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Just-in-Time Training Workshop 8
February 2017

Facilitator's Guide

Maths

Jika iMfundo
what I do matters

Endorsed by:

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Foundation Phase JIT
Workshop 8 Mathematics: January/February 2017
Workshop guide for facilitators

In this workshop participants will find out more about the teaching of sharing leading to fractions, and adding and subtracting on a number line in the Jika Imfunda materials, and how the Jika Imfundo mark record sheets align to SA SAMS.

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 have many group discussions in which you can share what you have found.

Participants need some paper to work on, 20 counters per group (activities 1 and 2).

Workshop plan
8.00 – 8.30 – Arrival and distribution of materials for the workshop
8.30 – 10.30 – Session 1: Sharing leading to fractions (2 hours = 120 min)
10.30-11.00 – Break
11.00-12.30 – Session 2: Adding and subtracting on a number line (1 ½ hours = 90 min)
12.30 – 13.30 – Session 3: SA SAMS (60 min)

Session 1: Sharing leading to fractions (2 hours = 120 min)

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

- *Grade 1 Term 3 lessons 27, 28, 30 and 31.*
- *Grade 2 Term 3 lessons 22 and 23.*
- *Grade 3 Term 3 lessons 20 and 21.*

Materials: When you work through this activity you will need some blank sheets of paper and a set of about 20 counters per group.

In JIT 3 there was input on fractions. JIT 8 builds on that input and links more closely to the Jika iMfundo lesson plans on sharing leading to fractions in Term 1.

In the activities that form part of this section of the JIT it is important that teachers work through all of the activity questions using the counters and that they practice using the language of expression for "how to find a fraction". Examples of this are given in the guidelines that follow.

The first activity situates fractions in the overall curriculum of the CAPS topic 1 – Number, operations and operations. The JIT guide gives a curriculum extract and extracts from the Mathematics dictionary for certain key words in the CAPS extract.

Activity 1
Discuss the following questions in your group. Refer to the CAPS extract above in your discussion.

1. Why does whole number concept development need to be established before operational concept?
   Operations operate on numbers. We add two numbers together, subtract one from another, and so on. You can't work with something that you don't understand – imagine trying to add 5 and 6 if you don't know "how much" 5 actually is. It would not be possible.

2. In what way is fraction concept both a number concept and an operation concept?
   Fractions are numbers, but technically they are found by sharing. Sharing is division – and fraction number concept is developed through sharing activities.

3. How does the way we write a fraction symbol link to division?
   Sharing is division and so it is logical that the notation of a fraction symbol involves division. Notation means "how we write it".

4. CAPS recommends that learners are not expected to write fraction symbols in the FP.
    a. Discuss this idea.
    The notation of fractions (writing fraction symbols) is quite complicated for young learners of mathematics! Possibly the CAPS wants to keep things simple and hence it recommends that learners are not expected to read or write fraction symbols. On page 453 there is another mention of fraction symbols which says that learners are not "required" to write fraction symbols. This also does not say learners may not write the symbols, it just says they do not need to. We would recommend that learners are encouraged to write the fraction symbols from Grade 2. They should not be prevented from doing so as fraction symbols are the mathematical symbolic representation of the fraction numbers.

    b. When do you think learners should begin to write fraction symbols why?
    Learners should be introduced to fraction symbols as soon as they have started to work with fractions. They are exposed to them in everyday contexts (at the shops for one) and it would be useful if their teaching at school could start to demystify the fraction symbol notation and link it to the concept of division right from the start. This can be done gradually and through the use of many varied hands-on problems which allow learners to grasp the concept and develop the skills required to work with(and write) fractions. They can't begin to work with fractions efficiently without learning how to write them using mathematical symbols.

Continuous and discontinuous wholes
The importance of knowing the difference between continuous and discontinuous wholes must be stressed. Teachers should allow learners ample opportunities to work through all of the examples practically and to talk about what they are doing, and then to write about it.

- **Continuous wholes** – Single items that need to be broken up in order to be shared e.g. slices of bread, cakes, chocolate bars, etc.
- **Discontinuous wholes** – Groups of items that need to be divided into smaller groups in order to be shared e.g. sweets, marbles, beads etc.

There is lots of terminology given above – your teaching of fractions will be informed by all of this theory and so it's important for you to be able to understand and apply the theory.

Activity 2
Use your blank sheets of paper and counters to demonstrate how you find fractions in this activity.

1. What does it mean to "find a fraction of a whole"?
    This is the concrete way of finding fractions – when the fraction takes on a visual form rather than simply being an abstract number. Learners start to learn about fractions by finding fractions of wholes. This teaches the idea that a fraction is a "part of a whole", that is not a whole number. Every time they find a fraction part it must be emphasised that the parts of the whole must be ***equal in size*** *in order for them to be fraction parts.*

2. Why does sharing lead to finding fractions?
    This follows because fractions are "parts of wholes". The idea of a part does not have to be something that is "cut up" however, as the whole could be continuous or discontinuous. And so sharing which is done (for example) could be the sharing of a cake or of a packet of biscuits. In both cases, sharing leads to the finding of a fraction. You could find half a cake or half a packet of biscuits – but half a cake is found by cutting the cake, while half the packer of biscuits is found by sharing out the biscuits into two parts, each with an equal number of biscuits.

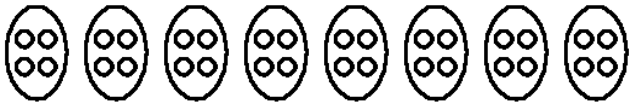
3. Give some examples of continuous wholes and show how you would find halves, thirds and quarters of the whole.
    Answers will vary. Any single item which is shared into parts by cutting, breaking, folding (etc.) is a continuous whole. To find halves you share the whole into two parts of equal size, to find thirds you share the whole into three parts of equal size and to find quarters you share the whole into four parts of equal size. For example:

4. Give some examples of discontinuous wholes and show how you would find fifths, sixths and eighths of the whole.
   Answers will vary. Any group of items which is shared into parts by sharing into groups of equal size is a discontinuous whole. To find halves you share the whole into two groups of equal size, to find thirds you share the whole into three groups of equal size and to find quarters you share the whole into four groups of equal size. For example:

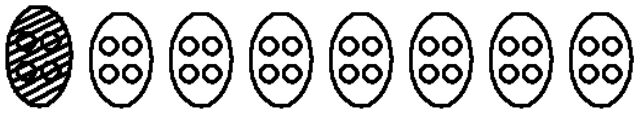
   Find $\frac{1}{8}$ of 32 counters. 32 counters represent the whole

   I put my counters into 8 groups of equal size.

   There are four counters in each group. One of the groups of equal size is $\frac{1}{8}$ of the whole.

5. Discuss the difference between continuous and discontinuous wholes.
   Continuous wholes are single items and discontinuous wholes are made up of several items grouped together to make a "whole".

6. Why do you think it is important for learners to be exposed to both continuous and discontinuous wholes?
   Learners need to be exposed to both categories of wholes so that they are able to generalise the concept of a fraction as a part of a whole – not related only to a certain kind of whole, but all of the possibilities for a whole. We need to ensure that learners are given adequate exposure to a ***great enough variety of examples*** *of fractions in concrete demonstrations, so that they are able to form their own abstract concept of a fraction as a number.*

Sharing leading to fractions is introduced in Grade 2 in the FP.

Fractions are formally introduced in Grade 2 in the FP. The next activity relates to another CAPS extract (page 23).

The CAPS overview extract summarising these two topics is included in the participants' guide.

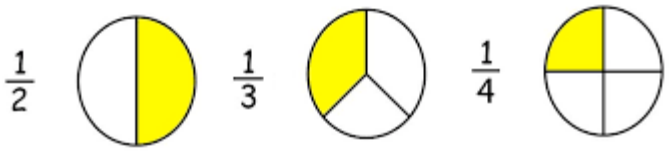
Activity 3

1. What is meant by the phrase "*problems that involve equal sharing*"?
   Equal sharing means sharing into parts that are equal in size or number.

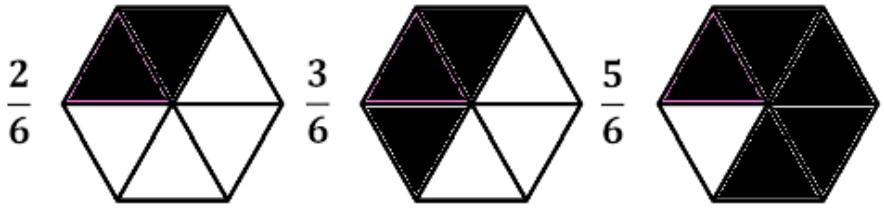
2. Why is equal sharing essential in the context of fraction concept development?
   Initial examples of sharing that lead to finding fractions involve equal sharing because this stresses the idea of the equality of the parts that make up the whole, when we find fractions.

3. The curriculum uses the terminology "unitary" and "non-unitary". Give some numeric examples of "unitary" and "non-unitary" fractions.
   A fraction which has a numerator value of 1 is a unitary fraction. For example, $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, etc.$ *A fraction which has a numerator value greater than 1 is a non-unitary fraction. For example,* $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, etc.$

4. Which of the following are examples of "unitary" fractions and which are examples of "non-unitary" fractions? What makes them different?



These are unitary fractions, in each case only one part is shaded and so the fraction has a numerator of 1.



These are non-unitary fractions, in each case more than one part has been shaded and so the fraction has a numerator of more than 1.

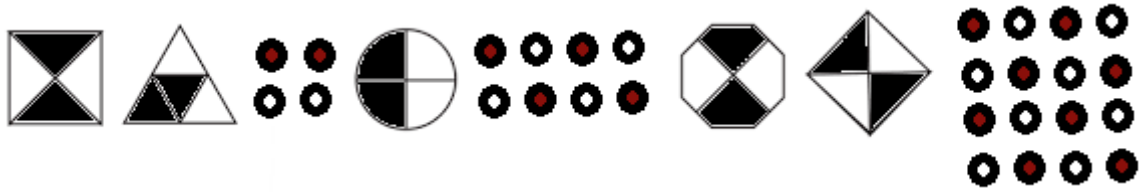
5. Draw some other diagrammatic form of unitary and non-unitary fractions using a discontinuous whole.
   Answers will vary. Encourage the use of many different fractions not just halves and quarters. (Use the full FP range - halves, quarters, eighths, thirds, sixths, fifths

6. Why are diagrammatic forms useful in the teaching of fractions?
   Diagrams are semi-concrete – they help to move the learner from the concrete to the abstract.

7. The curriculum talks about learners beginning to recognise the equivalence of certain fractions.
   a. What could you do to promote this recognition?
      Giving learners lots of opportunities to work with as many different kinds of fractions as possible and find as many different unitary and non-unitary fractions as possible.

   b. How will you know that they are starting to recognise equivalent fractions.
      Learners will start to say to you things such as "but one half is the same as two quarters: and so on.

8. Are each of the following diagrammatic forms of 2 quarters? Why/why not?



YES. Because in each case two quarters of the whole has been shaded.

9. Draw diagrammatic forms of 2 thirds using as many different kinds of wholes as you can think of.
   Answers will vary. Encourage the use of a variety of wholes (continuous and discontinuous).

10. What are *non-unitary* fractions? Give some examples of non-unitary fractions.
    Fractions that are not unitary fractions. They have a numerator which is bigger than 1. For example, $\frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{5}{8}, etc.$

The next few activities are linked to lessons from the Jika iMfundo lesson plans on sharing leading to fractions. All lesson activity extracts that are needed for the discussion are included in the handout.

Activity 4

1. Why does the lesson plan recommend putting the learners into groups of 5?
   Because in the activity the counters need to be shared among 5 people each time. Teachers need to think about things such as the group size when they prepare – this guidance in the Jika lesson plan helps with advance preparation.

2. How is the first activity suggested (share 15 counters) different from all of the other activities suggested?
   In this question there is no remainder after the sharing has been done. In the other activity questions there is a remainder.

3. How would you add to this lesson to enable further consolidation of sharing division? Discuss other activities to include and explain why you would include them.
   Answers will vary. Add more sharing activities – include more that do not have remainders and also some that do have remainders. Build in some questions to actively talk about the presence or absence of a remainder.

In the lesson plans the classwork and homework are designed to consolidate concepts and skills learned in the lesson of the day.

Activity 5

NOTE: The use of the words "is" and "are" in the English version of the material could be used for a language across the curriculum exercise.

1. Work through the activities.
   (Solutions given above in context)

2. In what way do the classwork and homework activities for Lesson 24 consolidate concepts and skills learned in the lesson of the day?
   The classwork and homework activities for Lesson 24 consolidate concepts and skills learned in the lesson of the day because they are repeated examples of a similar type using different numbers. They give learners further opportunities to talk about sharing and to do sharing activities.

3. How would you add to or change these classwork and homework activities to enable further consolidation of sharing division? Discuss why you would make these changes.
   Answers will vary.

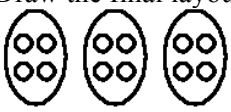
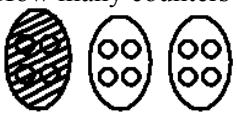
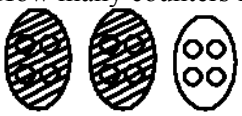
The next activity is designed to allow further consolidation of the correct use of language when finding fractions. The correct language patterns are given in the participants' guide. You should stress the importance of becoming fluent in the language of finding fractions as this enables abstraction of the concept of fractions.

Activity 6

1. Why is it a good idea to take the learners outside at the beginning of this lesson before moving onto the worksheet activity?
   This varies the classroom activities, keeps the interest of the learners and motivates them. Think about what you could use if you don't have hula hoops. You could draw circles on the ground for learners to stand in, you could use string to mark the circles, and so on.

2. Does this activity involve parts of a continuous or discontinuous whole? Explain why you say so.
   Discontinuous whole. Because the whole is made of up several items which have to be shared in order to find the fraction parts.

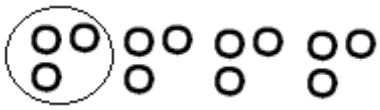
3. If you have 12 counters, how many different equal sized groups can you divide them into?
   12 counters can be divided into 2, 3 ,4 ,6 and 12 equal sized parts.

4. Talk through the division of 12 into thirds.
   a. What will you say while you find one third of 12?
      To find $\frac{1}{3}$ of 12 counters, I first divide the counters into 3 groups of equal size. I find three groups with four counters in each group. Each group is $\frac{1}{3}$ of the whole, and so 4 counters is $\frac{1}{3}$ of 12 counters.
   b. Use counters to demonstrate the process.
      Do the practical sharing using the concrete counters.
   c. Draw the final layout of the counters into three groups of equal size.
      
      Three groups of four. Each group is one third of 12.
   d. How many counters in one third of 12?
      
      There are four counters in one third of 12.
   e. How many counters in 2 thirds of 12?
      
      There are eight counters in two thirds of 12.
   f. How many counters in 3 thirds of 12?
      
      There are 12 counters in three thirds of 12.

5. Talk through the division of 12 into quarters.
   a. What will you say while you find one quarter of 12?
      To find $\frac{1}{4}$ of 12 counters, I first divide the counters into 4 groups of equal size. I find four groups with three counters in each group. Each group is $\frac{1}{4}$ of the whole, and so 3 counters is $\frac{1}{4}$ of 12 counters.

b. Use counters to demonstrate the process.
Do the practical sharing using the concrete counters.

c. Draw the final layout of the counters into three groups of equal size.



Four groups of three in each group. One group of 3 is one quarter of 12.

d. How many counters in one quarter of 12?
Three counters.

e. How many counters in 2 quarters of 12?
Six counters.

f. How many counters in 3 quarters of 12?
Nine counters.

g. How many counters in 3 quarters of 12?
Twelve counters.

6. In your groups work through the activity on the printable sheet. Discuss each row as you do so using the correct language of fractions.
The language used in questions 4 and 5 of this activity should be repeated while participants work through the worksheet. Make sure that all participants have a turn to speak it out loud – working with the counters while they do so. Learners need to become fluent in this language and so teachers need to feel comfortable with using it as well.

7. Design another worksheet for a Grade 3 class on sharing leading to finding fractions.
Answers will vary - discuss and share with the bigger group.

Session 2: Adding and subtracting on number line (1 ½ hours = 90 min)

In this session the following lesson plans from the Term 1 Jika iMfundo FP Maths materials are relevant:

- *Grade 1 Term 1 lessons 13-16.*
- *Grade 2 Term 1 lessons 8, 9, 12, 13, and 14.*
- *Grade 3 Term 1 lessons 8 and 9.*

Materials: When you work through this activity you will need a set of about 20 counters.

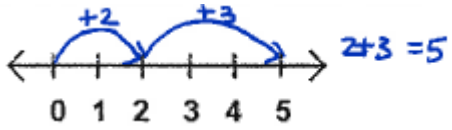
Scale
Information in scale is given in the participants' guide to stress the importance of accuracy when drawing and labelling number lines.

Reflection
When do you need to start the labels of a number line with the label '0' (zero)?
When the scale is chosen so that the counting of the number line labels can begin at zero. For number lines that are used to represent a higher range of numbers that do not start at zero, zero will not be included in the labels.

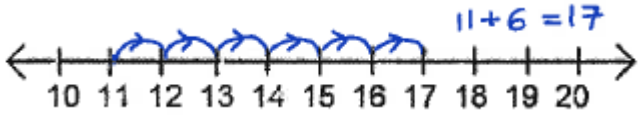
Several exercises are given.

Activity 1
You can choose a different range and scale. In each case explain your choice.

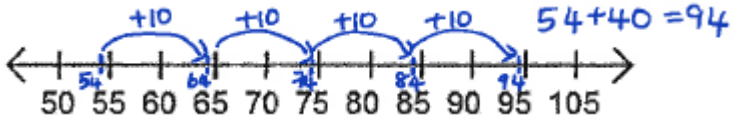
1. You want to represent the solution of the following addition questions on a number line:
   a. 2 + 3 on a number line in a Grade 1 lesson.



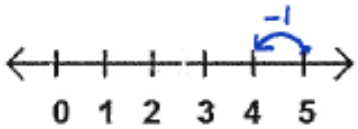
   b. 11 + 6 on a number line in a Grade 2 lesson.



   c. 54 + 40 on a number line in a Grade 3 lesson.

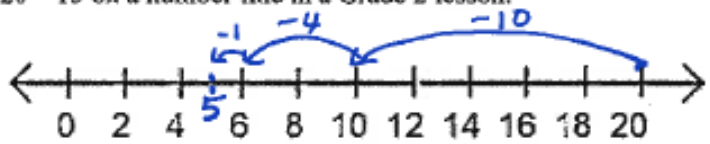


2. You want to represent the solution of the following subtraction questions on a number line:
   a. 5 – 1 on a number line in a Grade 1 lesson.



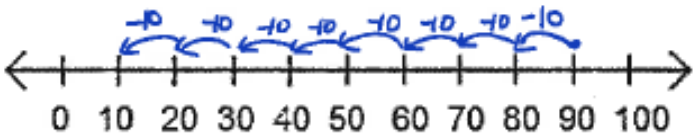
5-1 =4 (You can show jumps above or below the line. In this document it is shown above for greater clarity)

   b. 20 – 15 on a number line in a Grade 2 lesson.



20-15=20-10-4-1
=5

   c. 90 – 80 on a number line in a Grade 3 lesson.



90-80 =10

The next activity examines a lesson from Grade 1 Term 1, where number lines are used on the teaching of addition.

Activity 2

1. The activity above links teaching using a number line and teaching using blocks. On the number line below fill in the blocks and show the jumps for the first question in the activity: 1 + 4

2. How do you count the blocks on the number line?
   You count them using unit counts by pointing at the blocks.

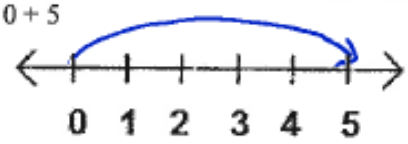
3. How do you count the jumps on the number line?
   You count them in unit counts by showing jumps along the number line, the first jump is from zero to 1, then next is from 1 to 2 and so on.

4. What do grade 1 learners learn about using a number line through doing this activity?
   They learn that when you count on a number line you count the jumps between the markers not the gaps between the labels.

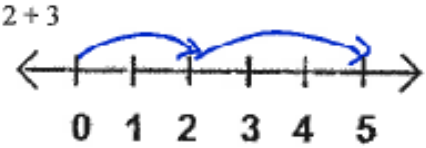
5. What other learning is consolidated by such an activity?
   Number concept, the progression of numbers, number symbols, number names, etc.

6. i. Practise talking about using a number line to show addition of the bonds of five by completing the number line demonstrations for the other bonds of 5: *(show drawings)*

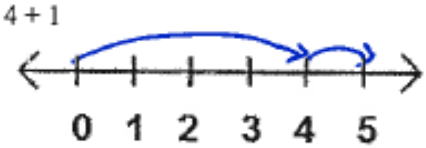
a. 0 + 5



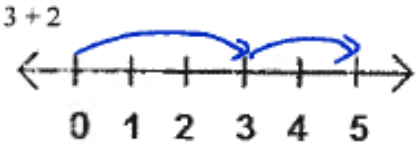
b. 2 + 3



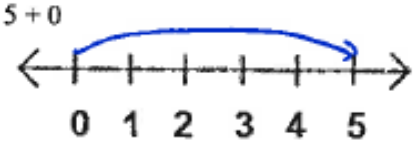
c. 4 + 1



d. 3 + 2



e. 5 + 0



ii. What other mathematical conceptual learning is embedded in this question?
The concept of inverse operations – that 0 + 5 = 5 + 0; 2 + 3 = 3 + 2 and so on.

The next activity examines a lesson from Grade 2 Term 1, where number lines are used on the teaching of addition and subtraction.

Activity 3

1. Why is it good idea to start talking about scale and number range to Grade 2 learners even though the number range for addition and subtraction in Term 1 is only 0-20?
   It is a good idea to start talking about scale when the range is small, because the idea is simpler when it is linked to smaller numbers and it can be extended to higher number ranges when these are introduced. It is better to introduce an idea related to simpler values and then build it up than to wait till later.

2. The activity below links teaching using a number line and teaching using blocks as in the Grade 1 lesson activity that you just discussed. *Work through the lesson activities in your group.*

3. In what way are the counters and number lines used differently in this Grade 2 lesson to the way they were used in the Grade 1 lesson?
   In this lesson the first activity uses only with counters. The second activity uses counters and number lines – but separately.

4. How does the link between counters and number lines included here help learners to consolidate their understanding of the concept of subtraction?
   The link is good because they are two different ways of finding the answer (one is concrete – the counters) and the other is semi-concrete (the number line). Finding the answer in two different ways helps consolidate the concept and the process.

The next two activities examine lessons from Grade 3 Term 1, where number lines are used on the teaching of addition and subtraction.

Grade 3 Lesson 8 – Addition on a number line

Activity 4

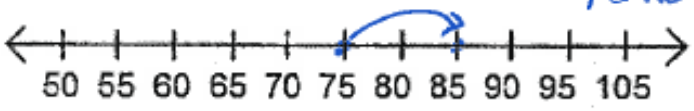
1. Work through the lesson activities from Grade 3, Term 1 Lesson 8. *Do this in groups.*

2. In what way does the lesson teach learners how to choose a scale for a number line representation of addition?
   The activity has steps which lead into the labelling of the number line.

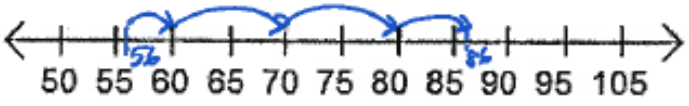
3. Use number lines in any way you choose to represent the following addition. Discuss the different ways in which group members choose scales and did their representations.
   Different scales to those shown can be chosen.

   a. 75 + 10 = ___

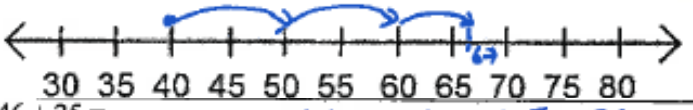
   75+10=85

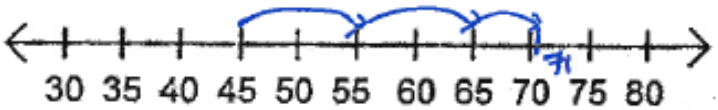
   b. 56 + 30 = ___ 56+4+10+10+6 = 86 ∴ 56+30=86

   c. 40 + 27 = ___ 40+10+10+7=67 ∴ 40+27=67

   d. 46 + 25 = ___ 46+25 = 45+26 = 71

4. Discuss the value of using number lines for addition of bigger numbers in Grade 3.
   It is interesting to show addition using a variety of methods. The number line method is semi-concrete and hence could help consolidate addition concept as well as number concept and the use of a number line (and scale).

Grade 3 Lesson 9 – Subtraction on a number line

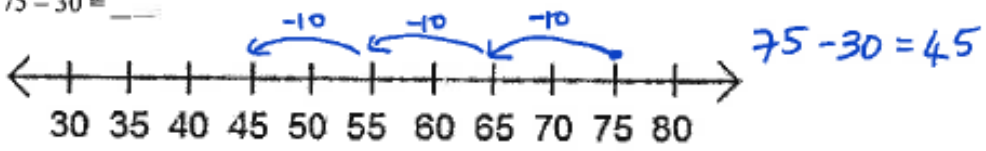
Activity 5

1. Work through the lesson activities from Grade 3, Term 1 Lesson 9. *Do this in groups.*

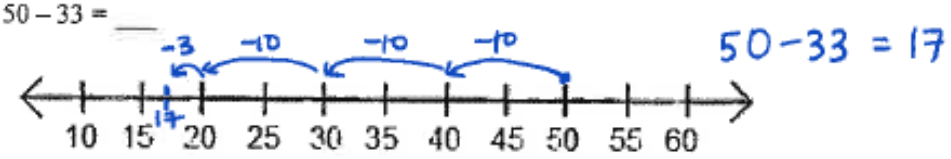
2. In what way does the lesson teach learners how to choose a scale for a number line representation of subtraction?
   It has worked steps that help the learner decide where to position the numbers on the number line in order to be able to use the number line to demonstrate the subtraction.

3. Use number lines in any way you choose to represent the following subtraction. Discuss the different ways in which group members choose scales and did their representations.

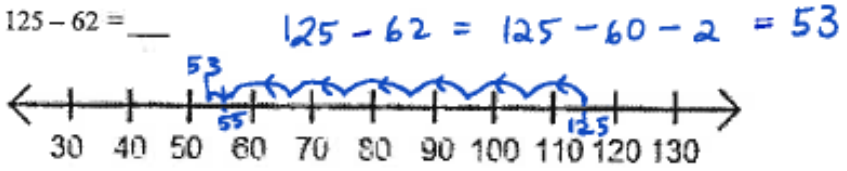
   a. 75 – 30 = ___

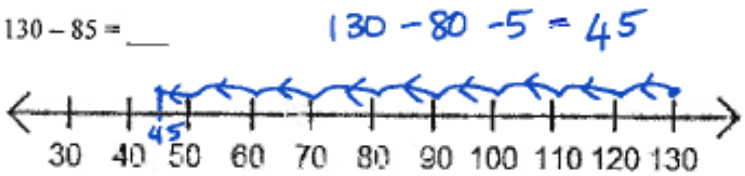
   b. 50 – 33 = ___

   c. 125 – 62 = ___

   d. 130 – 85 = ___

4. Discuss the value of using number lines for subtraction of bigger numbers in Grade 3.
   As above for addition, it is interesting to show subtraction using a variety of methods. The number line method is semi-concrete and hence could help consolidate subtraction concept as well as number concept and the use of a number line (and scale).

Session 3: SA SAMS (1 hour = 60 min)

The purpose of this session is to assist teachers with the entry of the marks for assessment in the lesson plans in SA SAMS.

The participants' handout includes background information on SA SAMS and also on how the Jika iMfundo lesson plans align to SA SAMS. You need to allow the participants time to read the information (and also present some of the info to them so that they do not have to spend too much time reading) and take time to discuss it with them so that it is clear to all.

In the activity you need to refer constantly to the two extracts which are exemplars that will enable the participants to become familiar with the SA SAMS style of marks sheet and also with the revised recommended formal mark sheet from the tracker for 2017.

Activity 1

1. What are the tasks named in SA SAMS? List them in the order they are given in SA SAMS.
   There are tasks given for Space and shape; Data handling; Measurement; Number, operations and relationships; and Patterns, functions and algebra.

2. How many marks can be entered per topic in the SA SAMS mark sheet?
   One per topic.

3. What are the assessment activities given in the Jika Grade 1 Recommended Assessment Mark Record sheet in the 2017 tracker? List them in the order they are given in the tracker mark sheet.
   Number, operations and relationships; Patterns, functions and algebra; Space and shape; Measurement and Data handling.

4. What is the difference between the SA SAMS 'tasks' and the tracker 'assessment activities'?
   The tasks in the tracker are given in the order of CAPS topics while the order on the SA SAMS mark sheet is different.
   In the SA SAMS mark sheet you enter all of the marks at the end of the term. In the Jika iMfundo mark sheet you enter the mark for each activity as it is done – throughout the term. At the end of the term you use your combined marks from the whole term to get the totals to enter into SA SAMS.
   The SA SAMS tasks split the record of marks into content topics and so they enable teachers to report of strengths and weaknesses of learners according to content topic (for example at parents meetings and so on).

5. You are allowed to change the SA SAMS mark allocations. How would you adjust the mark total per topic on the SA SAMS sheet so that it matches the Jika iMfundo entry sheet.
   You can make these changes on the hard copy in the handout using the totals from the Grade 1 Recommended Assessment Mark Record sheet in the 2017 tracker. Change the totals on the SA SAMS to correspond with the totals on the tracker mark sheet. (e.g. Number changes from 5 marks to 24 marks and so on.)

6. Do teachers have to work out the levels for learners after entering the marks into SA SAMS?
   No – SA SAMS is programmed to do this automatically for teachers.

7. Do teachers have to calculate the correct weighting (according to CAPS) when using the SA SAMS mark sheets?
   No – SA SAMS is programmed to do this automatically for teachers.

8. What could teachers do to align the LP activities to SA SAMS where there are more activities in the Lesson Plans than in SA SAMS?
   Answers could vary. Either use it as recommended -make one total per topic and enter into SA SAMS OR add more columns to the SA SAMS to enter all the individual marks).