AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE (AIMSSEC)
AIMING HIGH

This INCLUSION AND HOME LEARNING GUIDE
suggests related learning activities for all ages from 4 to 18
on the theme of SYMMETRY

Just choose whatever seems suitable for your group of learners

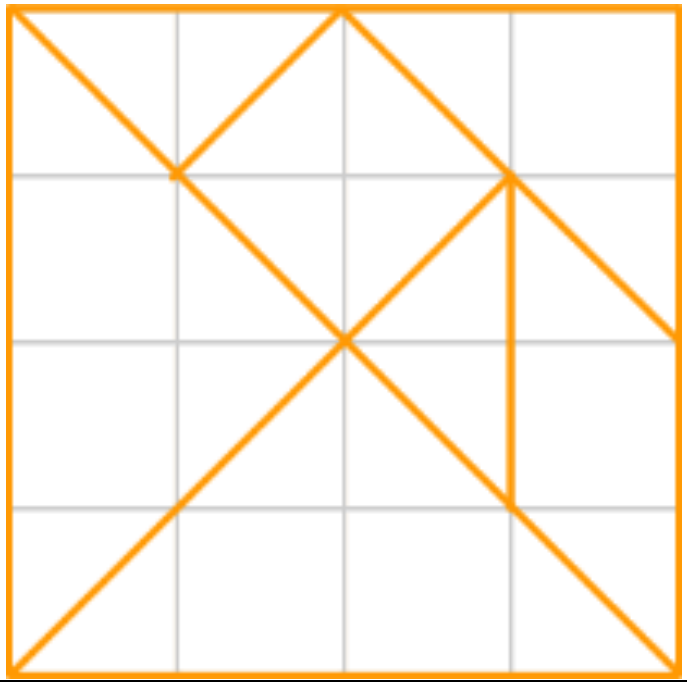
The original TANGRAM PATTERN activity was designed for Years 4 to 7

TANGRAM PATTERN

Arrange the 7 tangram pieces to make the pattern in the grey picture.

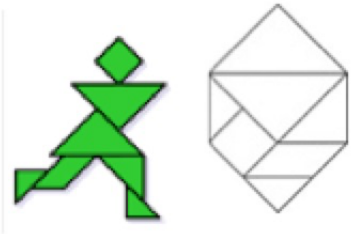
What do you notice about this pattern? Draw the pattern and make a list of what you see in it.

Make a pattern of your own using all 7 pieces.



You can cut out your own tangram pieces to make the grey pattern.

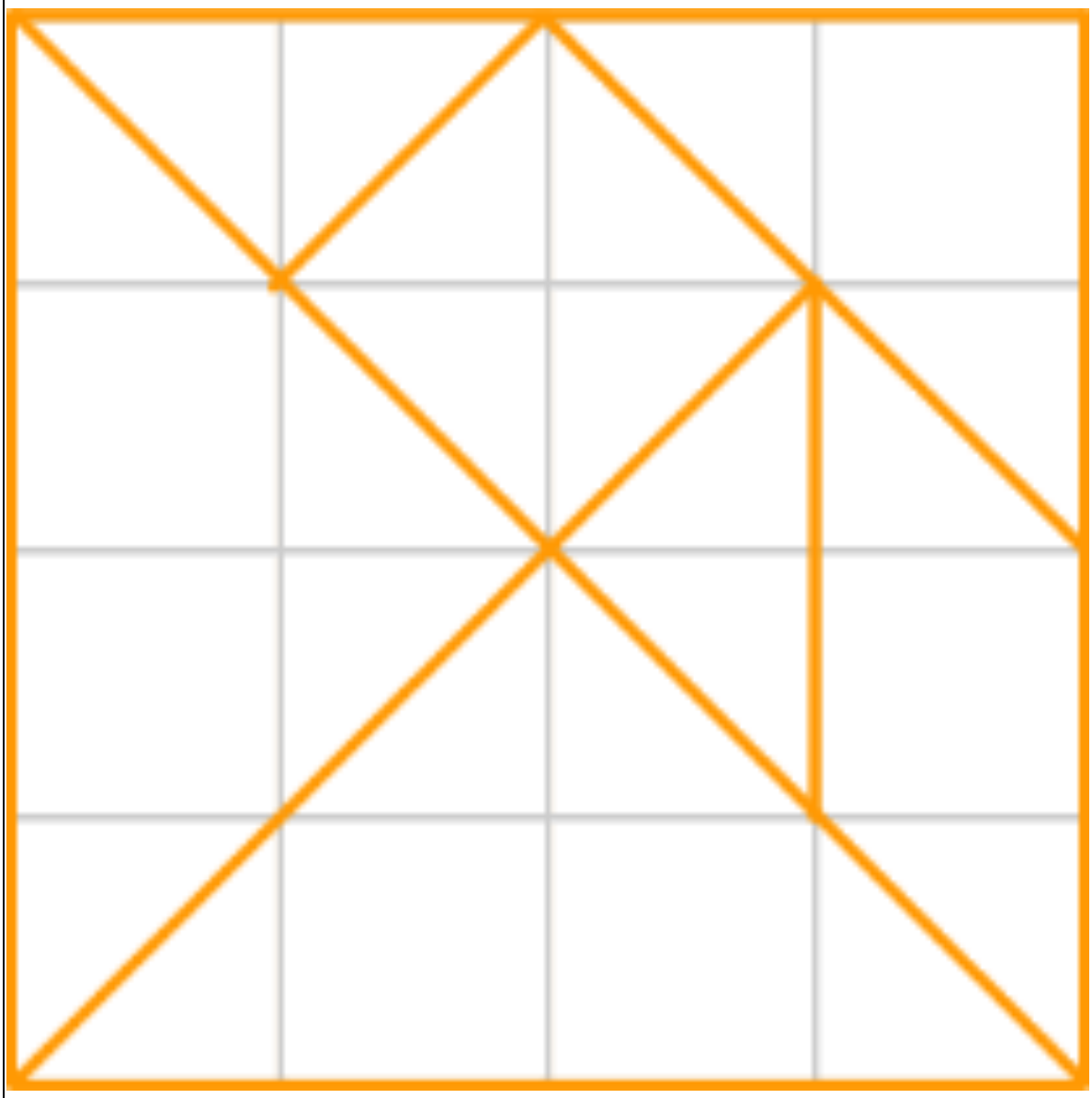
Here are some more patterns for you to make with the tangram pieces.



Can you make some other symmetric patterns?

HELP

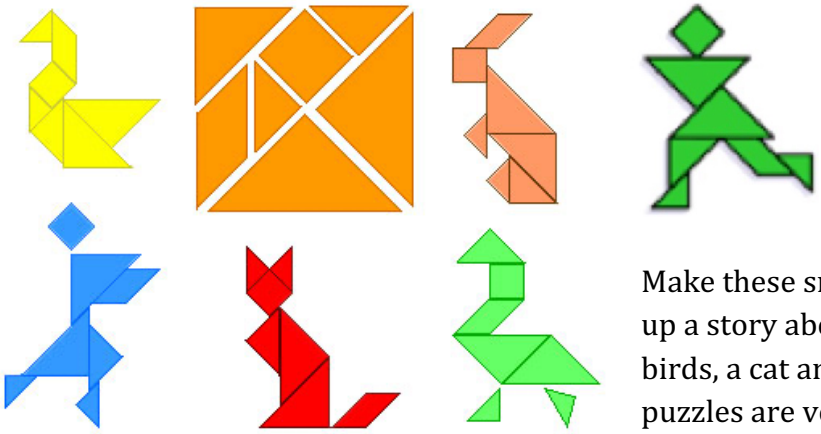
Using squared paper to draw the tangram lines, you can make your own tangram puzzle from scrap card or plastic. You could prick through the vertices of this template with a sharp pin to mark the vertices, then draw the edges using a ruler, then cut out the 7 pieces.



Alternatively, you can make a tangram by folding a square of paper or thin card.

See the video with instructions for making a tangram puzzle by paper folding.

NEXT



Make these small pictures and make up a story about the two people, two birds, a cat and a rabbit. These puzzles are very easy as the outlines of the 7 pieces are shown.

You might even make a smaller tangram and use it for the animals and a larger one for the people and then make a poster telling your story, illustrated by the tangram pictures.

INCLUSION AND HOME LEARNING GUIDE

THEME: SYMMETRY

Early Years

Cut out the 7 coloured pieces. Can you put them on top of the grey pattern to cover it exactly?

Look at your two hands in front of you.

What is the same about them and what is different?

Look at the reflection of one of your hands in a mirror.

What do you notice?

Which is your right hand and which is your left hand?

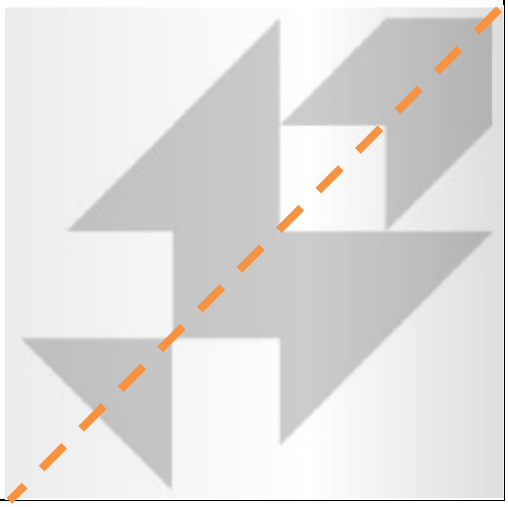
Which is your right ear and which is your left ear?

Which is your right foot? Which is your left foot?

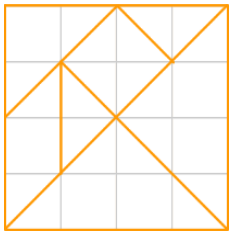
Look at a pair of shoes? What is the same about them? What is different?

Which is your right ear and which is your left ear?

Now fold the grey pattern in half so the two sides match exactly. Talk about the fold line as a mirror line. One half of the pattern is a reflection of the other half.



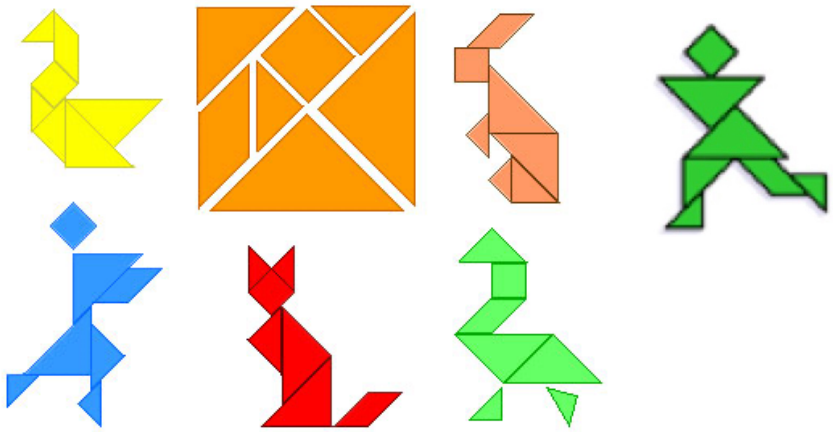
Lower Primary



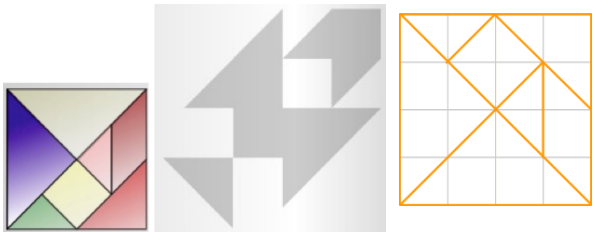
Using squared paper for the tangram helps everyone to see the properties of the shapes more clearly. Draw this for the learners or use the grid on page 2 and talk about the shapes.

As a group activity make tangram animals, birds and people in different sizes. Either use different coloured paper or colour them. Make up stories about them. The learners will enjoy this activity and it will help them to develop their visualisation of shapes and their properties.

Make a poster of your story. Stick your tangram creatures on the poster.



Upper Primary and Lower Secondary

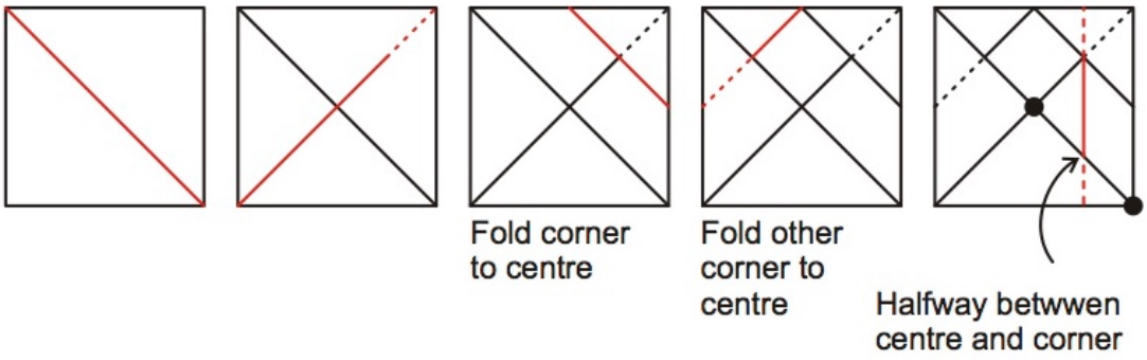


Either give each of your learners

1. a set of tangram pieces or
2. a copy of the template to cut out or
3. A square of paper and help them to make their own tangrams following the instructions from the video or from the instructions below.

[See the video with instructions for making a tangram puzzle by paper folding.]

Here's a simple way to make a Tangram without any measuring or ruling lines. All you need is a square of paper and some scissors to cut out the shapes when you have finished folding. Follow the steps shown in the diagrams. Remember that every fold you make splits a shape or a line exactly in half.



Draw the grey pattern and ask the learners to make it with their pieces. Ask them what they notice. You might like to write down their observations. Ask the key questions. Build on what the learners say helping them to learn the correct mathematical language in which to express their ideas.

Choose how far to pursue the discussion of symmetry and reflections. For example ask, which six of the tangram pieces have a line of symmetry? Talk about the parallelogram which does not have reflection symmetry and the fact that it has rotational symmetry of order 2.

You could also discuss the similarity between the triangles. For example: the edges of the largest triangles are double the edges of the smallest triangles so they are *similar* with a *scale factor 2* and one is an *enlargement* of the other.

Key questions

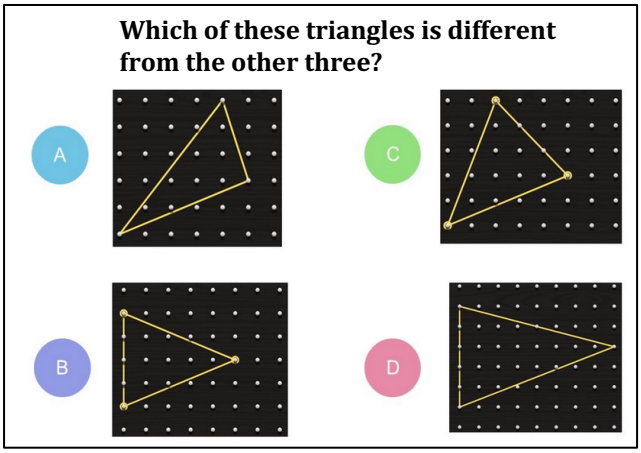
- What do you notice about the grey pattern?
- How many different shapes do you see in the grey pattern? What are they called?
- Look at the 5 triangles – what is the same and what is different about them?
- Look at the square and the parallelogram – what is the same and what is different about them?
- Where is the mirror line in the grey pattern?
- How have you made two parallelograms in the grey pattern?
- Look at your two hands in front of you. What is the same about them and what is different?

Before you finish with this activity, use the Diagnostic Quiz below to assess how much your group have learned.

Diagnostic Assessment This should take about 5–10 minutes.

Show this question to the learners and say to them:

"Put up 1 finger if you think the answer is A, 2 fingers for B, 3 for C and 4 for D".

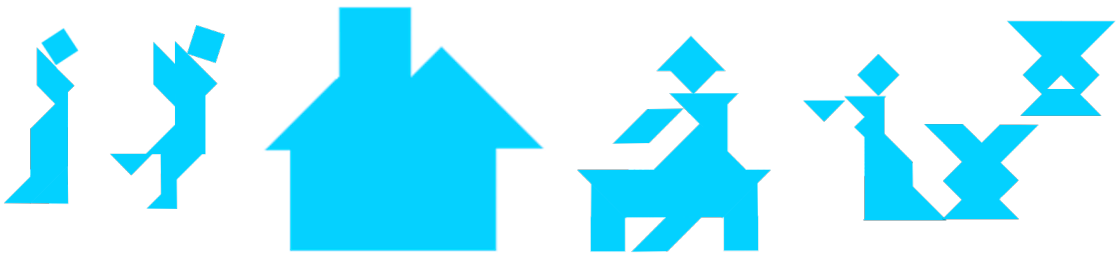


1. Notice how the learners respond. Ask the learners to explain why they gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
2. It is important for learners to explain the reason for their answer because it helps them to sort out their ideas and to develop communication skills.
3. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the group to vote again for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers. A. is the correct answer.
   The correct answer is triangle A because it is not symmetric.

https://diagnosticquestions.com

Upper Secondary

Make a Tangram puzzle by folding a square of paper. Give a full account and explanation of the properties of the 7 shapes that make up the Tangram, explaining all the symmetries and the enlargements that map each triangle to the other triangles. Make these pictures using 7 tangram pieces for each one. See World of Tan https://nrich.maths.org/14074



Take the edge of the square as 1 unit and work out the perimeter and area of each of the 7 pieces.

If you are in a home-learning group, then prepare a presentation to explain these ideas to the younger members.

Why do this activity?

This activity is very open ended and so all learners should experience success in making the patterns, creating their own patterns and observing the geometrical properties. The activity is designed to lead to spontaneous discussion of symmetry and you and your children can pursue this as far as you like.

To make the puzzles easy for young learners they are given showing the individual pieces (actually solutions to the puzzles). The template shows a background grid to facilitate drawing it and also to suggest other questions that can be asked about the individual pieces.

Learning objectives

In doing this activity students will have an opportunity to develop:

- recognition of triangles, squares and parallelograms;
- understanding of similarity and scale by comparing the triangles;
- understanding of line symmetry.

Generic competences

In doing this activity students will have an opportunity to develop ideas of symmetry and notice how symmetry appears in nature, art and design.

Follow up

You might like to follow on with
Tangram 2D shap**es** https://aiminghigh.aimssec.ac.za/years-7-9-tangram-2d-shapes/

Tangram Fractions: https://aiminghigh.aimssec.ac.za/years-6-10-tangram-fractions/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and school years up to Secondary 5 in East Africa.
New material will be added for Secondary 6.
For resources for teaching A level mathematics (Years 12 and 13) see https://nrich.maths.org/12339
Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13