

# CHAPTER 5: Foundations of Geometry

## MINI-MODULE C

# Spatial Reasoning

### Objectives

This mini-module aims to help teachers:

- Describe what children learn about spatial reasoning.
- Demonstrate how to teach spatial reasoning using 2D and 3D shapes.
- Practice a new teaching activity.

### Recommended Materials



### Illustration of Teaching



### REFLECT:

- What mistake did the student make?
- Why do you think the student made this mistake?
- What questions could you ask this student to help them see their mistake?
- What other examples could you use to help the student understand?

## Ideas to Consider

The student may not be familiar with geometry words yet. They may hear “cylinder” and incorrectly identify the sphere as a cylinder. Or they may not understand how to describe the positions of objects. In this example, the cylinder is on top of the cuboid, and the sphere is next to the cuboid. The student may correctly identify the cylinder but make a mistake in describing its position. They incorrectly say that it is “next to” the cuboid instead of saying that it is “on top of” the cuboid. The teacher could ask questions or give the student more examples to assess why they made the mistake. Then they could emphasize the names of the objects and position words with more examples.

In this mini-module, you will learn how to support children as they learn about the positions of shapes and their relationships to one another.



### ACTIVITY: DESCRIBE THE POSITIONS OF OBJECTS

This activity can be completed alone, in pairs, or with a group of teachers. If you have colleagues to work with, take turns positioning two objects. Discuss your responses to the questions.

**Purpose:** Practice describing the relative positions of objects and discuss why it is important.

**Materials needed:** Everyday objects.

#### Instructions

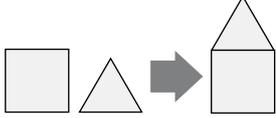
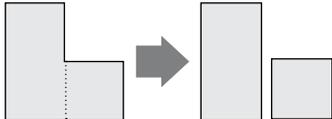
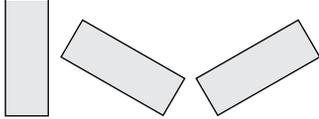
- Place two objects together (e.g., near each other, or one on top of the other).
- ***How can we describe the relationship between these objects?***
- Identify all of the possibilities that you can think of (e.g., The pen is on the book. The pen is on top of the book. The book is under the pen.). If teachers in your group speak different languages, you may discuss how position words are used in those languages.
- ***Why is it important for students to learn position words like “on” and “under” in the early primary grades? Why is this considered a geometry topic?***



## What Do Children Learn about Spatial Reasoning?

When they study numbers, children learn how to compose and decompose amounts (e.g., 5 is composed of 2 and 3). When they study geometry, they learn to compose and decompose shapes. They can do this by manipulating paper shapes, identifying shapes in drawings, or drawing their own shapes. They should also understand that moving a shape—including moving it to another location or rotating it—does not change its properties.

As they identify the location of shapes and manipulate them, children should learn how to use everyday language to describe the locations of the shapes in space and relative to other shapes. This includes positional words and phrases like “on top of” and “near.” Different positional words are used in different countries and languages. You may allow children to use words in the local languages they know, and teach them the words used in the language of instruction.

Children should be able to ...	What does this mean?	Example
<b>Compose shapes</b>	Compose larger 2D shapes from smaller shapes.	<p>This square and triangle can be placed together to make a house shape:</p> 
<b>Decompose shapes</b>	Decompose a larger 2D shape into smaller shapes.	<p>This L shape can be cut into a rectangle and a square:</p> 
<b>Identify rotated shapes</b>	Understand that rotation does not change the shape.	<p>This is the same rectangle.</p> 
<b>Describe the relative position of shapes and objects</b>	Use positional terms (e.g., on top of, left/right) to describe the location of 2D or 3D shapes and objects.	<p>The triangle is <b>next to</b> the square.  The square is <b>near</b> the triangle.  The triangle is <b>to the right</b> of the square.</p>  <p>The ball is <b>on top of</b> the box.  The box is <b>under</b> the ball.</p> 

## Reflection

Write your responses down or discuss your ideas with your colleagues:

- Choose one of the skills from the above table. Consider how you could use each of these materials to teach this skill:
  - Paper cutout shapes
  - Drawings
  - 3D shapes or everyday objects
- What mistakes might your students make when learning this skill? How could you support them?

## Teaching Practice

This practice activity may be completed by teachers with their own class or with a smaller group of students.



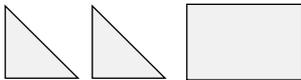
### ACTIVITY: COMPOSING SHAPES

**Purpose:** Compose a 2D shape from smaller shapes.

**Materials needed:** A set of paper cutout shapes for students (they may work in pairs or small groups); one set of composed shapes for the teacher to show students. See the following two pages for sample shapes. This activity uses one rectangle and two triangles, but you may try the same activity with a variety of different shapes.

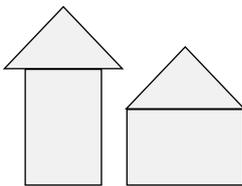
#### Instructions

- Give each student (or pair or group) a set of shapes.



- Discuss: **What shapes do you have?**
- Ask students to hold up a rectangle. Ask them to hold up a triangle.
- Say: **I want you to use your shapes to make a house. What shapes can you use to make a house?**
- Give students a moment to work, and then invite them to share their houses.

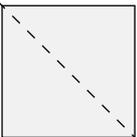
Example houses:



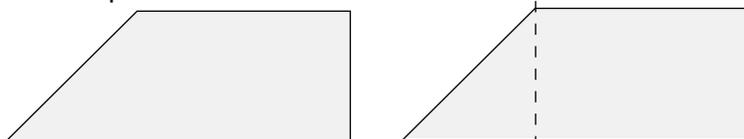
- Discuss: **How did you make a house?**
- Encourage students to use position words (e.g., "I put a triangle on top of a rectangle").
- Show students a new paper shape that they could make using their set of cutouts. For example:



- Say: **Now I want you to use your shapes to make another shape. Can you arrange them to make this shape?**
- Invite a few students to share and explain what they did (e.g., "I put two triangles together").



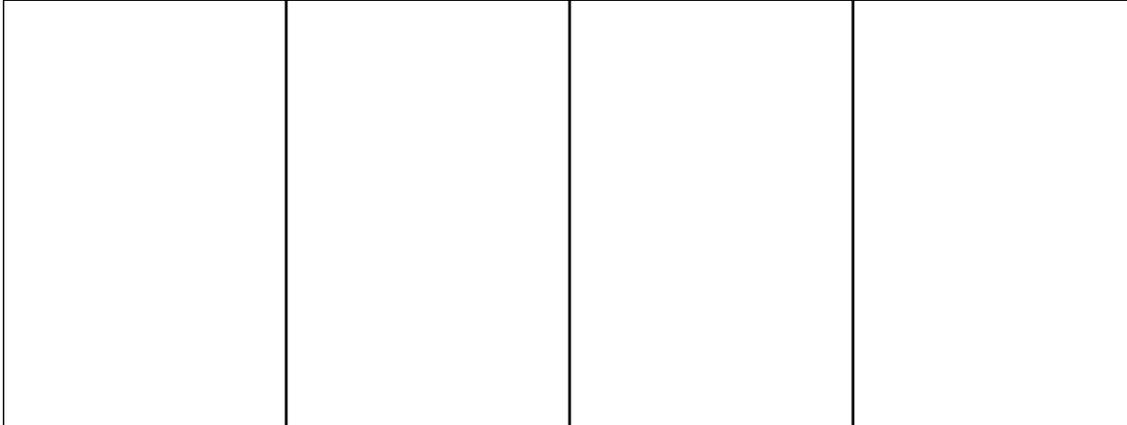
- Show students another shape, and ask them to compose it from their set of cutout shapes. For example:



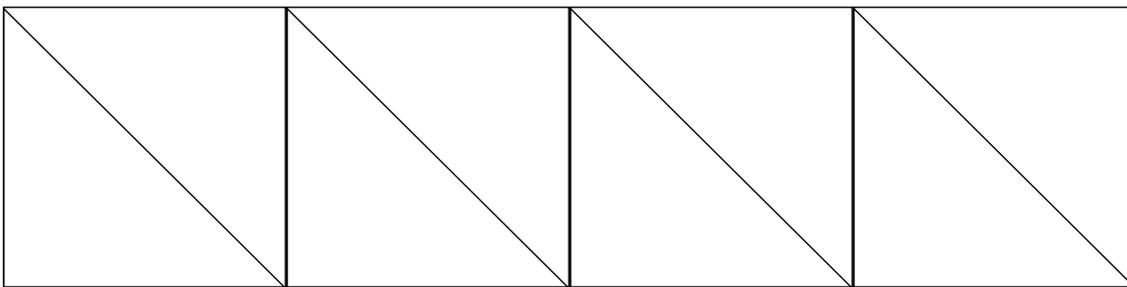
- Let students use their cutout shapes to make their own original shapes as well.

**Sample cutout shapes:** You may use this page to make sets of shapes for students to use. This page can be printed, photocopied, or traced, and then the shapes can be cut out using scissors. You may also use your own methods to create shapes.

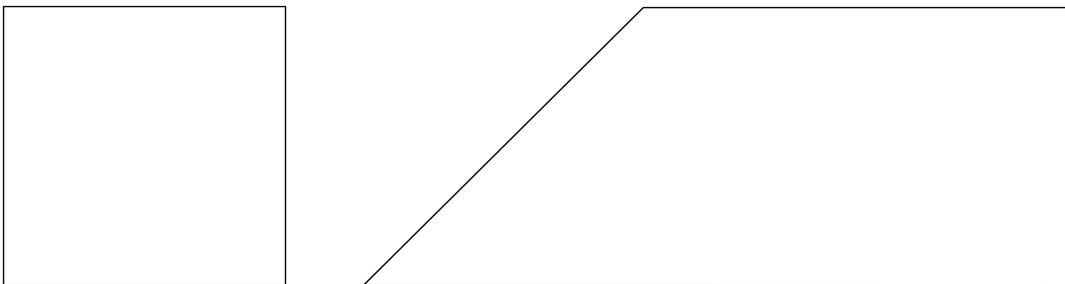
Rectangles:



Triangles:



**Sample composed shapes:** You may use this page to show students what shapes to compose with their cutouts. You can also create your own composed shapes. Make sure that the composed shapes are sized in accordance with students' cutouts.



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