

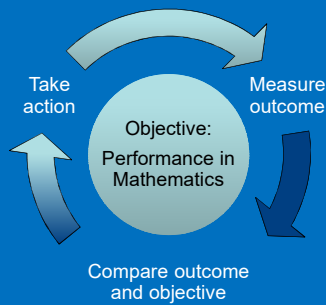


## Assessment in a NumberSense classroom

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## Assessment



## Assessment in a NumberSense classroom

- What are the issues:
  - Different children on different books – can they do the same assessment?
  - How do you test concepts/topics?
  - Will children cope:
    - In grade 4?
    - In grade 8?
    - On the scholarship exam?

## Assessment in a NumberSense classroom

- Roles of assessment:
  - Diagnostic – Who needs what remedial support? and What is the best book for a child?
  - Formative – What are the children learning and how can I adapt my teaching to their needs?
  - Summative – Which children are ready to be promoted?

## Assessment in a NumberSense classroom

- Roles of assessment:
  - Diagnostic – Who needs what remedial support? and What is the best book for a child?
  - Formative – What are the children learning and how can I adapt my teaching to their needs?
  - Summative – Which children are ready to be promoted?

Let's get practical...



We need a plan!



### Assessment planning

Mathematics	Total
	[100]

### Assessment planning

Mathematics	Total
Numbers, Operations and Relationships	60 – 50
Patterns, Functions and Algebra	10 – 10
Space and Shape	13 – 15
Measurement	12 – 15
Data Handling	5 – 10
	[100]

### Assessment planning

Mathematics	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships					60 – 50
Patterns, Functions and Algebra					10 – 10
Space and Shape					13 – 15
Measurement					12 – 15
Data Handling					5 – 10
	[20]	[20]	[20]	[20]	[100]

### Assessment planning

Mathematics	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships					60 – 50
Patterns, Functions and Algebra					10 – 10
Space and Shape					13 – 15
Measurement					12 – 15
Data Handling					5 – 10
	[20]	[20]	[20]	[20]	[100]

Count: whole numbers  
Problems in context  
Calculations (context-free)

### Assessment planning

Mathematics	Term	Count: whole numbers	Total
Numbers, Operations and Relationships		1.1 Objects	50
Patterns, Functions and Algebra		1.2 Forwards & back	10
Space and Shape		1.3 Symbols & names	15
Measurement		1.4 Describe, compare & order	15
Data Handling		1.5 Place value	10
	[20]	Problems in context	0]
		1.6 Problem solving	
		1.7 Addition & subtraction	
		1.8 Repeated addition	
		1.9 Grouping & sharing	
		1.10 Sharing for fractions	
		1.11 Money	
		Calculations (context-free)	
		1.12 Techniques	
		1.13 Addition & subtraction	
		1.14 Repeated addition	
		1.15 Division	
		1.16 Mental maths	
		1.17 Fractions	

### Assessment planning

Mathematics	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships		1.1 Whole numbers			60 – 50
Patterns, Functions and Algebra		1.2 Exponents			10 – 10
Space and Shape		1.3 Integers			13 – 15
Measurement		1.4 Common Fractions			12 – 15
Data Handling		1.5 Decimal fractions			5 – 10
	[20]	[20]	[20]	[20]	[100]

### Assessment planning

Mathematics	Term	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships		1.1 Whole numbers				
Patterns, Functions and Algebra		1.2 Exponents				
Space and Shape		1.3 Integers				
Measurement		1.3a Counting, ordering & comparing				
Data Handling		1.3b Calculations				
		1.3c Properties of integers				
		1.3d Solving problems				
		1.4 Common Fractions				
		1.4a Ordering, comparing & simplifying				
		1.4b Calculations				
		1.4c Calculation techniques				
		1.4d Solving problems				
		1.4e Percentages				
		1.4f Equivalent forms				
		1.5 Decimal fractions				
	[20]					

### Assessment planning

Mathematics	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships		Observation	Classwork		60 – 50
Patterns, Functions and Algebra		Homework	Investigation		10 – 10
Space and Shape		Test	Project		13 – 15
Measurement					12 – 15
Data Handling		Examination			5 – 10
	[20]	[20]	[20]	[20]	[100]

### Assessment planning

Mathematics	Term 1	Term 2	Term 3	Term 4	Total
Numbers, Operations and Relationships	Observation Test				60 – 50
Patterns, Functions and Algebra	Investigation				10 – 10
Space and Shape	Classwork				13 – 15
Measurement	Observation				12 – 15
Data Handling	Project				5 – 10
	[20]	[20]	[20]	[20]	[100]

### Assessment planning

Test	Total
	[50]

### Assessment planning

Test	Total
Whole numbers	
Exponents	
Integers	
Common Fractions	
Decimal fractions	
	[50]

### Assessment planning

Test	Knowing	Applying	Reasoning	Total
Whole numbers	Items	Items	Items	
Exponents	Items	Items	Items	
Integers	Items	Items	Items	
Common Fractions	Items	Items	Items	
Decimal fractions	Items	Items	Items	
	[20]	[20]	[10]	[50]

### TIMSS 2011 Mathematics Framework

#### Chapter 1

#### 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.,  $a \times b = ab$ ,  $a + a = a + a = 2a$ ).
- 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.

### Number – Grade 3

3. Complete.

4 ; 8 ; 12 ; \_\_\_\_ ; \_\_\_\_

3. 16; 20

### Number – Grade 6

1. Complete.

c) \_\_\_\_\_ +  $1\frac{5}{8} = 2$

1.c)  $\frac{3}{8}$

### Pattern – Grade 6

10. Use the flow diagram to complete the table.

Input  $\rightarrow \times 5 \rightarrow - 1 \rightarrow$  Output

Input	1	2	5
Output			

Input	1	2	5
Output	4	9	24

### Space and Shape – Grade 3

11. Circle (select) all the shapes that are triangles.

11.

### Space and Shape – Grade 6

13. Two sides of a rectangle are given. Complete the rectangle.

13.

### Measurement – Grade 3

16. Mrs Manga complains that it is a very hot day. What is the temperature?

A. 100 °C    B. 32 °C    C. 55 °C    D. 15 °C

16. B. 32 °C

### Measurement – Grade 6

16. Complete.

a) 85 hours = \_\_\_\_\_ days and \_\_\_\_\_ hours

16.a) 3 days and 13 hours

### 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.

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

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### Number – Grade 3

6. Complete.

h)  $240 \div 6 = \underline{\hspace{2cm}}$

6.h) 40

### Number – Grade 6

4. There are 50 000 tickets for the rugby match. 32 500 tickets have already been sold. How many tickets are left?

\_\_\_\_\_ tickets

4. 17 500 tickets

### Pattern – Grade 6

11. Ronny uses crosses to make patterns like this.

Picture 1      Picture 2      Picture 3

b) Complete the table.

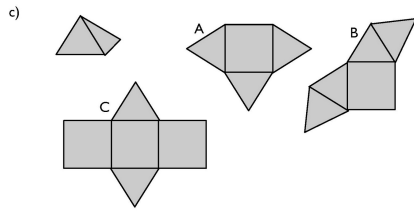
Picture number	1	2	3	4	5	10
Number of crosses	4	6	8			

11.b)

Arrangement number	4	5	10
Number of white tiles	10	12	22

### Space and Shape – Grade 3

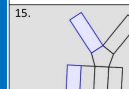
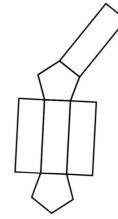
13. Match the object with its correct net.



13.c) B

### Space and Shape – Grade 6

15. This net of a pentagonal based prism is missing one face. Show all the possible places that the missing face could be placed.



### Measurement – Grade 3

17. Richard did spelling and mathematics for homework. He spent 20 minutes learning his spelling and half an hour doing mathematics.

a) How many minutes did Richard spend doing homework?  
\_\_\_\_\_ minutes

b) Richard then watched television from 5 o'clock until quarter past 6. How long did Richard spend watching television?  
\_\_\_\_\_ hour \_\_\_\_\_ minutes

17.a) 50 minutes

17.b) 1 hour 15 minutes

### Measurement – Grade 6

17. Rochelle phones Sabelo three times during a week. The lengths (in minutes and seconds) of the phone calls are given:

5:25      2:40      12:05

How long is that in total?

17. 20 min 10 seconds or 20:10

#### 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.

### Number – Grade 3

9. Susan needs  $1\frac{1}{4}$  metres of material to make one flag. How many flags can she make with 10 metres of material? Show how you work it out.



9. Answer: 8 flags

Possible methods:

$\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$  |  $\frac{1}{4}$

$$1\frac{1}{4} + 1\frac{1}{4} \rightarrow 2\frac{1}{2} + 1\frac{1}{4} \rightarrow 3\frac{3}{4} + 1\frac{1}{4} \rightarrow 5,$$

$$\text{so } 1\frac{1}{4} \times 4 = 5 \text{ and } 1\frac{1}{4} \times 8 = 10$$

### Number – Grade 6

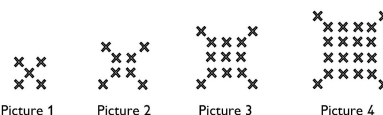
8. There are a total of seven bicycles and tricycles in a shop window. Each bicycle has two wheels and each tricycle has three wheels. They have a total of 19 wheels. Determine the number of bicycles in the shop window. \_\_\_\_\_ bicycles



8. 2 bicycles

### Pattern – Grade 6

12. Tumi uses crosses to build patterns like this.



How many crosses will she use for picture 15? Show your thinking.

\_\_\_\_\_ crosses

12. Answer: 229  
Possible method:  
 $15 \times 15 + 4 = 229$ , because each pattern is made up of a square arrangement and 4 crosses on each corner of the square.

### Space and Shape – Grade 3

14. A cube has 6 faces.  
This object is made by gluing together six wooden cubes. If you paint the object, how many faces will you paint?



14. 26 faces

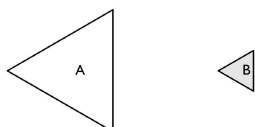
### Measurement – Grade 3

18. At one school, a bell rings every half an hour. At another school, the bell rings every 35 minutes. At 8 o'clock the bells ring at both schools. At what time will they both ring at the same time again?

18. half past 11  
or 11:30

### Measurement – Grade 6

19. A side of equilateral triangle A is three times the length of a side of equilateral triangle B. How many B triangles will fit into triangle A?



19. 9 triangles

### Assessment item treasure hunt





### Assessment item treasure hunt

- Using the NumberSense Workbooks for your grade:
  - Identify questions that assess:
    - Application
    - Reasoning

### Reflection



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- What are the issues:
  - Different children on different books – can they do the same assessment?
  - How do you test concepts/topics?

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