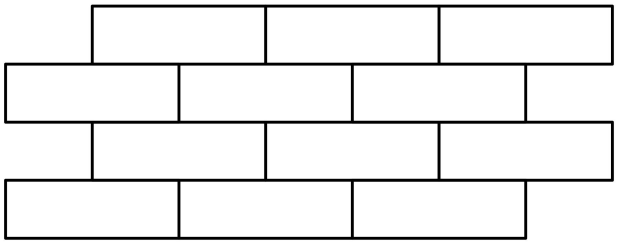
Name: _____

Math Adventures
Week 6: Tessellations and Nets of Shapes

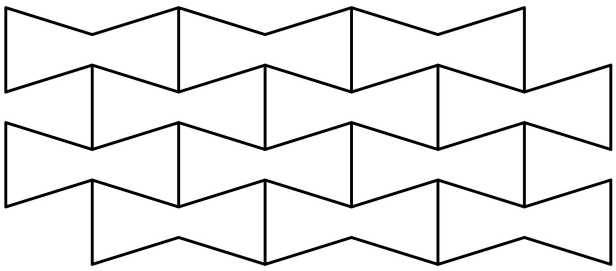
A **tessellation** is a repeated pattern of shapes that fit together without gaps or overlaps to cover the plane.

- A **tile** is a shape in a tessellation.

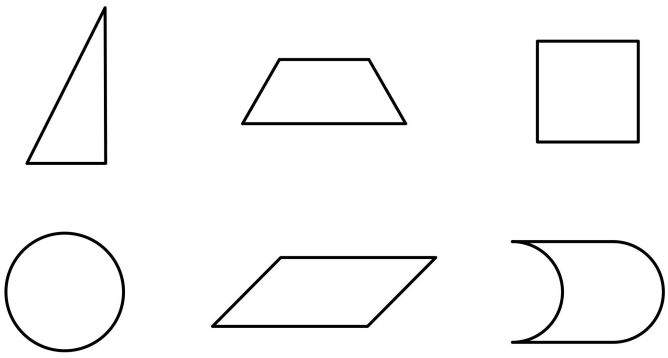
1. Add five more tiles to the tessellation below.



2. Add five more tiles to the tessellation below.

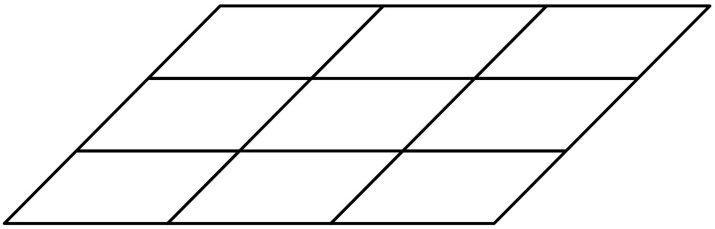


3. Circle the shapes below that can be tessellated.



A **vertex** of a tessellation is a point where the corners of tessellating tiles meet.

4. Circle the vertices you see in the tessellation below.



A **regular polygon** is a 2D shape with straight edges, where all the edges are equal and all the angles are equal.

Cut out your regular polygons!

A **regular tessellation** is a tessellation that uses only one tile, which is in the shape of a regular polygon.

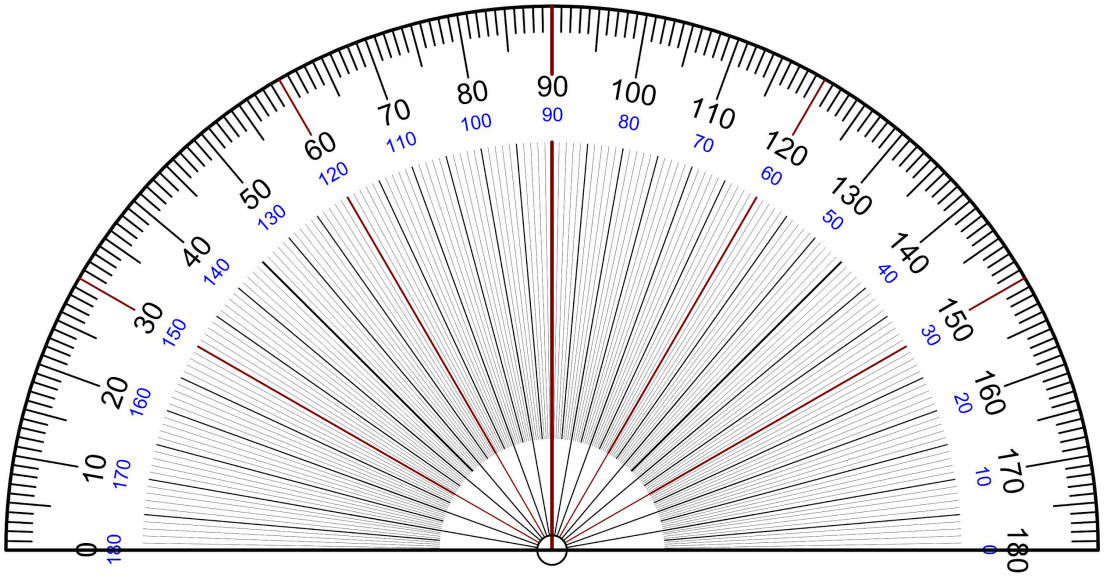
5. Experiment with arranging the regular polygons you cut out and fill out the table below.

	Triangle (3-gon)	Square (4-gon)	Pentagon (5-gon)	Hexagon (6-gon)
Can you create a regular tessellation with this shape?				
If you can create one, draw a vertex of the tessellation and the tiles that meet at the vertex!				

A regular polygon can be used to create a regular tessellation if at least three polygonal tiles fit together around a vertex to form a full circle without any gaps or overlaps.

- Since a full circle measures 360°, a regular polygon can only be tessellated if its angle measure can be multiplied by a whole number to get 360°.

6. Use the protractor below to measure the angles of the regular polygons you cut out, and fill out the table underneath.



	Triangle (3-gon)	Square (4-gon)	Pentagon (5-gon)	Hexagon (6-gon)
Angle measure				
Can the angle measure be multiplied by a whole number to get 360°? If so, what number?				

Does the information in this table match your results from problem 5?

The only three regular polygons that can be used to create regular tessellations are triangles, squares, and hexagons!

A **semi-regular tessellation** is a tessellation that uses multiple types of tiles, all of which must be regular polygons.

- Every vertex of a semi-regular tessellation **must be surrounded by the same shapes, in the same order**. (In other words, every vertex must look the same.)

7. Can you find all five semi-regular tessellations that use triangles, squares, and/or hexagons? For each tessellation that you find, draw a vertex of the tessellation and the tiles that meet at that vertex!

Triangles and squares 1	Triangles and squares 2
Triangles and hexagons 1	Triangles and hexagons 2

Triangles, squares, and hexagons

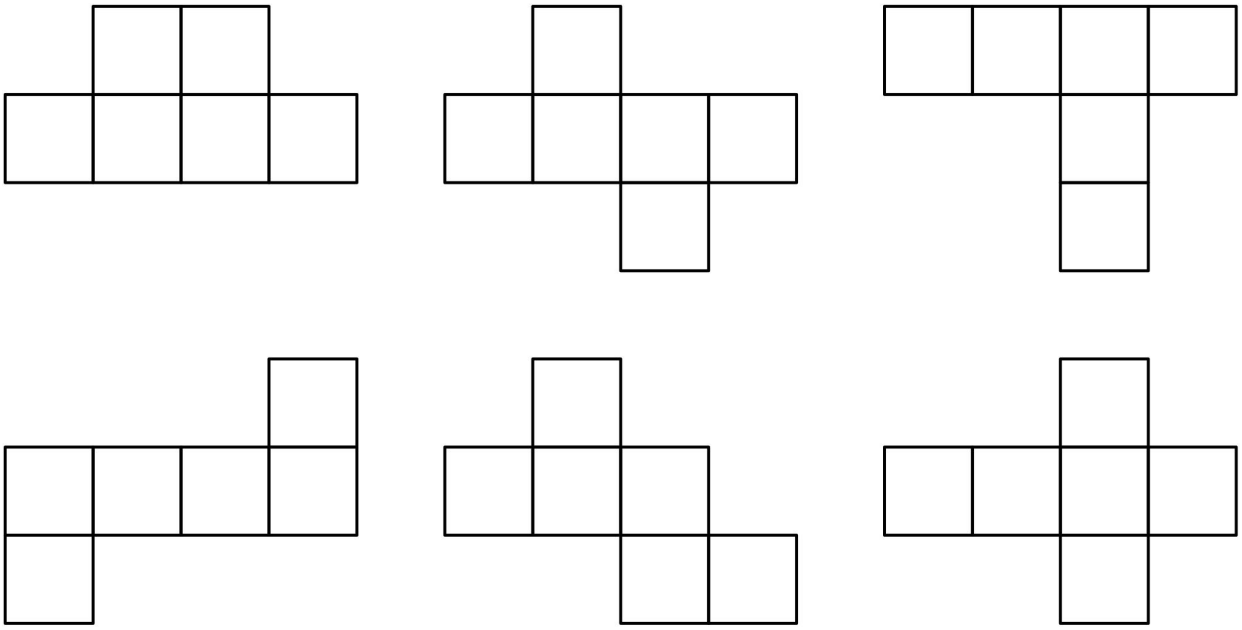
A **polyhedron** is a 3D shape made up of vertices, straight edges, and flat polygonal faces.

- A **vertex** is a corner of a geometric shape.
- An **edge** is a line segment that connects two vertices.
- A **face** is a flat surface that forms part of a 3D shape.

A **net** is a 2D pattern that can be folded up to create a polyhedron.

A **cube** is a type of polyhedron where all the faces are squares.

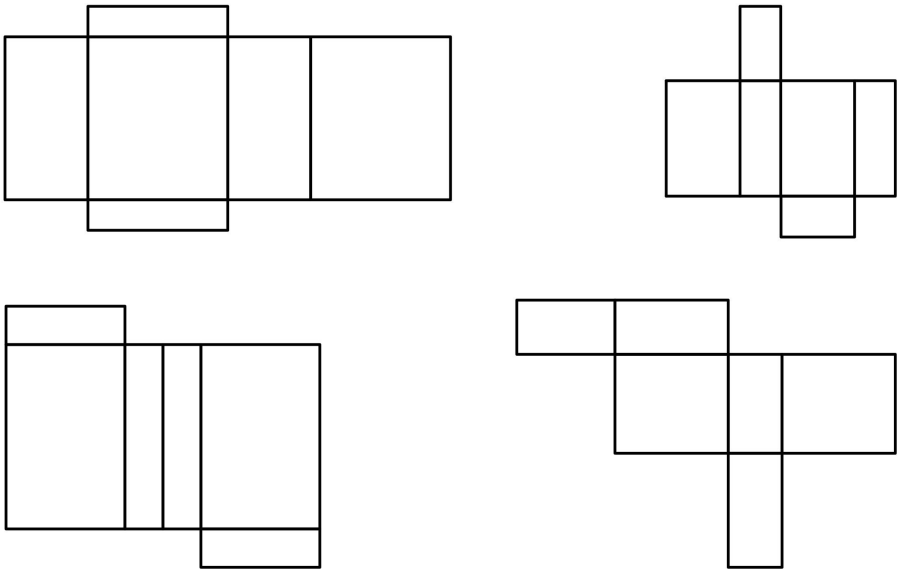
8. Circle the patterns below that are nets of cubes. It might help to label each panel with "top," "bottom," "front," back," "left," or "right."



9. Draw another net of a cube that is not shown above.

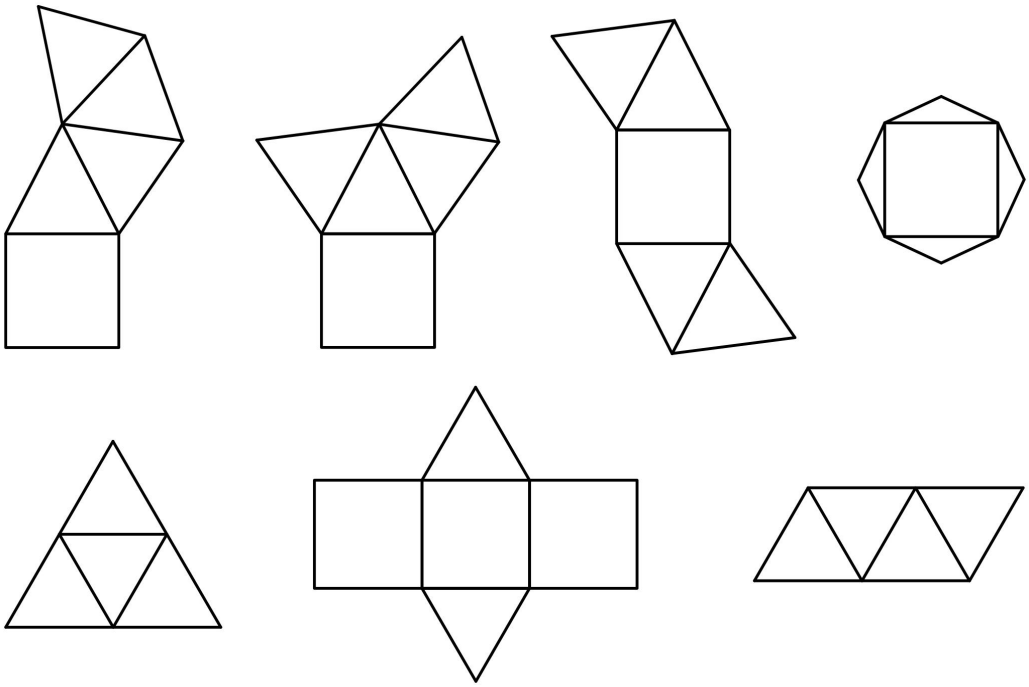
A **rectangular prism** is a type of polyhedron where all the faces are rectangles.

10. Circle the patterns below that are nets of rectangular prisms.

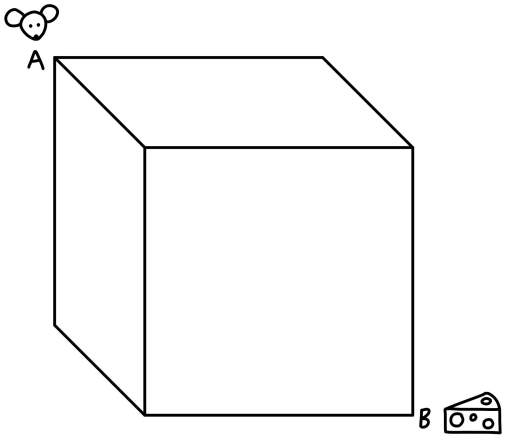


A **pyramid** is a type of polyhedron where the base is a polygon and all the vertices of the base are connected to a special vertex called the **apex**.

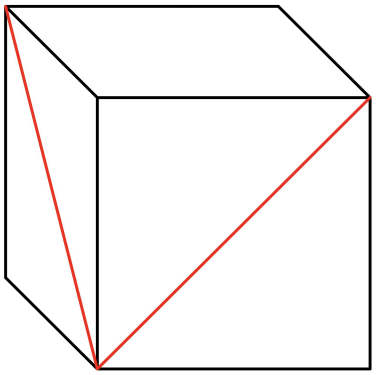
11. Circle the patterns below that are nets of pyramids.



12. A mouse is on a cube and wants to get from point A to point B as fast as possible by moving on the surface of the cube. Draw one of the paths that will get the mouse there the fastest.



13. What is the angle between the two red lines drawn on the cube below?



Lesson Summary

A **tessellation** is a repeated pattern of shapes that fit together without gaps or overlaps to cover the plane.

- A **tile** is a shape in a tessellation.

A **vertex** of a tessellation is a point where the corners of tessellating tiles meet.

A **regular polygon** is a 2D shape with straight edges, where all the edges are equal and all the angles are equal.

A **regular tessellation** is a tessellation that uses only one tile, which is in the shape of a regular polygon.

- A regular polygon can be used to create a regular tessellation if at least three polygonal tiles fit together around a vertex to form a full circle without any gaps or overlaps.
- Since a full circle measures 360°, a regular polygon can only be tessellated if its angle measure can be multiplied by a whole number to get 360°.
- The only three regular polygons that can be used to create regular tessellations are triangles, squares, and hexagons!

A **semi-regular tessellation** is a tessellation that uses multiple types of tiles, all of which must be regular polygons.

- Every vertex of a semi-regular tessellation **must be surrounded by the same shapes, in the same order**. (In other words, every vertex must look the same.)
- There are eight semi-regular tessellations in total. Five of them use only triangles, squares, and/or hexagons.

A **net** is a 2D pattern that can be folded up to create a 3D shape.

A **cube** is a type of polyhedron where all the faces are squares.
A **rectangular prism** is a type of polyhedron where all the faces are rectangles.
A **pyramid** is a type of polyhedron where the base is a polygon and all the vertices of the base are connected to a special vertex called the **apex**.

References: Olga Radko Endowed Math Circle archive, *Hard Math for Elementary School* by Glenn Ellison, NRICH Maths Project