PARTICIPANT'S HANDOUT

2017 TRAINING WORKSHOP NO.10

MATHEMATICS

FOUNDATION PHASE

PILO
IMPROVING LEARNER PERFORMANCE

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Foundation phase
Just-in-Time Training Workshop 10
August 2017

Participants' Handout

Maths

Jika iMfundo
what I do matters

Endorsed by:

SADTU

NAPTOSA

NATU
National Teachers' Union
Educating Our Nation

Jika iMfundo
Foundation Phase JIT
Workshop 10 Mathematics: August 2017
Workshop guide for participants

In this workshop participants will find out more about teaching and assessment in the context of the topics of addition, capacity and symmetry using the Jika iMfundo FP Mathematics materials.

Work in groups on all of the activity questions. Time guidelines are given and your facilitator will interact with you while you work. You will also be able to share key ideas together with the large group.

Workshop plan
8.00 – 8.30 – Arrival and distribution of materials for the workshop
8.30 – 10.30 – Session 1: Teaching addition and subtraction using the Jika iMfundo mathematics lesson plans (2 hours = 120 min)
10.30-12.00 – Session 2: Linking teaching and learning of capacity to assessment using the Jika iMfundo lesson plans and tracker. (1½ hours = 90 min)
12.00-12.30 – Break
12.30-13.30 – Session 3: Symmetry in geometric shapes and patterns (1 hour = 60 min)

Session 1: Teaching addition and subtraction using the Jika iMfundo mathematics lesson plans (120 min)

The purpose of this session is to give teachers the chance to think critically about the way in which addition and subtraction are taught while reviewing how the Jika iMfundo Lesson Plans are organised to sequence, structure and scaffold the teaching of mathematics in the FP.

In this session the following lesson plans from the Term 3 Jika iMfundo FP Mathematics materials are relevant:

- *Grade 1 Term 3 lessons 11-17*
- *Grade 2 Term 3 lessons 9-12*
- *Grade 3 Term 3 lessons 7-8*

This activity should take about 120 minutes.

In the Foundation Phase the concepts of addition and subtraction are introduced and consolidated. Generally addition is introduced followed subtraction but it is important to make the connections between these two operations as soon as both have been conceptually established. The connections are there because addition and subtraction both fall into the same grouping of operations – known as the ***additive relations***. This close relationship (***addition and subtraction are inverse relations***) can be used by learners when they work with addition and subtraction to work more flexibly when they do number operations.

ANA data on learners' work shows that many learners continue to try to do addition and subtraction using unit counts, in Grade 3 and beyond. This indicates that learners have not established more efficient methods of doing addition and subtraction which they need by the time they leave the FP.

In Grade 4 the number range for operations extends to 6 digits and learners cannot do these calculations using unit counting (or other counting methods) they have to be able to deal with the numbers and add or subtract them using ready knowledge about number bonds and properties of number. This problem progresses beyond Grade 4 and prevents learners from doing much of their later mathematics because they cannot do the basic operations competently. It is thus crucial that FP teachers enable learners to reach the full knowledge and understanding of addition and subtraction – both conceptually and procedurally.

Activity 1

1. Discuss the following questions:
   a. Why do we introduce addition first and then subtraction?
   b. In what way are addition and subtraction related?
   c. Give an example that shows the relationship between addition and subtraction.

2. What is the role of drawing when doing calculations?
   a) Should Grade 1 learners do drawings to show calculations and if so when and how?
   b) Should older learners do drawings to show calculations? Why/why not?

3. How do we know that the ANA data shows that learners continue to try to do addition and subtraction using unit counts, in Grade 3 and beyond?
   a) What evidence is there for this strategy?
   b) How do your learners show their addition and subtraction calculations?

4. Think about how learners would do the following calculations and show their working. Show/discuss the strategies you think they might use.
   a) Grade 1: 3 + 4 =
   b) Grade 2: 33 + 44 =
   c) Grade 3: 333 + 444 =
   d) Discuss the working you did when you did the calculations. Compare methods and the efficiency of the methods.

You have worked on addition and subtraction in a few other JIT sessions, looking mostly at different problem solving strategies involving these operations. The goal in FP is to develop conceptual understanding of the operations (addition and subtraction) and to consolidate the skill of writing out the symbolic representation of the calculation correctly.

Curriculum requirements
The table below gives the overview of the curriculum requirements for addition and subtraction for Grades 1, 2 and 3 for the full year.

Grade 1	Grade 2	Grade 3
1.7 Addition and subtraction		
Solve word problems in context and explain own solution to problems involving addition and subtraction with answers up to 20.	Solve word problems in context and explain own solution to problems involving addition and subtraction with answers up to 99.	Solve word problems in context and explain own solution to problems involving addition and subtraction leading answers up to 999.
1.12 Techniques (methods or strategies)		
Use the following techniques when performing calculations: • drawings or concrete apparatus e.g. counters • building up and breaking down numbers • doubling and halving • number lines supported by concrete apparatus	Use the following techniques when performing calculations: • drawings or concrete apparatus e.g. counters • building up and breaking down numbers • doubling and halving • number lines	Use the following techniques when performing calculations: • building up and breaking down numbers • doubling and halving • number lines • rounding off in tens
1.13 Addition and subtraction		
• Add to 20 • Subtract from 20 • Use appropriate symbols (+, –, =,) • Practise number bonds to 10	• Add to 99 • Subtract from 99 • Use appropriate symbols (+, –, =,) • Practice number bonds to 20	• Add to 999 • Subtract from 999 • Use appropriate symbols (+, –, =,) • Practice number bonds to 30
1.16 Mental mathematics		
Calculation strategies Use calculation strategies to add and	**Calculation strategies** Use calculation strategies to add and	**Calculation strategies** Use the following calculation

subtract efficiently: • Put the larger number first in order to count on or count back • Number line • Doubling and halving • Building up and breaking down	subtract efficiently: • Put the larger number first in order to count on or count back • Number line • Doubling and halving • Building up and breaking down • Use the relationship between addition and subtraction.	strategies: • Put the larger number first in order to count on or count back • Number line • Doubling and halving • Building up and breaking down • Use the relationship between addition and subtraction

This extract for the full year shows how far learners progress from the start of Grade 1 to the end of Grade 3.

In the next activity you will critically examine these curriculum requirements in order to decide for yourself how best to use them to enable learners to make the progression in conceptual and procedural knowledge of addition and subtraction from Grade 1 to Grade 3.

Conceptual and procedural knowledge

The following extracts are from Kilpatrick, J., Swafford, J. O., & Findell, B. (Eds.). (2001). *Adding it up: Helping children learn mathematics*. Washington DC: National Academy Press.

Broadly, the two terms you are going to read about are defined as follows:

- *conceptual understanding*—comprehension of mathematical concepts, operations, and relations.
- *procedural fluency*—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.

The reading that follows is detailed – you should skim read it for the group discussion but at home you may want to re-read since these two ideas are helpful to teachers of mathematics. Conceptual knowledge relates to the understanding of ideas while procedural knowledge relates to knowing how to do mathematics – but the two are connected – and so learners cannot progress without both of them being developed.

Conceptual understanding:

Conceptual understanding r**efers to an integrated and functional grasp of mathematical ideas**. Students with conceptual understanding know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which is it useful. They have organized their knowledge into a coherent whole, which enables them to learn new ideas by connecting those ideas to what they already know.

Conceptual understanding also **supports retention**. Because facts and methods learned with understanding are connected, they are easier to remember and use, and they can be reconstructed when forgotten.

If students understand a method, they are more likely to remember it correctly. They monitor what they remember and try to figure out whether it makes sense. They may attempt to explain the method to themselves and correct it if necessary. Although teachers often look for evidence of conceptual understanding in students' ability to verbalize connections among concepts and representations, conceptual understanding need not be explicit. Students often understand before they can verbalize that understanding.

A significant indicator of conceptual understanding is being able to **represent mathematical situations in different ways and knowing how different representations can be useful for different purposes**. To find one's way around the mathematical terrain, it is important to see how the various representations connect with each other, how they are similar, and how they are different. The degree of students' conceptual understanding is related to the richness and extent of the connections they have made.

Procedural fluency:

Procedural fluency refers to **knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently**. In the domain of number, procedural fluency is especially needed to support conceptual understanding of place value and the meanings of rational numbers. It also supports the analysis of similarities and differences between methods of calculating. These methods include, in addition to written procedures, mental methods for finding certain sums, differences, products, or quotients, as well as methods that use calculators, computers, or manipulative materials such as blocks, counters, or beads.

Students need to be efficient and accurate in performing basic computations with whole numbers (6 + 7, 17 – 9, 8 × 4, and so on) without always having to refer to tables or other aids. They also need to know reasonably efficient and accurate ways to add, subtract, multiply, and divide multidigit numbers, both mentally and with pencil and paper. A good conceptual understanding of place value in the base-10 system supports the development of fluency in multidigit computation. Such understanding also supports simplified but accurate mental arithmetic and more flexible ways of dealing with numbers than many students ultimately achieve.

Connected with procedural fluency is knowledge of ways to estimate the result of a procedure. It is not as critical as it once was, for example, that students develop speed or efficiency in calculating with large numbers by hand, and there appears to be little value in drilling students to achieve such a goal. But many tasks involving mathematics in everyday life require facility with algorithms for performing computations either mentally or in writing.

In addition to providing tools for computing, **some algorithms are important as concepts in their own right, which again illustrates the link between conceptual understanding and procedural fluency.** Students need to see that procedures can be developed that will solve entire classes of problems, not just individual problems. By studying algorithms as "general procedures," students can gain insight into the fact that mathematics is well structured (highly organized, filled with patterns, predictable) and that a carefully developed procedure can be a powerful tool for completing routine tasks.

Activity 2

Discuss the following questions in your group. Refer to the CAPS extract above in your discussion.

1. What is the progression from Grade 1 to Grade 3 in each of the following curriculum categories?
    a. 1.7 Addition and subtraction (solution of word problems)
    b. 1.12 Techniques (methods or strategies)
    c. 1.13 Addition and subtraction
    d. 1.16 Mental mathematics

2. Referring to the extracts from Kilpatrick et al, explain the difference between conceptual and procedural understanding. Why do learners need both kinds of understanding?

3. Which type of knowledge helps learners to interpret word problems? Conceptual or procedural or both? Discuss.

4. Explain how knowing about the difference between conceptual and procedural understanding might affect the way you teach.

5. In terms of the CAPS extract explain and give examples of the following:
    a. What is the progression in ***conceptual*** understanding in the FP for addition and subtraction?
    b. What is the progression in ***procedural*** understanding in the FP for addition and subtraction?

6. Does the CAPS clarify the progression well or if not, where and why not?

Teaching addition and subtraction using the Jika iMfundo lesson plans

The Jika iMfundo FP Mathematics materials provide a daily lesson plan activities followed by classwork and homework activities. The lesson plans include lessons that take the learner through the progression of content recommended by CAPS. They provide many teaching activities as well as classwork and homework activities. You could also add to these examples once you have worked through the lesson plans yourself and identify areas where even more practice might be beneficial to learners.

In Term 3, all learners will already have spent much time on addition and subtraction. There are still lessons allocated to these topics as these concepts take time to establish and more importantly, to become deeply understood, to the extent that learners have no doubt how to proceed when they come across a question that requires addition and/or subtraction in its solution.

Over the year, the lesson plans offer opportunities to learners to develop their conceptual understanding and procedural fluency in doing addition and subtraction. Consider the following lesson plan extracts to think about how they sequence and scaffold the teaching of these two operations.

Activity 3

These are the lesson plans from the Term 3 Jika iMfundo FP Mathematics materials on addition and subtraction:

- *Grade 1 Term 3 lessons 11-17*
- *Grade 2 Term 3 lessons 9-12*
- *Grade 3 Term 3 lessons 7-8*

Refer to the lesson plans to analyse the activities and think about ways in which you would use these activities. Some lesson plan extracts are given for you to use in the discussion.

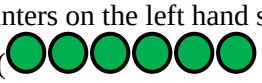
For each of the activities, discuss:

1. What content is covered and how it is presented?
2. How does it relate to the CAPS content specifications?
3. How do the lesson activities promote conceptual and procedural understanding?
4. How is the content scaffolded?
5. How would you use the activity?
6. Would you add to/change the activity in any way and if so, how and why?

Grade 1 Term 3 lesson 12

Activity 1: Learners work in groups.

Give the learners 10 counters.

- Ask them to put 6 counters on the left hand side of their desk. Ask them to explain to you what they have in front of them ( and ).
- *How did you count your counters?* (We counted 6, then 7, 8, 9, 10.)
- *Good, so you counted on 4 from the 6.*
- Encourage them to give you another combination for 10.
  E.g.  and  (8 and 2 is 10).
- *We can find the answer by counting on.*
- *We can say 8…9, 10.* (Learners touch and count.)
- Draw and label a number line on the board:

- Ask the learners to show you **8 and 2 is 10** by showing the hops on the number line.
- Starting at 8 will encourage them to count on instead of count all (starting at 0).
- *We can find the answer by counting on from the first number.*
- *We can say 8…9, 10.* (Learners touch the number line at 8 and then jump up to 9 and then to 10.)
- Do the same with other combinations of 6, 7, 8, 9 and 10, pointing to the number line.

Activity 2: Learners work in groups.
Give the learners number cards 1–10.

- Ask the learners to show you **8 and 2 is 10**.

  8 + 2 = 10

- Do the same with other combinations of 6, 7, 8, 9 and 10.

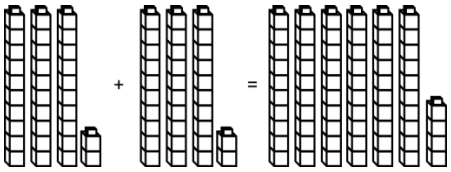
Activity 3: Learners work in groups.
Give each group of learners 15 Unifix blocks and number cards 1–15.

- Encourage them to use the Unifix blocks and number cards and give you as many combinations as possible, e.g. 
- *Let's count: 10, 11, 12.*
- *Let's show it using our number cards:* 10 + 2 = 12
- *Now we can say 10 and 2 is 12.*
- *We can write a number sentence using + and = like this: 10+2=12*

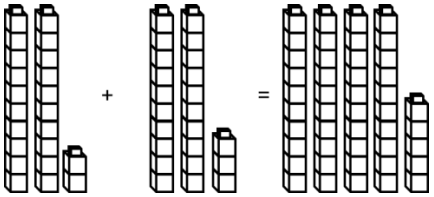
Grade 2 Term 3 lesson 11

Activity 1: Whole class activity.
Show learners near doubles by giving them Unifix blocks to use, or draw it on the board.

- Ask learners what 32 + 32 is and show it using Unifix blocks.



- Ask them what 22 + 23 is and show it using Unifix blocks.



- Do the following as well, using Unifix blocks:
  - 33 + 42 = 75
  - 27 + 14 = 41
  - 34 + 34 = 68
  - 44 + 14 = 58

Activity 2: Whole class activity.

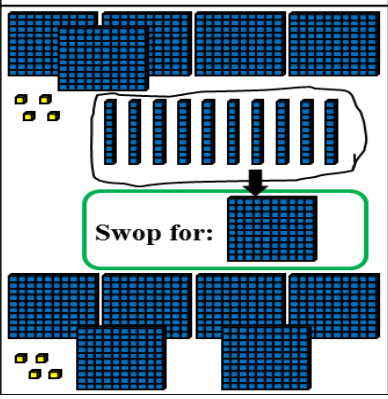
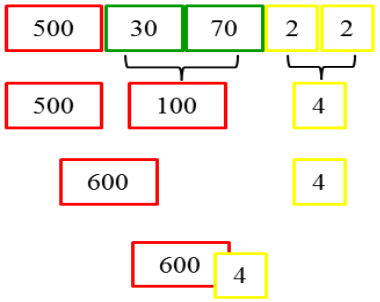
- Ask learners to double 22. (22 + 22 = 44)
- Show learners the solution with Unifix blocks.
- Now ask learners to show 22 + 21 = 43.
- *What did you do?* (I took one counter away.)

Activity 3: Learners work in pairs.
Learners work in pairs – calculating doubles and near doubles:

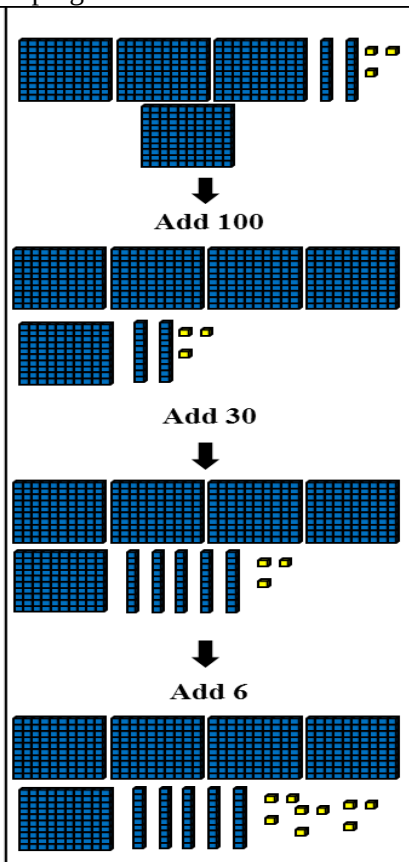
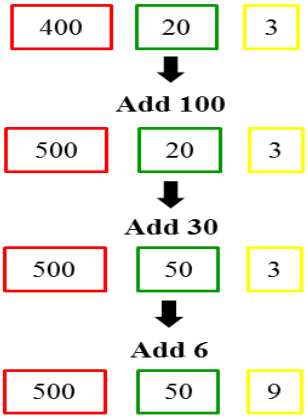
- Calculate 23 + 23 = 46 and 23 + 24 = 47
- Calculate 24 + 24 = 48 and 24 + 25 = 49

Activity 1: Whole class activity.

- Use breaking down of numbers, base ten blocks and flard cards to add three-digit numbers to two-digit numbers. (Revise how to represent numbers using base ten blocks if necessary.)

Number	Base ten blocks	Place value cards
532 + 72 **= 500 + 30 + 2 + 70 + 2** **= 500 + (30 + 70) + (2 + 2)** **= 500 + 100 + 4** **= 604**		

- Using breaking down of numbers, base ten blocks and flard cards to add three-digit numbers to Three-digits numbers by keeping the first number whole and breaking down the second number.

423 + 136 = (423) + (100 + 30 + 6) = (423 + 100) + (30 + 6) = (523 + 30) + 6 = 553 + 6 = 559		

Activity 2: Learners work individually.

- Complete the following operations using breaking up and/or building down.
- Encourage learners to use working that they understand.
- Insist on correct working and steps. Here are two worked examples, do more if necessary.

128 + 214 = 100 + 200 + 20 + 10 + 8 + 4 = 300 + 30 + 12 = 342	438 – 323 = 400 – 300 + 30 – 20 + 8 – 3 = 100 + 10 + 5 = 125

Session 2: Linking teaching and learning of capacity to assessment using the Jika iMfundo lesson plans and tracker. (90 min)

The purpose of this session is to give teachers the experience of using the revised assessment checklists from the 2018 tracker as well as to give input on the teaching of capacity.

Materials: When you work through this activity you will refer to an extract from the revised Tracker and lesson plans for 2018.

NOTE: In this session the following lesson plans from the revised Term 3 Jika iMfundo FP Mathematics materials are also relevant:

- *Grade 1 Term 3 lesson 39*
- *Grade 2 Term 3 lesson 7-8*
- *Grade 3 Term 3 lesson – no lessons on Capacity in term 3*

This activity should take about 90 minutes.

Piaget's conservation tests and capacity

In a previous JIT session you spoke about the psychologist Piaget who is well known with respect to his ideas on conservation of number. In relation to measurement, Piaget's ideas can be used to check our learners' readiness to proceed with the measurement of things (such as capacity).

We need to check that the learners have achieved conservation of the concept before we can teach about how to measure it. *Conservation of the concept means that they have a clear understanding of the constancy or unchanging nature of that concept (**for example capacity**).* Piaget went further to say that if a learner is able to explain that distorted amounts could be restored to their original appearance, the learner has achieved reversibility in relation to the concept under discussion.

In the next activity you will focus on the conservation test for capacity. Different children develop at different paces, and we cannot assume that "all 7 year olds" should have achieved conservation of the size concepts (length, mass etc.). It does not take very long to test for the conservation of these concepts, so we should always just take that little extra step to check for conservation before we proceed to teach the measurement of different amounts.

Conservation of capacity

Capacity is the amount of space inside, or the ability of an item to hold something. To test for conservation of capacity, show the learners two cups which can hold the same amount of water. They therefore have the same capacity. Let the learners satisfy themselves that they have the same capacity.

Fill both of the cups. Ask the learner if the two cups have the same capacity. Tip some water out of each of the cups. Ask again if the two cups have the same capacity.

Activity 1

1. Why is it important that a child achieves conservation of capacity before we teach the child to measure capacity?

2. What is the difference between conservation and reversibility of capacity, using the terms as Piaget spoke about them?

3. Discuss the activity on conservation of capacity using the two mugs. How will it help you test the learners understanding of the concept of capacity?

Capacity (and volume): Curriculum information

The table below gives the overview of the curriculum requirements for the teaching of capacity/volume in the FP.

Grade 1	Grade 2	Grade 3
4.4 Capacity/Volume Informal measuring		
Informal measuring □ Compare and order the amount of liquid (volume) in two containers placed next to each other. Learners check by pouring into a third container if necessary □ Compare and order the amount of liquid that two containers can hold if filled (capacity). □ Use language to talk about comparison e.g. more than, less than, full, empty □ Estimate, measure, compare, order and record the capacity of containers by using non-standard measures e.g. spoons and cups	**Informal measuring** □ Estimate, measure, compare, order and record the capacity of containers (i.e. the amount the container can hold if filled) by using non-standard measures e.g. spoons and cups	**Informal measuring** □ Estimate, measure, compare, order and record the capacity of containers (i.e. the amount the container can hold if filled) by using non-standard measures e.g. spoons and cup Solve word problems in context and explain own solution to problems involving addition and subtraction with answers up to 20.

NOTE: **Volume** is the amount of space taken up by an object.

In the next activity you will also need to refer to the extract from the English/IsiZulu dictionary (Appendix 1 page 22) giving definitions and examples of the key terms used in the CAPS extract above. You should know and be able to use this vocabulary and when you teach you should teach use all of the vocabulary – so that learners will learn it and be able to use it themselves.

Activity 2

Discuss the following questions in your group. Refer to the CAPS extract above in your discussion.

1. Fill in the missing words:
   a) _____ is a measurement of the amount of space taken up by an object.
   b) The amount of liquid (or other substance such as sand) that a container can hold is called the _____ of the container.

2. ***Capacity/volume***

   The CAPS refers to the section on capacity as 'capacity/volume'.
   a. Why does the CAPS put the two topics together and in what way are they related?
   b. How will you differentiate between these two terms in your classroom?

3. ***Progression***
   a. What is the progression across the grades in relation to the teaching of capacity?
   b. What are the links between the grades and how can teachers use these to consolidate the concept of capacity?

4. ***Vocabulary of capacity and volume:***
   a. Review the extract – discuss the given translations and how you would teach this vocabulary in FP classes.
   b. How can teachers make sure that they teach all of the vocabulary in the lessons that they present on the CAPS topics?

Teaching capacity using the Jika iMfundo lesson plans

The Jika iMfundo lesson plans include lessons that take the learner through the progression of content recommended by CAPS. They provide many teaching activities as well as classwork and homework activities. You could also add to these examples once you have worked through the lesson plans yourself and identify areas where even more practice might be beneficial to learners.

When working with learners on capacity it is important to remember to bring concrete examples of the containers that you are working with. **You should allow learners to hold and work with the real objects.** You should also give lots of time to learners for them to experiment with capacity of containers and to talk about their capacity. This will help them to establish the concept firmly.

Activity 3

In this activity you will refer to the Term 1 lessons about capacity from the **revised Grade 3 Jika iMfundo FP Mathematics materials (for 2018)**: *Grade 3 Term 1 lessons 32-33*

Refer to the lesson plans to analyse the activities and think about ways in which you would use these activities. The revised lesson plan extracts are given below for your reference.

For each of the activities, discuss:

1. What introductory information is given for the teacher at the beginning of the lesson plan?
2. What content is covered in the lessons and how it is presented?
3. How does it relate to the CAPS content specifications?
4. How do the lesson plans scaffold the content (in each of the lesson plans)?
5. What is the progression between the two lessons?
6. What sequencing do you notice and how will this work to consolidate the conceptual teaching?
7. How do the lessons link to the theory you discussed at the beginning of this session?
8. How would you use the activities?
9. Would you add to/change the activities in any way and if so, how and why?

Grade 3 Term 1 lesson 32.

In this activity you will use non-standard units. The non-standard units suggested in the lesson activities are spoons (which you will use to fill up cups with sand). Working with the non-standard unit gives you the opportunity to introduce the language for measuring capacity and the concept of capacity (*how much something can hold*).

First you demonstrate to the whole class how to fill the containers to do the measuring activity and then they work in groups to experience the measuring themselves. If you do not have enough resources for learners to work in groups for this lesson, you will have to do the whole lesson as a demonstration. Make sure that you involve learners in the demonstration so that they do feel engaged in the activity.

Learners should have measured using non-standard units before in Grade 2. While you do this activity with the class you are revising the process of measuring by counting a certain number of units. Estimation is an important part of this activity. Learners need to develop the ability to make a good approximation (near answer) of a measurement.

Activity 1: Whole class activity.
Draw the table shown below on the board before the lesson.

- Place a cup and a small margarine tub on the table.
- Ask the learners to estimate how many spoons of sand it will take to fill each of the containers.
- Record the class's estimation of the measurement using non-standard units.
- Use the sand and teaspoons to measure the capacity of the cup in spoons.
- Ask, *What is the capacity of this cup*? (Learners count with you the number of spoons of sand used to fill the cup.).
- Record the class's actual measurement of the capacity of the cup using non-standard units. (… spoons of sand)
- Learners should now copy this table from the board to record the findings and to compare the estimations with the measurements when they measure capacity of the other containers in the group activity that follows:

	Capacity in spoons		
	I estimate	**I measure**	**Difference**
Cup			
Margarine tub			
Other small containers			

Activity 2: Learners work in groups

- Continuation of whole class activity in small groups. Learners now work in groups needs a few small containers, some sand and some spoons.
- Estimate how many spoons of sand will fill each of the containers (to the brim.) (Record your estimation)
- Measure how many spoons of sand will fill each of the containers (to the brim.) (Record your measurement)
- Calculate the difference between your estimation and the actual measurement. (Record the difference)
- Complete the columns in the table, for all of the containers provided for this activity.

Activity 3: Whole class activity

- Discuss the findings as a whole class. Learners' estimates and measurements might differ.
- Discuss the importance of good estimates. Estimates should be close to the actual measurements.

Grade 3 Term 1 lesson 33.

Activity 1: Whole class activity

- Explain to the class that yesterday they used non-standard measurements (teaspoons of sand) in the estimation activity. Because of this there might have been differences between the measurements learners found. Today they are going to learn about some of the standard units of measurement for capacity.
- Tell them about the litre and the millilitre – the standard units that we use to measure capacity.
- 1 litre = 1 000 millilitres. We often use abbreviations (shortened forms) to write the standard units of measurement. 1 *l* = 1 000 *ml*
- A standard cup holds 250 *ml* and a teaspoon holds 5 *ml*. Learners need to know these standard measurements.
- In the next two activities (and in the classwork and homework activities) you will work with these units.

Activity 2: Learners work in groups

- Give each group cut-out pictures of products or empty containers on which they can see the capacity, e.g.

3l

1l

5l


500 ml

2l

- Discuss the capacity of each of the containers for which they have pictures. (e.g. the capacity of the water bottle is 3 *l*, etc.)
- Ask the learners to order the containers from the one that holds the least to the one that holds the most.
- Give another set of pictures, where learners have to order and compare products whose capacity s stated only in millilitres. For example, 200 *ml* cool drink, 500 *ml* milk; 400 *ml* sunlight liquid, 150 *ml* shampoo, etc.

Activity 3: Whole class activity

- Talk about filling from the smaller container into the bigger container. When you do this, work out how many times you will need to pour from the smaller one into the bigger one in order to fill it. (Use your product pictures and measurements if they are different to what is pictured here.)
- Ask, *How many Pepsi bottles (500 ml) will fill the milk container?* (10); *the yoghurt container?* (2)
- *How many standard cups (250 ml) will fill the Pepsi container?* (2); *the oil container?* (8).

Assessment in the 2018 tracker

The 2018 lesson plan sequence has been changed to enhance the sequencing but also to help allow continuous assessment of all of the CAPS content strands is well spaced over the term. There are now six formal assessment activities per term, two for numbers, operations and relationships and one for the other curriculum strands from CAPS. There are suggested informal assessment activities for the weeks in which formal assessment is not recommended, to be used according to the professional discretion of the teacher.

There is an assessment rubric or checklist for each formal (and informal) assessment activity. The assessment rubrics and checklists have also been revised to make them more user-friendly. The mark sheet has been revised to simplify entry of marks per term (and it is aligned with SA SAMS).

The following extracts from the 2018 tracker can be found at the end of this document in Appendix 2 – you need to refer to these pages for the next discussion.

1. The tracker page for Grade 3, Term 1, Week 9, with an assessment checklist for the topic of capacity, relating to the two lessons that you have just discussed (showing assessment link). (*For an example of this see* Appendix 2.1 page 23.)

2. The introduction to the new written assessment item pack which will be found at the back of the tracker with the summary of items for the term, listing the items and the lessons to which they are linked. (*For an example of this see* Appendix 2.2 page 24.)

3. The assessment items for measurement (including one for capacity) that are included in the tracker for term 1. (*For an example of this see* Appendix 2.3 page 26.)

4. The suggested marks sheet for formal assessment linking to the tracker assessment programme. (*For an example of this see* Appendix 2.4 page 27.)

With reference to the extracts – discuss the following activity in your groups.

Activity 4

1. Study the description of the task in the tracker page for Week 9 (See Appendix 2.1).
   a. What CAPS content area does it relate to and what specific content from the CAPS topic does the activity assess?
   b. What mark is allocated to the activity and where will you record this mark?
   c. Is the activity formal or informal? What does this mean?

2. The marks are given in the left hand column and the criteria are given in the right hand column of the checklist.
   a. How do the criteria relate to each other?
   b. How would you allocate marks using this checklist?
   c. How would you calculate the percentage of a learner once you have found his mark out of 7 using the checklist?

3. Unpack each of the seven criteria – explain what evidence in learners' work would lead to them achieving each of the criteria.

4. Study the other extracts (Appendix 2.2, 2.3 and 2.4, pp. 23-27) to find out more about the assessment package in the 2018 tracker. Discuss how it is the same/different from the current tracker and in what ways it will be useful to teachers.

Session 3: Symmetry in geometric shapes and patterns (60 min)

The purpose of this session is to give teachers the experience of an activity that can be used to teach symmetry effectively.

Materials: Scrap paper.

In this session the following lesson plans from the Term 3 Jika iMfundo FP Mathematics materials are also relevant:

- *Grade 1 Term 3 lesson 36*
- *Grade 2 Term 3 lesson 36*
- *Grade 3 Term 3 - no lessons on symmetry this term*

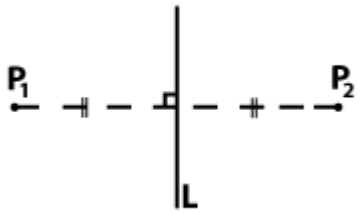
This activity should take about 60 minutes.

When we say symmetry we mean **line symmetry**. Line symmetry is also called reflection symmetry (because it has a lot to do with reflections) and bilateral symmetry (because of the 'two-sided' nature of symmetrical figures).

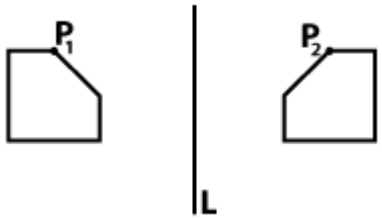
We say line symmetry because of the line of symmetry – the line (or axis) about which the symmetry occurs. When two points are symmetrical to each other we say that the one is the reflection of the other.

We can define symmetry in a formal mathematical way, as follows:

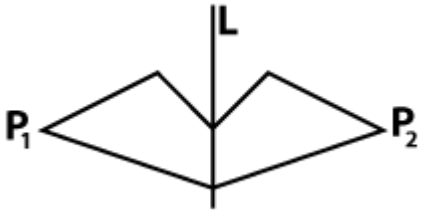
1. **Line symmetry for a pair of points**:
   Two points, P_1, and P_2, are symmetrical with respect to a line L if the line L is the perpendicular bisector of P_1P_2,.



2. **Line symmetry for a pair of congruent figures:**
   Two congruent figures are symmetrical with respect to a line L if for each point P_1 in the one figure there is a point P_2 in the other figure, such that $P_1$and P_2 are symmetrical w.r.t. line L.

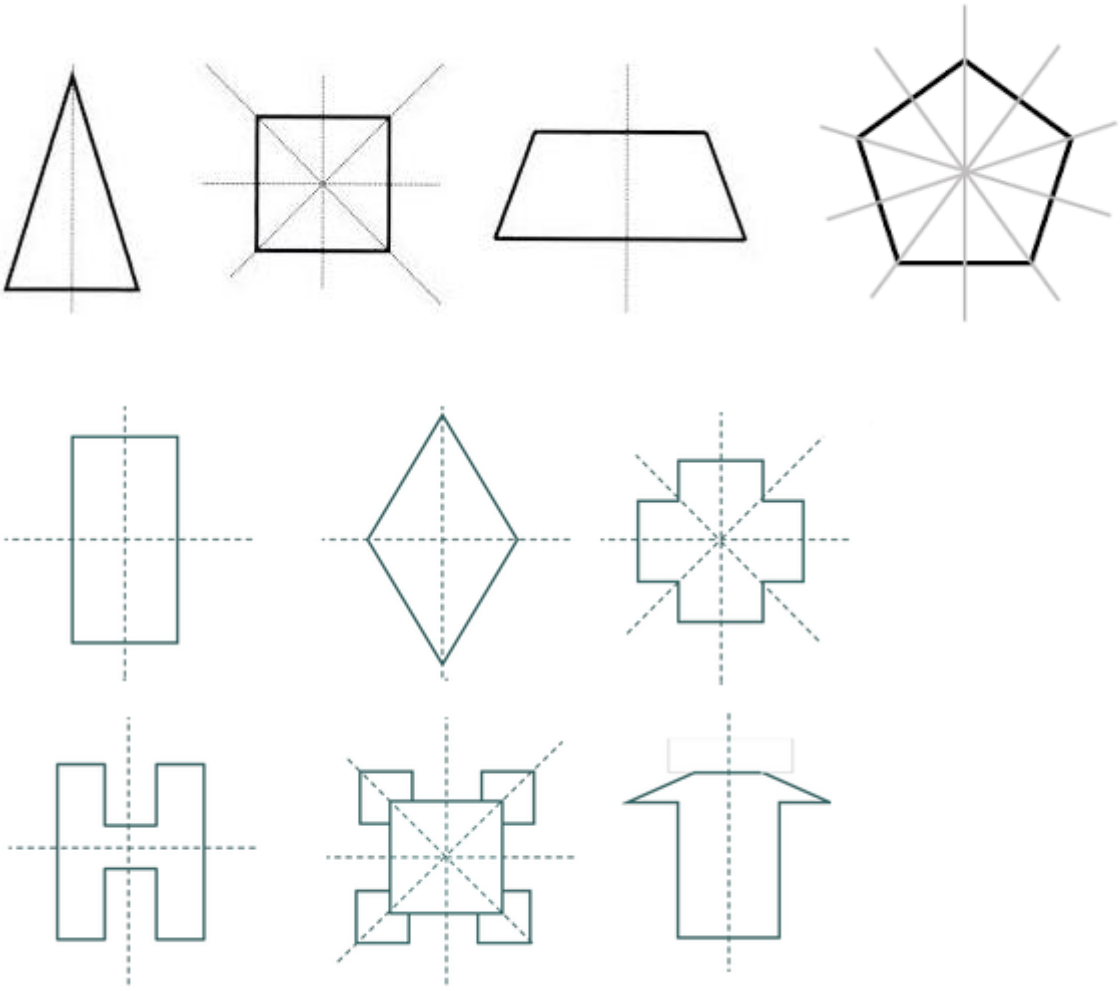


3. **Line symmetry for a single figure:**
   A figure is symmetrical w.r.t. a line L if for each point P_1 in the figure we can find a point P_2 in the figure, such that $P_1$and P_2 are symmetrical w.r.t. the line L.

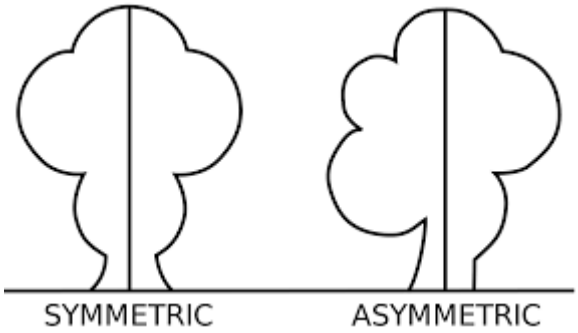


NOTE: **Congruent shapes** are shapes that are exactly the same. If you cut them out they would fit exactly on top of each other.

Some more drawings of shapes with lines of symmetry are given below: Notice that the lines of symmetry may be horizontal, vertical or oblique (at an angle). All of the shapes below are symmetrical – they each have at least one line of symmetry.



A figure needs to have only ONE axis of symmetry to be symmetrical, though it may have MORE THAN ONE axis of symmetry. When a shape is ***not symmetrical*** it is called ***asymmetrical***. For example:

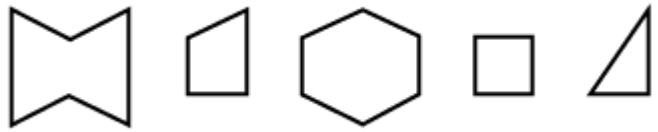


The topic of symmetry lends itself well to practical activities in the classroom. You could use any of the following **suggested activities**:

1. Folding and making holes in paper with compass/pen nib.
2. Folding and cutting paper shapes – experiment with one and more folds and cutting on the different edges, too. Let the children predict what the shape will look like before they open it up.
3. Point plotting on the Cartesian plane (work out the unknown co-ordinates of a given symmetrical shape).
4. Use mirrors – with real objects (pens, pencils, sharpeners, etc.) and with drawings (crazy ones and familiar ones).
5. Paint blobs on one side of a piece of paper and then squash two sides of the paper together along a fold – see what interesting symmetrical images you can produce.

Activity 1

1. Identify which of these shapes are symmetrical figures. Explain your choices.



2. Identify which figures represent congruent pairs of symmetrical shapes with respect to the given line. Explain your choices.

3. Draw:
   a) a pair of congruent symmetrical figures
   b) a shape with one axis of symmetry
   c) a shape with two axes of symmetry
   d) a shape with four axes of symmetry (four separate drawings).

4. Discuss how you would use two of the suggested activities (page 16) to teach symmetry in your class.

Symmetry: Curriculum information

The table below gives the overview of the curriculum requirements for the teaching of symmetry in the FP.

Grade 1	**Grade 2**	**Grade 3**
3.4 Symmetry		
□ Recognise symmetry in own body. □ Recognise and draw line of symmetry in 2-D geometrical and non-geometrical shapes	□ Recognise and draw line of symmetry in 2-D geometrical and non-geometrical shapes	□ Recognise and draw line of symmetry in 2-D geometrical and non-geometrical shapes. □ Determine line of symmetry through paper folding and reflection

In the next activity you will also need to refer to the extract from the English/IsiZulu dictionary (Appendix 1 page 23) giving definitions and examples of the key terms used in the CAPS extract above. As always, you should know and be able to use this vocabulary and when you teach you should teach use all of the vocabulary – so that learners will learn it and be able to use it themselves.

Activity 2
Discuss the following questions in your group. Refer to the CAPS extract above in your discussion.

1. ***Progression***
   a. What is the progression across the grades in relation to the teaching of symmetry?
   b. What are the links between the grades and how can teachers use these to consolidate the concept of symmetry?
2. ***Vocabulary of symmetry:***
   a. Review the extract – discuss the given translations and how you would teach this vocabulary in FP classes.
   b. How can teachers make sure that they teach all of the vocabulary in the lessons that they present on the CAPS topics?

Teaching symmetry using the Jika iMfundo lesson plans

The Jika iMfundo lesson plans include lessons on symmetry as per CAPS specifications. It is important for you the teacher to decide what will be the most meaningful way to teach the prescribed content and you can always change or add to the lesson plans in ways that you think will benefit your learners. In the next activity you can go through some more of the Jika iMfundo lesson plan activities.

Activity 3

These are the Term 3 lessons on symmetry in the Jika iMfundo FP Mathematics materials:

- *Grade 1 Term 3 lesson 36*
- *Grade 2 Term 3 lesson 36*
- *Grade 3 Term 3 - no lessons on symmetry this term*

Refer to the lesson plans to analyse the activities and think about ways in which you would use these activities. The lesson plan extracts are given below for your reference.

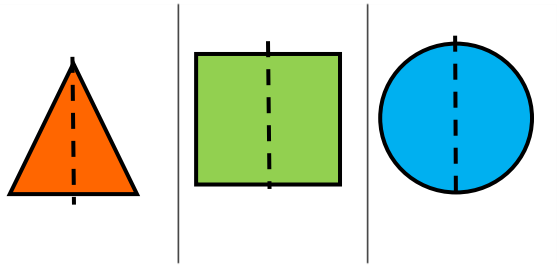
For each of the activities, discuss:

1. What content is covered and how it is presented.
2. How does it relate to the CAPS content specifications?
3. How would you use the activity?
4. Would you add to/change the activity in any way and if so, how and why?

Grade 1 Term 3 lesson 36

Activity 1: Whole class activity.

- Draw the following on the board. (The line divides the shape into two shapes which look exactly the same.)

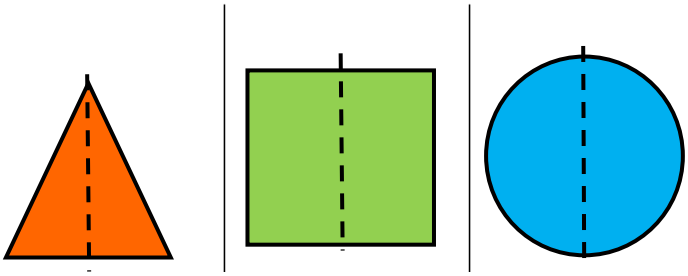


- *What do you notice?* (The shapes have a line through them.)
- Discuss the following with the learners:
  - → The *dotted line is called the 'line of symmetry'*
  - → *The dotted line divides the shape in half so that the two sides look* ***exactly*** *the same.*

Activity 2: Whole class activity.

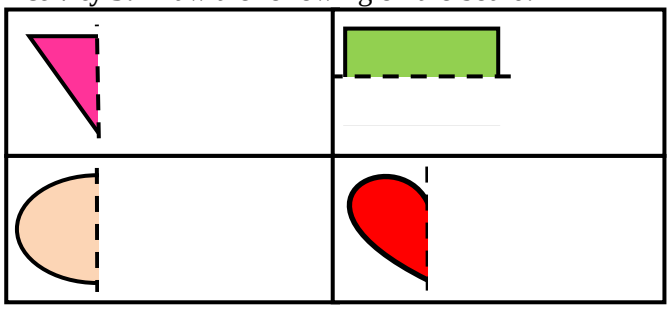
- Ask the learners to copy a triangle, square and circle from the board.

- Ask learners to draw the dotted line down the middle of each shape.



- *What is this line called?* (The line of symmetry.)
- *What does it do?* (It divides the shape in half so that the two sides look exactly the same.)

Activity 3: Draw the following on the board.

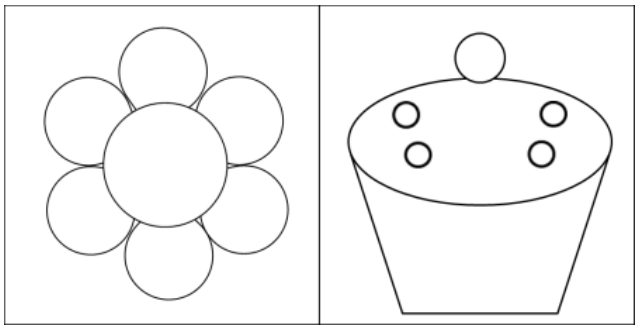


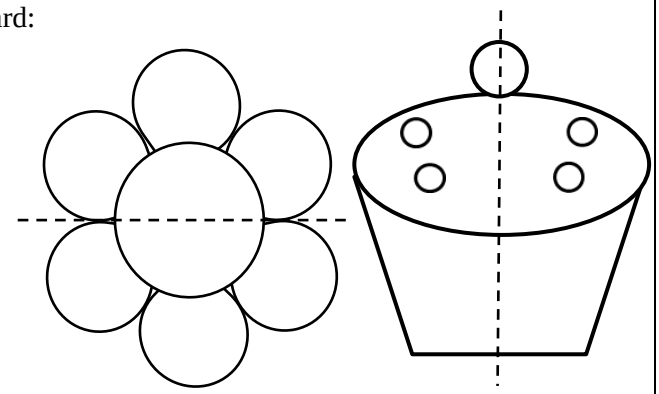
- Ask learners to draw the other half of each shape.

Grade 2 Term 3 lesson 36

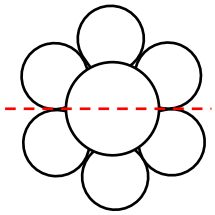
Activity 1: Whole class activity.

- Draw these pictures or similar ones, on the board:





- Draw a line of symmetry through the picture of the flower and the cupcake.
- Explain to the learners that when you draw a line of symmetry, the two sides of the picture or object must look exactly the same.
- Also explain to them that the line of symmetry is not necessarily a vertical line. It can be a horizontal (or sloping) line as well. See the flower example.



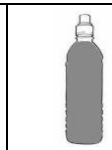
Activity 2: Learners work in groups.

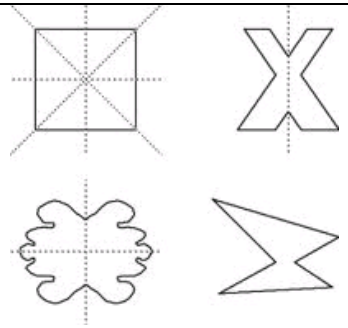
- Give each learner an old magazine.
- Ask the learners to find a symmetrical picture of a person's face (or draw a face).
- Learners cut out the face and fold it vertically in half.
- Now open the picture and cut on the fold.
- The face will now be in two halves that look exactly the same.
- Discuss this as an example of symmetry.

Acknowledgement: The following resource was used in the preparation of this workshop. Sapire, I. (2010). *Mathematics for Primary School Teachers*. Saide and the Wits School of Education, University of the Witwatersrand, Johannesburg.

Appendix 1 – Vocabulary – Extracts from the Jika iMfundo Bilingual Dictionary

Session 2: Capacity

capacity	The amount a container can hold when it is full. E.g. This container is filled to its capacity. 	umthamo	Ubungako obungamuma thaw isitsha uma sigcwele. Isb. Lesi sitsha sigcwele ngokuphelele. 
informal unit	The same as non-standard. E.g. A non-standard unit for measuring length is the width of you hand.	into engenazimiso	Kuyafana nento engekho emthethweni. Isb. Into engekho emthethweni yokukala ubude wububanzi besandla sakho.
measure	To find the size or amount of something. This can only be done for things that can be measured. For example you can measure the length, mass, capacity and volume of objects.	ukukala	Ukuthola ubungako noma inani lento, okwenziwa ezintweni ezikalekayo. Isibonelo, umuntu ukwazi ukukala ubude, umthamo, kanye nesisindo.
standard unit	When you measure formally, you use standard units of length. E.g. If you measure the width of your school desk using a tape measure, you are using centimetres as a formal unit.  	okokukala ngokusemthethweni	Uma ukala izinto ngokusemthethweni, usebenzisa izinto zokukala ubude. Isb. Uma ukala itafula laseklasini usebenzisa intambo enamaqophelo, kumele kube ngamasentimitha asemthethweni.
standard cup	A cup which has a capacity of 250 ml.	inkomishi eyisilinganiso	Inkomishi enesilinganiso sama-250 ml.
teaspoon	A measuring instrument for small quantities. A teaspoon has a capacity of 5 ml.	ithisipunu	Into yokukala imithamo emincane. Ithisipunu linomthamo wama-5 ml.

geometric object/shape	A geometric shape is a geometric figure that can be described with mathematics and that is used in geometry.	into/isimo ngokwezibalo	Isimo ngokwezibalo yisimo esingachazwa ngamazwi ezibalo kanti kumele kube ngesisetshenziswayo ezibalweni.
line of symmetry	See symmetry	umugqa wohhafu abafana ncimishi	Bheka ohhafu abafana ncimishi.
non-geometric shape	A shape which is irregular and is not described by geometric properties. E.g. A leaf is a non-geometric shape.	okuseduzane kweshumi	Isimo esingajwayelekile esingachazeki ngamazwi ezibalo. Isb. Ikhasi lesitshalo alisona isimo esichazwa ngamazwi ezibalo.
symmetry / line of symmetry	We see symmetry in a shape when one half of it is a mirror image of the other half. The line of symmetry is the line we draw between the two symmetrical halves of the shape. E.g. Some shapes have one line of symmetry, others have more than one. Some shapes are not symmetrical. 	okufuzene / umugqa wofuzo/isimetri	Sibona ukwakheka entweni eyisimo uma uhhafu waleyo nto ufana ncimishi nohhafu okolunye uhlangothi. Umugqa ohlukanisa izinhlangothi ezimbili umelwe ukudwetshwa phakathi nendawo esimeni. Isb. Ezinye izimo zinomugqa owodwa ohlukanisa izinhlangothi, ezinye zinemigqa engaphezu kowodwa. Ezinye izimo kazinazo izinholangothi ezifanayo.

Appendix 2.1: Tracker 2018 Grade 3, Term 1, Week 9

Day	CAPS content, concepts, skills	LP no. & p.	DBE workbook	Resources	Date completed
36	Fractions – fraction shapes: Solve and explain solutions to practical problems that involve equal sharing leading to solutions that include unitary fractions e.g. 1/2, 1/4, 3/4, 2/5 etc.; Begin to recognise equivalent fractions	29		Scrap paper, fraction circles, fraction wall, (see *Printable Resources*)	
37	**Capacity: Estimate measure, compare and order the capacity of containers by using non-standard measures e.g. spoons and cups; Describe the capacity of the container by counting and stating how many of the informal units it takes to fill the container**	30	Worksheet 14 (p. 30)	**Spoons, clear/see-through cups (2 cups for each group and an extra set for the teacher for demonstration), various other containers (e.g. jugs, 1-, 2- and 3-litre plastic bottles, margarine containers)**	
38	**Capacity: Compare, order and record the capacity of commercially packaged objects whose capacity is stated in litres; Know that a standard cup is 250 ml and that a teaspoon is 5 ml**	31	Worksheet 14 (p. 31)	**Containers and pictures on which you can see the capacity (e.g. 250 ml-cup, teaspoon, an empty 1-litre bottle)** Written assessment item 14.	
39	Time – calendars: Read dates on calendar; Place birthdays, religious festivals, public holidays, historical events, school events on a calendar	32	Worksheet 12 (pp. 26, 27)	Current calendar (1 per pair)	
40	Complete and consolidate the week's assessment and work	n/a			
Week 9 Assessment Activity: PRACTICAL – FORMAL CAPS: Measurement: Capacity Estimate, measure, compare and order capacity					Mark: /7

Mark	Criteria: Checklist (1 mark for each criterion achieved)
1	Can use the vocabulary of capacity – e.g. full, empty, half full, half empty, filled to capacity.
1	Can estimate capacity in non-standard units. e.g. spoons and cups.
1	Can estimate capacity in standard units. e.g. using 5 ml teaspoons and 250 ml cups.
1	Can measure capacity using non-standard units
1	Can measure capacity using standard units
1	Can compare two containers according to capacity.
1	Can order a set of containers according to capacity.

1 (0%–29%) 1 of 7 criteria	2 (30%–39%) 2 of 7 criteria	3 (40%–49%) 3 of 7 criteria	4 (50%–59%) 4 of 7 criteria	5 (60%–69%) 5 of 7 criteria	6 (70%–79%) 6 of 7 criteria	7 (80%–100%) 7 of 7 criteria

Reflection

Think about and make a note of: *What went well? What did not go well? What did the learners find difficult or easy to understand or do? What will you do to support or extend learners? Did you complete all the work set for the week? If not, how will you get back on track?*

What will you change next time? Why?

HOD _____ Date _____

Appendix 2.2: Extract from assessment pack at end of 2018 Grade 3 Term 1 tracker.

Exemplar written assessment items with suggested marking memos

Resources that can be used for written assessment of each curriculum content strand and their memos are given in the following section. They are given in bilingual format.

Written assessment is to be done in addition to oral and practical assessment to carry out meaningful continuous assessment throughout the term. The tracker provides a suggested set of oral and practical assessment activities with rubrics or checklists that can be used to help you carry out your oral and practical assessment of learners.

You need to plan when you will do written assessment. We suggest you do it during the lessons in which you are teaching the same content (links to the items are given in the *Resources* column of the tracker). The questions provided here are taken from past written assessment papers that were previously in the lesson plans. We suggest you use selected items as smaller written assessment tasks. This aligns better with the curriculum objective of continuous assessment in FP.

You could choose to mark and record the mark the selected items OR of an equivalent classwork activity.

Lesson sequence: The content in each lesson has been carefully sequenced; it is therefore important that lessons are not skipped. Should you miss a mathematics lesson for any reason, you should continue the next day from where you last left off. Do not miss a lesson. You may need to speed up the pace of delivery – by covering the lesson concept content of two consecutive days in one day – to catch up the lesson schedule. To do this, you could cut out or cut back on some of the routine activities including mental mathematics or homework reflection to save time until you are back on track with the dated delivery of the plans.

There is one lesson "slot" per week that is assigned for you to catch up or consolidate the lesson plan content covered in the week's lessons. This lesson should also be used for the purpose of carrying out written assessment tasks or to complete oral or practical tasks for that week.

Written assessment item mark breakdown (according to exemplar items)

1. Written assessment items for number operations and relationships.

There are several items for number. These are linked in the Resources column of the tracker. You could use the following sheet to record the written assessment marks for number and operations per learner as the term progresses. There is a column in the overall exemplar mark sheet for the total mark per learner for written assessment.

Question number	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10	Total
Mark	3	2	2	2	4	6	1	2	5	2	29
Learner name											

There is also a column in the overall exemplar mark sheet for the total mark per learner for written assessment in each of the other CAPS curriculum strands: pattern, space and shape, measurement and data handling. The information below summarises the items for these content topics given in the exemplar items.

2. Written assessment items for Pattern

Questions 11 and 12 – Marks 3 + 4 = 7

3. Written assessment items for Space and Shape

Questions 13 – Marks 12

4. Written assessment items for Measurement

Questions 14 and 15 – Marks 3 + 2 = 5

5. Written assessment items for Data Handling

Question 16 – Marks 9

The exemplar items and suggested marking memoranda for these items are given on the pages that follow.

Appendix 2.3: Written assessment items (extract from Grade 3 Term 1 tracker 2018).

Written assessment items for Measurement

Question 14
Umbuzo 14 (3)

340 ml

1 000 ml

a. What is the capacity of the milk carton? _____
Ibhokisi lobisi lunomthamo ongakanani? _____
b. What is the capacity of the Fanta can? _____
IFanta isekanini elinomthamo ongakanani? _____
c. Which container has the greater capacity? _____
Yisiphi isitsha esinomthamo omkhulu kulezi zombili? _____

Question 15
Umbuzo 15 (2)

a. Write half past 7 in digital time:
Bhala uthi ligamenxe elesi-7 ngokwewashi elicwayizayo:

_____

b. Write 05:30 in analogue time
Bhala 05:30 ngokwewashi lezinti

_____

Written assessment items on Measurement: solutions and mark allocations

14. (1 mark for the correct answer) (Imaki eli-1 ngempendulo eyamukelekile) a) 1 000ml b) 340 ml c) The milk carton ikesi lobisi	(3)
15. (1 mark for each correct answer) (Imaki eli-1 ngempendulo ngayinye eyamukelekile) a) 07:30 b) 5.30 am	(2)

Appendix 2.4: Suggested Mark Sheet for formal assessment, from the 2018 Grade 3, Term 1 tracker

GRADE 3 MATHEMATICS TERM 1 SUGGESTED FORMAL ASSESSMENT RECORD SHEET																
TASK/TOPIC/COMPONENT	Number	Number	Number	**TOTAL FOR NUMBER**	Patterns	Patterns	**TOTAL FOR PATTERNS**	Space and shape	Space and shape	**TOTAL FOR SPACE AND SHAPE**	Measurement	Measurement	**TOTAL FOR MEASUREMENT**	Data handling	Data handling	**TOTAL FOR DATA HANDLING**
Week and activity type	3: Oral	5: Oral and practical	Written		6: Oral	Written		7: Practical	Written		8: Practical	Written		9: Practical	Written	
(Out of) marks	7	7	24	38	7	7	14	7	5	12	7	5	12	7	9	16
LEARNER NAME AND SURNAME																