

Geometry 1

Objectives

By the end of Sessions 11 and 12 teachers will:

- have explored activities involving angles and shapes;
- have considered how to help students to understand angle;
- have considered how practical work underpins more advanced analytical work in later grades.

Resources

For the trainer

- Computer with data projector, Microsoft PowerPoint and Presentation 11.ppt
- Whiteboard and flipchart
- Centimetre squared paper, dotted squared paper and isometric paper
- Pinboards (or paper showing pinboards)
- Selection of geometric activities for the workshop arranged on tables, including four laptop computers with Smile software
- Smile program: *Symmetry and transformations* (see www.smilemathematics.co.uk)
- *Curriculum Standards for mathematics: Grades K to 12*

For each teacher

- *Teacher's pack*
Handout 11.1
- *Curriculum Standards for mathematics: Grades K to 12*

Session outline

Introduction Slides 11.1–11.2	Whole group presentation and discussion Task 1: Looking at the standards	15 minutes
Introducing the workshop activities Handout 11.1	Whole group presentation and discussion, paired work Task 2: Pentominoes	25 minutes
Workshop	Task 3: Completing the notes	35 minutes
Summary Slide 11.3	Summary	5 minutes

Introduction

15 minutes

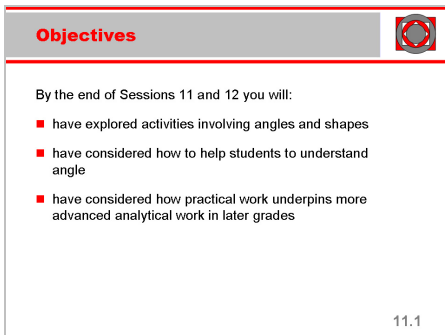
Welcome everyone back and make any introductions. Deal with any domestic or administrative matters.

Refer to the *Teacher's pack*. Point out the programme for the fourth day, the evaluation form for completion at the end of today's sessions and the reduced copies of the slides at the back of the pack.

Say that the next two sessions focus on aspects of geometry. Use **slide 11.1** to introduce the objectives.

Before everyone arrives, brief any interpreter about the key points of the session.

Load **Presentation 11.ppt**.



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11.1

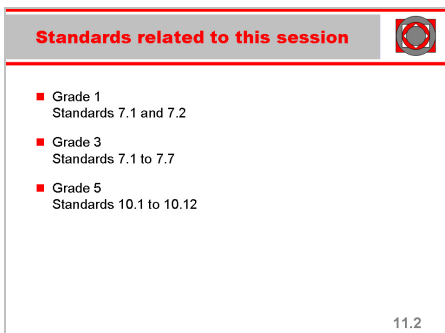
Explain that the sessions will consider the early stages of knowing and using geometrical properties to more advanced work involving construction. The first session will consider properties of shapes, including symmetry. In the second session, the theme will be angles. Stress that practical work is essential if students are to understand geometrical ideas. This includes:

- visualising shapes, patterns and movements;
- using apparatus;
- drawing and interpreting geometrical diagrams to solve problems.

(Remind teachers of the video they saw in the first workshop of students visualising and then drawing shapes made by joining triangles edge to edge.)

Task 1: Looking at the standards

Show **slide 11.2**. Ask teachers to look at the relevant standards in Grades 1, 3 and 5. Allow 5 minutes.



Standards related to this session

- Grade 1
Standards 7.1 and 7.2
- Grade 3
Standards 7.1 to 7.7
- Grade 5
Standards 10.1 to 10.12

11.2

Ask teachers to find the related standards in Grades 2, 4 and 6. Allow a further 5 minutes.

Say that it is important that students are taught about the properties of lines (one-dimensional shapes), two-dimensional shapes and three-dimensional

shapes, not just their names. From the early stages, students should explore and compare shapes and be able to identify and describe similarities and differences.

Introducing the workshop activities

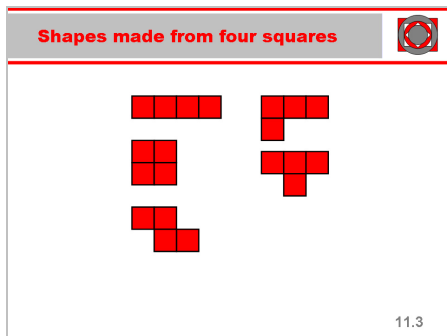
25 minutes

Show teachers how you have organised the room. Each group of tables has a collection of activities based on using certain resources. Teachers should work in pairs with someone from another school who teaches a similar or close grade. Refer everyone to **Handout 11.1**. Explain that they should complete this as they move round the different tables.

Explain that teachers should spend about 6 to 7 minutes at each table. Each teacher should complete Handout 11.1 to record the standards linked to the activity, and the relevant grade or grades. Use the following activity as an example.

Task 2: Pentominoes

Remind everyone that in the first workshop they arranged squares to make different shapes. The squares were joined edge to edge, and reflections and rotations did not count. Remind teachers that they found that for two squares there is only one arrangement, for three squares there are two arrangements, and for four squares there are five arrangements. Show the arrangements for four squares on **slide 11.3**.



Give out some centimetre squared paper. Ask teachers to work in pairs and to explore arrangements of five squares. They should draw the arrangements, called *pentominoes*, on squared paper. They should discover that there are 12 different pentominoes.

Ask the teachers how they went about adding the fifth square. Did they work systematically? How did they know they had all the possible arrangements?

Ask them now to visualise cutting out one of the shapes and folding it to see if it forms an open-top cube. Again in pairs, teachers should discuss and justify to each other which of their pentominoes would do this. Remind them that a net is a flat shape that can be folded up to make a solid shape.

Explain that a further extension would be to find all the nets of a closed cube.

Discuss with the whole group how these activities link to the standards. If it does not come out in the discussion, emphasise that a number of different ideas are covered in the activity:

- Grade 5 standard 10.9 on the nets of a cube;
- reinforcement of understanding of rotation symmetry and reflection;
- reasoning and problem solving skills, such as explaining methods and reasoning, searching for all possibilities and working systematically.

Workshop

35 minutes

Task 3: Completing the notes

Remind teachers to complete **Handout 11.1** as they circulate.

Table 1: 2-D and 3-D shapes

- Cutting through 3-D shapes to make different 2-D plane shapes
- Creating different shapes by cutting through a square
- Making three- and four-sided shapes on pinboards
- Combining equilateral triangles to make different polygons
- Exploring parallel and perpendicular lines
- Coordinates

Table 2: Congruent halves

- Exploring polygons

Table 3: Smile software: *Symmetry and transformations*

- Exploring a number of programs

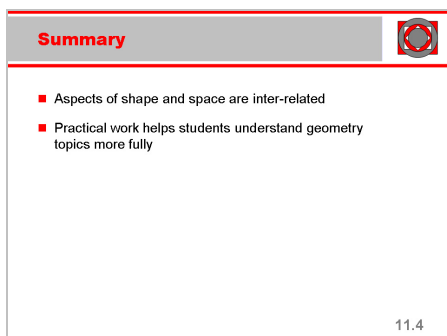
Table 4: Robots

- Tracing pathways

Summary

5 minutes

Show **slide 11.4**.



Summary

- Aspects of shape and space are inter-related
- Practical work helps students understand geometry topics more fully

11.4

Review the session by summarising the key ideas.

Ask if there are any questions. Explain that the topic of geometry is continued in the next session.