

# Developing Mathematics Assessment Tasks

## A NumberSense workshop for Foundation Phase teachers



A\_ Unit E23, Prime Park, Mocke Road, Diepriver | T\_ (021) 706 3777 | E\_ info@brombacher.co.za | www.brombacher.co.za

#### Contents

Annual assessment plan	2
Assessment task plan	3
Cognitive Levels	4
Test items for analysis	10
Notes:	14

1

Curricu	ulum topic	Term 1	Term 2	Term 3	Term 4	Year
Numbe	ers, Operations and Relationships	[]	[]	[]	[]	[]
Count:	whole numbers					
1.1	Objects					
1.2	Forwards & back					
1.3	Symbols & names					
1.4	Describe, compare & order					
1.5	Place value					
Probler	ns in context					
1.6	Problem solving					
1.7	Addition & subtraction					
1.8	Repeated addition					
1.9	Grouping & sharing					
1.10	Sharing for fractions					
1.11	Money					
Calcula	tions (context-free)					
1.12	Techniques					
1.13	Addition & subtraction					
1.14	Repeated addition					
1.15	Division					
1.16	Mental maths					
1.17	Fractions					
Pattern	s, Functions and Algebra	[]	[]	[]	[]	[]
2.1	Geometric patterns					
2.2	Number patterns					
Space	and Shape (Geometry)	[]	[]	[ ]	[]	[]
3.1	Position, orientation, views					
3.2	3-D objects					
3.3	2-D shapes					
3.4	Symmetry					
Measu	rement	[]	[]	[]	[]	[]
4.1	Time					
4.2	Length					
4.3	Mass					
4.4	Capacity/Volume					
4.5	Perimeter & Area					
Data H	andling (Statistics)	[]	[]	[]	[]	[]
Objects	3					
5.1	Collect & sort					
5.2	Represent					
5.3	Discuss & report					
Data						
5.4	Collect & organise					
5.5	Represent					
5.6	Analyse & interpret					
	Total	[]	[]	[ ]	[]	[]
	i Stai	[]]		1 1	1	ĹĴ

## Annual assessment plan

### Assessment task plan

Topic (from the curriculum)	Knowing	Applying	Reasoning	Total
	[]	[]	[]	[]
	[]	[]	[]	[]
	1	r 1	r 1	г 1
Total	[]	[]	[]	[]

#### Knowing

Facility in using mathematics, or reasoning about mathematical situations, depends on mathematical knowledge and familiarity with mathematical concepts. The more relevant knowledge a student is able to recall and the wider the range of concepts he or she has understood, the greater the potential for engaging in a wide range of problem-solving situations and for developing mathematical understanding.

Without access to a knowledge base that enables easy recall of the language and basic facts and conventions of number, symbolic representation, and spatial relations, students would find purposeful mathematical thinking impossible. Facts encompass the factual knowledge that provides the basic language of mathematics, and the essential mathematical facts and properties that form the foundation for mathematical thought.

Procedures form a bridge between more basic knowledge and the use of mathematics for solving routine problems, especially those encountered by many people in their daily lives. In essence a fluent use of procedures entails recall of sets of actions and how to carry them out. Students need to be efficient and accurate in using a variety of computational procedures and tools. They need to see that particular procedures can be used to solve entire classes of problems, not just individual problems.

Knowledge of concepts enables students to make connections between elements of knowledge that, at best, would otherwise be retained as isolated facts. It allows them to make extensions beyond their existing knowledge, judge the validity of mathematical statements and methods, and create mathematical representations.

1	Recall	Recall definitions; terminology; number properties; geometric properties; and notation (e.g., $a \times b = ab$ , $a + a + a = 3a$ ).
2	Recognize	Recognize mathematical objects, e.g., shapes, numbers, expressions, and quantities. Recognize mathematical entities that are mathematically equivalent (e.g., equivalent familiar fractions, decimals and percents; different orientations of simple geometric figures).
3	Compute	Carry out algorithmic procedures for +, -, $\times$ , $\div$ , or a combination of these with whole numbers, fractions, decimals and integers. Approximate numbers to estimate computations. Carry out routine algebraic procedures.
4	Retrieve	Retrieve information from graphs, tables, or other sources; read simple scales.
5	Measure	Use measuring instruments; choose appropriate units of measurement.
6	Classify/Order	Classify/group objects, shapes, numbers, and expressions according to common properties; make correct decisions about class membership; and order numbers and objects by attributes.

## Applying

The applying domain involves the application of mathematical tools in a range of contexts. The facts, concepts, and procedures will often be very familiar to the student, with the problems being routine ones. In some items aligned with this domain, students need to apply mathematical knowledge of facts, skills, and procedures or understanding of mathematical concepts to create representations. Representation of ideas forms the core of mathematical thinking and communication, and the ability to create equivalent representations is fundamental to success in the subject.

Problem solving is central to the applying domain, but the problem settings are more routine than those aligned with the reasoning domain, being rooted firmly in the implemented curriculum. The routine problems will typically have been standard in classroom exercises designed to provide practice in particular methods or techniques. Some of these problems will have been in words that set the problem situation in a quasi-real context. Though they range in difficulty, each of these types of "textbook" problems is expected to be sufficiently familiar to students that they will essentially involve selecting and applying learned facts, concepts, and procedures.

Problems may be set in real-life situations, or may be concerned with purely mathematical questions involving, for example, numeric or algebraic expressions, functions, equations, geometric figures, or statistical data sets. Therefore, problem solving is included not only in the applying domain, with emphasis on the more familiar and routine tasks, but also in the reasoning domain.

1	Select	Select an efficient/appropriate operation, method, or strategy for solving problems where there is a known procedure, algorithm, or method of solution.
2	Represent	Display mathematical information and data in diagrams, tables, charts, or graphs, and generate equivalent representations for a given mathematical entity or relationship.
3	Model	Generate an appropriate model, such as an equation, geometric figure, or diagram for solving a routine problem.
4	Implement	Implement a set of mathematical instructions (e.g., draw shapes and diagrams to given specifications).
5	Solve Routine Problems	Solve standard problems similar to those encountered in class. The problems can be in familiar contexts or purely mathematical.

#### Reasoning

Reasoning mathematically involves the capacity for logical, systematic thinking. It includes intuitive and inductive reasoning based on patterns and regularities that can be used to arrive at solutions to non-routine problems. Non-routine problems are problems that are very likely to be unfamiliar to students. They make cognitive demands over and above those needed for solution of routine problems, even when the knowledge and skills required for their solution have been learned. Non-routine problems may be purely mathematical or may have real-life settings. Both types of items involve transfer of knowledge and skills to new situations, and interactions among reasoning skills are usually a feature. Problems requiring reasoning may do so in different ways, because of the novelty of the context or the complexity of the situation, or because any solution to the problem must involve several steps, perhaps drawing on knowledge and understanding from different areas of mathematics.

Even though of the many behaviors listed within the reasoning domain are those that may be drawn on in thinking about and solving novel or complex problems, each by itself represents a valuable outcome of mathematics education, with the potential to influence learners' thinking more generally. For example, reasoning involves the ability to observe and make conjectures. It also involves making logical deductions based on specific assumptions and rules, and justifying results.

1	Analyze	Determine, describe, or use relationships between variables or objects in mathematical situations, and make valid inferences from given information.
2	Generalize/ Specialize	Extend the domain to which the result of mathematical thinking and problem solving is applicable by restating results in more general and more widely applicable terms.
3	Integrate/ Synthesize	Make connections between different elements of knowledge and related representations, and make linkages between related mathematical ideas. Combine mathematical facts, concepts, and procedures to establish results, and combine results to produce a further result.
4	Justify	Provide a justification by reference to known mathematical results or properties.
5	Solve Non-routine Problems	Solve problems set in mathematical or real life contexts where students are unlikely to have encountered closely similar items, and apply mathematical facts, concepts, and procedures in unfamiliar or complex contexts.

## Test items for analysis

No.	Item	Content domain	Cognitive evel
1.			
2.	Arrange from smallest to biggest. 52 $345$ $26$ $354$ $92$ $92$		
3.	What number does the arrow point to? 14 16 18 20		
4.	What number does the arrow point to? 44 $66$ $110$ $110$		
5.	Complete the row of numbers.		
	10 ; 14 ; 18 ; What will the eighth number in the row be?		
6.a)	Complete. 543 = 500 + + 3		
6.b)	Complete. 54 – 28 =		
6.c)	Complete. 76 + 154 =		
6.d)	Complete. 23 × 6 =		
6.e)	Complete. 48 ÷ 3 =		

No.	Item	Content domain	Cognitive evel
6.f)	Complete. $4\frac{2}{3} + \frac{1}{3} = $		
7.	Complete.		
	Cooldrinks         1         2         5         10         20		
	Rand 8 16 40 80 96		
8.	Granny plants 8 rows of mealie plants. She plants 15 plants in a row. How many mealie plants did she plant altogether?		
9.	Mr Slebi buys 90 apples. He fills 5 bags so that each bag has the same number of apples in it. How many apples did he put in each bag?		
10.	Father had R450. He spent some money. He now has R198. How much money did he spend?		
11.	Jan has R70. Sara has R44. How much money must Jan give to Sara so that they have the same amount?		
12.	Three friends want to share 7 chocolate bars equally. Draw a picture to show how they can do it.		
13.	Five friends share 13 chocolate bars equally. How much will each friend get? Show them how to do it.		
14.	These chocolate bars are cut into equal pieces.		
	Each piece is called		
	Each piece is called		
15.	What is bigger: one fourth of a chocolate bar or one sixth of a chocolate bar? Explain.		

No.	Item	Content Iomain	Cognitive evel
16.	Mrs Faku needs $\frac{1}{2}$ of a cup of nuts to make one muffin.	0 0	
	She has 5 cups of nuts. How many muffins can she make?		
17.	Fundi buys 5 litres of cooldrink.		
	How can she do that using the least amount of		
	1L = R7.00 money?		
	2L = R12.00		
18.	Ben has 20 to 30 marbles.		
	If he counts them in 4's, there are 2 left over.		
	If he counts them in 5's, there is 1 left over.		
	How many marbles could Ben have?		
19.	What is the time?		
	$ \begin{array}{c} 11 \\ 12 \\ 10 \\ 29 \\ 38 \\ 7 \\ 6 \\ 5 \end{array} $		
20.	Ben runs for 35 minutes every day.		
	<ul><li>How many minutes does he run for in 4 days?</li><li>How many hours and minutes is that?</li></ul>		
21.	Yusuf gives his sick puppy one tablet at 8 o'clock in		
	o'clock in the afternoon.		
	How many hours later is that?		

12

No.	Item	content omain	Cognitive evel
22.	Draw the next two pictures in the pattern.	00	<u> </u>
	$\underline{\wedge} \underline{\wedge} \underline{\wedge} \underline{\wedge}$		
23.	Draw <u>one</u> line of symmetry through Shape A. Draw <u>two</u> lines of symmetry through Shape B.		
24.	Circle the shapes that are NOT triangles.		
25.	ARNON AR		
	Grace has used these coins to make R8 in one way. Show how you can		
	Grace's answer: $R5 + R2 + R1 = R8$		
26.	In April, Faku recorded 10 rainy days, 7 partly cloudy days and 13 sunny days. He starts to draw a graph.		



#### Notes:




Materials developed and workshop presented by: Brombacher and Associates

www.brombacher.co.za