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- features and properties of an object in relation to measurement

1. Time

- Vocabulary and knowledge learners must acquire
- Measurement concepts and skills
- The process of teaching and learning mathematics
- Informal measurement of time
  (Non-standardised measuring)
- Formal measurement of time
  (Standardised measuring)

2. Length / Distance

- Vocabulary and knowledge learners must acquire
- Difference between length and distance:
- Informal measurement of length / distance
  (Non-standardised measuring)
- Formal measurement of length / distance
  (Standardised measuring)

3. Mass / Weight

- Vocabulary and knowledge learners must acquire:
- Difference between weight and mass
- Informal measurement of mass / weight
  (Non-standardised measuring)
- Formal measurement of mass / weight
  (Standardised measuring)

4. Capacity / Volume

- Vocabulary and knowledge learners must acquire:
- Difference between capacity and volume:
- Informal measurement of capacity / volume (Non-standardised measuring)
- Formal measurement of capacity / volume (Standardised measuring)

5. Perimeter / area

- Vocabulary and knowledge learners must acquire:
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CHAPTER 1
How foundation phase learner learn mathematics

The meaning of the concept 'mathematics'.

Mathematics tells us a story of people around us. It gives us the knowledge to know how people trade, what the time is, what is distance.
The language of mathematics consists of numbers, symbols, shapes and images to communicate our thoughts.
To live a quality life we need to have mathematical knowledge to function every day.
Numeracy is a big part of our daily lives and includes addition, subtraction, multiplication and dividing.
Being numerate means to understand the basic number facts and to be able to perform basic number operations. These skills will enable children to understand the way the world works and how to use mathematics to be productive.

The concept of a constructivist approach to mathematics in the Grade R classroom.

The constructivist approach implies that a child learns best with hands on practical experience and activities that challenge them to make sense of mathematics and to understand the concept of mathematics.
This means that the constructivist approach implies that children should learn mathematics through their senses and movements like climbing, kicking, jumping etc. The basis of this approach is discovery and curiosity. Learners should engage in mathematics through concrete experiences rather than being taught by teachers.
The goal of teaching the constructivist approach is to help learners become critical thinkers who are experts in mathematics.

Advantages and disadvantages of Whole-class teaching

Whole-class teaching	
Advantages	**Disadvantages**
Effective use of time	Learners may find mathematics boring and passive.
Better control over learners behaviour	Information taught by the teacher is easily forgotten by the learners
Teachers can ensure that correct strategies and methods are learned by learners	Learners do not think for themselves
Teachers can ensure that lessons outcomes are achieved successfully	Learners may experience a lack of understanding

Advantages and disadvantages of Small-class teaching

Small-group teaching	
Advantages	**Disadvantages**
Motivated learners	Time consuming
Learners remember information taught by teacher better (concrete understanding)	Maintaining discipline in the class can be challenging
Creativity is encouraged	Detailed planning is required
Learners develop autonomously	No interruptions allowed
Assessment can be effectively done by the teacher	Teacher must be aware of all levels of abilities amongst learners

5 strands of mathematical proficiency

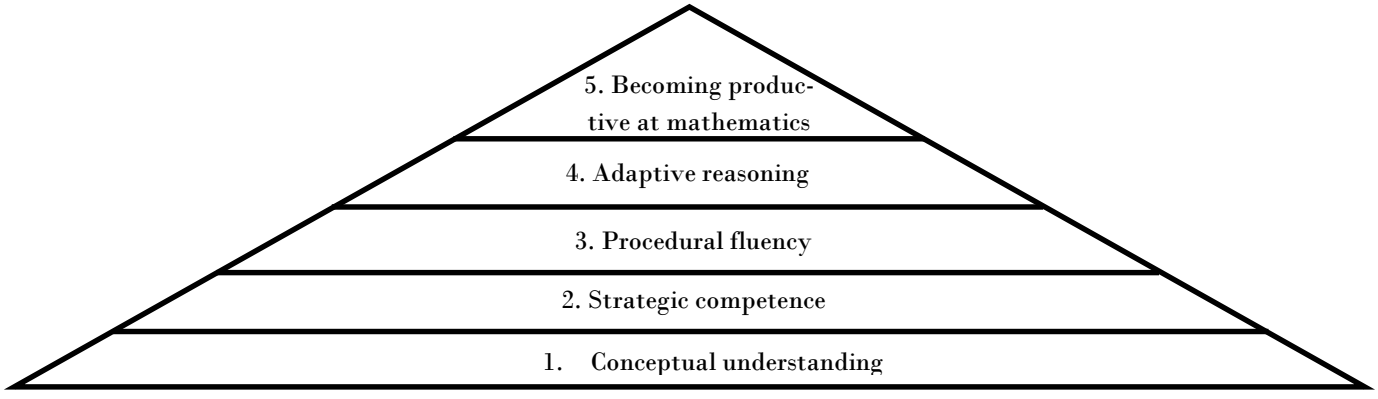
1. Conceptual understanding – learners can do the following:
   - Recognise concept and name it
     cube  & square 
   - Know facts and apply facts correctly to the concept
     A cube `has sides, angles and faces that will always be the same size
   - Use symbols signs and words to explain a concept
     A cube is a 3D shape made of a 2D shape (square)
     Height x Length x Width = Volume
   - Manipulate to represent the concept
     Draw a cube from scratch

2. Strategic competence – Learners flexible with numbers and can perform the following
   - 15 = 1 ten and 5 units
   - 15 = 3 x 5
   - 15 = 7 + 7 + 1
   - 15 = 8 + 8 – 1

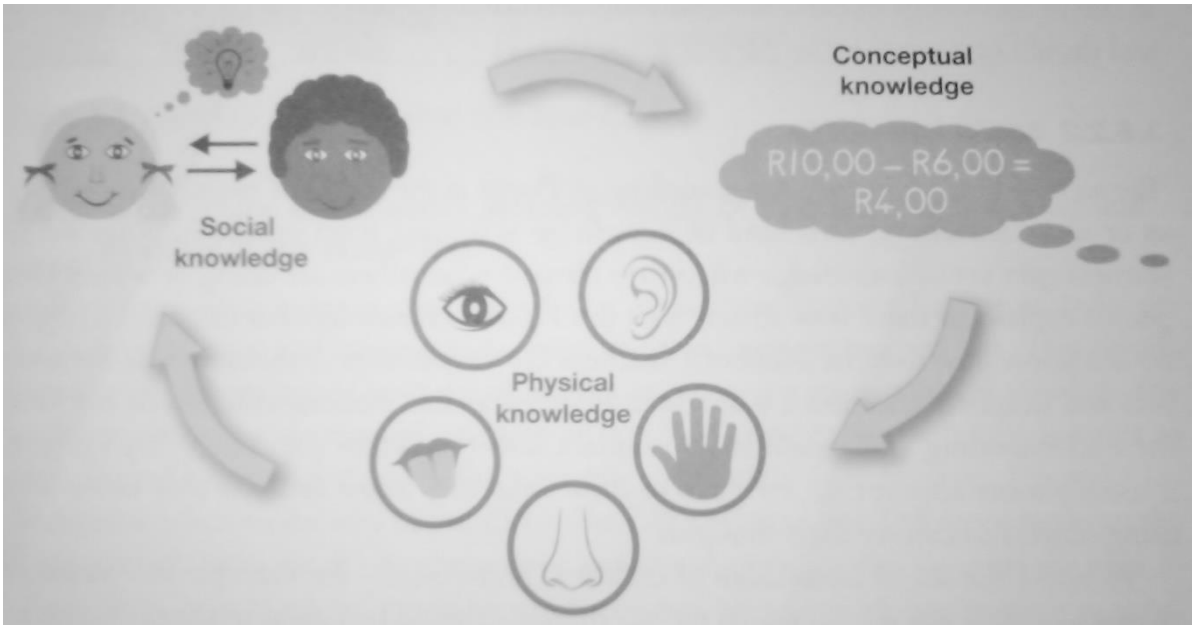
3. Procedural fluency
   Knowing basic number operations - + x ÷ mentally or by writing

4. Adaptive reasoning
   To be able to think about a sum and explain how and why.

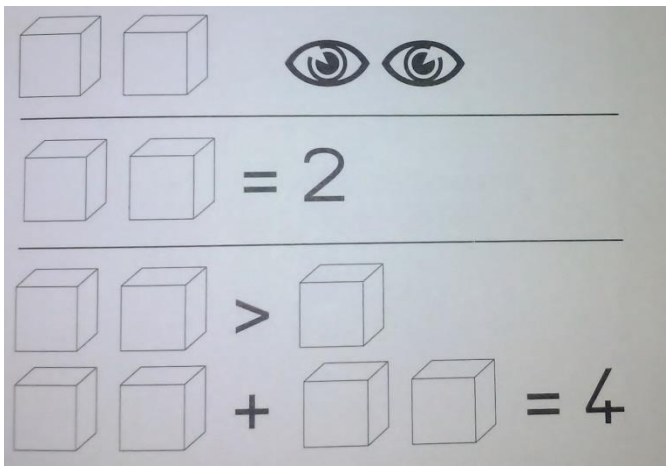
5. Becoming productive in mathematics
   Self-efficacy – to believe in their own mathematical abilities and to have the confidence to try and succeed.



Jean Piaget 3 kinds of knowledge



1. Physical knowledge
   Learners must discover and explore through their senses as well as manipulating objects through play and activities.
   Concrete objects and activities will encourage physical knowledge.
2. Social knowledge
   Knowledge acquired through personal experiences. This knowledge is learnt from others by observation of what other do and say. Learners know the names of shapes because they learnt it from their teacher.
3. Conceptual knowledge
   This knowledge can only be constructed internally by the learner himself or herself. Once learners has acquired this knowledge they are able to reflect and verbalise what they know and how they know it.



Physical knowledge

Social knowledge

Conceptual knowledge

Each picture depicts the kind of knowledge that learners acquire when involved in mathematical tasks

CHAPTER 2

Teaching mathematics to culturally diverse learners

Definition of diversity

To include any variety of humankind

Influence of culture on education

Cultural factors influencing teaching and learning process in the mathematics classroom.

1. Socialisation:
   Teachers are responsible to equip learners with the knowledge, values, language and social skills to integrate in society. Handling money should be taught at an early age, otherwise the learner will have a big disadvantage
2. Communication:
   Different cultural groups may speak different languages. Non-vcerbal communications is largely culturally determined and can have a big effect on the communication and understanding between the learner and the teacher.
3. Learning preference
   The way in which a child learns is influenced by his/her culture. That is why teachers must plan all lesson to accommodate all learning styles.
4. Social values
   Values can differ from one culture to another. Conflict may arise when values are not understood or frowned upon and this can have a big effect on learning in the classroom.
5. World views
   This refers to how a certain cultural group's view is on people and events. These learner who are similar in such ways will develop similar ways of learning.

Guidelines for effective communication in a culturally diverse classroom.

Effective communication between teacher and learner requires much planning, skills and patients. The following list will help teachers to minimise the barrier to communication.

1. Listen
   Teachers must listen for words, meaning and never jump to conclusions. Listening to a learning speaking in their second language will require high concentration, Verbal and non-verbal messages should be listened to.
2. Check perception
   The teacher should check that the learner perceptions are clear and correct.
3. Seek feedback
   The teacher must request feedback to check that what has been said is understood.
4. Resist judgemental reactions
   Teachers should always avoid making stereotypical comments.
5. Develop self-awareness
   A teacher should be aware of his or her communicating style and improve where needed.

The Pygmalion effect

This is also known as the self-fulfilling prophecy.
This effect happens when teachers form certain expectations about a learner's behaviour and academic abilities and in turn can effect these learners positively or negatively.
Teacher form expectations on the following basis:

- Impression on meeting a learner
- Quality of school work
- Gender
- Home language
- Socioeconomic background
- Previous teacher and parent discussions
- School records
- Previous contact with older brothers and sisters
- Physical appearance
- Social class

The teacher with expectations will go through the following phases, as stated by Brophy and Good (1973)

- Phase 1
  The teacher forms expectations about the learner by means on the above mentioned basises.
- Phase 2
  As a result of these expectations the teacher will interact differently towards each learner.
  Positively expected learners are praise and called upon more often.
  Negatively expected learners are given less attention and time to answer questions.
- Phase 3
  Learners are sensitive to the different ways the teacher interacts with them. This will eventually effect the learner's behaviour and academic performance negatively or positively and have a great effect on his/her self-esteem.
- Phase 4
  Over time, each learners expected performance come to conform to the teachers expectations.

The effect of negative teacher expectations on learners:

Low expectation learner are...

- seated further back in the classroom
- given less attention verbally and non-verbally when communicating
- called on less often to answer questions
- given fewer clues and hints
- criticised more often
- praise less frequently

Strategies for valuing learners

- Every learner can succeed
  This teacher will send out clear and positive messages to the whole class and believes that all learners can and will succeed.
- Praise learners
  Effective praise should...
  - be followed by an explanation of why he/she is praised
  - be specific
  - be communicated verbally and non-verbally (with a smile)
  - be communicated to a parent, peer or guardian.
  - Link to the learners past performance
- Be inclusive
  Teachers should consider attributes of learners that can help them at school.
- Establish trust
  The classroom must make learners feel safe to express their thoughts and feelings
- Use language carefully
  A teacher must be careful of using put-down words as they do hurt.
- Cooperation
  Learners must not feel that they should compete for attention, materials, space or friends as this can lead to poor cooperative skills and group work.

Planning guidelines for working with learners with barriers to learning:

- Gather information regarding the learners barrier or learning difficulty
- Seek assistance or advise from other teachers or specialists
- Use specialised equipment like large print so the learner can function to an optimal level
- Remove physical and psychological barriers that will limit the learners learning abilities

CHAPTER 3
Teaching mathematics in Grade R: a play-based approach

The 6 types of play through which young learners discover mathematics.

1. *Exploratory (heuristic) play*

   This type of play is when a child explores the possibilities of objects. Children are naturally inquisitive and will explore and unfamiliar object by using their senses. Teachers need to create an environment which is safe for children to explore and satisfy their curiosity needs.

   Mathematic discoveries taking place during exploratory play:

   - Problem solving
   - Classifying

2. *Construction play*

   This type of play focuses on creating, reasoning and problem solving.
   Children need to use available resources in their surroundings to determine what they want to achieve (solving the problem), what they will use (creating) and how they will do it (reasoning).

   Mathematic discoveries taking place during construction play:

   - Creating
   - Reasoning
   - Solving problems
   - Shapes

3. *Creative play*

   Children are naturally creative. The environment must be inviting for them to feel they can use and create new things and ways.
   Creative play can promote mathematics like patterns, colour, shapes, sequence, classification etc.

   Mathematic discoveries taking place during creative play:

   - Exploring patterns
   - Shapes

4. Physical and locomotor play

There are so many ways that mathematical concepts can be explored through physical play. These activities must be done outdoors as there will be enough space for the child to move from one place to another (locomotor play), as well as moving in the same spot (non-locomotor play). Mathematical concepts are evident in locomotor play, like counting, ordinal counting, seriation etc.

Mathematic discoveries taking place during physical/locomotor play:

- Distance
- Time
- Problem solving
- Counting

5. Fantasy play

Fantasy play is when the child uses his/her imagination to portray their understanding of the world. Mathematical exploration from past experiences may exercise mathematical concepts like, measurement, adding and subtracting (playing with money), counting, estimating etc.

Mathematic discoveries taking place during fantasy play:

- Measurement and estimation
- Counting
- Real life mathematical concepts like working with money

6. Word play

Mathematical chants, poems songs and rhymes are an excellent way of learning words and vocabulary.

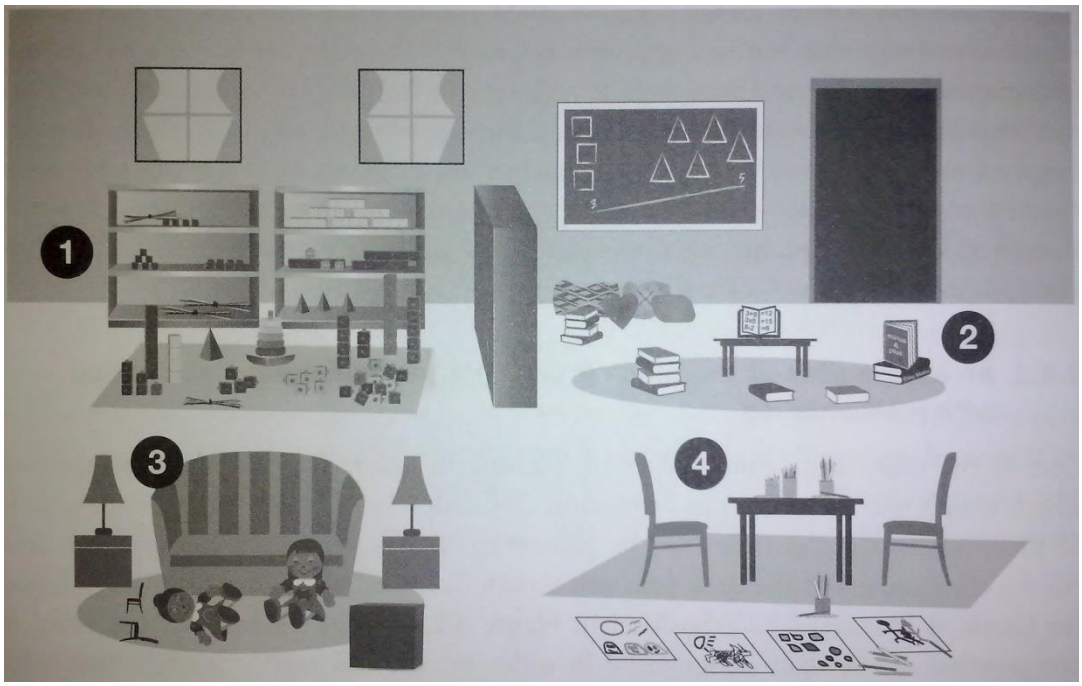
Mathematic discoveries taking place during word play:

- Mathematic vocabulary
- Counting

Components of the Grade R daily programme and the relationship of mathematics to each of these components.

Grade R daily programme	
Components	**Relationship to mathematics**
Arrival and free play	The classroom should be setup for free play when the children arrive. Learning opportunities to discover maths would be • number & word recognition • Patterns • Space and shapes • Writing experiences • Measurement • Counting
Register, Calendar work and birthdays	During register time, children gather on the carpet in their divided groups and have the opportunities for the following maths discovery to take place: • Counting • Subtraction • Addition • Number recognition • Time
Teacher-guide mathematics activities	These outdoor/indoor lessons are planned according the curriculum. These activities include the following mathematic discoveries: OUTDOORS: • Positions (up, down, left, right, over) • Time and distance • Number recognition • Space and shapes INDOORS: • Patterns • Shapes • Number recognition
Art activities (creative play)	Art is a great way for a child to put his/her views through visual art. Art lessons also have great opportunities for mathematic discoveries like: • Number concepts • Patters and repeated patterns • Measurement • Sorting • Classifying
Routine activities	Routine activities are not classified as play-based activities, but rather as regular and specific activities done during the day like toilette break, washing hands etc. Although children still learn mathematics while doing these basic activities. They can still discover: • Classification and sorting while tidying up • Seriation, patterns and ordinal counting while going to the bathroom • Counting while setting the table and serving of food
Language activities	Language activities create opportunity to build a child's mathematic vocabulary. Children can experience the following: • Measurement of time • Number recognition (visually and through hearing) • Maths vocabulary • Counting through listening to poems, songs and rhymes
Music and movement (creative play)	Music and movement will usually be guide by a teacher, but is obviously creative. Children experience the following mathematic discoveries: • Beginning of fractions by counting and holding notes • Counting notes • Patterns by using different parts of their bodies to produce a certain beat.

Setting up a classroom for mathematical discovery



1. Shelf for wooden building blocks, toys to supply opportunity for construction play
2. Paging through mathematical books, supplies opportunity for word play
3. The doll corner supply opportunity for fantasy play
4. Drawing supplies opportunity for creative play

CHAPTER 4
Teaching mathematics in Grade R: a play-based approach

Section A
Counting

Cardinal number / Cardinality
Cardinality is used to express quantity, but not order
Ordinal numbers / Ordinality
Ordering numbers in a certain sequence (first, second, third)

Counting principles

- Stable order principle
  Number words will always stay in the same order (1,2,3,4,5,6,7,8,9,10)
- One-to-one correspondence
  The idea that each object counted will represent one and only one.
- Cardinality
  The total number of objects is the cardinal number. The cardinal number shows quantity and not order.
- Order irrelevance principle
  Learners must understand that it does not matter where they start counting, as long as each object is only counted once. (23,24,25,26)
- Movement is magnitude
  When counting, you move up with the counting sequence and the quantity will increase. (counting in 1's - 1,2,3,4,5 or counting in 2's – 2,4,6,8)
- Abstraction
  Quantity can be represented verbally, without the use of concrete objects to represent a number.

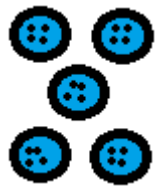
Section B
Order, compare and describe whole numbers

Anchoring numbers 5 and 10 referring to the following types:

1. Concrete

   The use of physical objects, such as counters, beads, beans, fingers and more to represent quantities.

   Example of using buttons as counter, anchoring 5 and 10



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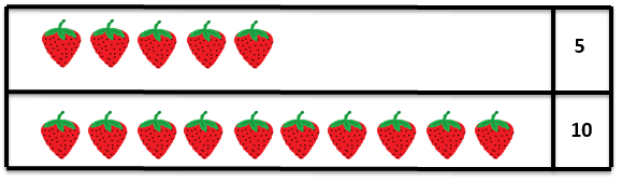
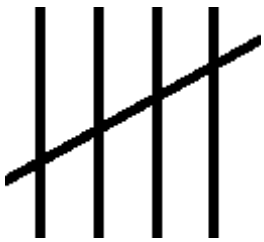
2. Semi concrete

   When learners has grasped the idea and methods of counting with concrete materials they move on to using pictures as representatives for quantities.



3. Semi abstract

   Now learners start to use figures to represent numbers dots or tallies



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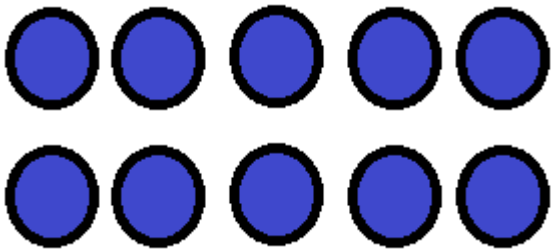
Or



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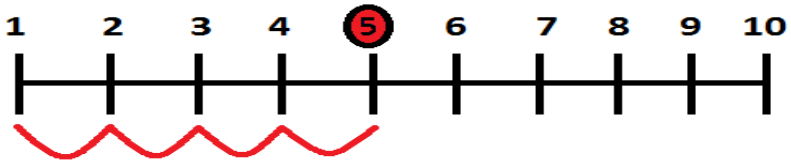
4. Abstract



When learners start using numbers. Because of the learner's conceptual understanding of quantity, he/she now realises that the number 5 represents five dots, lines etc.

Section C
Teaching four basic operations in mathematics through problem-solving

Properties of addition

Properties	Mathematical meaning	Meaning to learners
Identity element: Zero is the identity element of addition	For any whole number x. $x + 0 = x$	When I add 0 to a number, the answer is that number. $9 + 0 = 9$
Commutative: Addition is a commutative operation	For any whole number x and y. $x + y = y + x$	I know that $4 + 5 = 9$ and $5 + 4 = 9$
Associative: Addition is an associative operation	For a whole number x, y and z. $(x + y) + z = x + (y + z)$	If I have to solve the problem $8 + (2 + 5)$, then it is easier to add $(8 + 2) + 5$. Either way, it's the same

Properties of subtraction

Properties	Mathematical meaning	Meaning to learners
Identity element: Zero is the identity element of subtraction	For any whole number x. $x - 0 = x$	When I subtract 0 from a number, the answer is that number. $9 - 0 = 9$

Properties of multiplication

Properties	Mathematical meaning	Meaning to learners
Identity element: One is the identity element of multiplication. Zero multiplied by any number is zero.	For any whole number a. a X 1 = a For any whole number a. a X 0 = 0	When I multiply a number by 1, the answer is that number. When I multiply a number by 0, the answer is zero
Commutative: Addition is a commutative operation	For any whole number a and b. a X b = b X a	I know that 4 X 5 = 20 and 5 X 4 = 20
Associative: Multiplication is an associative operation	For a whole number a, b and c. (a X b) X c = a X (b X c)	If I have to solve the problem 4 X 16 then it is easier to rename the 16 = 2 X 8. (4 X 2) X 8 = 4 X (2 X 8) The product stays the same
Distributive property of multiplication over addition: Addition is an associative operation	For a whole number a, b and c. a (b + c) = a X b + a X c	If I have to solve the problem 5 (2 + 8) I have to multiply first, before I add: (5 X 2) + (5 X 8) This is important, otherwise my answer will be wrong

Properties of division

Properties	Mathematical meaning	Meaning to learners
Identity element: One is the identity element of division	For any whole number x. x ÷ 1 = x	When I divide a number by 1, the answer is that number. 9 ÷ 1 = 9

Read through Basic operations pg. 106 – 113 to understand the different interpretations of different - + X and ÷ problems sums

Section D
Place value

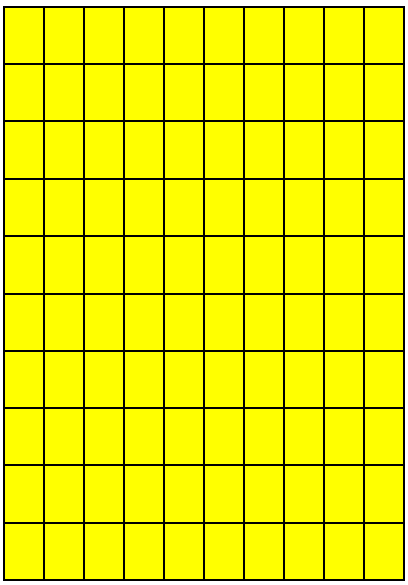
Preparation for understanding place value:
It is important to help the learners understand the concept that 10 objects are grouped to become 1 object.

For a complete understanding of place value it is better to read through pg. 116 – 123 as most of the information is examples and pictures.

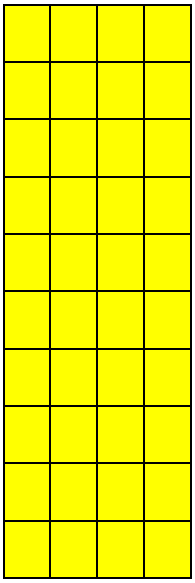
The following calculation using the above base ten model. 144 x 3 =
Base ten concepts is one of the most popular ways to help learner gain a concrete sense of place value.
First 144 will be broken up into hundreds, tens and units.
144
100 – Hundreds
40 – Tens
4 – Units

The calculation will be as follow:
144 x 3 = **432**
100 x 3 = 300
40 x 3 = 120
4 x 3 = 12
300 + 120 + 12 = **432**

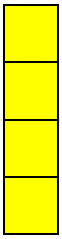
Dienes blocks layout:



100 x 3



40 x 3



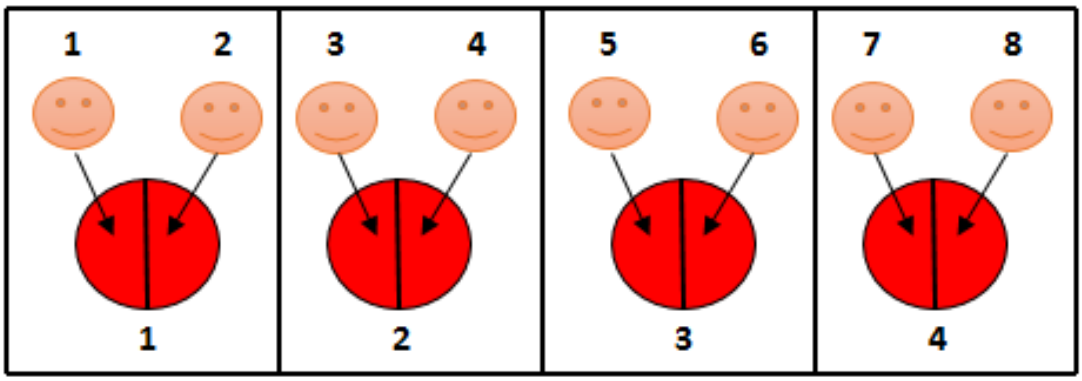
4 x 3

Section E

See pg. 124 - 130

Section F
Fractions

There are different models that one can use to do fractions



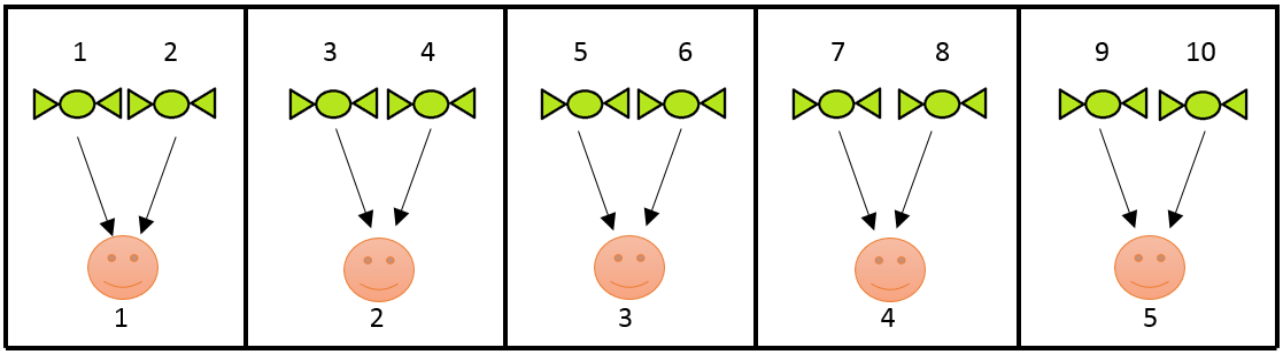
One area model

1/1									
1/2					1/2				
1/4			1/4		1/4			1/4	
1/6		1/6		1/6	1/6		1/6		
1/8		1/8		1/8	1/8	1/8		1/8	
1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10

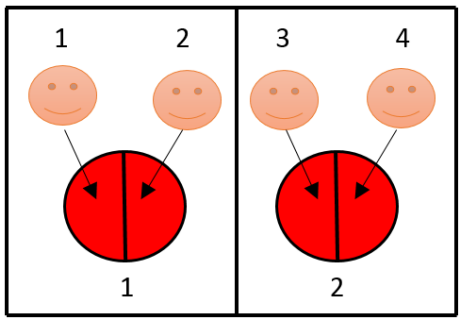
One length model

Partitioning:

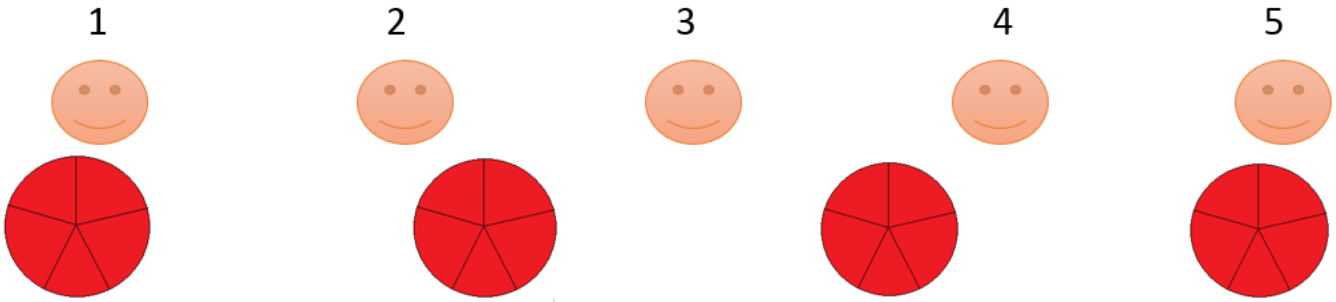
- Sharing simple quantities like 10 sweets between 5 learners = 2 sweets each



- Sharing 2 pizzas among 4 learners = ½ a slice of pizza each



- Sharing 4 pizzas among 5 learners = 4/5 slices of pizza each

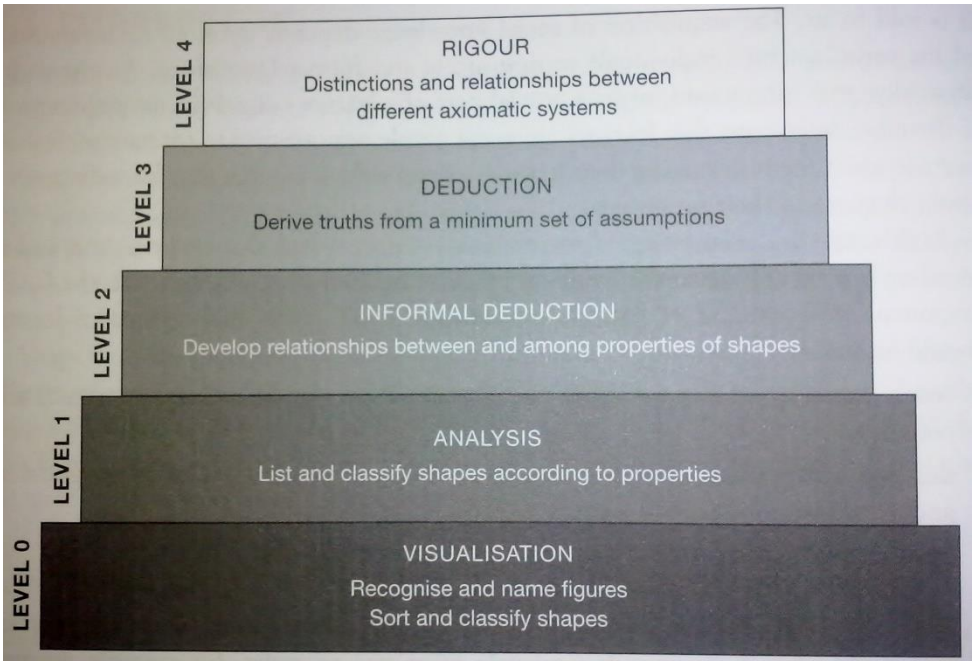


See pg. 130 – 138 for more lessons, exercises and methods

CHAPTER 6
Learn about space and shape in the foundation phase

Van Hiele's level of geometric development

According to Van Hiele there is a sequenced structure that all children develop their mathematical thinking in geometry. Movement from the one level to the next, does not depend on age, but mathematical experience.



Definition of space

Space can be defined as position and movement such as inside, outside, on top, behind as well as left and right.
Regarding the movement of an object, there are three – translating, reflecting and rotating.

Definition of shape

Shape can be described as a geometric figure such as a square, triangle or a rectangle. A shape has physical features such as points, lines and curves

Properties of shape

When learners sort and classify shapes, they learn to identify the differences and similarities between shapes.
The features and attributes of shapes include the following:

- Straight or curved sides
- Flat or curved faces
- Number of angles and sides
- Parallelness
- Symmetry

Vocabulary when describing the properties of a shape:

- Edge – where only two surfaces meet
- Face – A 2D part of a shape (surface)
- Vertex – where three or more edges or faces meet (corner)
- Base – the flat part that the shape stands on.

Creating with shape

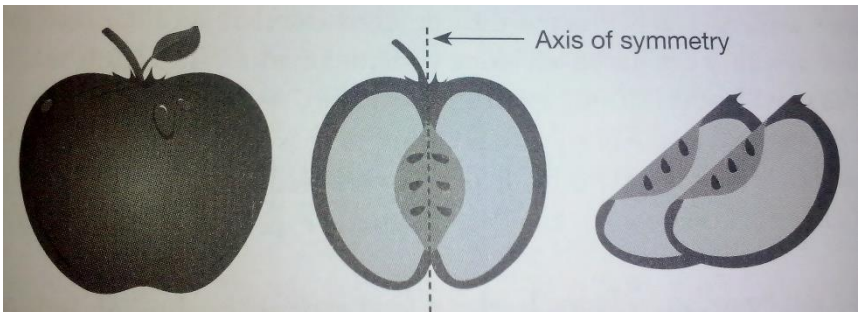
It is important that learners are given the opportunity to create with shapes, as this will help develop a deeper knowledge and understanding of shape.
The following are examples of assisting learners to create shape:

- Making body shapes – Forming shapes with one or more bodies.
- Walk the shape – illustration of a certain shape by walking and drawing a line in the sand.
- Building or modelling with shapes – build a 3D shape out of tooth picks and jelly tots

Symmetry

When a shape has *line symmetry* it means the one side of the shape can mirror the other side.

The line that me draw through a picture or object to indicate symmetry is called the *axis of symmetry*.



The following exercises can help learners understand the concept of symmetry:

- Using a mirror – hold a stick to indicate the body's symmetry. Learners should realise that they are symmetrical from left to right, but not from top to bottom.
- Body symmetry – Learners trace around each other's bodies on large paper. Folding these pictures in half can assist with understanding symmetry.

Amount of Sides	Name of shape
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
11	Hendecagon
12	Dodecagon
13	Tridecagon
20	Icosagon

CHAPTER 7

Learning about measurement of

1. Time
2. Length / distance
3. Mass / Weight
4. Capacity / Volume
5. Perimeter / Area

Learners must be made aware of certain features and properties of an object in relation to measurement.
The following Table summarises this knowledge

Properties / features	**Non-standardised**	**Standardised**
Time	Sundial	Minutes (min)
	Sand-timer	Hours (h)
Length / distance	Paper clips	Millimetres (mm)
	Straws	Centimetres (cm)
	Strings	Meters (m)
Mass	Balance scale	Grams (g)
		Kilograms (kg)
Volume / capacity	Cups of water	Millilitre (ml)
	Buckets of sand	Litre (l)
Perimeter	Rope	Centimetre (cm)
	Index cards	Meter (m)
Area	Shape tiles	Centimetre (cm)
	Index cards	Meter (m)

I. Time

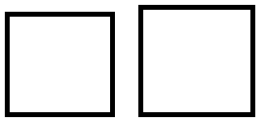
Vocabulary and knowledge learners must acquire:

- Day, night, morning, afternoon
- Late, early
- Longer, shorter, faster, slower
- Yesterday, today, tomorrow
- Days of the week, months of the year
- Hours, half-hours, quarter-hours, minutes

Measurement concepts and skills:

- Direct comparison
  Comparing two objects by putting them next to, on top of or hold separately in each hand to compare mass, size, length etc.
- Indirect comparison
  Comparing two objects by estimation when they cannot be directly compared, example, feather vs. elephant
- Non-standard units
  Inconsistent - Objects that are used for measurement that are not all the same sizes like hands, feet
  Consistent - Objects that are used for measurement that are all the same sizes like straws, paperclips, ice cream sticks etc.
- Standard units
  Worldwide used objects to measure volume, distance, mass etc.
  (Scale – g/kg, ruler – mm/cm, measuring cups – ml)
- Continuous measurements
  When two objects are measured with a piece of string, merely to judge which object is the longest.
- Discrete measurements
  When a measuring tool is used repeatedly to determine the length of an object, example, measuring a table using your hands.

- Conservation
  When an object is moved or rearranged it stays the same size
- Transitivity
  When object A is the same as object B and object B is the same size as object C, then object A is the same size as object C.
- Estimation
  Using visual and prior knowledge to "measure" or compare two objects without using any measuring instruments, example, which is block is the biggest?



The process of teaching and learning mathematics:

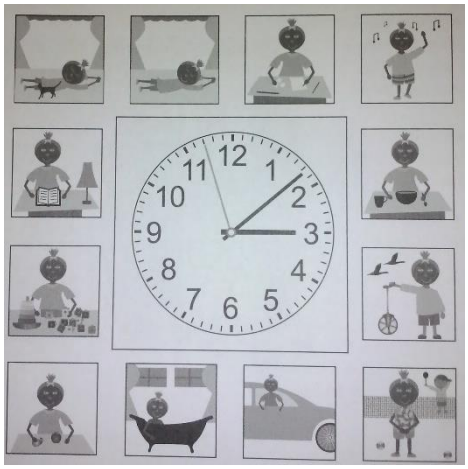
Step 1:
The learner must understand the specific feature that has to be measured
Step 2:
Learners must understand the measurement unit that will be used
Step 3:
Learners must know which measurement strategy to use to determine the measurement.
Step 4:
Learners will use number measurement to develop and solve their own real-life problems.

Informal measurement of time
(Non-standardised measuring)

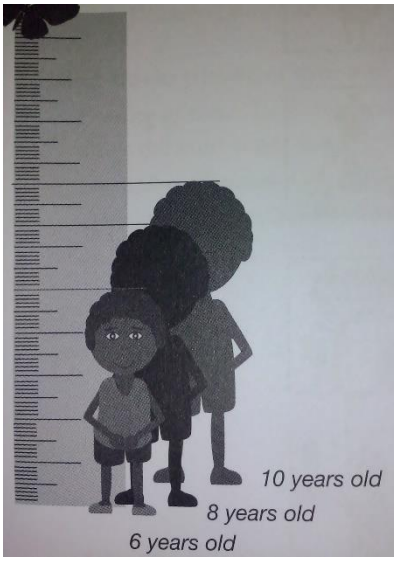
In order to teach children the abstract concept of time, they should first become aware of time in an informal manner.
Activities should use non-standardised instruments to measure the time by comparing and measuring events, sequence of events and the passing of time.

Learners needs to understand the concept of ***sequencing of time*** and a teacher can make use of the following informal measurements of time to grasp the abstract measurement of time:

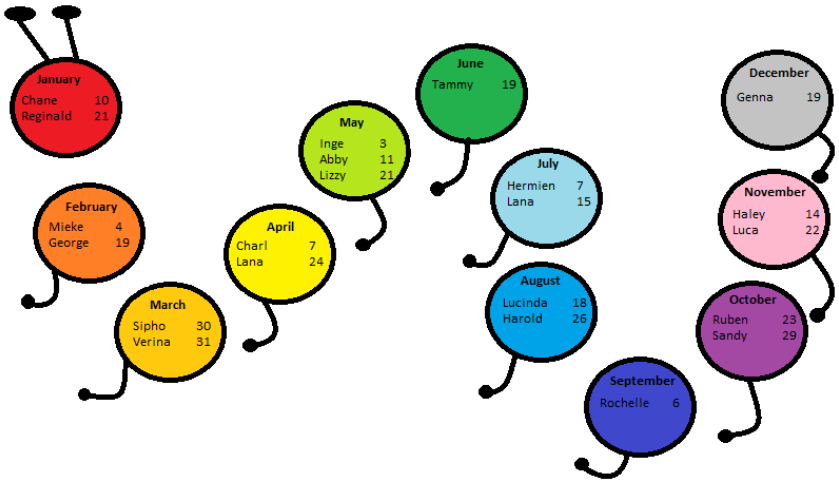
1. A clock with the seasons and the months of the year.
2. A timeline with a clock of daily sequenced activities (waking up, eating breakfast etc.)
3. Timeline by measuring learners on a monthly basis
4. Calendar and weather chart
5. Birthday chart











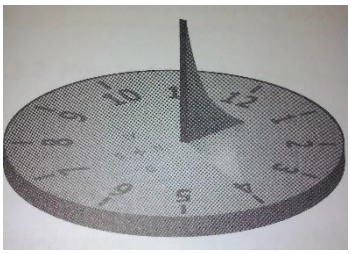
Measuring time

The following non-standardised instruments can help learners to develop a concrete concept of time.

- Sundial

  Passing of time – Observe how the shadows move from start of school to break etc.

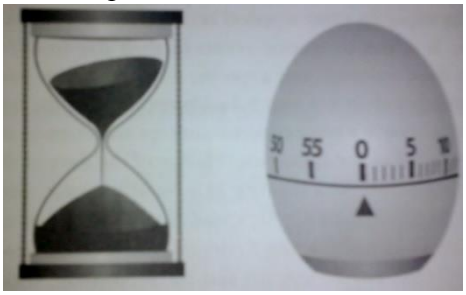
  Duration of events – Compare the movement of the shadows of both breaks during school.



- Sand-timer

  Passing of time – Turn the sand timer over at the start of an event. Count how many times the sand timer was turned around during the event.

  Duration of events – Compare the passing of time between two events by turning the sand timer and counting.

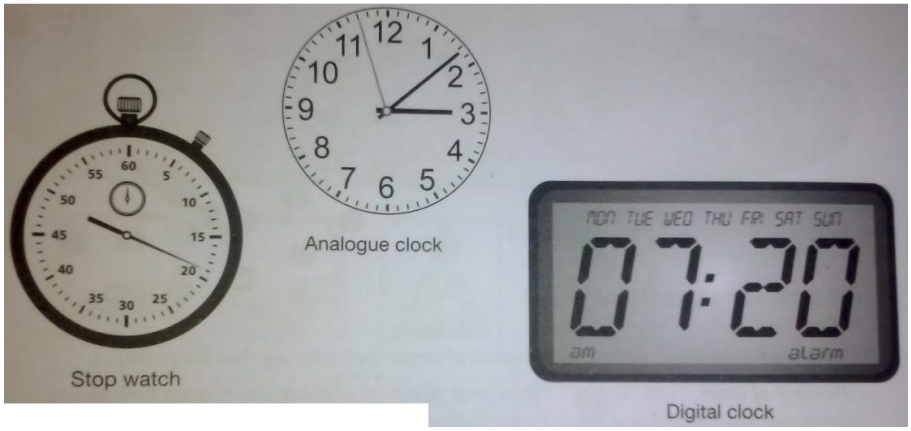


Formal measurement of time
(Standardised measuring)

Formal reading of time needs to be developed by a learners pre-knowledge of time.

Formal measurement of time starts by reading the hours, half-hours, quarter-hours, minutes and seconds on an analogue clock.

The number line and the circle shape divided into halves and quarters have proven to be a valuable resource. Thereafter the link between the analogue and the digital clock can be made.



How to teach the reading of time on a clock

When teaching time it is very important to link prior-knowledge and link it to the following concept to be taught.

- Link time to counting to 12
- Teach the position of the hour on the clock
- Understand that the short arm indicates hours on the clock
- Teach half-hours by linking it with fractions
- Teach quarter-hours by linking it with fractions
- Understand that the long arm indicates half-hours and quarter-hours
- Teach that hours, half-hours and quarter-hours can be broken down into minutes
- Link minutes with counting in 5's up to 60 and show that 60minutes = an hour
- Make the connection between the analogue and the digital clock

2. Length / Distance

Vocabulary and knowledge learners must acquire:

- Longer, shorter
- Taller, wider, narrower
- meter, centimeter

Difference between length and distance:

Length:
How long an object is from one end to the other
Distance:
The length of space between two points or two objects

Informal measurement of length / distance (Non-standardised measuring)

Teaching learners to grasp the concept of measuring length and distance can be challenging and concrete activities will allow for these mathematical concepts to come naturally. Concrete activities to promote the learning of length and distance must supply opportunity to measure with non-standardised instruments such as:

- Hands
- Feet
- Strings

The concept of measuring length and height should start with continuous measurement activities:

- Measure each other
- Sort the class from shortest to tallest
- Measure tables and books with hands

Teaching the concept of measuring distance can be the following examples:

- How many steps from A – B (desk – chair etc.)
- What is the closest? Ball or rope

Formal measurement of length / distance (Standardised measuring)

Teaching learners the concept of measuring distance and length with standardised instruments is the same as teaching informal measurement, but the focus is to measure with a ruler, correctly when measuring formally. Learners will first observe that short lengths are measured in cm's and linger lengths with a tape measure, using m's.

Concrete standardised measuring instruments for measuring length:

- Ruler
- Tape measure

Teaching learners to measure distance with formal measuring instruments can include the use of an Odometer and a measuring wheel.



Bicycle odometer



Car odometer



measuring wheel

3. Mass / Weight

Vocabulary and knowledge learners must acquire:

- Light, heavy
- lighter, heavier
- kilograms, grams

Difference between weight and mass

Weight:
The force of gravity acting on an object. Measured in newton (N)
Mass:
The amount of matter in an object. Measured in kilograms (kg)

Informal measurement of mass / weight (Non-standardised measuring)

Learners should start their knowledge of the concept, mass, by becoming aware of objects mass, for example heavy or light
Concrete activities of mass will include the following:

- Holding two objects and, concluding the lightest and the heaviest, then putting both on a balancing scale to test their theory.
- Holding two objects and describing the difference in mass.

Non-standardised measuring instruments for concrete activities can include:



- Balancing scale
- Using one's hands to compare mass

Formal measurement of mass / weight (Standardised measuring)

Formal measuring of mass can only continue once the learner has developed the concept of informal measuring of mass.

Standardised measuring instruments:



Bathroom scale



Kitchen scale

4. Capacity / Volume

Vocabulary and knowledge learners must acquire:

- More than, less than
- Full, empty, half
- liter, milliliter

Difference between capacity and volume:

Capacity:
The amount a container can hold. A cup has capacity because it can hold a certain amount

Volume:
The amount of space an object takes up. It is a three dimensional concept. A cup has volume as it takes up space.

Example to clarify the difference:
A brick has volume, but no capacity.
A brick takes up space (volume), but cannot hold anything.

Informal measurement of capacity / volume
(Non-standardised measuring)

The concept of measuring capacity and volume should start with continuous concrete activities:

- How many cups can fill a jug (capacity activity)
- How many bricks can fit into a box (volume activity)

Formal measurement of capacity / volume
(Standardised measuring)

Formal measurement of capacity involves the knowledge of capacity of standardised measuring instruments, for example:

- Cup = 250ml
- Teaspoon = 5ml
- Jug = 1 liter

Examples of standardised capacity measurement activities:

- How many ml fills a jug – 4 cups (250 x 4) = 1 liter
- How many jugs will fill up a 5 liter bucket – 5 jugs (1 liter x 5) = 5 liters

Learners must realise that smaller quantities are measured in ml and bigger quantities in liters.

Informal volume measurement needs to be understood completely as the formal measurement of volume includes the use of formulas
(height x length x width)

5. Perimeter / area

Vocabulary and knowledge learners must acquire:

- Longer, shorter
- More than, less than
- Meter, centimeter

Difference between perimeter and area:

Perimeter:

The distance around a three dimensional object or a two dimensional shape

Area:

The measurement of a flat surface (inside the perimeter) of a three dimensional object or two dimensional shape.

Informal measurement of perimeter / area
(Non-standardised measuring)

Continuous concrete activities will supply opportunity to understand the measurement of perimeter.

Concrete activities include:

- Using a string to measure the perimeter of a book

Concrete activities to exercise measuring area with non-standardised measuring instruments:

- Using 1 cm x 1 cm tiles to fill the space of a square or rectangular object.

Examples of non-standardised measuring instruments:

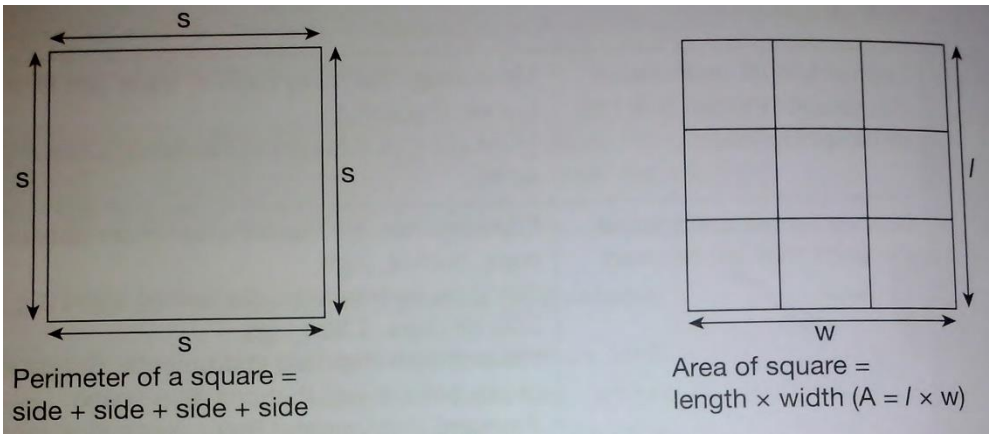
- String
- Square tiles

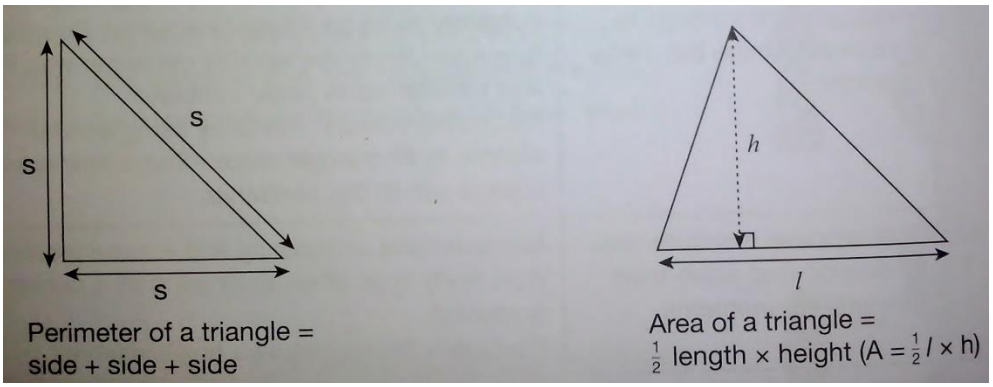
Formal measurement of perimeter / area
(Standardised measuring)

Formal measuring of perimeter and area can only continue once the learner has developed the concept of informal measuring of perimeter and area.

Continuous concrete activities will supply opportunity to understand the measurement of area.
Formal measurement include observing the relationship between shapes, as well as the difference formulae for different shapes in order to be accurate.

Example of these formulae for different shapes:





CHAPTER 8
Data handling

Important definitions for chapter 8:

Classification

To put thing in a logical group

Classifying

Grouping or sorting according to properties such as size, shape, colour, habitat, food etc.

Comparing

To find the relationship between two items, based on a specific attribute. Compare a bear and a lion according to their food = they both eat meat, have sharp teeth etc.

Properties

Attributes according to which an item must be sorted and classified.

Seriation

To put items in a logical series or sequence

Sorting

The process when a large group of items are separated into two or more groups

Animals → 1 – Domestic,
2 – Wild animals,
3 – Farm animals.

<u>Teachers are responsible for</u> helping learners to

- Explore problems
- Asking questions
- Collect data
- What to collect
- Organising data
- Representing data
- Analysis of data
- Interpretation of data
- Answer questions asked.

Data handling requires five steps

Step 1 – Organise data

Sorting of similarities and differences to categorise objects

Step 2 – Represent data

Make a frequency table on Excel or Word

Step 3 and 4 – Analyse and interpret data

Have a data representation that is visible to all learners, so everyone can share and respond on the represented data.

Step 5 – Report data

The teacher must ask questions from a bar chart that represents the collected data. Learners must be able to answer questions related to the bar graph (how many? which is most? which is less?)

Read through this chapter to get a good overview of data handling in the foundation phase and answer the questions at the end of the chapter.

Pg. 236 – 260

CHAPTER 9
Assessment of mathematics

Evaluation:
Making a value judgement about something, according to a specific set of standards.

Assessment:
The process of gathering information to make decisions about the learner.

Five important reasons why we assess mathematics in.
Meaningful assessment must be well planned and have purpose.
There are 5 reasons why teachers should assess mathematics in the foundation phase.

1. *To determine a learners current level of understanding:*
   There are three levels that a teacher can use to determine a child's concept and understanding of mathematics, namely concrete, semi-concrete and abstract. By assessing a child according to their level of development the teacher can determine if the child is able to apply mathematics in various situations. This will enable the teacher to link his/her teaching to the level of the child.
2. *For planning and teaching purposes*
   Mathematics is a structured subject. A student will struggle to move on to the next mathematical concept if he/she does not understand the previous concept. That is why the teachers must know exactly what the level of understanding is of his/her class before planning and teaching the next lesson.
   Assessment will help the teacher make the right decisions regarding teaching methods.
3. *To helps teachers to determine learners with developmental and learning barriers.*
   A teacher can identify a child with learning barriers through assessment information.

When the teacher finds a child has a learning barrier the teacher must refer the child to a specialist. The teacher will then have to have supporting documents to prove his/her findings, like assessments records.
A teacher must be sensitive towards children whose LoLT (Language of Learning and Teaching) is not their home language, because the child might only understand certain concepts in his/her home language and may seem to the teacher as if the child has a lack of understanding and knowledge.
Teachers can determine new and different methods of teaching by revising the child's assessment records and helping the child with barriers to learning so the student can reach their full potential.

4. *To give caregivers guidance and assistance.*
   If a teacher suspects a child to have barriers to learning, assessment records can serve as formally structure information. This information can be given to caregivers as guidance to understand the child's development progress and the child's behaviour.
   Feedback to caregivers is very important as we want them to be involved and informed on the child's progress at school.
5. *To improve mathematical teaching*
   Assessment is a good way of reflecting on the teacher's methods and quality of lessons. This can assist the teacher in adjusting and modifying teaching efforts for more effective results and improvement in their children.

Guidelines to reliable and valid assessments of mathematics:

Rule 1 – Each learner is unique
Rule 2 – Assess the total learner
Rule 3 – Assess the learner in a variety of settings and use of a variety of methods
Rule 4 – Assess both the process and the final answer
Rule 5 – Assessments should be trustworthy
Rule 6 – Repeat assessment to get valid results
Rule 7 – Remain objective
Rule 8 – Know what you are going to assess
Rule 9 – Keep assessments confidential

Assessment methods

- Observation
- Anecdotal records (detailed descriptive)
- Checklist
- Portfolios
- Tests

Definitions of important mathematical concepts:

1.1 *Pattern*

The search for mathematical regularities and structure through auditory, visual and motor discovery and to bring order to an unorganised situation.

1.2 *Core of pattern*

This is the basic string of elements that repeats itself in a patters

Example:

- AAABB-AAABB-AAABB (Core pattern = AAABB)
- 1237-1237-1237 (Core pattern = 1237)

1.3 *Element of pattern*

The element of a pattern is the specific item that is used to create the pattern namely objects, shapes, numbers, letters

Example:

- ABD-ABD-ABD (Elements = letters)
- 123-123-123 (Elements = numbers)

1.4 *Algebra*

Algebra is a content area in mathematics that make use of letters, symbols or characters to represent numbers and to express mathematical relationships.

1.5 *A function in mathematics*

A function is a rule that matches two sets of numbers in a way that for each first number there is only one possible second number value in the order set.

So for every input value there is only one output value. *Pg. 179 to see diagram.*

1.6 *Area and circumference*

Area is when we measure the surface of a two dimensional shape or three dimensional object.

Area is measured in cm^2 and m^2

Circumference is also known as perimeter and measures the distance around a two dimensional shape or three dimensional object.

Circumference is measured in km, m, cm, mm etc.

1.7 *Capacity and volume*

Capacity refers to the amount of something a container can hold.

Capacity is measured in ml, litres etc.

Volume is the amount of space an object occupies and is measured in mm^3 and cm^3