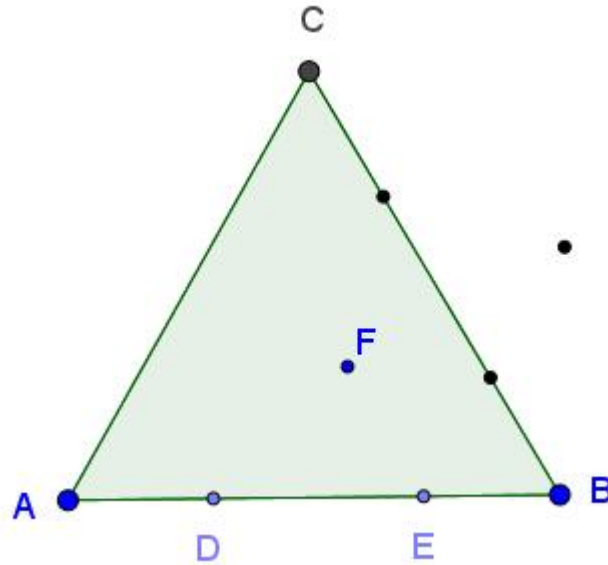|	
	1. Use the **Regular Polygon** tool to construct an equilateral triangle.
	2. Use the **Point** tool to construct points *D* and *E* on line segment *AB* and point *F* in the interior of the triangle.

3. Use the **Rotate Object around Point by Angle** tool to rotate point *D* around point *B* 60° clockwise. Repeat for points *E* and *F*.
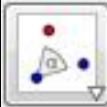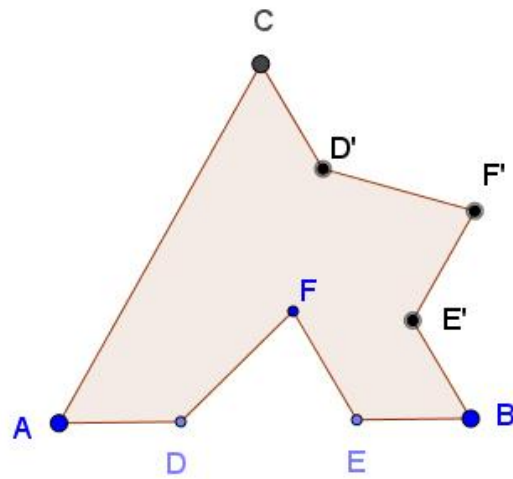

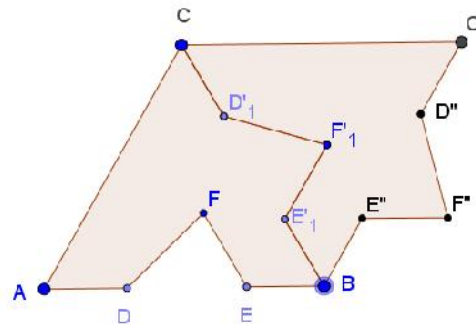4. Right-click in the interior of the triangle and deselect **Show Object** to hide the triangle.
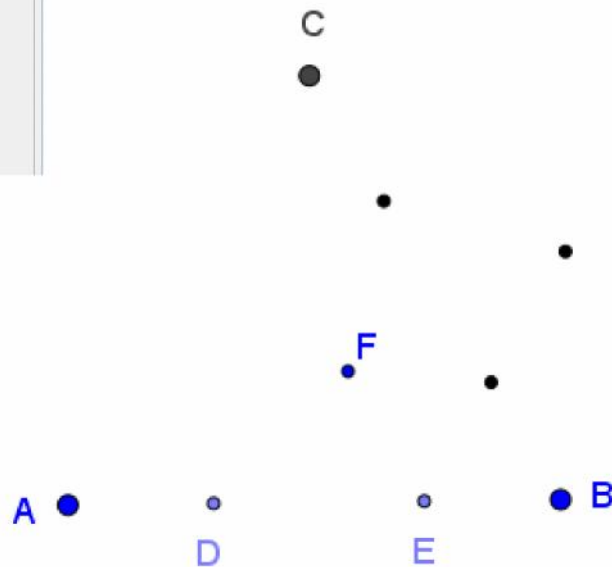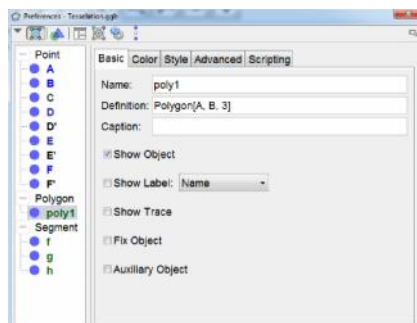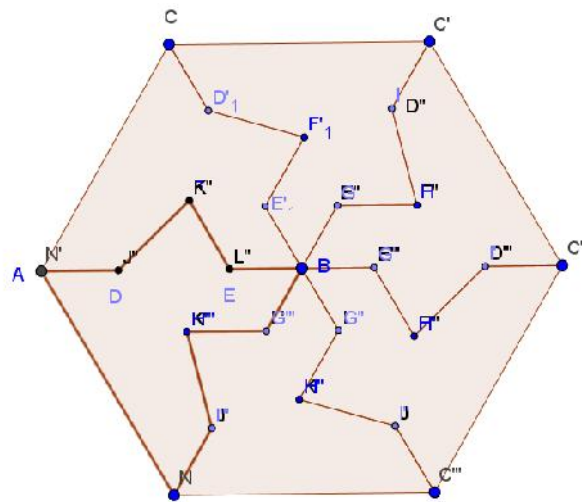
5. Use the **Polygon** tool to construct polygon ADFEBE'F'D'C.

6. Use the **Rotate Object around Point by Angle** tool to rotate the polygon 60° clockwise around point *B*.


Continue to rotate the new images around point *B* until you fill the space around vertex *B*.

7. Color each of the six polygons a different color. Right-click a polygon, go to **Object Properties** and click the **Color** tab. Select a color and click **Close**. Repeat for the remaining five polygons. Click the **Style** tab to increase the filling if desired.
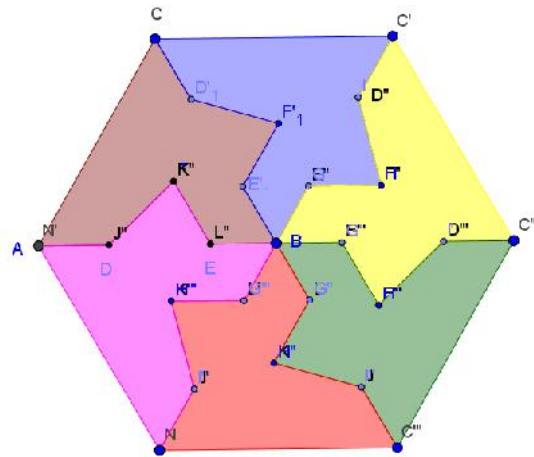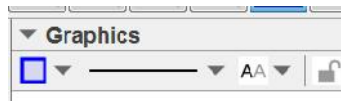
8. Turn off labels for all points except *A, B, D, E, F*. Right-click a point and go to **Object Properties**. Use Ctrl-click to select all points except for *A, B, D, E, F*. Uncheck **Show Label** and **Show Object**.
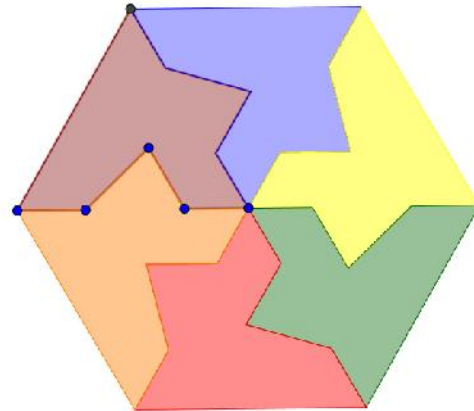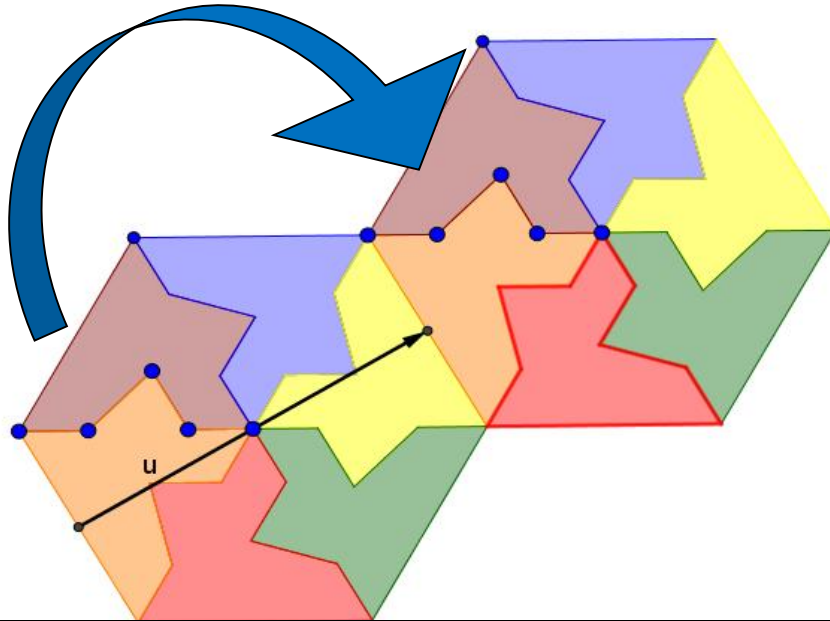
9. Use the **Midpoint or Center** tool to construct the midpoint on an outer edge of one of the polygons. Construct the midpoint on the outer edge of the opposite polygon. Use the **Vector between Two Points** tool to construct a vector **u** from one midpoint to the other.
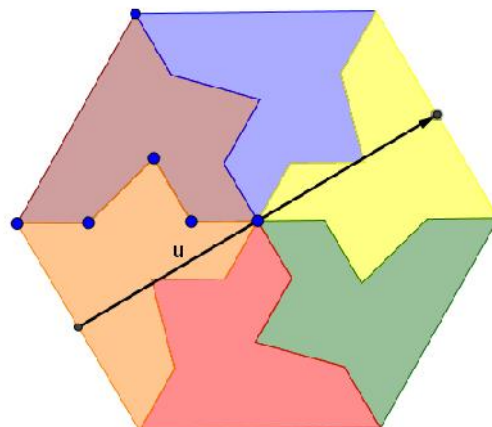
10. Use the **Translate Object by Vector** tool to translate each of the
    six colored polygons. Choose the tool indicated in the column on the left,
    select one of the colored polygons (as illustrated) and then the vector **u.**
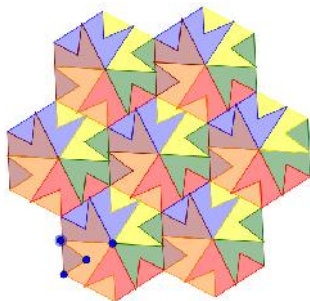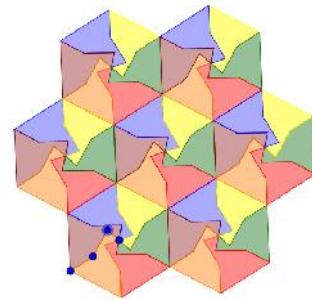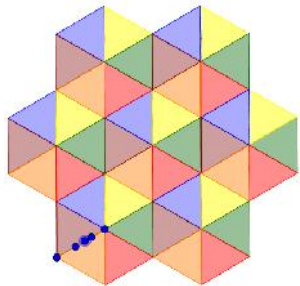

11. Use the **Midpoint or Center** tool to construct the midpoint on an
    outer edge of another one of the polygons. Construct the midpoint on
    the outer edge of the opposite polygon. Use the **Vector between
    Two Points** tool to construct a vector **v** from one midpoint to the
    other. Use the **Translate Object by Vector** tool as before to
    translate each of the six polygons again.
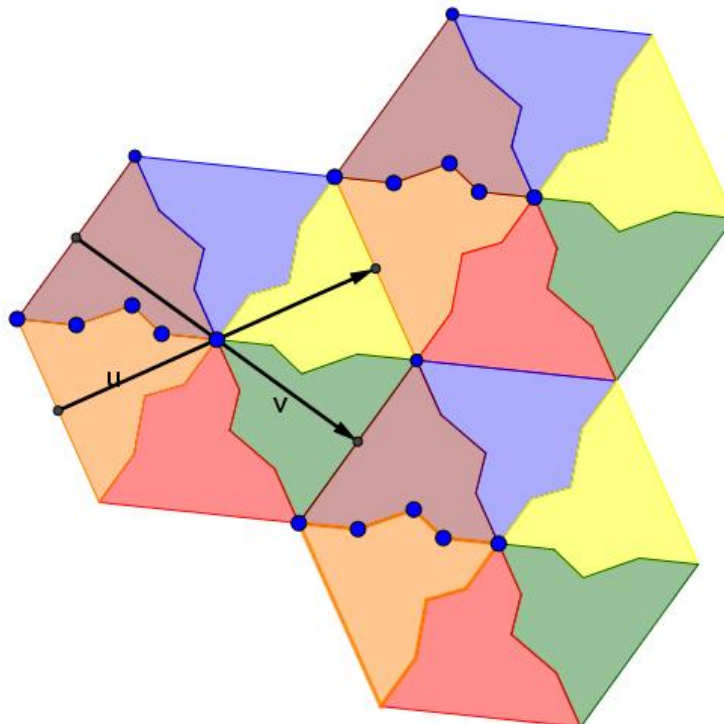
12. Repeat the previous step to continue tessellating shapes in the plane using a new vector **w**.
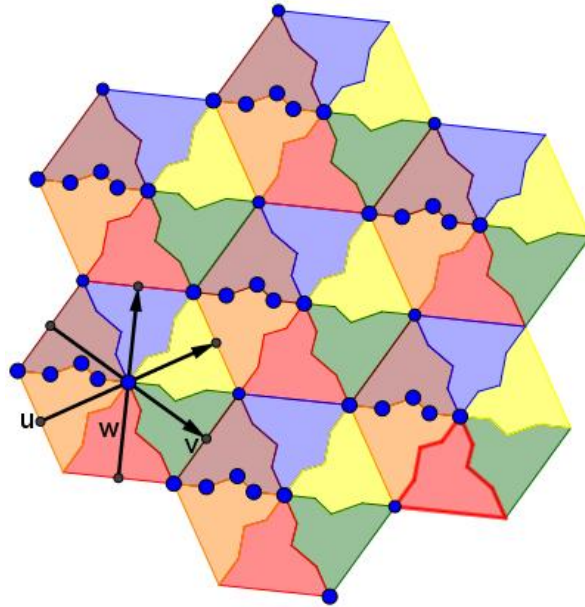
13. Hide all points except points *A, B, C, D, E, F*. Drag points *A, B, C, D, E, F* to change the shape of the tessellation. Note that all edges could be made more pronounced by selecting all segments in the algebra view and setting color to be black and bolder.

Explore Artistic Features!!!!!