FACILITATOR'S GUIDE

2015 TERM 3 TRAINING WORKSHOP

MATHEMATICS

GRADE 4

PILO
IMPROVING LEARNER PERFORMANCE

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Just-in-Time Training Workshop
Term 3

Facilitator's Notes

Grade 4 Mathematics

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what I do matters

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Facilitator's Guide

JIKA IMFUNDO
Grade 4 Mathematics Workshop
2-D shapes and 3-D objects

Preparation

Training of HODs and lead teachers:

- Ensure that each participant in the workshop has the learner guide. If you are training HODs and lead teachers, ensure that they also have the facilitator's guide.
- Each group of participants needs a box of recyclable materials
- Each participant needs blank A4 paper, a set of nets, scissors and glue.

Plan the timing of the workshop sessions carefully to give your participants maximum benefit from the tine available. If you start on time, you can complete the first three sessions before the tea break. Otherwise, the tea break may need to be halfway through Session 3, which is made up of several practical activities.

When HODs run this workshop for the teachers:

- Each teacher needs a textbook, a tracker and the CAPS document.
- The HOD needs to provide a box of recyclable materials (her teachers can collect these a few days before the workshop)
- Each participant also needs the following:
  - a set of nets of the 9 polygons we study on thin cardboard or paper
  - scissors and glue.

NOTE:

- *The workshop needs about 4 hours, excluding tea break and lunch break.*
- *All HODs and lead teachers who participate are expected to have their own textbooks with them from the schools at which they teach.*
- *Resources: This workshop cannot be successful without resources and this needs preparation time – collecting materials and time to set up before the workshop.*
- *Participants should be seated in groups of 8 – 10 people for the whole workshop, depending on the size of the whole group. These groups need to be arranged so that participants in each group have reference to the same textbook.*

Introduction

Use the quote from TED talks to remind teachers about how important they are in giving learners a chance to succeed at school, in the economy and in the world. Grade 4 is a critical year in the child's development. A good experience of this year allows learners to thrive and progress; a negative experience of this year can easily become an obstacle that impacts on the rest of the child's schooling.

Briefly introduce the topic of the workshop and what is planned.
Session 1 is a review and feedback session. In Session 2, we look at how the tracker, the year plan and the textbook activities are linked and the time allocations for each document are aligned. Session 3 gives participants a series of activities to do and reflect on how these can be used in the classroom. Session 4 considers the importance of play and the importance of a progressive sequence of activities that meet the needs and interests of the Grade 4 learner. In Session 5, participants complete their lesson planning for shape and space for Term 3.

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Session 1: What you do, matters

Refer to the Learner Guide for resources needed and for the purpose of each activity.

The introduction is a repeat of the important role of the HOD discussed in Workshop 2. No matter how small the success or progress made, encourage HODs to share the steps they have made in their schools and with their teachers.

The tracker: Start with a quick reminder about the purpose of the tracker. Participants will see how the details of the tracker work when they use it in the activities later.

The tracker provides classroom management tools:

1. Daily tracking to plan and check your pace and your content delivery
2. References to CAPS, textbook pages and the DBE workbook
3. Resources you need in the classroom
4. Assessments and record sheets for the Formal Assessment required by CAPS
5. Review and Reflection tools to support you in your teaching

The purpose of this is to help the teacher plan and prepare lessons. With this tool, she can manage her time well so that the curriculum is covered properly over the year and the content is taught sequentially. She can ensure that assessment tasks are completed and assessed. Most importantly, she has an opportunity to reflect on her teaching and her HOD can provide her with support and feedback.

The THINK – PAIR – SHARE Process

Subject advisors:
It may be a success with a school workshop; ongoing feedback from some teachers; good reflection time with teachers; a teacher who has been inspired by your input and support; changes you see in the classrooms etc.

Explain that even if some things did not go well, we will first focus on those that did. "Going well" can refer to something that has improved in the classroom, and apply to one learner or many; it could be something the teacher has become better at or something he/she has learned about. You may need to encourage his/her positive thinking.

Time: Be very strict about keeping time and how you are going to indicate that time is up.

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Session 2: Consulting the tracker and the year plan

Refer to the Learner Guide for resources needed and for the purpose of each activity.

It is important to inform participants that we have consulted with their districts' subject advisors, both on the topics chosen and at different stages during the development of the workshop material. Their subject advisors have made significant and useful input into the direction of the workshop and they have participated in it themselves in order to have first-hand experience of what HODs and teachers experience in the workshops.

Make it clear what the purpose of the session is before you start.

Discussion:

- Teachers need the overview of the year plan as the context for shape and space topics in Term 3. They need to confirm for themselves that the time allocations in the tracker do actually match the time allocations in CAPS and in their textbooks.
- Explain to teachers that although we are in the third term, we will address Shape and Space for the whole year.
- If a teacher just does the written work from the textbook for this topic, then they are not addressing CAPS fully and they are not giving learners practical experiences of shapes and objects. They will realise how important this is later in the programme. For now, it is important just to note that teachers need to plan for practical activities when they do their lesson planning.

- Any burning issues that participant wants to raise can be noted at this point and written on the board or flipchart. However, most of the issues raised will be addressed during the workshop.

Time allocations for shape and space across the year:	Weighting: 15%
Term 1: 2-D shapes (5)	5 hours
Term 2: 3-D objects (5) + symmetry (2)	7 hours
Term 3: Viewing objects (2) + 2-D objects (4) + transformations (3)	9 hours
Term 4: 3-D objects (4) + position and movement (2) + transformations (3)	9 hours
	30 hours

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Session 3: Curiosity and play

Refer to the Learner Guide for resources needed and for the purpose of each activity.

Go through the purpose of the session with participants.

The quote helps participants to see that, although learners in Grade 4 can begin to have abstract ideas about shapes, they still attach their ideas to their experience of concrete shapes. So although they see that this rectangle has 4 sides, they have not yet decided if that makes it the same as any other kind of quadrilateral or not (except by sight).

3.1 Free Play – Make something!

Preparation:

The facilitator must ensure that each group has a box of materials to use.
Resources needed:

- Box of materials: paper bags, thin cardboard, toilet rolls, pine cones, twigs, seeds, bottles, bottle tops, string, containers, egg boxes.
- Scissors, glue, sellotape, crayons

At first, participants may not want to 'play' because they are embarrassed, or they can't see the purpose for it, or they have no ideas. They might cautiously put one or two things together. Encourage them to push past their mental block and think imaginatively.

To encourage them, you need to be enthusiastic about the activity yourself and reassure them that there really is a good purpose for the activity. Move between the groups, encouraging those that are showing some creativity and showing the others what fun the activity can be for them!

Learners have been introduced to objects and shapes in the Foundation Phase and even in Grade R. Unfortunately, many of them have not had enough opportunities of free play and concrete experience of shapes and objects as they need, in order to encourage their curiosity and develop their sense of discovery.

So, although they may know the names of shapes and objects, their experience of these in the classroom may be limited to pictures in books. Their experiences on the playground and at home of shape and space, although real, have not been linked to mathematical learning.
Keep in mind that spatial perception is an important skill for many areas of life, school and sports. In secondary school, learners need a good understanding of space and shape to apply it in Geography, geometry, technical drawing and even Art.

Discussion: These points should be made only if they are not made by participants already.
Vocabulary:
These are some of the words that teachers should encourage their learners to use when they describe their models. If participants don't include these words, you can bring them into the conversation.

- Flat, straight, curved, 3-D objects, 2-D shapes, round, circle, box, ball, cylinder, square, rectangle, triangle.

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Learning:

- Children can learn to trust their own imagination and creativity. They need many of these kind of experiences to move them away from the expectation that learning is only repeating what the teacher says.
- Free play allows children to be curious about their environment and to discover things by themselves. If you try to interrupt this process, or 'speed it up' by telling children what to make, you are preventing them from reaching their own 'aha' moment.
- Children can have fun and learn at the same time!
- By touching and manipulating materials, children are naturally learning about the properties of objects and shapes. They are building their spatial perception.
  Children can learn to name objects and shapes with the right names.

Curiosity is a seeking and an exploration. … Curiosity is not about finding, but exploring. It almost has a spiritual sensibility about it, as though to be curious is to embrace … the path; the goal *is* the path.

NOTE: Although assessment is a necessary way to measure learning, be cautious.
Assessment … 'should support learning. It shouldn't obstruct it, which of course it often does. So in place of curiosity, what we have is a culture of compliance. Our children and teachers are encouraged to follow routine algorithms rather than to excite that power of imagination and curiosity. '

TED talk, "how to escape education's death valley" by Sir Ken Robinson.

- Extra question for participants:
  Can a polygon only have two sides? Why not?

Objects and shapes

Objects are things that you can hold, pick up, turn around. They have surfaces (faces). Most importantly, they take up space.

Shape is the word to describe the shape of a face or surface. You can make an outline of it on paper. The outline of your hand is a shape!

In Maths, we focus on closed shapes with straight sides called polygons (poly = many; gon = side). Polygons include 3-sided shapes (triangles), 4-sided shapes (quadrilaterals), pentagons, hexagons, octagons … even 100-sided shapes with straight sides are polygons. The name of the shape tells you how many sides it has.

In Grade 4, it is not helpful to define objects as having three dimensions and shapes as having two dimensions, as they see objects and shapes as a whole, and do not know dimensions such as length and breadth. Rather talk about objects and shapes and avoid talking about 3-D and 2-D.

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3.2: Focused play – Tangram

This activity is a resource only. It will not be done in the workshop.

Purpose:
To learn how to make a tangram from an A4 piece of paper.

Teachers might want to use this activity in their classrooms, but it does not need to be used. Tangram templates are included in this resource. If possible, teachers should photocopy onto thin cardboard. Otherwise, photocopies can be glued onto cardboard and cut out. The same applies to the silhouette pictures.

3.3: Focused play: Problem solving with tangrams

Purpose:
To use focused play to make shapes using the tangram pieces.
To discover what learners can learn through working with a tangram.

1. Making a square

Participants should work on their own, even though they are tempted to look at other people's solutions. Give them enough time to struggle with the problem and for most of them to find a solution for themselves. This allows them to understand how important it is for learners to struggle through and have an 'aha' experience.

If you interrupt participants too quickly and you are urged to give them hints or show them how to make the squared, you will interrupt the key learning of this activity. Participants need to struggle on their own for as long as you can allow in the workshop. Those that solve the puzzle without help will experience an 'aha' moment that improves their confidence in their own mathematical abilities. The more often these moments, the more likely it is that teachers will begin to enjoy the challenge of maths and grow in their competence as teachers.

2. Discussion:

d) What can learners learn from this activity?
An important learning experience is to persevere and not to give up until you manage to make the shape you were given. Teachers need to give learners time to do this without stopping them and showing them the solution. If they don't finish in class, they should take a paper tangram home and carry on trying to make the picture.

In the process of trying to create the picture, learners are concretely experiencing the possibilities and properties of the square, four different sized triangles (they are similar triangles and all right-angled isosceles), a parallelogram (which learners only know as a kind of quadrilateral or 4-sided shape).
Likewise, teachers need to allow learners enough time to solve the square on their own before offering help or giving them solutions.

Tangrams can also be used to teach fractions, symmetry, properties of shapes, building with shapes etc.

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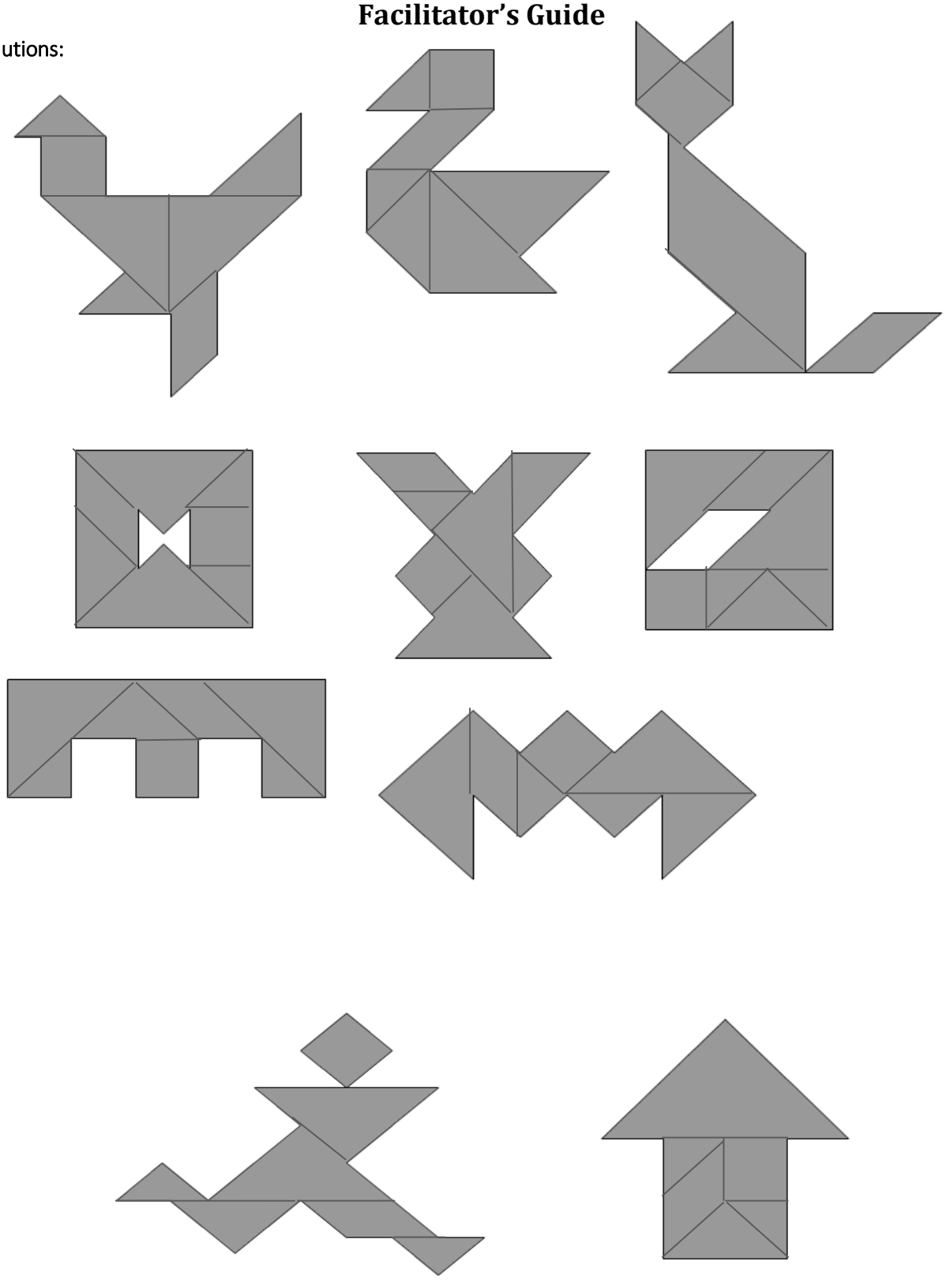
Solutions:



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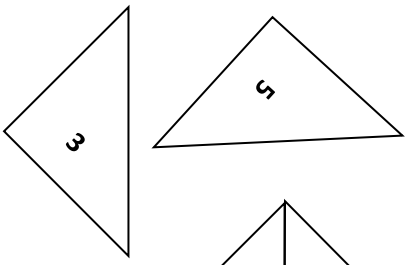
3.4: Discover the properties of shapes with the tangram

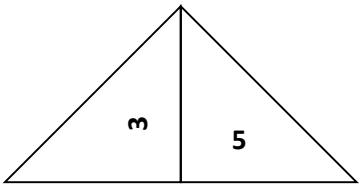
Refer to the Learner Guide for resources needed and for the purpose of each activity.

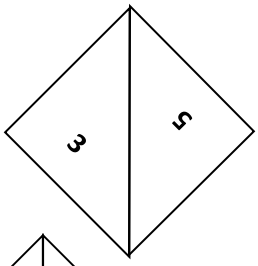
Although HODs won't have time to complete the whole activity, encourage them to use the whole activity with their teachers back at school.
The tangram is an excellent tool for discovering the properties of shapes. The small triangles (3 and 5) are right angled isosceles (teachers should understand this, but Grade 4 learners do not have this terminology yet). A number of these small triangles can be used to form all the other shapes in the tangram.

Transformations: As the participants complete this activity, encourage them to describe the transformations they used to make the different shapes. Did they shift, flip or turn the pieces? This provides a useful informal understanding of transformations that can be consolidated with more formal transformations in Term 4.

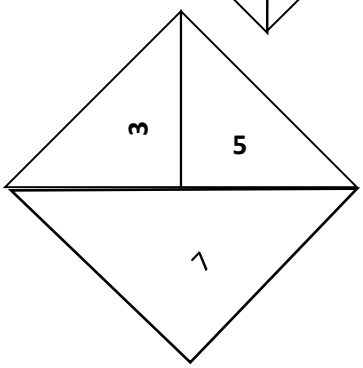


1. Shapes 3 and 5 make a square by rotating one or both of the shapes. We know the sides of the triangles are the same size, so all four sides of the square are equal.
2. Shapes 3 and 5 make a triangle.

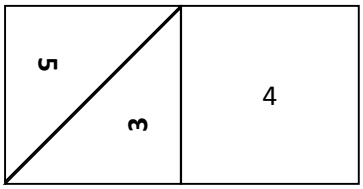




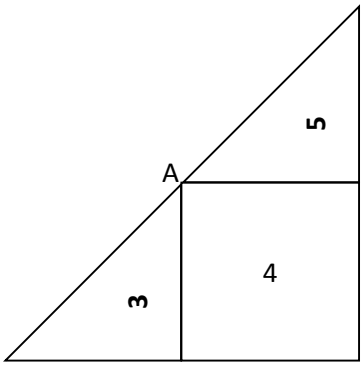
3. Shapes 3, 5 and 7. The four sides are equal because each side is the same as the longest side of triangle.



4. The shape is a rectangle because opposite sides are equal.



5. Using the shape from question 4, this shape can be made by rotating shape 5 by 180° around point A.



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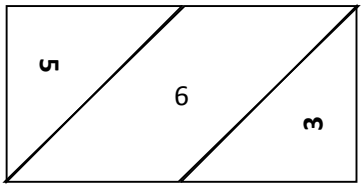

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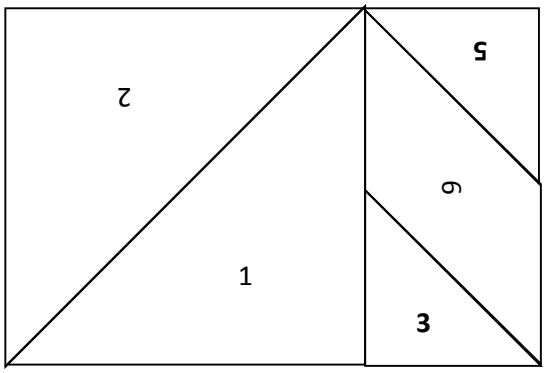
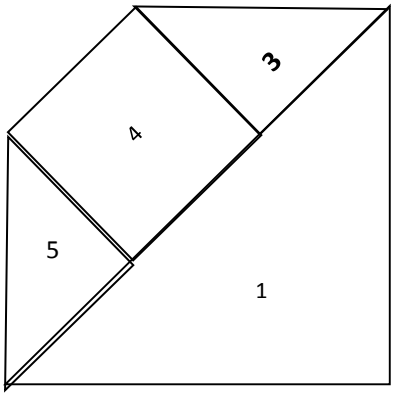


8. One way to make a pentagon:



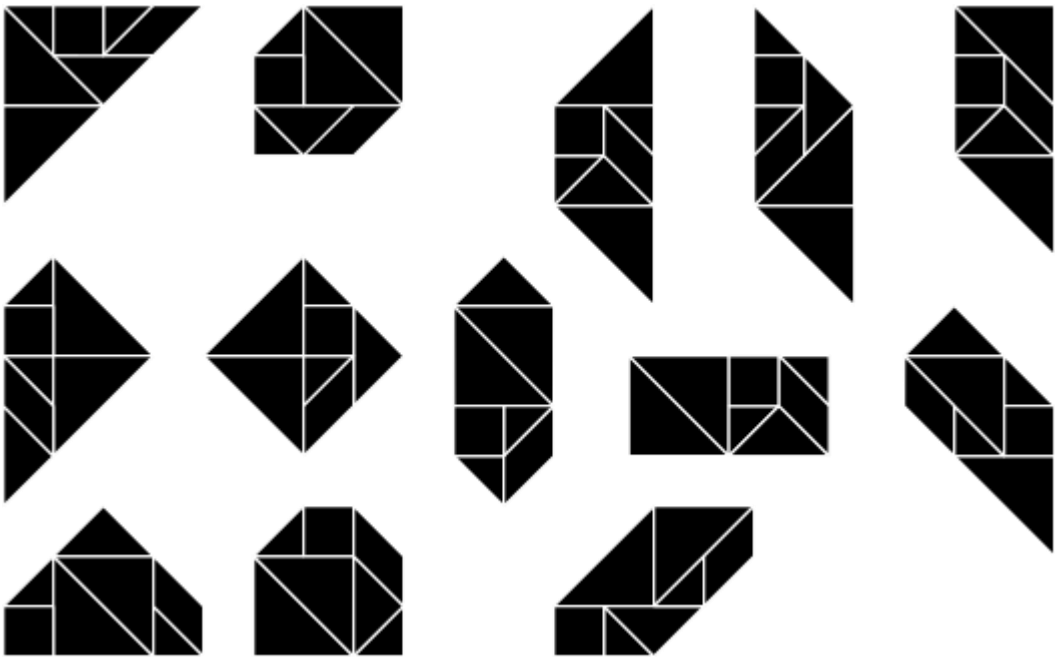
9. Shape 7 can be made from shapes 3 and 4.
10. Shape 1 can be made from shapes 3, 5 and 7; or from shapes 3, 5 and 6; or from shapes 3, 4 and 5.
11. Yes. The other shapes can't make a square without using one of the big triangles 1 and 2.

Have a discussion about how the participants become more flexible in their thinking as they progress with the questions. This flexibility is what we want to develop in the learners.

For your interest (or for use in the classroom)

Here are some other possible geometric shapes made from the tangram.

They include a triangle, hexagons, trapezium (quadrilateral); parallelogram (quadrilateral), a square, rectangle, pentagons.

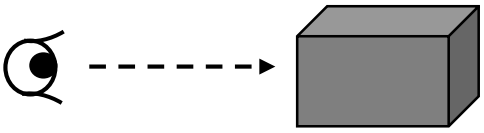


3.5: Making models made from polygons

In each group, participants need to make sure that at least one of each of the 7 models is made.

Notes:

- Curved surfaces of the cylinder and the cone are not considered faces. Faces must be flat. This is confirmed in CAPS (page 78, Clarification)
- In order to see exactly and only one face of the object, it is important to place the object with one face directly in your eye's line of view (parallel to the ground)



Session 4: Reflecting on the learner and learning

Refer to the Learner Guide for resources needed and for the purpose of each activity.

4.1: Considering the child's needs and interests

The groups of participants should find this activity interesting. As they discuss, they realise that there are ways to use shape and space activities to match the needs of learners. If they don't have much to say, you can prompt them with any of these comments below:

- They prefer active learning experiences:
  Textbooks do not provide these and you need to make them happen!
- They are expressive and talkative and like an adult to listen to their views:
  So they need a chance to explain their thinking around describing classifying and generalising properties of different 2-D shapes and 3-D objects; towards refining their mathematical language
- Able to understand concepts – with help develop independent critical thought:
  So for example they can understand that in order for a shape to be a pyramid, it must have triangular faces and the number of these will differ according to the shape of the base/end face).
  Or in 2-D they know that one large triangle in a Tangram is the same size as whatever small pieces make up that shape – informally developing concepts of area of polygons.
- Generalise or link facts together:
  For example the investigation that a square is a kind of rectangle?
- Curious about their worlds, rather learn from their peers:
  So they could do projects together where they collect waste materials of different objects; build models etc using a variety of objects
- Have lots of energy and can play until they are exhausted:
  We can reinforce play as an exploratory stage of learning about Shape/Space; (following Van Hiele); Also encouraging (physical games) to develop ideas around position, orientation etc

4.2: Van Hiele model of geometric thought

Take the participants through the notes in this section.

- The van Hiele model helps teachers to see that they cannot teach learners about rules or properties of shapes and objects before the learners have a chance to discover the properties for themselves.
- In this workshop, we also want teachers to see how important free play *and* focused play are as a way for learners to really experience shapes and objects and discover their properties.
- If learners have a good experience of shape and space at primary school, this builds a strong foundation for their secondary school geometry work. It also allows them to see shape work as enjoyable and builds their confidence.

Session 5: Planning with your tracker

Refer to the Learner Guide for resources needed and for the purpose of each activity.

5.1 Foundation Phase shape and space

What is different from Grade 3?

These are taken from CAPS and summarised below.

In Grade 4:

- the 3-D objects studied are the same, but they now use the formal names for rectangular prisms and spheres.
- Make 3-D objects by putting together cut-out polygons, helps to focus attention on the shapes of the faces of 3-D objects.
- The flat surfaces of a 3-D object are called faces. Describe objects according to the kinds of 2-D shapes that make up the flat surfaces.
- Interpret pictures (2-D representations) of 3-D objects.
- New 2-D shapes: any quadrilaterals (not just the square and the rectangle), pentagon, hexagon.
- Closed 2-D shapes with straight sides are called polygons.
- Recognise and sort regular and irregular polygons without knowing the terms 'regular' and 'irregular'.
- Draw 2-D shapes on grid paper and free hand.
- Create shapes and composite shapes with apparatus.
- Count the number of sides of a polygon in order to identify what it is.

5.2 Lesson planning

- Every district, circuit and school has their own lesson plan template, so we do not provide one here.
- Participants should create an exciting series of lessons, uninhibited by the structure of a template. They need to discuss, brainstorm and plan first, with a focus on methodology used and content of activities.
- Encourage BIG thinking and creativity, using the resources available.
- So Question 1 of the activity needs lively discussion.
- Question 2 requires a more focused and practical approach to the ideas coming out of the discussion.
- Mental mathematics, which should be part of every lesson, will not be planned in the session, but teachers need to add it to their final lesson planning.

This process should provide teachers with some inspiration for planning other topics.