



LESSON PLAN FOR ADVENTURES IN FASHION & INTERIOR DESIGN CAREER EXPLORATION BOOKLET

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Tessellations and Angles

Goal: At the completion of this lesson students will have a realistic idea of how to create a geometric pattern and identify regular and semi-regular tessellations. Students will be asked to think critically and calculate angles of a polygon.

Objectives:

Students will be able to do the following:

- ✓ Make a translation according to a rule
- ✓ Design a tessellation
- ✓ Use a part of a square to create a polygon
- ✓ Calculate angles of a polygon

State Standards:

Grade 7 Mathematics-Measurement and Geometry:

3.0 Students know the Pythagorean theorem and deepen their understanding of plane and solid geometric shapes by constructing figures that meet given conditions and by identifying attributes of figures:

3.4 Demonstrate an understanding of conditions that indicate two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures.

Grade 7 Visual Arts-Creative Expression:

Creating, Performing, and Participating in the Visual Arts

Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

Skills, Processes, Materials, and Tools

2.1 Develop increasing skill in the use of at least three different

2.2 Use different forms of perspective to show the illusion of depth on a two-dimensional surface.


2.3 Develop skill in using mixed media while guided by a selected principle of design.

Grade 8 Mathematics-Geometry:

The geometry skills and concepts developed in this discipline are useful to all students. Aside from learning these skills and concepts, students will develop their ability to construct formal, logical arguments and proofs in geometric settings and problems.

12.0 Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems.

13.0 Students prove relationships between angles in polygons by using properties of complementary, supplementary, vertical, and exterior angles.



Grade 8 Visual Arts-Creative Expression:

Creating, Performing, and Participating in the Visual Arts

Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

Communication and Expression Through Original Works of Art

2.5 Select a medium to use to communicate a theme in a series of works of art.

CTE Standards:

B. Interior Design, Furnishings, and Maintenance Pathway

The Interior Design, Furnishings, and Maintenance Pathway is designed to prepare students for careers in this rapidly growing field. Students pursuing this career pathway study the principles and elements of the design, selection, and care of textiles and furnishings; the principles of space planning and interior systems; and the principles of computer-assisted design.

B3.0 Students understand and apply the elements and principles of design to various aspects of the interior design industry:

B3.1 Understand the elements and principles of design and their interrelationships.

B3.2 Understand the concept of universal design and relate it to the industry.

B3.3 Use the elements and principles of design when designing, marketing, and merchandising products.

B3.4 Understand the fundamentals of color theory and color forecasting.

B3.5 Use various types of technology in the design process.

3.0 Career Planning and Management:

Students understand how to make effective decisions, use career information, and manage personal career plans:

3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.

Time Allotment: 50 minutes

Materials: Graph paper, scissors, stiff paper or cardboard, tape, Tessellations Worksheet, and samples of M.C. Escher's work.

Introduction: Geometric patterns in architecture, art, fabric, wallpaper, and flooring are created by sliding, flipping, and turning figures. These movements are called **transformations**.

A transformation starts with an original figure and ends with a new figure in a new position. The new figure is the image of the original figure. A **translation** is a slide from one location to another.

You may cut out shapes from paper. Use an overhead projector to show how to get a congruent image by sliding, flipping, and turning the shape. Place two congruent shapes on the screen and have students decide whether to slide. Slide and turn, or slide and flip on shape to get the other as an image.

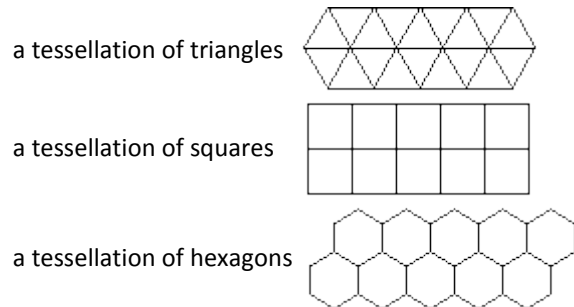
M.C. Escher used tessellations to create art. Use attached samples of Escher's work. M.C. Escher was a Dutch painter who lived from 1898 to 1972. His works are very famous.

A **tessellation** is created when a shape is repeated over and over again covering a plane with out any gaps or overlaps. Another word for tessellation is a **tiling**.



Regular Tessellations

A regular polygon has 3, 4, 5, or more sides and angles, all equal. A regular tessellation means a tessellation made up of congruent regular polygons. **Regular** means that the sides and angles of the polygon are all equivalent. **Congruent** means that the polygons that you put together are all the same size and shape.



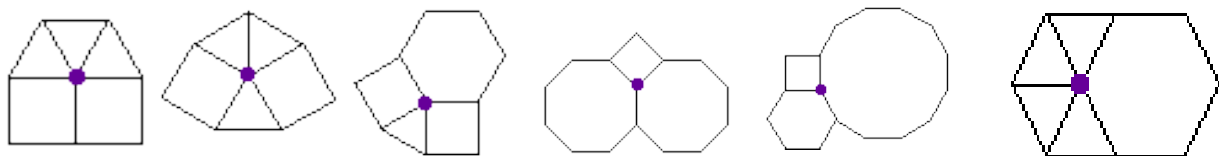
When you look at these three samples you can easily notice that the squares are lined up with each other while the triangles and hexagon's are not. Also, if you look at 6 triangles at a time, they form a hexagon, so the tiling of triangles and the tiling of hexagons are similar, and they cannot be formed by directly lining shapes under each other, unless a translation is involved.

Since the regular polygons in a tessellation must fill the plane at each vertex. The interior angle must be an exact divisor of 360 degrees.

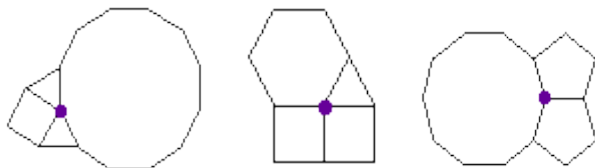
Semi-regular Tessellations

You can use a variety of regular polygons to make semi-regular tessellations. A semi-regular tessellation has two properties.

1. It is formed by regular polygons.
2. The arrangement of polygons at every vertex point is identical



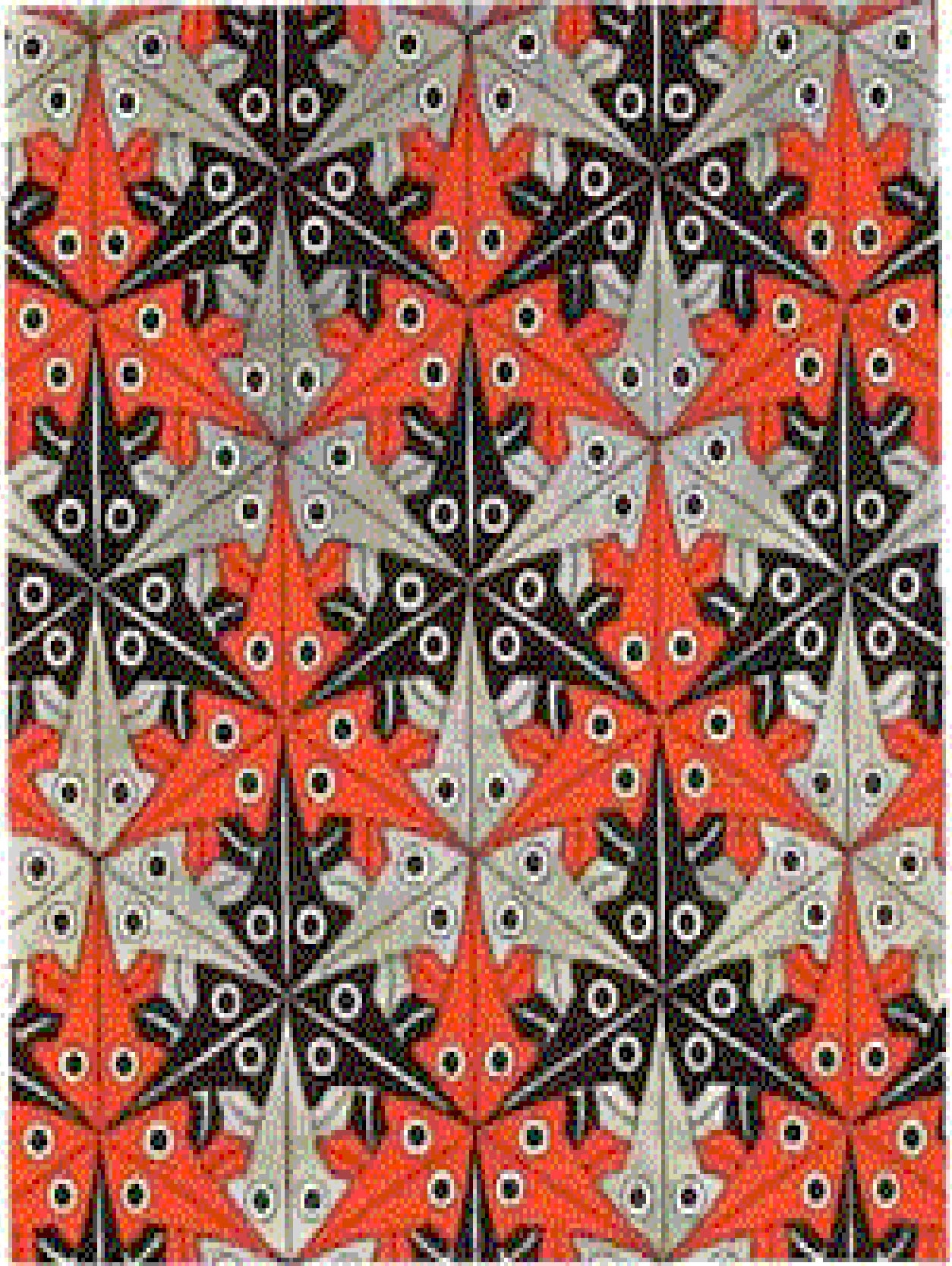
There are other combinations that seem like they should tile the plane because the arrangements of the regular polygons fill the space around a point. If you try tilling the plane with these units of tessellation you will find that they cannot be extended infinitely.



Activity: Have students work in groups of two. Provide them will copies of the Tessellation Worksheet.

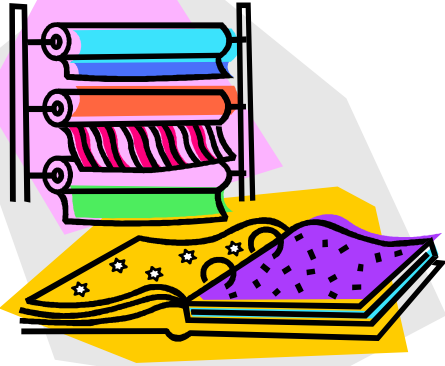
Assessment/Application: Have students use the Tessellation Worksheet to create their own tessellation. Have students use the information given in the introduction to complete the angle chart and analyze the potential of polygons to tessellate a plane.





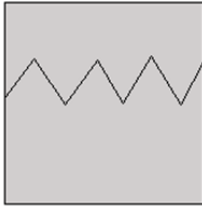
TESSELLATIONS WORKSHEET

Have you ever thought about a career in Fashion and Interior Design? This activity will give you an idea of a regular task a fabric designer would do to create a new pattern on a fabric. At the end of this lesson consider if this is an activity you would like to do on a regular basis.

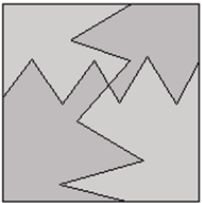


Scenario: Tessellations are often used when designing patterns for wallpaper, fabrics, and flooring. You are a fabric designer and you have been asked by Dolce & Gabana to design a special geometric patterned fabric for their fall collection. You will translate a part of a square to create a polygon. The polygon will then be used to tessellate a plane.

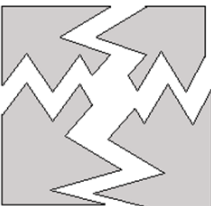
1. Draw a square on a piece of cardboard. (A square is a quadrilateral that has four congruent sides and four right angles.)
2. Cut out the square.
3. Draw a random line on the square paper.



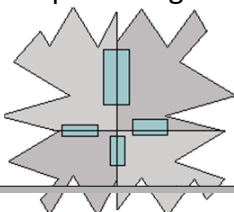
4. Draw a second random line on the paper.



5. Cut out your shapes on the lines you drew.
6. Erase lines you still see on the paper.

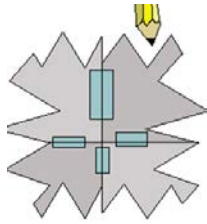


7. Place the pieces together so the corners of the square meet in the center.
8. Tape the pieces together. You have just created a stencil.

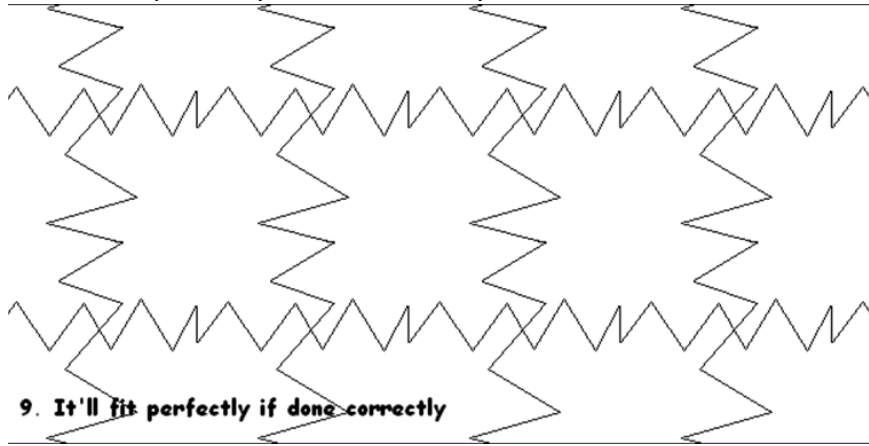




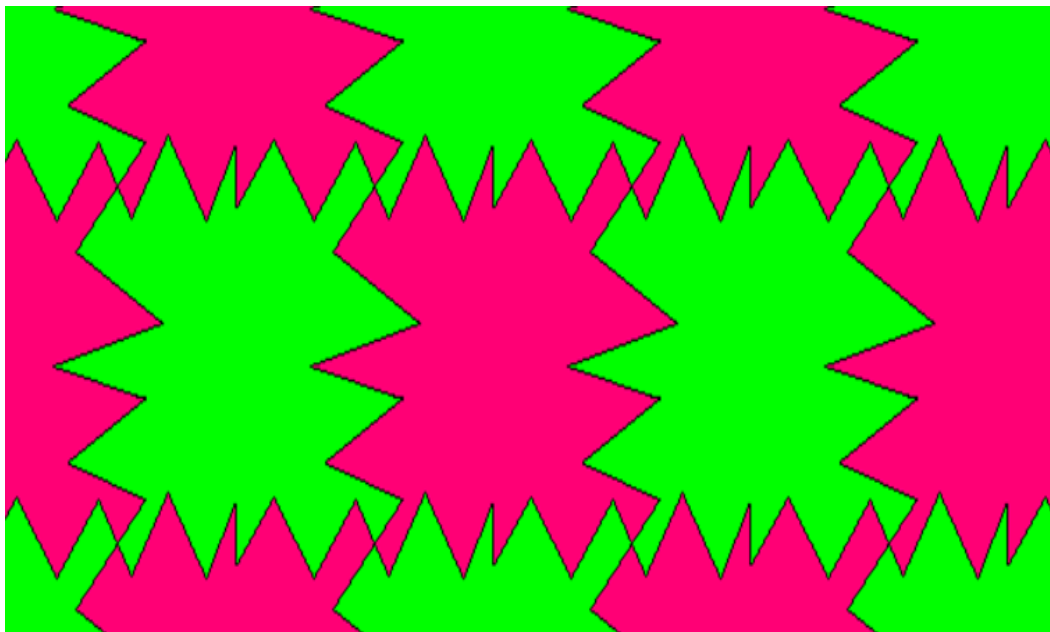
9. Start tracing your stencil. Translate the cutout to a new position and trace it again. Continue this process until you have tessellated the entire paper.



10. It will fit perfectly if done correctly.



11. Color it!





Analysis

1. A rectangle tessellates because when the rectangle repeats around a common point, the rectangles completely cover the region.
2. Calculate the angle measure of the regular polygons in the chart below.
3. Which of the regular polygons shown can be used to tessellate a plane? (Hint: The angles must divide evenly into 360 degrees)

NAME OF POLYGON	DEGREES OF THE INTERIOR MEASURE OF EACH ANGLE	360 DEGREES DIVIDED BY # IN COLUMN 2	WRITE YES OR NO IF THE POLYGON CAN BE USED TO TESSELLATE A PLANE
TRIANGLE	60		
SQUARE	90		
REGULAR PENTAGON	180		
REGULAR HEXAGON	120		
REGULAR OCTAGON	135		