Notes for parents (1).

The purpose of the activity is to help your student to:

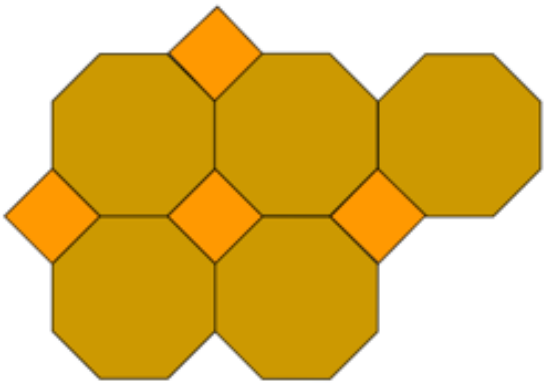
- Create tiling patterns to cover a flat surface.
- Describe the features of shapes that allow coverage of a flat surface.

Here is what to do:

Read the activity together and discuss the pictures of facades.

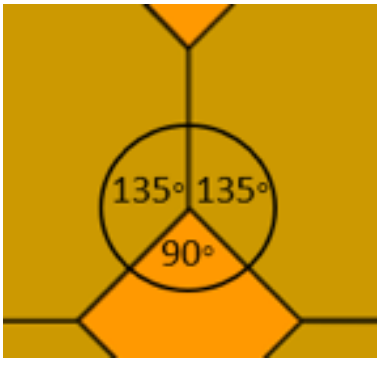
What shapes are used?
How are the shapes fitted together so there are no gaps or overlaps?
What features of the shapes make fitting together possible?

There are two important criteria for shapes to tessellate like that. The angles that meet around a vertex (point) must total 360° otherwise there will be an angular gap left or the shapes will overlap. Sides that meet are of the same length. For example, consider this arrangement of octagons and squares.



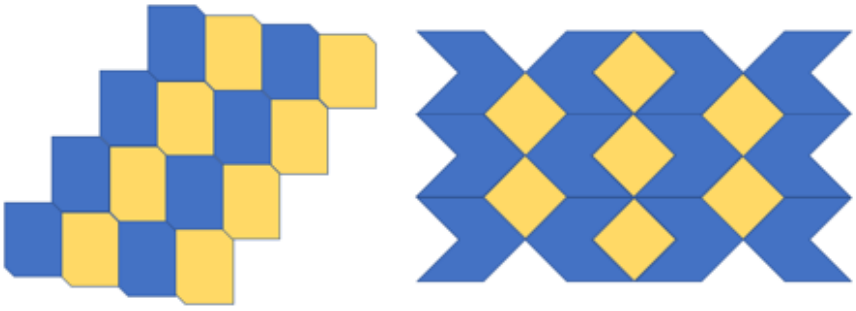
The side lengths are all equal as these shapes are regular polygons. The angle sum around each vertex is made from the internal angles of two octagons and one square.

You might check with your student to see that these properties hold true for the facades in the pictures. You will need a protractor to measure angles and side lengths can be checked visually or with a ruler.



Notes for parents (2).

The task requires your student to create their own tile design. Thy could do this using an online tool, a drawing program, or by creating tiles from card to trace around. Your student will need to think hard about the side lengths in angles, particularly getting shapes with angles that will fit around a vertex.



Points to note

In Years 9 and 10 students are expected to attend to the angle properties of polygons and other special arrangements of lines (parallel and perpendicular). While students commonly know the internal angles for regular triangles and quadrilaterals they seldom extend their knowledge to other polygons. Measuring the angles in pictures of regular polygons can help.

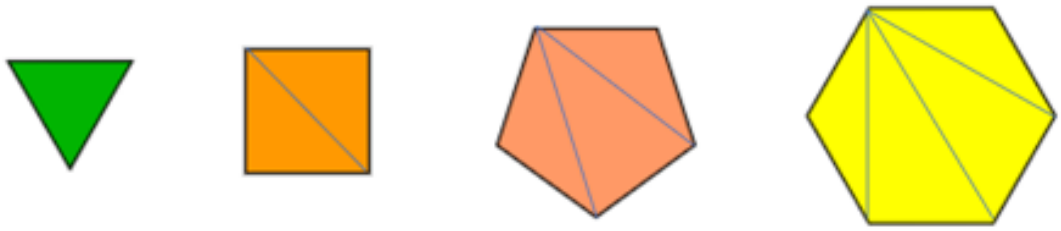
There is always some inaccuracy in measurement. The interior angle sums for the triangle, square and hexagon should be 180°, 360° and 720° respectively. For example, 6 x 120 = 720° (hexagon). If the pattern is linear then an angle sum of 360 + 180 = 540° might be expected for the regular pentagon. Regular polygons have equals angles so 540 ÷ 5 = 108° should be the size of each internal angle. The pattern can be extended in a table:

Number of sides	3	4	5	6	7	8	9	10
Name	triangle	square	pentagon	hexagon	heptagon	octagon	nonagon	decagon

Total of internal angles	180°	360°	540°	720°	900°	1080°	1260°	1440°
Measure of each angle	60°	90°	108°	120°	128.57°	135°	140°	144°

Notes for parents (3). Activity next page.

One explanation for the growth of the pattern in angle sums is in the number of triangles that contribute to the sum. Each time an extra side is added an extra triangle can be made as shown below. Since a triangle has an angle sum of 180° that should be the amount added to the sum as another side is added.



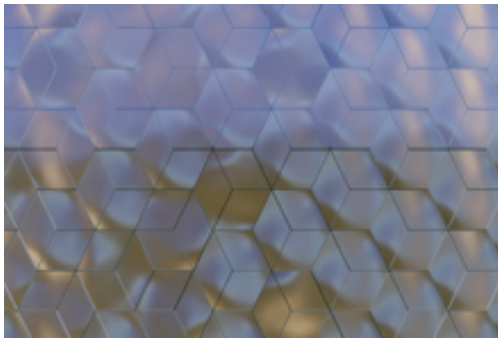
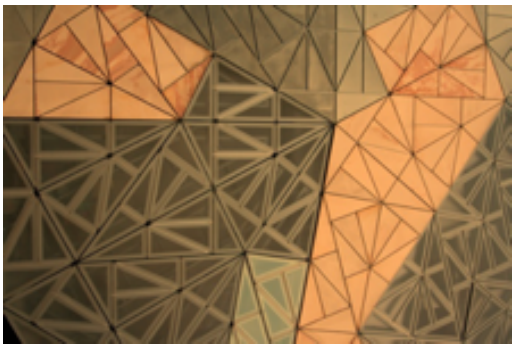
In considering possible combinations of polygons that might tessellate the internal angles are useful. Heptagons are not good candidates as it is hard to get 360° around a vertex using angles of 128.57…°. Some shapes will tesselate by themselves. Six triangles around a vertex gives 6 x 60 = 360°, as does four squares (4 x 90 = 360°) and three hexagons (3 x 120 = 360°). Combinations of shapes also work. The pattern above has two octagons and one square around a vertex which gives an angle of 135 + 135 + 90 = 360°.

Tessellation can be made with non-regular polygons, as the façade pictures show. Any triangle or quadrilateral will tessellate by itself. Since the angles in triangles and quadrilateral total 180° and 360° each internal angle needs to be used around a vertex, twice for a triangle and once for a quadrilateral.

Decorating flat surfaces with designs makes cities more attractive by turning boring spaces into landmarks. Facades of buildings and pavements are opportunities for artists to shine.

Here are some facades from modern buildings.




The key to covering a flat surface is to find a shape or collection of shapes that fit/s together with no gaps or overlaps. As the designer you have this brief.

Create a façade with a tessellating pattern with no more than three shapes. The tiles must be polygons of some kind. Use colour to enhance your pattern.