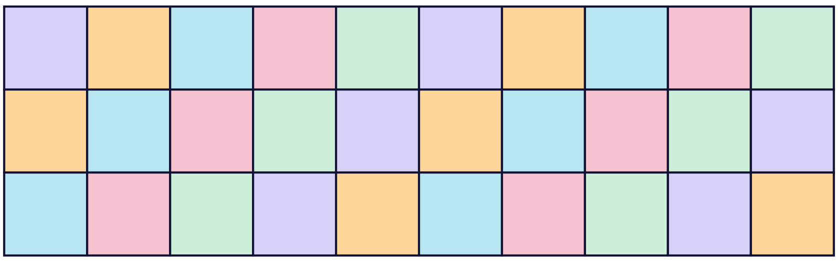
PATTERNS EVERYWHERE

Tessellation Puzzles

Cut, Turn, Fit & Discover

Five optional puzzles for children who want to keep exploring after the tessellation lesson. Cut out shapes, make conjectures, test them, and then explain why the patterns work.



HOW TO USE THIS PACK

1. **Predict first.**
   Do not tell the learner which shapes will work.
2. **Cut and experiment.**
   Turning, flipping and rearranging are part of the mathematics.
3. **Explain the surprise.**
   Older learners can use the extension questions to prove what they found.
4. **Keep failed attempts.**
   A gap is evidence about one arrangement - not proof that no tessellation exists.

Ages 7+ | Younger children can focus entirely on cutting and arranging.

PUZZLE 1

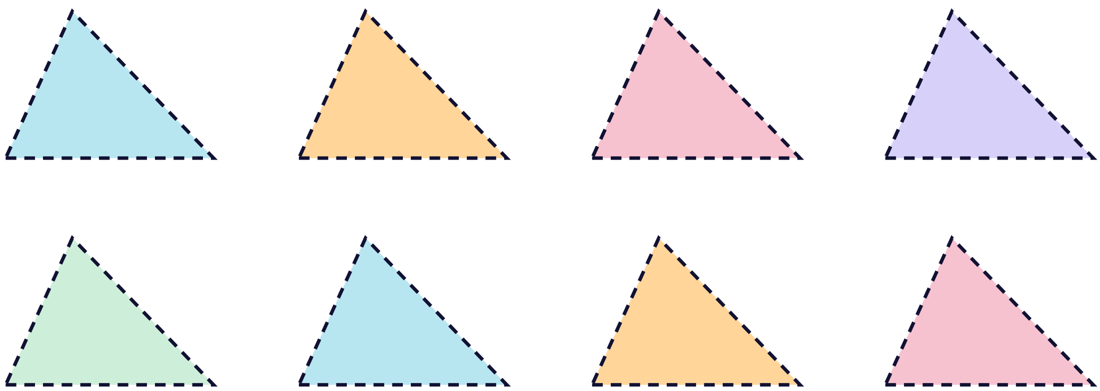
Does every triangle tessellate?

These triangles are deliberately awkward. They are all exactly the same scalene triangle.

TRY IT

Cut out the triangles below. Can you cover an area without gaps or overlaps? Then try this smaller challenge: can two copies make a parallelogram?

SCISSORS Ask a grown-up before using scissors. Cut around the dashed outlines and keep each piece intact.



OLDER EXPLORER

Label the triangle angles A, B and C. Two identical copies can be joined along a matching side to make a parallelogram. Can you explain why this proves that every triangle - not just equilateral triangles - tessellates?

MY CONJECTURE

I think every / not every triangle tessellates because ...

PUZZLE 2

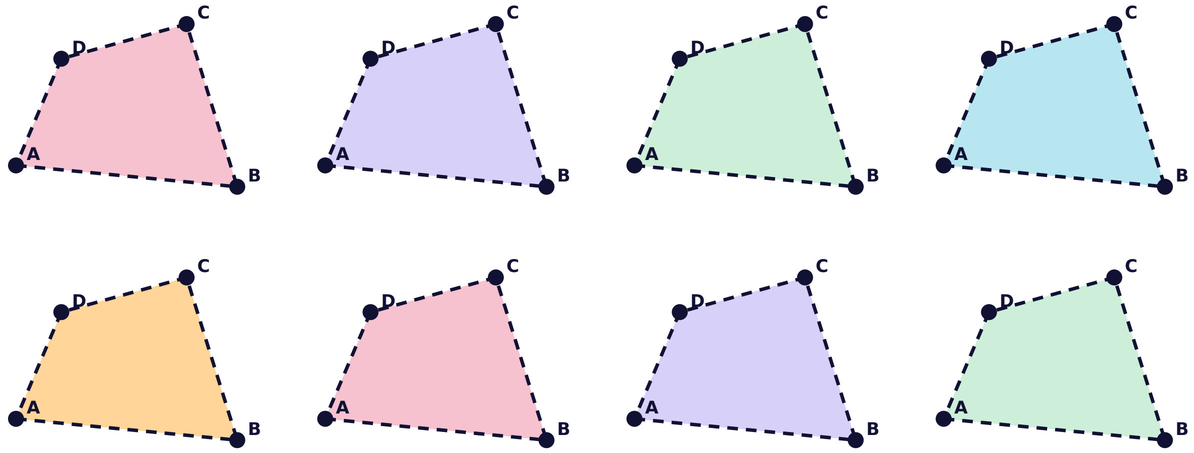
The wonky quadrilateral challenge

This four-sided shape does not look much like a square. Can copies of it still tile?

TRY IT

Cut out the eight identical quadrilaterals. Turn some through 180 degrees. Can you make a repeating patch with no gaps?

SCISSORS Ask a grown-up before using scissors. Cut around the dashed outlines and keep each piece intact.



WHY MIGHT THIS ALWAYS WORK?

Every quadrilateral has four interior angles whose total is 360 degrees. Try arranging rotated copies so an A, B, C and D corner meet around one point. What do you notice?

DRAW YOUR TILING IDEA HERE

PUZZLE 3

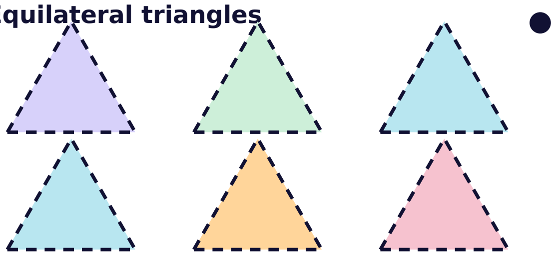
Which regular polygons can tile by themselves?

Cut out the shapes. Try fitting identical corners around a point until they make one complete turn.

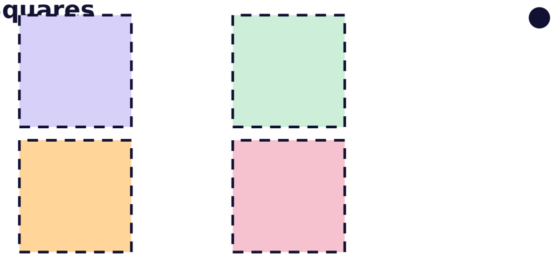
THE RULE OF THE GAME

Use only one kind of regular polygon at a time. Around the black dot, there must be no gap and no overlap.

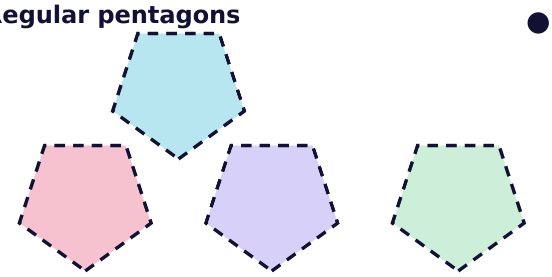
Equilateral triangles



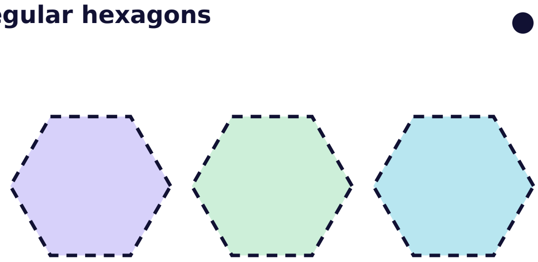
Squares



Regular pentagons



Regular hexagons



ALGEBRAIC EXTENSION

For a regular n-sided polygon, one interior angle is 180(n-2)/n degrees. If k identical corners meet at a point, then k x 180(n-2)/n = 360. Which whole-number pairs (n,k) are possible?

My possibilities: ______________________________

____

PUZZLE 4

Penrose kite-and-dart puzzle

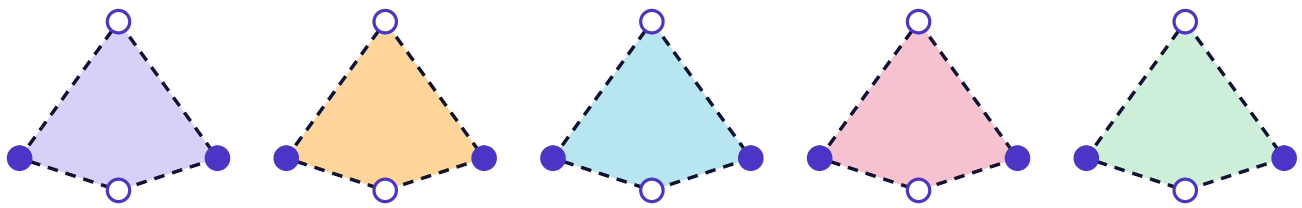
These two special quadrilaterals can make an aperiodic Penrose tiling - but only when the matching rule is obeyed.

MATCHING RULE

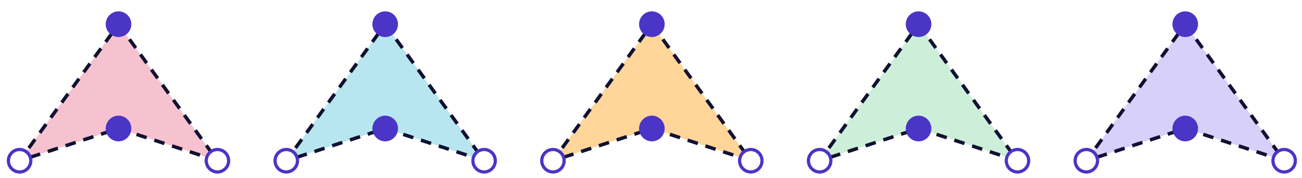
When two tile edges touch, the vertex marks at both ends of that shared edge must match: filled purple dot to filled purple dot, open dot to open dot. Try to grow one legal patch.

SCISSORS Ask a grown-up before using scissors. Cut around the dashed outlines and keep each piece intact.

KITES



DARTS



GO FURTHER: Can you spot five-fold shapes appearing in your patch? Can you extend the patch without ever finding one small block that simply repeats by sliding?

PUZZLE 5

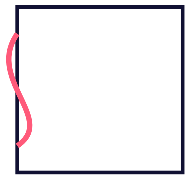
Make an Escher-style tessellating tile

Start with a square. Change its boundary without changing how opposite sides match.

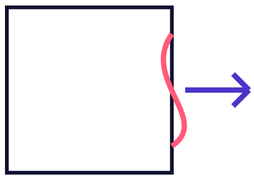
CUT - MOVE - TAPE

1. Cut one strange piece from the LEFT edge. Move that exact piece, without turning it, to the RIGHT edge and tape it there. 2. Do the same from TOP to BOTTOM. 3. Trace several copies. They should fit together like a jigsaw.

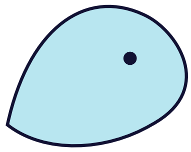
1. Start



2. Move side piece



3. Invent a creature



YOUR TILE TEMPLATE

Cut around this square first. Then invent your own cuts.

DRAW / CUT / MOVE / TAPE

ART CONNECTION: M. C. Escher became famous for tessellations in which repeating tiles turn into birds, fish, lizards and other recognisable forms. What could your tile become?

GROWN-UP GUIDE

Answers, discoveries & useful prompts

The goal is not speed. Give children time to try arrangements that fail before revealing the general rule.

1. Every triangle tessellates

Two congruent triangles can be joined to form a parallelogram. A parallelogram tessellates by translation, so every triangle tessellates. Prompt: “Can you make a bigger shape from two copies first?”

2. Every quadrilateral tessellates

A general quadrilateral also tessellates. One useful construction uses 180-degree rotations of copies. Since its four interior angles total 360 degrees, copies can be arranged so the four different corners meet around a point.

3. Regular polygons

Using just one kind of regular polygon, only equilateral triangles, squares and regular hexagons tessellate. In the algebraic extension, $k \times 180(n-2)/n = 360$ gives the whole-number cases $(n,k) = (3,6), (4,4), (6,3)$.

4. Penrose kite and dart

The kite has angles 72, 72, 72 and 144 degrees; the dart has angles 36, 72, 36 and 216 degrees. Their long-to-short edge ratio is the golden ratio. The vertex matching marks are essential: without matching rules, the same shapes can be arranged in periodic ways.

5. Escher-style tile

The cut-and-move trick preserves matching opposite boundaries. Repeating translated copies therefore fit together. Encourage the learner to draw a creature inside the tile only after confirming that the outline tessellates.

GOOD QUESTIONS

“What stays the same?” “What did the turn change?” “Does one failed arrangement prove it cannot work?” “How could you convince someone it always works?”