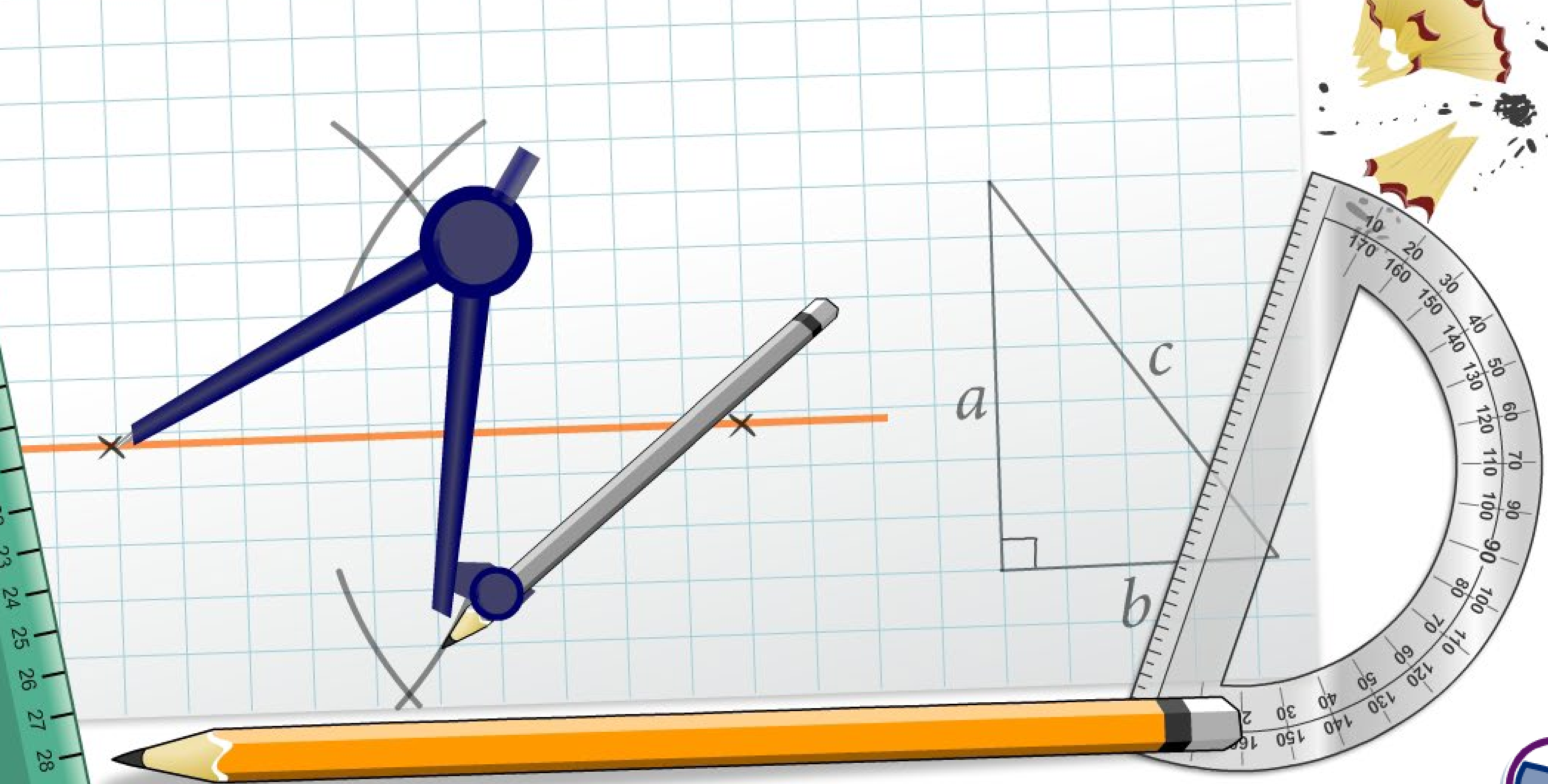
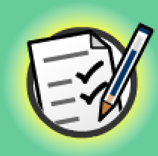
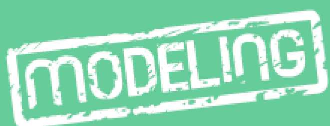
Polygons



Common core icons



This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.



Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

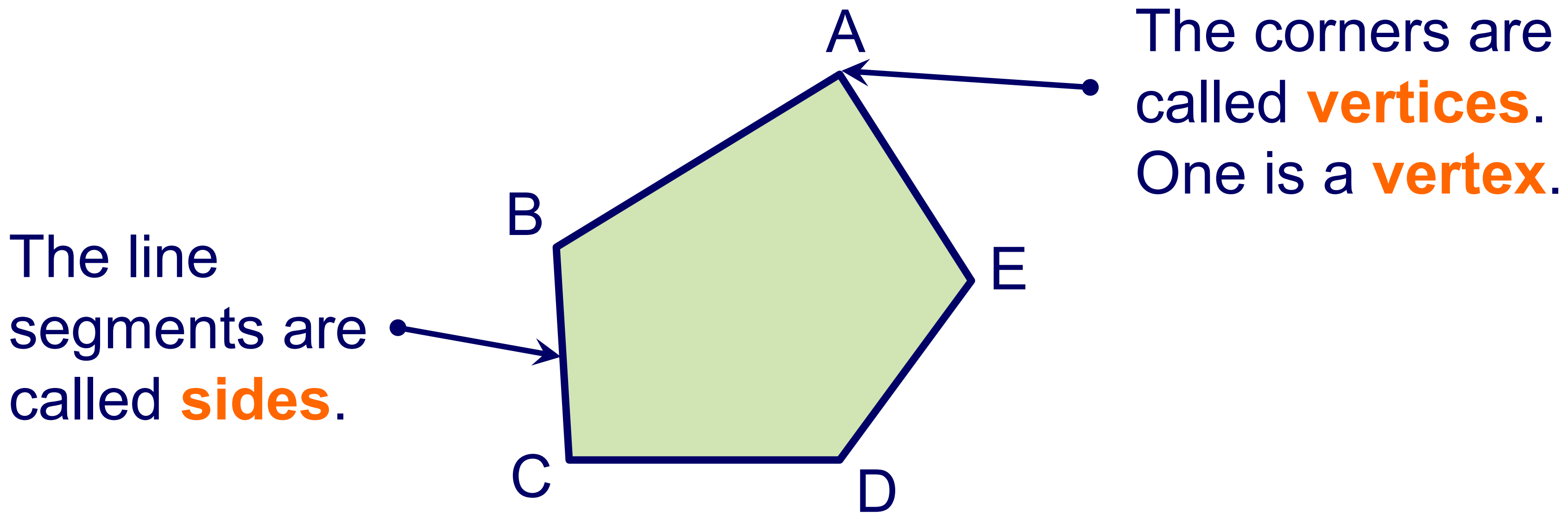
8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

What is a polygon?

A **polygon** is a **2-D** shape made when line segments enclose a region.



2-D stands for **two-dimensional**. These two dimensions are length and width. A polygon has no thickness.

Types of polygon

Polygons

regular

convex

concave

Polygons can be described as regular, convex or concave depending upon the length of their sides and size of their angles.

Press the buttons to see the differences.

Polygons

regular	convex	concave

Drag one shape and one property into each box.

Press **start** to begin.

start

Naming polygons

hexagon	5
quadrilateral	10
de	
tr	
nc	
oc	
heptagon	7
pentagon	8

Match each polygon to its number of sides.

Press **start** to begin.

start

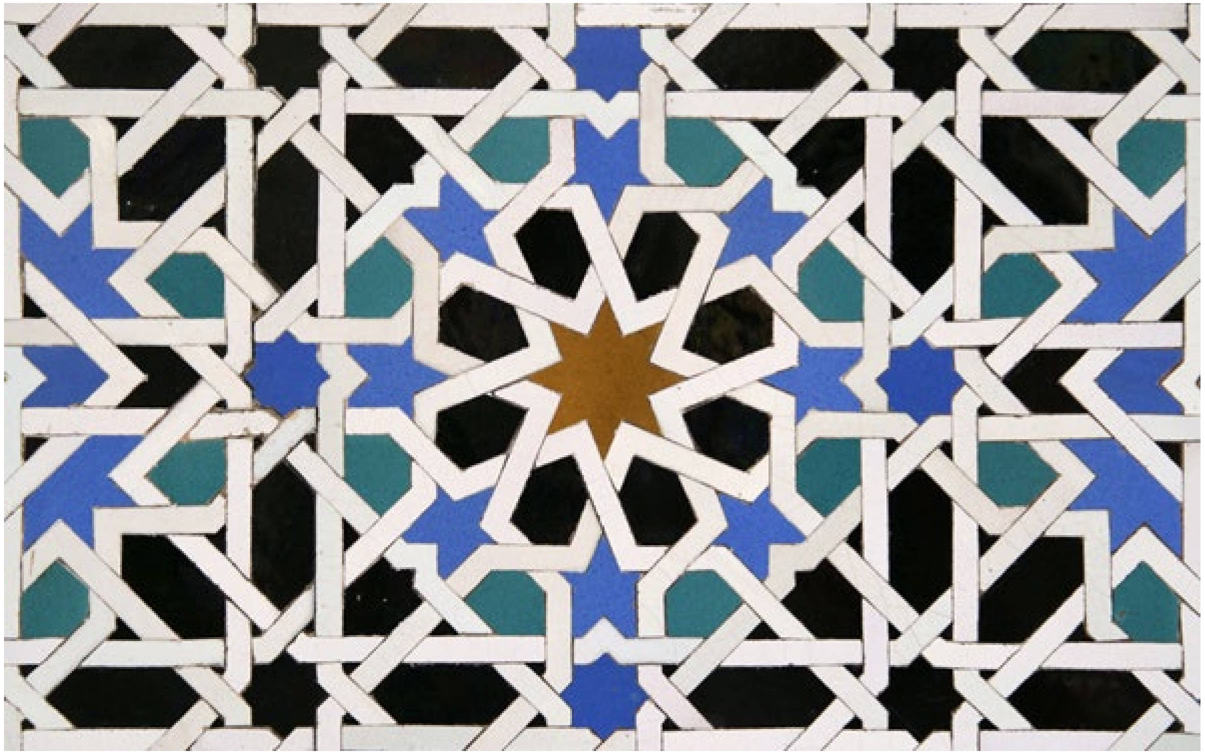
Press to find the pairs of polygons and their names.

Press **start** to begin.

start

Tiling patterns

Some important buildings have beautiful tiled walls. These tiles are from the Alhambra Palace in Spain.

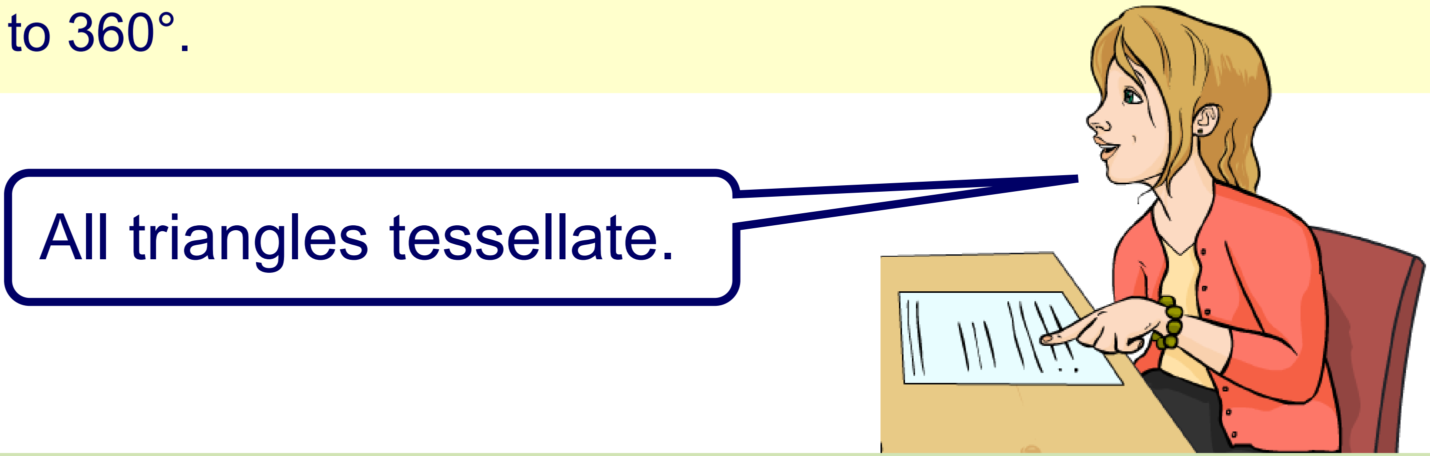


Describe the polygons you can see in this tiling pattern.

What is tessellation?

What does it mean if certain shapes "tessellate"?

If shapes **tessellate**, they fit together in a repeating pattern with no gaps or overlaps. The measures of the angles that meet at each vertex must sum to 360°.

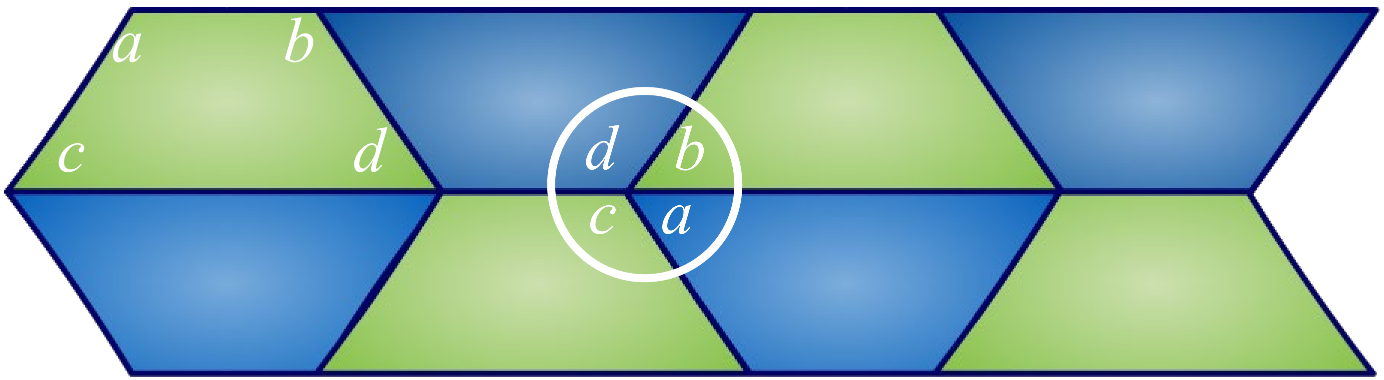


Is Amy correct? Use multiple cut-outs of congruent triangles to justify your answer.

Amy is correct – all congruent triangles tessellate.

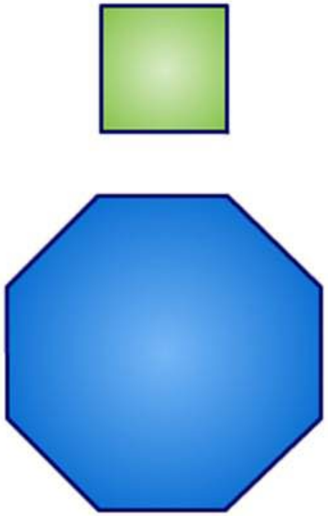
Tessellation of quadrilaterals

Use angle facts to explain why all quadrilaterals tessellate.



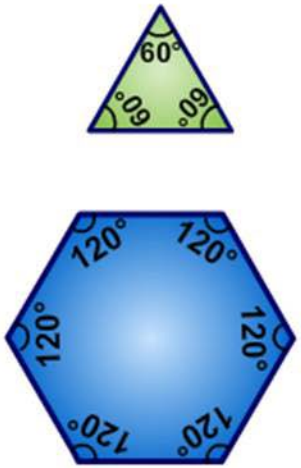
- By labeling angles a, b, c and d, it can be shown that all 4 angles in a quadrilateral will meet at a point.
- We know that angles around a point always add to 360°.
- The interior angles of quadrilaterals sum to 360°, meaning that they will always tessellate, with one of each vertex around a point.

Drag the shapes onto the panel to show how a regular octagon and a square can tessellate together.



Tessellation

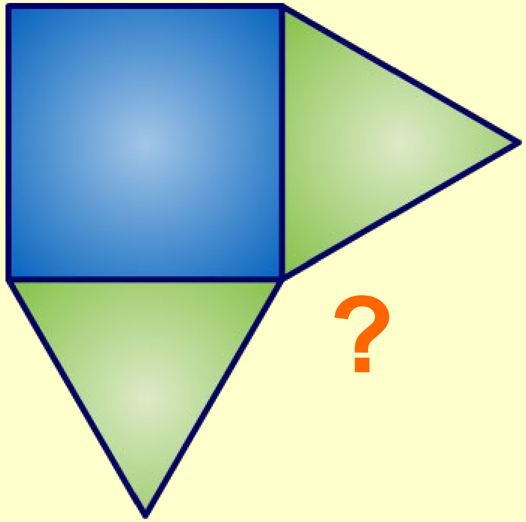
Drag the shapes onto the panel and rotate to show how a regular hexagon and an equilateral triangle can tessellate.



What fits?

Here is the start of a shape pattern. It is made from a square and two equilateral triangles.

Suggest two possible shapes that could fit in the space, giving details of their interior angles.



The space requires an angle of:
360° – (90° + 60° + 60°) = 150°

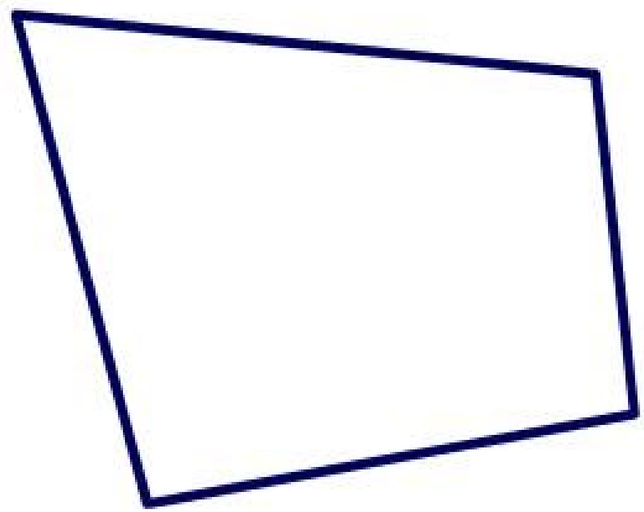
The following shapes would fit in the space:

- an isosceles triangle with one angle of 150° and two angles of 15°
- a rhombus with two angles of 150° and two angles of 30°.

Interior angles in a quadrilateral

The interior angles in any quadrilateral add up to 360°.

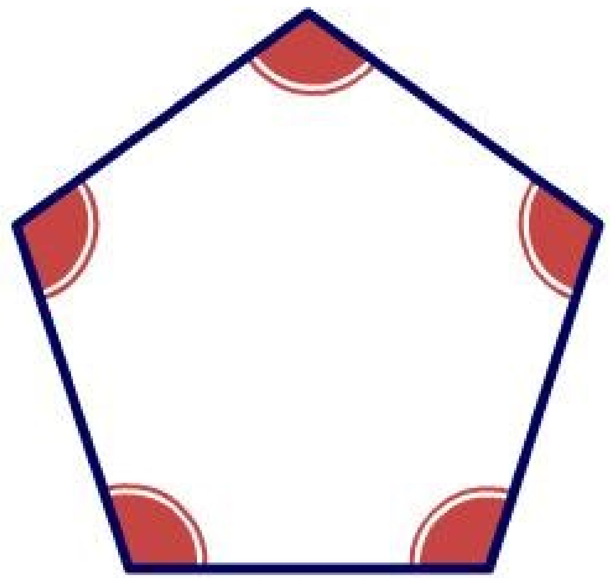
Press **play** to see how to prove that this is true.



Polygon angle sum theorem

Polygon angle sum theorem: The sum of the measures of the interior angles in an n-sided convex polygon is $180°(n-2)$.

Press **play** to see how to show that this is true.



Interior angles in regular polygons

A regular polygon has equal sides and equal angles.
Complete the table for each regular polygon

name of regular polygon	sum of the interior angles	size of each interior angle
equilateral triangle	----------°	----------°
square	----------°	----------°
regular pentagon	----------°	----------°
regular hexagon	----------°	----------°

Type the missing numbers on the dotted lines.

What's the size of each interior angle?

Shape: 1/6

The sum of the interior angles in an ... s $(n-2) \times 180°$.

...ze of ... es below.

Calculate the size of the interior angles of each of the following regular polygons. Input the number of degrees into the text box.

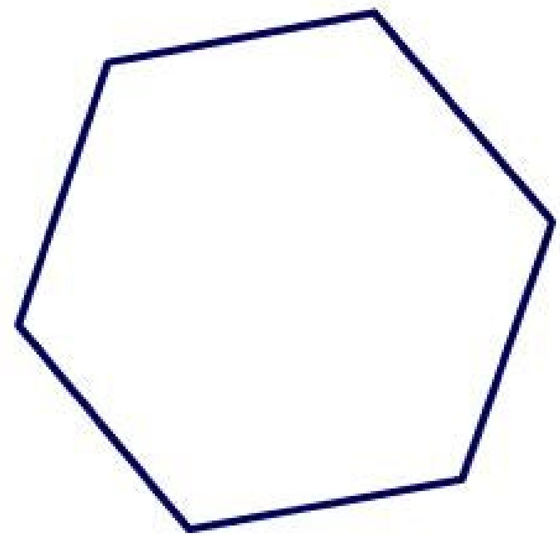
Press **start** to begin.

start

Polygon exterior angle sum theorem

Polygon Exterior Angle Sum Theorem:
The sum of the measures of the exterior angles of a convex polygon, one angle at each vertex, is 360°.

Press **play** to see how to show that this is true using a hexagon.



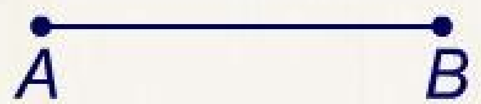
Constructing an equilateral triangle

Constructing an equilateral triangle

An equilaterial triangle has three congruent sides.

How can you make an equilateral triangle using one line segment?

Press **play** to learn how.



Constructing an equilateral triangle inscribed in a circle

An equilateral triangle is said to be **inscribed** in a circle when the circle contains all of the triangle's vertices.

Press **play** to see how to construct an equilateral triangle inscribed in a circle.

Constructing a square

Constructing a square

A square has four congruent sides.

How can you construct a square?

Press **play** to learn how.

Constructing a square inscribed in a circle

A square has four congruent sides.

We can constuct a square by inscribing it in a circle.

Press **play** to learn how.

Constructing an inscribed hexagon

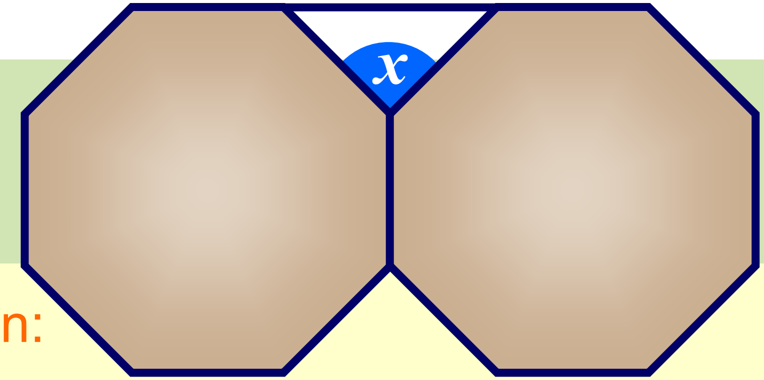
Constructing a regular hexagon

A regular hexagon has six sides, each is the same length as the radius of the circle that circumscribes it.

How can you construct it?

Press **play** to learn how.

An architect designs a new hotel building consisting of two regular octagonal towers, joined along one edge. In the space between the towers, she designs a lobby whose outer wall creates a flat front to the entire building.



Describe the shape of the lobby and its interior angles.

calculate interior angle of a regular octagon:

$$(180° \times 6) \div 8 = 135°$$

find the angle x between the towers:

$$360° - (135° \times 2) = 90°.$$

The lobby is a right isosceles triangle with interior angles of 45°, 45° and 90°.