Grade R Mathematics Improvement Programme

Concept Guide



English

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The **Schools Development Unit** (SDU) at the **University of Cape Town** (UCT) is the mathematics technical partner to the Grade R Mathematics and Language Improvement Project. The SDU is a unit within UCT's School of Education that focuses on teachers' professional development in Mathematics, Science, Literacy/Language and Life Skills from Grade R to Grade 12. The SDU offers teacher qualifications and approved UCT short courses, school-based work, materials development and research to support teaching and learning in all South African contexts.

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Foreword from the Head of Department

Dear Teacher/Practitioner

Welcome to the training for the Grade R teachers/practitioners. The Gauteng Department of Education (GDE) has prioritised Early Childhood Development as its Strategic Goal 1. This is to ensure that we can lay a solid foundation and seamless transition of learners to Grade 1.

The Grade R Mathematics and Language Improvement Project has been developed to provide the much-needed classroom-based *support* for the Grade R teachers/practitioners in Gauteng. It is about classroom practices with exciting techniques and methodology most appropriate for Grade R teaching and learning. This is in response to a study that reported that 65% of children across South Africa have not mastered the skills required to be able to succeed in Literacy and Numeracy when entering Grade 1. This project is intended to support the Grade R teachers/practitioners to address this challenge.

The Department's expectation is that you are ready to learn and be a more empowered Grade R teacher/practitioner. Your commitment to the training process and thereafter the implementation of *lessons* learnt in *your* classroom, will contribute to the improvement of Grade R learner readiness for Grade 1.

We trust that this intervention will help enhance your potential, innovation and creativity as you lay an important foundation for learning for our children. This project would not have been possible without the support of our partners. The GDE is grateful for the support of the GEDT, Zenex Foundation and USAID who contributed to this initiative.

I trust you will learn a great deal from this training programme and improve the learning experience of the young children in your care.

Yours sincerely

Mr Edward Mosuwe Head of Department: Gauteng Department of Education 3 June 2020







SECTION 1

Grade R Mathematics Improvement Programme (Grade R Maths)

Introduction

Grade R Maths is an early maths programme for Grade R that is aligned to and extends the content of Grade R Mathematics in CAPS. The Grade R Maths programme:

- is designed to provide a framework for teaching and learning maths in Grade R
- is based on a set of teaching principles that encourage successful learning
- explains the concepts that are important for young children's maths development
- sequences Grade R maths content and gives practical ideas for the classroom
- gives teachers detailed guidance that supports their lesson planning.

The word 'maths' is used in different ways in this book. Here is how it is used and what each term means:

- **maths** is the body of knowledge called 'mathematics' that includes concepts, skills and applications
- Grade R Mathematics is the curriculum in the Curriculum and Assessment Policy Statement (CAPS)
- Grade R Maths is the name of this early maths programme for Grade R
- maths in Grade R is the kind of maths learning that takes place in Grade R.

In this guide, the word 'children' is used to talk about children before they enter Grade R. The word 'learner/s' is used to talk about children in Grade R.

Features of the *Concept Guide* include:

- information about teaching and learning maths
- 'In practice' boxes that give examples of how the principles and ideas in this book could be used with or by learners
- glossary boxes that give the meaning of words that may be new or difficult to understand
- * a glossary list of all the new words used in this book.

Grade R Maths

There are four parts to Grade R Maths:

- * the Concept Guide
- four Activity Guides one for each school term that provide Grade R teachers with weekly suggestions for teaching and learning maths
- * a Poster Book with eleven posters
- * a classroom *Resource Kit* with maths apparatus for individual and small group learning and teaching.



Figure | The Concept Guide



Figure 3 The Poster Book



Figure 2 Activity Guides Term I-4



Figure 4 Resource Kit

You can find more information on each of the Grade R Maths components in this *Concept Guide*.

The guiding principles of teaching maths in Grade R

Grade R Maths encourages an approach to teaching and learning that is stimulating and motivating for learners. Learners will develop the knowledge and skills that they will build on in later grades. Education research in classrooms has highlighted a set of teaching **principles**, which contribute to successful learning. The Grade R Maths programme is built on eight of these principles.

GLOSSARY

principle a general rule that is accepted to be true



Although these eight teaching principles are listed separately, they are all linked.

The next part of the *Concept Guide* takes you through the eight principles on which Grade R Maths is based. Each principle has:

- \star a definition
- \star an 'In practice' box
- more information about the principle.

1. The context principle

Definition

Learning takes place when a situation (or context) is meaningful to the learner. Very often, the best kinds of maths problems involve maths ideas that come from real-life situations. Learners find it easier to explore solutions to problems that they are able to relate to because of their life experiences.



There are opportunities for learning maths in almost all daily classroom and home activities. The challenge for teachers and parents is to be aware of these opportunities and to use them to build on what learners already know.

More about the context principle

Early maths at home

Young children's experiences at home and in outdoor play, lay the foundations for their understanding of important maths **concepts**.

Babies, toddlers and young children use their senses to learn about the world around them. They show an interest in basic shapes, create simple patterns and can learn to count before they come to school. They learn about the world as they talk, eat and play, while acquiring maths concepts at the same time. For example:

- When they try to fit things that are too big into their mouths, they are developing an understanding of size.
- When they use boxes and toilet roll inners to build imaginary cars, they are developing a sense of shape.
- When they try to lift an object that is too heavy to carry, they are beginning to understand the concept of mass.
- When they see similarities and differences between small collections of objects, they are matching, sorting and comparing.

Young children start to form ideas about maths concepts long before they are taught maths at school.

GLOSSARY

concept

an idea or thought. In other words, it cannot be touched. Maths concepts include number, counting, space, addition and subtraction.



The everyday activities of children at home are full of opportunities for early maths. For example:

- during daily routines, e.g. mealtimes, washing, getting dressed and putting things away
- when they use objects, e.g. putting lids onto plastic tubs and cutting with scissors
- as they play, e.g. when they share things, pretend to cook or pretend to drive a taxi
- ✓ when they draw and paint
- ✓ when they imitate adults counting.

These activities build children's self-confidence. At the same time, they develop their knowledge and understanding of the world around them.



Figure 6 Using daily activities to explore maths concepts

Young children's understanding of maths develops over time.

- They learn that numbers have an amount or quantity attached to them that does not change, e.g. when a three-year-old holds up three fingers to show the quantity 'three'.
- They may repeat a series of numbers, e.g. 'one, two, three, six, ten'. When they do this they are copying adults by using counting words without having a deeper understanding of what they mean.

As children play on their own and with other children, and as they **interact** with the adults around them, they start to develop ideas about the concepts of number, shape, space and measurement.

The concepts that children develop at home during their daily activities are sometimes called their 'everyday knowledge'. An example of this is when children put out enough bowls for everyone eating a meal and then put out one spoon per bowl. As they do this, they are learning about one-to-one matching.

GLOSSARY

interact communicate with other people; do activities with other people

Maths in the school context

Many people think maths is just about numbers and doing sums, but this is just one part of maths, called arithmetic. Maths actually includes many different concepts and skills. It also includes different ways of using these concepts and skills. These are called '**applications**'. So when we talk about maths we mean maths concepts, skills and applications.

Children use maths concepts every day even if they don't think of it as doing maths. They apply maths concepts when they fill a cup without it overflowing, know which container to use to fit in all the blocks, go shopping or say how many of something we have.



Figure 7 We all use maths concepts in our daily lives — choosing the right size box.

At school, children build on this knowledge when, for example, they sort objects into groups and then compare the number of objects in each group. Then they learn to count using the correct sequence of numbers and use one-to-one correspondence to find the total number in a collection. This is called 'school knowledge'.





GLOSSARY

applications

different ways of using maths concepts and skills, e.g. checking your change in a shop, counting out your taxi fare, or dividing a packet of peanuts between three friends When children arrive in Grade R, they come with their experiences as well as their understanding and ideas about the world. This is their everyday knowledge. Everyday knowledge will not be the same for all children as it depends on the child's family, community and culture. Everyday knowledge is sometimes called **prior knowledge** and teachers use it to build on what learners already know and can do.

In Grade R, learners should have the chance to explore, investigate and experiment with new ideas. They should also be encouraged to talk with their teacher and other learners about what they are doing and thinking. Learners need the right kind of teaching to help them:

- * think and talk about their experiences using maths language
- build new maths knowledge
- deepen their understanding of maths
- develop a positive attitude to maths.

They need to engage in activities at home and at school that allow them to explore maths concepts, and to see maths as fun and enjoyable.



Figure 9 Counting and one-to-one matching at home and at school

Creating a maths learning environment

Teachers should create a classroom environment in which learners:

- ✓ feel safe and secure
- are confident enough to express themselves
- ⋆ participate in all activities.

The physical environment for maths learning should include:

- resources (such as games, construction materials and puzzles) that are organised so that learners can see what is available and choose what they need to use
- opportunities to explore and investigate
- opportunities for learners to use materials to solve problems and record their solutions
- opportunities for learners to use maths language, like 'more', 'bigger than', 'corner' and also numbers

GLOSSARY

prior knowledge what learners know from before and can already do activities that involve observing, matching, comparing, sorting and ordering.



- Set up a maths-rich area in your classroom. Use a table against a wall so that labels, pictures and objects can be displayed and discussed.
- Arrange the weather chart, calendar, number line (number washing line) and number friezes in this area and use these for daily discussions.
- bisplay the learners' work in this area.
- Encourage the learners to bring items from home for discussion. Add these to the display table and give the learners who brought them an opportunity to talk about them.



2. The activity principle

Figure II The maths area

Definition

The activity principle means learning by doing things yourself. Learners should be actively involved in their own learning. Learning maths in Grade R should consist of enjoyable, hands-on activities that involve everyday objects and meaningful experiences. Wherever possible the activities should provide learners with the opportunities to use their whole bodies and their senses, especially sight, hearing and touch.

GLOSSARY

observing

using our senses to find out about objects, events and attitudes. We need to observe to gather information about the world, e.g. looking and listening carefully to what is happening around us.

matching

identifying the same attribute in two or more objects, e.g. all the yellow objects. Matching is an important skill for learning one-to-one correspondence.

comparing

looking for similarities and differences between two or more objects, e.g. 'these are both animals, but one of them is blue and the other one is red'. Comparing is about finding the relationship between objects based on specific features. This skill leads to the ability to classify objects.

sorting

finding things that are the same, or alike, and grouping them by specific features. First sort by one feature, such as colour, e.g. 'all the green shapes'. Then sort by two features, such as colour and size, e.g. 'all the small, green shapes'.

ordering

lining up three or more objects or events in a sequence, e.g. the daily classroom routine, the learners' morning routine ('after I wake up I get out of bed, wash my face, eat my breakfast ...') or the events in a story Grade R learners should learn to count and order numbers through songs and rhymes, using actions and big movements, such as clapping, jumping and stomping to represent numbers as they count. Rote counting, copying numbers from the board and writing number symbols between lines with a pencil are not the best way to learn about numbers.

Learners should physically look for and pack out collections of objects that they can count and label with number word and symbol cards. They should write number symbols in the sand, form them using Plasticine, paint them, or trace them on their friend's back. This approach is aligned with emergent writing and links the formation of the number symbol with the number name.

When introducing a new number, it is a good idea to connect the number name, symbol, physical actions and collections of objects through a story. This can be done by encouraging learners to count objects in a picture, or to recall the number of things in a story, or they can clap, jump or show their fingers to represent the number in a story.



Figure 12 Children learn in hands-on activities.

3. The play principle

Definition

Play consists of activities that are enjoyable and that promote a child's growth and development. Play has behavioural, social, physical, cognitive and emotional rewards. Play allows learners to be actively involved in their own learning and exploration of their environment. Learning in Grade R should consist of enjoyable, hands-on activities and experiences that make use of many concrete objects and **symbols**.

Learning through play

For children, learning and play are not separate activities. Play can mean many things, such as outdoor physical activities; playing with sand or water; pretend play with friends or alone; playing with blocks and construction toys; or playing listening games, guessing games or card games. Although some play activities need extra time and resources, children often enjoy playing with everyday objects and simple homemade materials. Play is how children learn at home and at school. It is not something that learners do only in their 'free time' or when a teacher is not around.

Learners need many opportunities to:

- explore their environment using their senses, e.g. physical activities done outdoors, such as climbing and running, or games with rules that have to be followed, such as hopscotch and ball games
- investigate and solve problems, e.g. using construction materials to make a tower, or using water or sand to fill containers
- practise what they already know or can do, e.g. playing structured games, such as snakes and ladders or dominoes.

Five types of play

Researchers have identified five types of play that can be seen in all cultures and that support the physical, social, emotional and cognitive development of a child.

- Physical play includes active exercise, fine motor practice and roughand-tumble play. It is important for gross and fine motor coordination and for building strength and endurance.
- Play with objects includes exploring, investigating and experimenting with different obejcts in their world. This develops their thinking and problem-solving skills.
- Symbolic play is when children use a toy, object, picture, drawing or other mark-making to represent real-life objects.
- Pretence and socio-dramatic play involves dressing-up and roleplaying. This promotes cognitive and social development and helps children to manage their own behaviour and thinking.
- Games with rules encourage children to follow the rules of a game, and to learn to share and take turns as well as help one another.

GLOSSARY

symbols

things that represent or stand for something else, such as a number symbol, logo or road sign



Figure 13 Types of play

The play-based approach

The play-based approach to teaching and learning recognises that at times children learn best from free-play activities which are initiated and directed by the child without adult involvement. At other times learners learn best from guided-play activities that are directed by the teacher for the whole class or small groups. A well-planned teaching and learning programme should include a balance of all the different types of play activities.

Learning maths concepts through play

Play often involves children taking on adult roles. For example, they might imitate adults preparing food, or a pilot flying an airplane, or a teacher teaching a class. In these games, they often use objects in their environment and pretend that they are other things, e.g. a wooden construction block 'becomes' a chopping board for chopping vegetables. In this kind of play, children use one object to 'stand for' or represent another one.



Figure 14 A cardboard box can represent a car, a wooden block can represent an apple and stones can represent money.

When children play and draw they use objects and pictures to represent real-life things. This is the beginning of learning that symbols can represent real things. They learn:

- * that a drawing of two people can represent two real people.
- that symbols can represent other things, e.g. '2' stands for two things and this can be two of anything.

- about abstract thoughts and ideas, e.g. printing with a block and talking about the printed shape helps children to recognise the properties of a square.
- how things relate to each other, e.g. some containers fit into each other, some blocks can support other blocks, construction toys have some pieces that fit together, but not all of them do.

There are many other play activities that promote maths learning. Here are some examples.

- When learners use different-sized containers, sand and water to build sandcastles, they explore the concepts of capacity (more/less), size (big/small) and quantity (many/fewer).
- Games, such as hopscotch and skipping, encourage children to use counting and to recognise patterns.
- Children can explore the shape and size of objects by putting objects (such as boxes and balls) in a 'feely bag', choosing one object and describing it.



Plan activities that interest learners and make them curious about maths.

- Encourage fantasy play by starting a game, e.g. place chairs in a row to make a train. Then ask a learner to be at the front as the train driver or on the second or third chair as a passenger. In this way, learners have fun, but also learn concepts such as position and number order.
- Join in and share activities with learners as they play. Show your enjoyment and involvement by thinking aloud and talking about what is happening in the activity, e.g. 'I filled three cups with water – one, two, three. Now I've filled one more so, look, there are four. Look how neatly they are lined up!' Discussion is an important way to teach maths language to children.
- Notice how learners talk about their ideas about counting, combining and sharing during their play, and repeat their findings back to them, e.g. 'You counted out five red beads and then counted out five blue beads. Let's count how many beads you have. That's right, ten beads.'
- Help children to think about symbols during fantasy play. Suggest how one thing might represent another, e.g. 'You could turn that table upside down and use it as your boat.'

4. The level principle

Definition

Skills and concepts build on one another. This is called **developmental progression**. Learners build their knowledge on what they already know and can already do. Good teaching depends on the teacher first finding out what learners already know and understand, and then using activities and everyday situations to build on that to help them learn new knowledge and skills.

GLOSSARY

developmental progression order in which skills and concepts build on one another

GLOSSARY

relate how objects and ideas are connected to each other Each learner in your class will have had different experiences. This means that they are all at different starting points in Grade R. Each learner's prior knowledge is the starting point for what he or she will learn. Learners can use what they know already to learn new maths concepts and skills.



- Plan games and activities that are appropriate for observing learners' prior knowledge.
- Booserve what learners do and say when they play, and how they manage different activities.
- 🖐 Record individual learners' strengths and needs.
- Plan new activities that build on each learner's prior knowledge and current understanding.

More about the level principle

Differentiation

Learners in a Grade R classroom are all a similar age, but they each have individual personalities, needs, abilities, strengths and challenges. They differ in:

- ★ their home experience
- their cultural background
- their socio-economic background
- their language level
- their interests
- their prior knowledge
- * their readiness to learn
- * the pace at which they need to learn
- * the support they need from teachers and others to learn.

Teachers need to continuously observe and record each learner's progress and development in maths. Differentiation means that what you teach and the way in which you teach it needs to take into account the different abilities or developmental levels of your learners.

To use this approach, teachers need to observe each learner during activities and determine what they understand and are able to do successfully, and then use this information to plan activities and support for the learners. Some learners may understand a new idea that is presented in an activity, with just a little support from the teacher. Other learners might need more time, more demonstrations, more examples and more support from the teacher to achieve the same level of understanding.

Consider the example of learners in a Grade R class who are all learning about the same topic – position in space (on/under, in front of/behind).

Some learners will understand the difference between these positions with a little time and explanation from the teacher. They will soon be ready to move on to the next concept – positions in space found in pictures. Other learners may need more time and explanation from the teacher while working on activities. They will also move on to the next concept, but it will take them longer and they will need more support.



You can use differentiation in your teaching by:

- being aware of similarities and differences amongst your learners
- blanning the best way to teach each learner based on their strengths
- changing what is taught so that it takes into account the ability, sensory perceptual skills, prior knowledge, interests and cultural background of all learners
- & adjusting, where necessary, what you expect each learner to have learnt by the end of the activity
- thinking about learners' personalities as well as their abilities when you decide how to group learners so that they can learn from and support each other in their groups
- 🖐 using appropriate activities and resources
- teaching different learners at different rates, e.g. some learners may require more time to complete activities or answer questions than other learners
- busing small group activities so that you can focus on individual learners and provide appropriate support for them if they need it
- planning activities for those learners who need more challenging tasks.

5. The interaction principle

Definition

Learning involves communication and the sharing of ideas. Learners should be encouraged to talk with the teacher and with each other about what they are thinking and doing. Sharing ideas, asking questions and explaining what they are doing helps them to develop their understanding of concepts. It also helps them learn to use maths language with confidence.



- The classroom atmosphere needs to be relaxed so that learners feel free to ask questions and to share their ideas with each other while they are busy solving problems.
- Young learners need to be taught to use maths words correctly so that they can use them to express their ideas and thinking, e.g. learning to describe a ball as 'round' rather saying it is 'a circle'.

GLOSSARY

sensory perceptual skills using your senses to gather information about your environment, for example: seeing, hearing, touching, smelling and tasting



Learners tend to say, 'too small'. Reinforce the maths language by repeating what the learner has said, but use 'too short' instead.

Figure 15 Teachers can quide children to use maths language.

More about the interaction principle

Communication: Active listening and speaking

We learn best when we do something and talk with another person, in pairs or groups. Learners need to develop skills in communicating and need to know how to be part of a conversation. They should learn to listen actively to what the other person is saying, and respond appropriately. This means that they need to be able to:

- ✓ listen to what is being said
- ✓ respond in a way that is appropriate
- take turns in speaking and listening.



Help learners to develop good listening and speaking skills by providing opportunities for them to:

- 🖐 join in a conversation or discussion
- 🖐 listen carefully in a focused way
- 🖐 share or express their thoughts and ideas
- [₩] give responses and feedback
- ✤ ask questions
- 🖐 follow instructions.

When teachers listen to learners actively, learners:

- * are encouraged to share their ideas, questions, problems and opinions
- feel that the teacher is interested in them and cares about whether they understand something
- develop their own active listening skills.

Responding in an appropriate way to something is an important part of communication, and of teaching and learning. When learners get a proper response to their questions or ideas, they believe that their ideas are important and have value. It also models for them how to respond appropriately.



You can respond appropriately to your learners by:

- $\overset{\text{\tiny{W}}}{ up}$ never allowing them to feel they have asked a stupid question
- sometimes repeating a question they ask, so that they know they are being listened to
- & encouraging them to ask clear questions by rephrasing one of their questions, or asking them to repeat it in a different way
- trying to answer their questions in ways that are meaningful to them, e.g. by drawing on what they already know, and/or by using examples from their experience.

The role of language in maths

We all use language to communicate. We use it to share ideas and information, and to describe **abstract** ideas. Language is also important for maths. We need it to describe, understand, question, think, reason, explain and represent maths concepts.

The language of maths includes the words and symbols we use to communicate or share maths ideas or concepts. Sometimes we use everyday language, but maths language is **exact** and specific. You can read more about everyday knowledge and school knowledge on pages 8–11. Here are three examples of this.

- In everyday language the word 'half' might be used to describe something that is more or less shared into two parts of a similar size. However, in maths, 'half' means two parts of a whole that has been divided equally. The two parts are exactly the same size or number.
- In everyday language we might say, 'The teacher is big.' However, in maths we would say, 'The teacher is tall', and measure his/her height, counting 'one', 'two', 'three', and so on as we measure.
- In everyday language we might say that the triangle is a pointy shape. However, in maths we would say that a triangle has three straight sides and three corners.



Figure 16 Maths language is exact.

GLOSSARY

abstract an idea, a thought or a feeling exact precise, accurate

Developing children's maths language

Part of learning new concepts involves learning new language. Teachers need to guide learners as they gradually begin to understand and use new maths language at school and in their daily lives. They need to introduce Grade R learners to the correct maths vocabulary that will allow them to follow instructions, ask questions and express their thinking and reasoning. Learners acquire new language and maths at the same time. As they learn new words, they learn more concepts, then they learn more words and more concepts, and so they become more and more successful in their maths tasks.



Learners who know the meaning of the words 'round' and 'flat' can describe the mathematical properties of objects. For example, through their play they come to realise that round objects roll and objects with flat sides slide. Learners who do not know the terms 'round' or 'flat' can only draw limited conclusions about the objects they explore – boxes slide and balls roll. These learners need to be encouraged to learn the appropriate new language to extend their conceptual understanding and knowledge.



Encourage learners to use their home language as much as possible. This helps to develop their general language abilities and thinking skills. In South Africa, many Grade R learners learn through their second or third language. Maths teaching can help to develop their ability to use these languages if they are given opportunities to talk about what they are doing during maths activities, to share their ideas and to discuss their reasoning.



Learning correct maths vocabulary

Learners need the vocabulary to talk and think about maths concepts. For example, they need to know words such as these to describe:



Figure 18

quantity (a lot, more, many, fewer)



Figure 20

\star shape (round, square)



Figure 22

\star size (big, small)



Figure 19

calculation (add, take away)



Figure 21

 position (first, second, third, last, before, after, between)



Figure 23

 measurement (more, less, long, wide, full, heavy, tall, short, morning, night)

Encourage learners to use maths vocabulary by using it yourself when you speak with them about maths concepts, and by rephrasing what they say into maths language. At the end of each Content Area in Section 3 there is a full list of maths vocabulary specific to the Content Area.





Maths focuses on the relationship between things. Learners need the language to think and talk about these relationships, including:

- ★ comparisons between collections (many, few, more, fewer)
- comparison of size and measurement (big/small, taller/shorter, heaviest/lightest)
- comparison of shape (three sides, four sides, round or curved)
- position in space (in front of, behind, under, next to, between)
- the order of things (first, last, second, next, before, after, between)
- comparisons between the amount of something (more, less, the same).

Understanding and using symbols

Symbols are all around us. The signs that learners see in their everyday environment often have both words and symbols on them. Learners learn that these words and symbols have meaning. For example, symbols show you when to cross the road or how much something costs.

Young children experiment with written symbols through their drawing and early writing attempts. In Grade R, understanding maths language builds the foundation for using maths symbols correctly.

Reasoning and predicting

Learners also need the language to:

- follow and comment on someone else's reasoning
- explain their own thinking and use this to predict what will happen next. They need language to describe a pattern and to say what will come next if the pattern is continued.



Figure 25 A stop sign and the numeral '2' are both symbols.

GLOSSARY

reasoning the thinking behind an idea or statement

predict to say or estimate what will happen in the future



Figure 26 Predicting what shape comes next in the sequence.



To encourage maths language development, learners need plenty of opportunities to:

- 🖐 play
- 🖐 talk about their ideas and reasoning.



Figure 27 Play is an opportunity to use maths language.

Notice how learners use maths language when they:

- 🖐 talk about what they are doing
- & describe their experiences outside of school, e.g. setting the dinner table, playing a game or explaining how they got from home to school
- make up words when the don't yet know the correct maths language for something, e.g. describing a corner as a 'sharp end' or naming 'eleven' as 'eleventeen'
- predict what will happen, e.g. 'The tower will fall over if I put more blocks on the top.'

6. The guidance principle

Definition

Teachers guide learners in understanding new knowledge. They organise the teaching and learning situation to create opportunities for learners to focus on specific tasks and materials so that the learners can explore an idea and share their thinking about a maths problem. Teachers model what to do and ask guiding questions to help learners solve the problem. This is sometimes called **mediation**. Through mediation, learners develop new knowledge, behaviours and strategies for solving problems that they can use in other contexts.

GLOSSARY

mediation

a joint activity where a person who knows more or has more highly developed skills guides others to learn something new



How to use mediation in the classroom

- 1. Identify what concepts and skills the learners already know and plan an appropriate activity.
- 2. Give the learners an activity that focuses on the new concept or skill.
- 3. Model the activity or show the learners how to complete it.
- 4. Give feedback to the learners on what they are doing.
- 5. Give hints or clues to assist learners, but don't provide the solution.
- 6. Prompt the learners by asking questions about what they are doing.
- 7. Encourage learners to ask questions so that they make new connections and discoveries for themselves.
- 8. Give the learners another activity that they complete on their own, using the concept or skill they have learnt. In this activity, they should practise using the new skill or knowledge in different ways. Guide and support them, but in a less hands-on way.
- 9. Give the learners more activities and gradually withdraw your guidance and support, allowing them to do things on their own.

More about the guidance principle

Teaching approaches

Teaching involves using different approaches at different times:

- Direct instruction involves very little discussion. Learners might ask questions, but these are mostly to do with following the instructions. Direct instruction should be a very small part of teaching.
- Guided instruction involves teachers and learners working together to solve a problem or learn a new concept or skill. The teacher gives guidance and support until the learners are able to do the activity on their own. In Grade R Maths this is called a teacher-guided activity.

Structured activities

- Structured activities are teaching and learning activities, often guided by the teacher. They focus on a particular maths concept or skill.
- * In the Grade R Maths programme, structured activities are divided into:
 - whole class activities
 - small group teacher-guided activities
 - small group independent activities
 - free choice activities.

Asking questions

Good questioning techniques are essential for teaching. Grade R Maths encourages teachers to use open-ended questions that stimulate maths thinking. These kinds of questions are found in problems and investigations. Open-ended questions also help teachers to gather information about learners' level of understanding and knowledge.

Closed questions	Open-ended questions
(Low order questions)	(Higher order questions)
Questions that have a limited or 'yes'/'no' response.	Questions that have more than one possible answer.
Example: Is this a triangle?	Example: What can you tell me about triangles?
Example: Is this a triangle or a square?	Example: How is a triangle different from a square?



Problem solving

Learners encounter problems that they cannot solve immediately. Grade R teachers should support learners to develop skills to approach these problems more and more independently. This includes adequate time to talk about the problem, try out ideas, learn from mistakes, play with the problem and adapt their ideas based on investigations.



- Learners do most of the talking.
- Learners are encouraged to try out ideas and make mistakes.
- 🖐 Teachers listen to learners' ideas.
- Teachers' questions are generally open ended and guide learners' thinking.

7. The inclusivity principle

Definition

Respect for **diversity** and inclusion are children's rights. They are essential if we want all children to learn and develop to their full potential. Teachers need to be aware of each learner's identity, needs and interests.

Every South African classroom is diverse. There are many different children and each one brings their own identity, personality, capabilities, interests and background. **Inclusivity** is the practice of ensuring that all children, regardless of diversity, are included in all classroom activities, especially those learners who would otherwise be excluded or marginalised. Disability is *one* of the reasons why children are often excluded, but importantly, social, emotional, physical and attitudinal issues also present barriers to learning. Teachers who have an inclusive mindset, welcome and embrace diversity amongst their learners.

Inclusive education means that all children attend school in ageappropriate classes. They are welcomed, encouraged to participate in all aspects of the school and are supported to learn and achieve their full potential.



- All learners have a right to feel special, participate and be included in classroom activities and discussions. This includes children who have disabilities, behavioural issues or other barriers to learning.
- All learners, their parents and the school staff should be welcome, included, treated fairly and respected regardless of culture, ethnicity, race, sex, gender identity, sexual orientation, physical or intellectual ability, religion or socio-economic status.

GLOSSARY

diversity

a range of people with a variety of differences of, for example, identity, personality, capabilities, interests and background

inclusivity

the practice of ensuring that all children, regardless of their differences, are included in all classroom activities

More about the inclusivity principle

Different learning styles

Diversity is not only about our physical characteristics, beliefs, or faith, it can also include how we learn new skills. Not all children learn in the same way. There is a diverse range of learning styles that are appropriate to each learner. For example, not all learners can follow the teacher's instructions by only listening to what she is saying. Some learners would benefit from seeing a picture that represents what they have to do. Others may need an action or hands-on activity to fully understand an instruction or concept.



Successful teachers are able to identify the learning needs of each learner in their class and to then adapt activities to best suit each learner's needs. The following eight learning styles are appropriate for learning and teaching in Grade R:

- Visual (Spatial): Visual learning involves the use of pictures or diagrams to remember information. Some learners understand and remember information easier when it is represented as pictures or diagrams.
- Auditory (Aural-Musical): Auditory learning depends on listening to information to fully understand and remember it. Some learners learn best when they can listen to the teacher, or to a song or recording.
- Verbal (Linguistic): Verbal learning involves speaking and expressing ideas out loud, and drawing or writing to fully understand and remember information.
- Physical (Kinaesthetic): Physical learning takes place when the learner is involved in a physical, hands-on activity. These learners use their bodies and sense of touch (tactile) to understand information.
- Logical (Mathematical): Logical learning involves the use of logic and reason to make sense of information. Logical learners will use logic and look for reasons when they are learning new things.
- Social (Interpersonal): Social learning involves learning with others. Some learners prefer to learn as part of a group or with a friend.
- Solitary (Intrapersonal): Solitary learning involves learning on your own. Some learners concentrate best when they can focus on their thoughts and feelings on their own, without being distracted by others.
- Waturalist (Nature): Naturalist learning takes place in nature. Some learners learn and understand best when they can explore and investigate nature through outdoor experiences, such as observing animals, gardening, taking care of the earth or exploring the environment.

Barriers to learning maths

A **barrier to learning** is anything that prevents a child from being able to learn effectively. Barriers can be linked directly to the child (intrinsic), for example, cognitive impairment, grief or a broken arm. Barriers can also be outside of the child (extrinsic), for example, poverty, neglect or an overcrowded classroom.

Language is a very important learning tool. In South Africa this often presents as both an intrinsic and extrinsic barrier to learning, particularly where a child's home language is different from the language of teaching and learning.

Many children experience one or more barriers to learning. They may need more practice and support than other learners do. Barriers to learning are factors that make it difficult for some learners to learn maths. Examples of barriers are shown in the following diagram.



Figure 29 Barriers to learning





Some of the ways in which you can include all learners in your Grade R classroom are the following:

- Plan your lessons, activities and materials to make them suitable for the needs of different learners, e.g. a maths problem based on a picture might need to include a detailed description in order to help a learner to focus on the important aspects of the picture.
- Allow learners more time and support to complete activities, to think and/or to answer questions, if they need it.
- It may be helpful to discuss, with a colleague or the school support team, the level you are working at with a learner to make sure you are offering him/her the best support possible. You may also need to follow up with the child's parents or caregivers and the district-based support team to provide the learner with all possible opportunities for learning and development.

Schools must ensure that all classrooms and teachers have adequate and appropriate resources to accommodate all the learners, despite barriers to learning. This includes:

- teachers trained to identify barriers to learning
- diverse teaching strategies
- an adequate classroom set up
- managed class size
- classroom assistants.



Screen all learners when they are admitted to Grade R and record your findings on a Learner Profile according to the national policy on Screening, Identification, Assessment and Support (SIAS) for all learners.

- Develop an Individual Support Plan (ISP) for any learners experiencing barriers to learning. This information should be shared with the parents and/or caregivers so that they are aware of any additional needs and the support plan for their child.
- Collaborate with the School Based Support Team to provide the necessary support. A learner is referred to the District Based Support Team if additional support is required.

Perceptual and motor development

The development of perceptual and motor skills in young learners is extremely important in laying a foundation for all future maths development and learning. Sensory perception means using the senses to get information about the environment. Sensory perceptual skills are important for learning maths because they help us understand:

- ★ the way things are linked
- similarities and differences
- \star size, shape and pattern
- space and position
- symbols and their meanings.

Perceptual skills allow us to make sense of the world around us. Sensory information is collected by our five senses, for example, what our eyes see, ears hear, skin feels, tongue tastes and nose smells.

This information is sent to our brain. The brain processes, organises and remembers this information so that we can use it later for everyday activities, such as reading, drawing, writing, cutting, completing puzzles, completing maths problems, enjoying a story, dressing, finding our shoes in the cupboard, singing, as well as many other skills.



Figure 30 Our five senses



Observe learners playing outside and inside with different equipment. & Can they:

- ~ tell the difference between different sounds, different words?
- ~ spot the difference between two pictures or groups of objects?
- ~ remember what they have seen and heard?
- ~ repeat a list of words or numbers in the correct order?
- ~ respond to different sounds, their names, instructions?
- ~ feel the difference between smooth and rough?
- ~ taste the difference between sweet and sour while blindfolded?

Motor skills are actions that involve using our muscles. We use the big muscles in our bodies for gross motor activities, e.g. kicking a ball, running and jumping. We use smaller muscles for fine motor activities, e.g. cutting, writing and drawing.

Sensory perceptual motor development includes the following:

- visual perception
- auditory perception
- ★ tactile perception
- kinaesthetic perception.

Grade R Maths recognises the importance of these skills for the development of maths concepts in Grade R learners.

Visual perception

Visual perception is the ability of the brain to use what the eyes see and to interpret this information. Visual perception skills are important for manipulating objects, drawing, reading and writing in maths.

Visual discrimination

Visual discrimination is the ability to see similarities and differences between objects. For example, to recognise what is the same and what is different between 2-D shapes, such as a picture of a square and a rectangle.

Visual motor coordination

Visual motor coordination is the ability of the eyes, brain and body muscles to work together to perform actions. In maths, it is important for activities, such as handling objects, drawing and writing.

Activities that help develop visual motor coordination include:

- ball and beanbag games
- using building blocks
- * playing with objects that roll or slide
- drawing patterns
- cutting and pasting
- ★ threading.

Visual closure

Visual closure is the ability to complete objects, pictures or drawings that are incomplete. In other words, the learner is able to recognise or identify a whole object even though the total picture is incomplete. Learners who struggle with visual closure will, for example, find it difficult to complete puzzles. They may also have difficulty describing what is missing in a picture that shows only the right side of the face or body, or completing the picture.

Form constancy and form perception (recognition)

Form constancy is the ability to tell the difference between forms and symbols, even though their size and position might change. In other words, it means being able to recognise the constant characteristics of something. For example, a circle is a circle because of its shape. It remains a circle even if it is blue, purple, large or small, in a book or drawn in the sand. In the same way, the number symbol '5' remains the same whether it is written in different colours or in big or small writing.

Visual figure-ground perception

Visual figure-ground perception is the ability to recognise the difference between objects that are in the foreground and those that are in the background. You can help learners to develop this skill by asking them to identify particular objects in a picture or in a collection of objects, e.g. 'Find the girl with red pants in the picture' or 'Find the box with oranges in the picture' or 'Find your shoes in this pile of all of our shoes'.

Visual sequencing

Visual sequencing is the ability to place objects or items in the correct order after looking at them or observing them. Help learners to develop this skill by asking them to look at a pattern of different coloured beads on a string and then repeat the pattern themselves.

Visual motor integration

Visual motor integration is the ability to make sense of visual information and then use it in another activity that uses motor skills. Learners use visual information and fine motor skills when, for example, they copy numbers or draw objects in front of them.

Visual conceptualising

Visual conceptualising is the ability to make pictures in your mind (mental images) based on experiences, observations or other visual information. Learners use this skill when, for example, they draw pictures of something like a room in their homes or of their families.

Auditory perception

Auditory perception is the ability of the brain to use what the ears hear and to interpret this information. Auditory perception is important for developing language skills, following and understanding instructions as well as sharing and discussing ideas and information.

Auditory discrimination

Auditory discrimination is the ability to recognise similarities and differences in sound, e.g. being able to hear the difference between the words 'rectangle' and 'triangle'.

Auditory memory

Auditory memory is the ability to store and remember something you have heard. Learners use this skill when they follow a set of instructions or repeat a number sequence that is read aloud, e.g. 4, 6, 8, 1.

Auditory figure-ground perception

Auditory figure-ground perception is the ability to recognise or isolate a sound from other sounds. It is also the ability to focus on a particular sound separately from background noise. This skill allows learners to focus on what someone in their group is saying without being distracted by the noise of other groups talking.

Auditory sequencing

Auditory sequencing is the ability to remember the objects or items in the correct order after hearing a list. For example, the order of the numbers from 1 to 10 or months of the year. Asking learners to describe a few of the day's events in order helps to develop this skill.

Tactile and kinaesthetic perception

Tactile perception is the ability to use the sense of touch to explore your environment. Kinaesthetic perception is the awareness of body movements and position in space. They work together to provide the brain with information. An activity that helps to develop learners' tactile and kinaesthetic perception is to ask learners to shut their eyes, then to feel and describe a number of different objects in a bag or pillowcase. For example, they could say it has corners or it is round.



8. The practice principle

Definition

Learners should have plenty of time to practise new skills and knowledge. When learners get regular practice in what they have already learnt, they get better at it and become more confident. They enjoy repetition and practice. The Grade R teacher should provide repeated opportunities for learners to practise and improve new skills.



- Counting and problem solving are done every day as regular activities – even if the focus is on other concepts, such as shape or measurement.
- Provide varied materials and tasks so that learners can practise newly learnt skills in different ways.
- Waths concepts can also be practised across the curriculum, for example, in Home Language and Life Skills activities, such as stories, drama, painting and obstacle courses.

More about the practice principle

Using rhymes, songs and stories

Singing songs and repeating rhymes together, and sharing stories is an enjoyable, non-competitive way of learning. Children learn maths concepts and skills when they repeat rhymes and songs, and listen to stories again and again. They learn and practise:

- number names (e.g. 'There were three little meerkats ...')
- ★ the order of number names
- forward and backward counting
- counting groups of things
- informal calculations, e.g. adding and subtracting
- ★ the sequence of events.



- Add movement, rhythm and music to songs, rhymes and stories to make them even more enjoyable. Experiences that use all our senses help learners to remember things more easily.
- Encourage parents and other caregivers to learn the stories, songs and rhymes you use with the learners. In this way, they become an important link for children between home and school activities.



Maths integration across the Grade R daily programme

Teachers need to make connections between maths, the daily routine and other subjects (e.g. Home Language and Life Skills), as well as between maths and learners' daily lives. Teachers should take advantage of all opportunities to practise maths skills.



Waking connections with maths concepts, such as size, measurement, time, estimation, counting, comparisons, shape and/or distance when you read stories to the learners.

Teach maths concepts during the Grade R maths focus time and look for other opportunities to develop maths language and concepts throughout the day. This:

- helps learners develop an understanding of how different areas of knowledge are related
- 🖐 ensures a more holistic or complete learning experience
- 🧩 gives learners more opportunities to practise what they have learnt.


SECTION 2

Mathematics in the Grade R Daily Programme

Introduction

The Grade R Maths programme has been developed to strengthen and support the Grade R Mathematics curriculum. Grade R Maths:

- includes and extends the CAPS Grade R Mathematics content outlined in the five Content Areas
- encourages inquiry-based learning by suggesting ways to extend learners' natural curiosity to explore their surroundings
- provides activities that encourage learners to investigate and explore maths concepts
- encourages teachers to talk with learners about their thinking and to help them express their ideas
- suggests ways for learners to plan, observe and gather information, and then to compare, sort, classify and interpret their findings
- provides appropriate materials and resources.

Mathematics Content Areas

Mathematics in the Foundation Phase (including Grade R) covers five Content Areas. Each Content Area contributes towards the learner developing specific maths knowledge and skills. The Content Areas are:

- Numbers, Operations and Relationships
- ✤ Patterns, Functions and Algebra
- ✗ Space and Shape (Geometry)
- ✗ Measurement
- 🔻 Data Handling

You can find out more about each Content Area in the CAPS and in Section 3 of this guide (page 55).

Weighting of Mathematics Content Areas

CAPS suggests that the instructional time for Mathematics in Grade R should be 23 hours per week. However, CAPS does not provide a weighting or a breakdown for Grade R of the time that should be spent

on each Content Area for each term. The weighting of Mathematics Content Areas serves two primary purposes:

- It gives guidance on the amount of time needed to address the content within each Content Area adequately.
- It gives guidance on how much weighting to give to the different parts of the Grade R Mathematics curriculum during assessment.

The Grade R Maths programme suggests an approximate weighting of the Content Areas. This is based on the following:

- All Content Areas are equally important even though the same amount of time might not be spent on each one.
- Some Content Areas need more time for concept development, e.g. Numbers, Operations and Relationships, and Space and Shape (Geometry).

The Grade R Maths programme focuses on a specific Content Area each week whilst ensuring consolidation and integration of new knowledge. The *Activity Guide* for each term organises the content and number of weeks around this weighting to ensure that the CAPS Content Area topics and key conceptual development are covered. The table below shows the number of content focus weeks needed for each Content Area each term.

Weighting of Grade R Mathematics Content								
Content Area	Торіс	Term 1 weeks	Term 2 weeks	Term 3 weeks	Term 4 weeks	Total number of weeks per year	Total % of time	
Numbers, Operations and Relationships	Counting Number recognition Number sense (relationships) Problem solving Calculations	3	4	5	5	17	42,5	
Patterns, Functions and Algebra	Identify, copy, extend and create own patterns	1	1	1	1	4	10	
Space and Shape (Geometry)	Position, orientation and view 3-D objects and 2-D shapes Symmetry	4	3	2	2	11	27,5	
Measurement	Time	1				4	10	
	Length		1					
	Mass			1				
	Capacity/Volume				1			
Data Handling	Collecting, sorting, representing and analysing objects/information	1	1	1	1	4	10	
Total weeks		10	10	10	10	40	100	

Table I Number of weeks per Content Area for each term

Maths and the Grade R daily programme

The daily programme

The Grade R daily programme is a timetable that has its own unique features. It is not the same as the timetables used in other grades in the school. It provides for the learners' developmental needs whilst addressing CAPS policy requirements.

The Grade R daily programme diagram (Figure 31) includes a breakdown of approximate time as a guide for teachers. These times need to be flexible in Grade R, but there should be:

- 4 hours and 36 minutes per day (or 23 hours per week) of learning and teaching contact time
- activities that cover three subjects: Home Language (10 hours per week), Mathematics (7 hours per week) and Life Skills (6 hours per week).

Each of the subjects has a daily focused session and is also integrated into other activities throughout the day. The daily programme in Figure 31 highlights focused maths time as well as opportunities for incidental maths learning. Maths learning takes place in:

- whole class sessions where learners interact as one large group with the teacher
- small group teacher-guided sessions where up to eight learners work with the teacher
- small group sessions where up to eight learners work independently on activities at tables (workstations)
- free choice sessions where learners choose for themselves what they would like to do from a selection of activities set out by the teacher (own choice).



Figure 31 GDE exemplar Grade R Daily Programme

Grade R Mathematics time allocation

The time allocated to Grade R Mathematics is seven hours per week and 1 hour 24 minutes (84 minutes) per day. Each day this time is made up of:

- ✓ 50 minutes of focused maths learning and teaching activities
- 34 minutes of integrated learning, structured activities and independent learner activities inside and outside the classroom.

Figure 32 shows a suggestion of how you could use the daily allocation of 1 hour 24 minutes.



Figure 32 Suggested use of daily maths time

Figure 33 shows how each day's maths focus time is structured in Grade R Maths.



Figure 33 Daily maths focus time in Grade R Maths

Additional activities that can be offered to learners include:

- puzzle building
- playdough activities
- construction activities
- educational games
- book corner 'reading'
- DBE workbooks and worksheets.

Once the focused maths session has been completed, all learners participate in tidying up and then transition to the next part of the daily programme.

How to organise your classroom for the daily maths session

Follow these guidelines to help you put the Grade R Maths programme into practice in your classroom every day.

The Grade R Mathematics focus time should be organised and planned for a combination of whole class and small group activities. Differentsized groups fulfil different teaching and learning goals. The choice of a large or smaller group will depend on the teaching or assessment activity that the teacher has planned. Managing a large class is challenging, especially if the teacher plans to focus on individual learners and includes learners with barriers to learning.

Whole class maths sessions

Whole class maths sessions are usually between 15 and 25 minutes long and all the learners sit in a circle together with the teacher.

The following maths activities can be done in whole class maths sessions:

- consolidating and practising previously taught concepts
- introducing a new concept
- extending the concept that is the main focus of the week
- oral/rote counting (rhymes, songs, sequencing numbers)
- mental maths (posing problems, memory games)
- giving instructions for the tasks to be done in the small group context whilst you are busy with the teacher-guided activity.



Figure 34. A whole class maths session

Small group maths sessions

In small group sessions, the class is divided into five groups of learners. Each day, one group works with the teacher (teacher-guided activity) while the other four groups work independently on maths activities that the teacher has planned.

The advantage of planning for small group teacher-guided and independent activities is that:

- Fewer resources are required for a small group than a whole class, for example, scissors, counters, blocks, etc.
- * Every learner has an opportunity to handle the materials and resources.
- It encourages interpersonal skills, for example, sharing, taking turns, talking and listening.
- * Learners take responsibility for group tasks, such as tidying up.
- The teacher can pitch instructions and questions at the level of the group.
- The teacher can observe each learner individually to ensure independent skills.

Using small groups gives teachers the opportunity to group learners with similar levels of skill and ability. In other words, the teacher is able to group learners according to the level of support they need in order to learn effectively.

Over the course of five days, the groups rotate to a different activity each day. This means that in a week all learners have the opportunity to complete the **teacher-guided focused activity** and four other small group activities (**a total of five different maths activities**). The four independent activities (or **side activities**) should be set out at four **workstations** around the classroom – either at the tables where the learners are seated or stand, or on the mat, or outside. The groups rotate over the course of a week, depending on how the teacher has planned the activities.



Ways of grouping learners for maths

The continuous observation of learners during outdoor and indoor activities will give teachers insight into the learners' abilities and interests. These insights will help you divide learners into different groups. The groups could be based on ability or could be determined by the learners' competence in a new skill.

- Ability groups: In these groups, learners are on a similar developmental level. Sometimes it is easier to teach new maths concepts using ability groups as some learners will need more time to complete a task, while others will need more challenging tasks. At times you may want learners with barriers to work with you to consolidate concepts, such as one-to-one correspondence and counting collections, or you might want to extend more advanced learners by giving them challenging maths problems.
- Wixed-ability groups: In these groups, learners have different levels of skill and understanding of a concept. These kinds of groups work well for construction, measurement, patterning and sorting activities, and games.

Whichever way you choose to group the learners, the groups should not remain the same over an extended time and each group should have their own symbol (picture or shape) and name.

Teacher-guided small group activities

In the teacher-guided activity, the teacher works with one group of learners while the other groups are busy completing the planned activities at one of the other four workstations.

The following activities are best suited to the teacher-guided small group context:

- consolidating and practising previously taught concepts
- deepening an understanding of a new concept.



Tips for teacher-guided small group maths activities

- Complete activities that focus on the Grade R Mathematics concept planned for that week.
- Work with the learners on the floor or at a table.
- Wake the session interactive, with both you and the learners joining in.
- W The focus should be on working orally and practically with the learners.



Figure 35 Matching counters and number cards

Small group activities

The following activities are best suited to the small group context where learners work independently of the teacher:

- consolidating and practising previously taught concepts
- investigating the new concept that is the main focus of the week
- practising the concept that is the main focus of the week.



Tips for planning and managing independent small group maths activities

- Learners with a range of different abilities must be able to complete the activities.
- 🖐 The activities must be meaningful for learners.
- The activities must be clear and simple enough to be completed without learners having to ask the teacher for help.
- If learners are working slowly, explore the reasons. Change or adapt the activity if necessary.
- Learners need to be responsible for completing their activities and should not need to disturb the teacher who will be busy with the teacher-guided activity.
- Teach the learners simple rules for what to do and how to behave during small group activities: how to tidy/pack up their work when done; how to behave in the transition activities. Repeat the rules daily until the learners know and can follow them automatically. This takes time! Be consistent. Gently correct learners if they challenge the rules.

Free choice activities

Additional activities should be provided for those learners who complete their individual small group activity before the end of the maths session. These activities should serve as reinforcement of the maths content you have taught. Learners should choose an activity from those set out by the teacher. These activities should have a maths focus, for example, a puzzle, stacking blocks, drawing, colouring, moulding, sorting shapes or role-play.

Moving between activities (transitions)

A transition is the time when learners move from one activity to another. For example, after the maths whole class session is over, the classroom needs to be tidied and prepared for the next session. Transition times should be used to practise Mathematics, Home Language and Life Skills, e.g. oral counting, clapping patterns.

Teachers who plan and manage transitions are more likely to have calm, organised classrooms with happy, cooperative and stress-free learners.



Tips for emphasising maths during transitions

- Give the learners enough warning before they need to change activities, e.g. 'In two minutes we are going to complete the session.'
- Give clear instructions, e.g. 'First pack away what you are doing and then line up quietly at the door/sit in a ring.'
- Use 'attention grabbers', such as counting the number of claps, number songs and rhymes, and number signals (counting down/up).

Planning and preparing maths lessons

There are approximately 40 weeks in the year. You will need to plan and prepare thoroughly for each week.

In the week before the lesson

- Read the relevant sections of the *Concept Guide* and *Activity Guide*. These explain the content and concepts that will be taught, and give suggestions for appropriate activities and discussions.
- Plan and prepare the activities in the week before they will be taught.
- Identify the focus of assessment. (You can find more information on assessment on page 49.)
- * Prepare the resources and organise the classroom for the week.
- Some resources need to be collected well in advance, e.g. egg boxes, toilet roll inners, yoghurt cups, milk bottles or objects for sorting.

During the week

- Focus on understanding the maths concept being taught that week.
- * Read the relevant section in the *Concept Guide*.
- Each day, check that you have the resources needed for the following day's activities.
- Familiarise yourself with the activities well in advance. Teachers should never prepare while learners are sitting and waiting for an activity to begin.

The Grade R Maths programme resources

The Grade R Maths programme has four components.



Figure 36 The components of the Grade R Maths programme

Concept Guide (this book)

This book provides:

- the principles behind the Grade R Maths programme for teaching maths to young learners
- guidance on how to organise your classroom for effective teaching and learning
- * suggestions on how to teach maths in Grade R
- an outline of the maths content to be taught in the Grade R Maths programme
- guidelines on using Grade R Maths
- ⋆ a glossary.

Activity Guides

There are four *Activity Guides* – one for each school term. Each *Activity Guide* includes:

- ✓ an overview of what will be covered in the term
- * a maths concept area topic to be focused on in each week
- suggested activities for each week: whole class, and independent and teacher-guided small group activities
- teaching tips for planning and organising maths activities
- maths vocabulary that is learnt through the activities each week
- information on the resources that will be needed for the week
- resources, such as rhymes, songs, stories and templates.

Poster Book

The *Poster Book* is a big book containing eleven posters. The posters are meant for use in whole class activities and small group teacher-guided activities. They help to link maths to everyday life and can be used in different ways, e.g. for counting, discussing position and direction, time (sequencing events) and problem solving.

Resource Kit

The *Resource Kit* contains essential teaching and learning materials that will be used regularly as part of the teacher-guided activities. The kit provides enough apparatus for a small group of six to eight learners. Each kit has the following as shown in Figure 4 on page 6:

- counting materials, e.g. coloured discs and sticks, fruit and animal counters, and Unifix blocks
- \star jumbo dice
- ★ strings of ten structure beads
- number cards: number symbols (0–10) and number words (zero-ten)
- \star attribute blocks
- ✗ dot cards.

Other resources

- ✗ CAPS policy documents
- DBE workbook and other resources

Additional resources (not supplied) that are needed for Grade R Maths activities include:

- \star 'pizza box'
- \star a height chart
- jumbo playing cards
- ✗ dice: with numbers and shapes
- ✗ pretend-money: coins and notes
- ✓ a calendar for the current year
- ✗ a large analogue wall clock
- \star a balance scale
- ✓ puppets
- * pattern blocks (attribute blocks) and cards
- pegboard and pegs
- ⋆ beanbags
- * large and small balls
- beads for counting, sorting, threading and patterning (and laces)
- building blocks and boards
- ✗ Lego: different sizes and shapes
- construction toys
- * puzzles: 8, 12, 20, 36 and 48 pieces
- modelling clay/playdough
- cookie cutters

- cardboard boxes of different shapes and sizes
- a variety of plastic bottles and containers for describing and comparing capacity
- mathematical games: Lotto, Ludo, snakes and ladders, jigsaw puzzles, dominoes (to include colour, shape, numbers, sequencing, matching, classification and memory games)
- ★ sand and water play equipment
- ✓ stacking cups of different sizes
- apparatus for climbing, balancing, swinging and skipping
- * a play shop with items to be bought with pretend money
- counters for sorting
- storage boxes: 40 litre, 5 litre and 2 litre.

Assessment in Grade R

In Grade R, assessment is a continuous, planned process of gathering, analysing and interpreting information about each learner. It should be mainly **formative** and informal. In other words, the information gathered about the learners' progress during assessment should help you to plan and/or adapt learning activities. In Grade R, assessment is used to make decisions about the best way to support each learner's development.

Assessment is the link between CAPS subject content, and teaching and learning activities. You cannot assess what you have not taught. The purpose of assessment is to:

- ★ establish the level of each learner
- ✓ guide planning and inform teaching
- encourage each learner's developmental progression
- help generate useful reports on learner's achievements.



Assessment tips

- Search Assessment should never make learners feel anxious or scared.
- Assessment activities should be appropriate and suited to each learner's attention span.
- While you are busy observing a small group of six to eight learners in the focused teacher-guided activity, the other learners should be busy working independently on activities in their small groups at different workstations.
- Work with one small group of six to eight learners each day on a specific activity (depending on the number of learners in the class). While the learners are engaged in the activity, carefully observe each learner in the small group and ask questions to gain insight into their thinking.
- Information about what learners know and can do (or 'evidence') should be collected continuously (daily) over time.
- Information about what you have observed should be recorded at the end of the day, after teaching time.

GLOSSARY

formative assessment

assessment that provides information while learning is taking place and measures learners' progress It is best to use many different ways of assessing learners. Here are some examples.

- Observe learners during whole class, teacher-guided small group activities and free play inside and outside the classroom.
- Record learners' understanding of specific maths concepts during and after teacher-guided activities.
- Questions and conversations with individual learners or small groups of learners can help you understand the level and depth of learners' thinking and reasoning.
- Look carefully at the things that learners do and record (using pictures, drawings, objects and/or 'writing'). These show you what the learners understand and have achieved.
- Listening to and recording learners' responses (practical, oral, written) allows you to do continuous assessment.

You need to continually assess all learners':

- maths knowledge
- maths understanding
- ✗ maths skills
- responses to solving problems
- ways of doing things. (Learners use their own ways of solving maths problems. These may be quite different from your methods, but this does not make them incorrect.)

Continuous assessment is especially important for helping teachers plan activities, check on learners' progress and plan additional support for learners who experience barriers to learning. (You can find more information on barriers to learning on pages 29–30.)

Assessment tools

In Grade R the focus of assessment is not to give marks but to inform detailed description and keep track of learners' progress. Teachers should use the following tools for assessment.

Observation book

In Grade R the teacher should observe learners inside and outside the classroom, during free play and structured activities. These observations will give teachers critical information that should inform their planning and selection of tasks. During the focused mathematics time, the teacher will work with one small group each day. The teacher will plan a specific activity that is linked to a concept in CAPS. While the learners are engaged in this activity, the teacher will carefully observe each learner and ask questions to gain insight into the learner's thinking and level of understanding.

Once the learners have gone home, the teacher will record the findings of these and other incidental observations. It is useful to use an indexed book to separate learners according to the first letter of their name.





Figure 37 Observe learners then record your observations

Checklists

A checklist is a list of assessment criteria that gives a summary of each learner's skills and abilities for each subject. At the end of each *Activity Guide* of the Grade R Maths programme there is an assessment checklist for the term. This checklist provides a summary of the new content that has been taught during that term. The teacher can use symbols to show the learner's level of achievement. For example, use a tick if the skill was achieved, use a cross if it was not achieved, and use a dot to indicate that the learner is not fully competent, but is showing indications that they are on their way to achieving the skill.

Figure 38 gives an example of how the content the teacher needs to record, can be arranged. Learners' names are recorded in the first column followed by the assessment date. A symbol ($\checkmark \times \bullet$) should then be recorded next to each learner's name to correspond with the concept or skill listed in each column. This assessment tool is only useful if teachers have a very good knowledge of each learner, based on their continuous observations and the notes they recorded in their observation book.

Кеу	NUMBERS, OPERATIONS AND RELATIONSHIPS FUNCTIONS AND ALGEBRA								COMMENTS											
 ✓ = competent ● = partially competent X = not yet competent Learners' names 	Counts forwards to 10	Estimates and counts objects 1–5	Counts backwards 5–1	Recognises numbers in familiar contexts	Understands ordinal numbers, e.g. lining up	Identifies dot/pictures cards 1–3	Identifies number symbols: 1	Identifies number names: one	Orders numbers: 1–3	Understands one-to-one correspondence	Distinguishes between many and fewer	Solves problems with concrete objects	Solves problems using fingers or counters	Identifies patterns in environment	Recognises the 'repeat' in patterns	Copies patterns using body percussion	Copies, completes and creates own patterns	Explains own pattern (repeating rule)		Final coding
Date																				
							· · · · · ·													
		· · · · · · · · · · · · · ·	· · · · · · · · · · · · · ·	· · · · · · · · · · · · · ·					· · · · · · · · · · · · · ·	· · · · · · · · · · · · · ·										

Term 1: Exemplar Record of Continuous Assessments

Figure 38 Exemplar checklist

Rubrics

A rubric is another tool for assessing learners' achievements. It also consists of a list of criteria with a description of levels of performance for a particular skill. Each description explains what the learner actually does or produces during an assessment task for that criteria. A rubric needs to provide well-written descriptions and levels of performance so that these can be accurately matched against each learner's performance. The rubric then allows teachers to be more objective and consistent in their assessment and guides their planning of further teacher activities as it highlights the strengths and gaps in the learners' knowledge.

Figure 39 provides an example of a rubric for solving addition problems up to 10 in a practical way.

Criteria	Not	Elementary	Moderate	Adequate	Substantial	Meritorious	Outstanding
	achieved	achievement	achievement	achievement	achievement	achievement	achievement
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Solves addition problems practically up to 10.	Unable to solve problems practically.	Is able to solve problems practically, using concrete apparatus.	Is able to solve problems practically, but cannot explain solution method.	Is able to solve problems practically and describes solution method when prompted.	Is able to solve problems practically and describes solution method independently.	Is able to solve problems practically and is able to explain solution method.	Is able to solve problems practically and is able to explain solution method and suggest alternative methods.

Figure 39 Exemplar rubric

The level descriptors on the rubric can be linked to rating codes. The Department of Basic Education (DBE) provides a rating code and description of competence, and links these to percentages (see Figure 40). For reporting purposes the rating codes and descriptors could be converted to percentages.

Rating code	Description of competence	Percentage
7	Outstanding achievement	80–100
6	Meritorious achievement	70–79
5	Substantial achievement	60–69
4	Adequate achievement	50–59
3	Moderate achievement	40–49
2	Elementary achievement	30–39
1	Not achieved	0–29

Figure 40 Rating code

In Grade R the focus of assessment is on describing performance rather than evaluating it against percentages. Reports that provide parents and other teachers with rich descriptions of behaviours and what learners produce, are far more valuable for assessing performance than percentages are. It is best to avoid negative evaluative assessments that fail learners early on in the system. Assessment should be used to gain insight into the learners' level of competence in order to adjust planning and teaching to accommodate and encourage each learner in the class.

You will need to record your assessment observations and other 'evidence' in a journal, and on an observation sheet or checklist. In this way, during the year, a complete picture of each learner, with all their strengths and weaknesses, is gradually built up.



SECTION 3

Mathematics in Grade R

Introduction

This section of the *Concept Guide* provides an overview of the Content Areas of the Grade R Mathematics CAPS and:

- ✓ offers practical ideas for classroom implementation
- * explains the maths concepts and content that teachers need to understand
- highlights the development of maths knowledge in young learners.

It also gives a breakdown of the Term 1–4 Grade R content (pages 57 to 68). The five CAPS Content Areas are:



Figure 41 Grade R CAPS Mathematics Content Areas

Each Content Area is divided into topics. For each of these topics, this section of the *Concept Guide* provides:

- an explanation of the topic, which includes identifying specific concepts and skills
- teaching suggestions in the 'In practice' boxes
- ★ an explanation of maths terms.

Although the Content Areas reflect particular strands of maths development, they are all closely linked and often overlap during activities. For example, when learners are focusing on a measurement task, they will integrate skills from another Content Area, for example, Numbers, Operations and Relationships, and so also use their knowledge of numbers, counting and skills of comparison. Learners have opportunities to apply their knowledge and skills in different contexts.



While teachers focus specifically on these Content Areas during the maths focus time, they should also remember to make the most of other opportunities in the daily programme to:

- 🖐 use maths language to introduce and reinforce concepts
- w model the use of a wide range of vocabulary linked to number, shape, space, measurement and data handling.

Here are some practical ways to do this:

- Provide bought, recycled and natural materials for learners to sort, compare and order.
- Provide resources to role-play buying and selling, weighing and measuring.
- We have sets of pictures to show the sequence of events during the day and the weather during the week.
- Observe and talk about shape and patterns in pathways, fences, vegetable gardens.
- Plan activities and games where learners use their physical and mathematical skills to follow and give directions.
- Link stories and outdoor play to maths.

Mathematics content

The content overview that follows provides a table of the Grade R Maths content to be taught in the Grade R year. It shows what content is to be taught each term.

- * The text in blue is the content from the Grade R CAPS for Mathematics.
- The text descriptions and content in black have been added to extend and build on CAPS.
- The topics are sequenced to show a developmental progression from one topic to another.



TOPICTERM 1TERM 2TERM 3COUNTING1.1Count objects (Estimate and count objects to develop number sense)Number range: 1–5 Count in ones: one-to-one correspondence: body parts and concrete objects Introduce the Helper's chart Introduce the concept of estimation (a reasonable guess) Dot cards: - identify number dots on cards, doiniones and dice (1–5) - match objects to pictures and dot cards Count 'how many' using fingers, dot cards, objects in and outside the clasping hands, stamping feetNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects Reinforce Helper's chartNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects Reinforce Helper's chartNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects Reinforce Helper's chartNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects Reinforce Helper's chartNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects and exents for counting 'how many' stamping feetNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objects and exents for counting 'how many'. Fingers, dot cards, objects in and outside the clasprom, pictures and actions, e.g. clap many clap many clap many clap many clap many clap many clap many clap manyNumber range: 1–7 <th colspan="9">1. NUMBERS, OPERATIONS and RELATIONSHIPS</th>	1. NUMBERS, OPERATIONS and RELATIONSHIPS								
COUNTING1.1Count objects (Estimate and count objects to develop number 	TERM 4								
1.1Count objects (Estimate and count objects to develop number sense)Number range: 1–5 Count in ones: one-to-one correspondence: body parts and concrete objects Introduce the Helper's chart Introduce the concept of estimation (a reasonable guess) Dot cards: - identify number dots on cards, doinoes and dice (1–5)Number range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objectsNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objectsNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objectsNumber range: 1–7 Estimate and count Count in ones: one-to-one correspondence: body parts and concrete objectsNumber ra Count in ones: one-to-one correspondence: body parts and concrete objectsNumber ra Count in ones: courte objectsNumber ra Count in ones: courteone correspondence: body parts and concrete objectsNumber ra Count in ones: correspondence: body part chartNumber ra Count in ones: concrete objects1-1-10-10-10-101-10-10-10-10 <th></th>									
stamping feet Show 'one more/ one less' Clap many times/ fewer times	ange:Number range: 0–10 and beyondind countEstimate and countnes:Count in ones:eone-to-onedence;correspondence; count all:ts- body partsobjects- concrete objectsHelper'sReinforce Helper's chartrecognise is of dotsDot cards: recognise collections of dotsto dominoes0 on dice (1–6) and dominoesvenStart at given number and 'count ng along a ack, using ure beads, rds, numbere more/ se:Show 'one more/ 								
1.2Count forwards and backwardsCounting forwards: 1-10Counting forwards: 1-15Counting forwards: 1-20Oral or rote counting (rhythmic)Counting backwards: 5-1Counting backwards: 5-1Counting backwards: 7-1Counting backwards: 7-1Incidental counting using number rhymes and songs, daily routine, body movements, etc.Incidental counting using number rhymes and songs, daily routine, body movements, etc.Counting forwards: 1-15Counting forwards: 1-20Incidental counting using number rhymes and songs, daily routine, body movements, etc.Incidental counting using number rhymes and songs, daily routine, body movements, etc.Counting forwards: 1-20Counting forwards: 1-20Counting using number rhymes and songs, daily routine, body movements, etc.Count in onesCount in onesCount in ones	forwards: Counting forwards: 0–20 and beyond Counting ls: 10–1 backwards: 10–0 counting using number d songs, ne, body ts, etc. movements, etc. ones Count in: ones. twos								



	ΤΟΡΙϹ	TERM 1	TERM 2	TERM 3	TERM 4
1.3	Number symbols and number names Recognise and identify number symbols and number names	Number symbols: 1, 2, 3 Number names: one, two, three Represent numbers using: - body (kinaesthetic) - objects (concrete) - pictures, drawings (semi-concrete) - dot cards (semi- concrete) Match with number symbol (abstract) and number name Number symbol: 1 Number name: one	Number symbols: 4 and 5 Number names: four, five Represent numbers using: - body (kinaesthetic) - objects (concrete) - pictures, drawings (semi-concrete) - dot cards (semi- concrete) Match with number symbol (abstract) and number name Reinforce: 1, 2, 3 Reinforce: one, two, three Number symbol: 2, 3, 4 Number name: two, three, four	Number symbols: 6, 7, 8 Number names: six, seven, eight Represent numbers using: - body (kinaesthetic) - objects (concrete) - pictures, drawings (semi-concrete) - dot cards (semi- concrete) Match with number symbol (abstract) and number name Reinforce: 1, 2, 3, 4, 5 Reinforce: one, two, three, four, five Number symbol: 5, 6, 7 Number name: five, six, seven	Number symbol: 0 to 10 Number name: zero (nought), eight, nine, ten Represent numbers using: - body (kinaesthetic) - objects (concrete) - pictures, drawings (semi-concrete) - dot cards (semi- concrete) Match with number symbol (abstract) and number name Reinforce all numbers
NUME	BER RECOGNITION				
1.4	Use numbers in familiar contexts	Use numbers in familiar contexts: - age - numbers in pictures and dot cards - number card games - attendance register	Use numbers in familiar contexts: - address - numbers in pictures and dot cards - number card games - numbers in adverts/ flyers/birthday cards - attendance register	Use numbers in familiar contexts: - address, contact numbers - birthday - numbers in pictures and dot cards - number card games - numbers in adverts/ flyers/birthday cards - attendance register	Use numbers in familiar contexts: - address, contact numbers - numbers in pictures and dot cards - number card games - numbers in adverts/ flyers/birthday cards - attendance register
NUME Descr	BER SENSE (RELATION IDE SENSE (RELATION IDE SENSE (RELATION IDE SENSE IDE SENSE IDE SENSE IDE SENSE IDE SENSE I BER SENSE (RELATION IDE SENSE IDE SENSE (RELATION IDE SENSE (RELATION IDE SENSE (RELATION IDE SENSE IDE SENSE (R	ONSHIPS) rder numbers			
1.4	Identify and describe whole numbers	Number range: 1–3 Identify and describe whole numbers up to 1, 2, 3 using collections and symbols (one more, one less than; before, after, between) Number range: 1	Number range: 1–5 Identify and describe whole numbers 4, 5 using collections and symbols Reinforce numbers 1–3	Number range: 1–8 Identify and describe whole numbers 6, 7, 8 using collections and symbols Reinforce numbers 1–5 Number range: 1–7	Number range: 0–10 Identify and describe whole numbers 0, 9, 10 Reinforce numbers 1–8



ΤΟΡΙΟ	TERM 1	TERM 2	TERM 3	TERM 4
Compare numbers	Compare which of two given collections of objects are: - big, small - bigger, smaller - biggest, smallest Order more than two given collections of objects from smallest to biggest and biggest to smallest Many and fewer, e.g. incidental clapping, snack time, sharing equipment	Compare which of two given collections of objects are: - big, small - bigger, smaller - biggest, smallest More than, less than, equal to Many and fewer, e.g. incidental clapping	More than, less than, equal to Many and fewer Ask questions: 'Which was most/least?'	More than, less than, equal to Many and fewer Ask questions: 'Which was most/least?'
		Make equal groups (sets) of objects, e.g. children or objects in the classroom	Use objects to make equal groups (sets)	Use objects to make equal groups (sets)
	Breaking down and building up collections of 2 and 3, e.g. 3 could be: 1 and 1 and 1 OR 2 and 1 OR 1 and 2 OR nothing (zero) and 3	Breaking down and building up collections of 4 and 5, e.g. 4 could be: 1 and 1 and 1 and 1 OR 3 and 1 OR 2 and 2 OR nothing (zero) and 4	Use manipulatives to investigate and develop strategies for breaking down and building up collections to 8	Use manipulatives to investigate and develop strategies for breaking down and building up collections to 10
Order (sequence) numbers	Order more than two given collections of objects from smallest to biggest and biggest to smallest	Order more than two given collections of objects from smallest to biggest and biggest to smallest	Order collections of objects from smallest to biggest and biggest to smallest	Order collections of objects from smallest to biggest and biggest to smallest Match number symbol card to collections
	Incidental ordering of numbers 'What comes next, after, between': - number/washing line - number track or ladder - number cards	Place number symbols in the correct counting order 'What comes next, after, between': - number/washing line - number track or ladder - number cards	Place number symbols in the correct counting order 'What comes next, after, between': - number/washing line - number track or ladder - number cards	Incidental: Number range: 0–10 Place number symbols in the correct counting order 'What comes next, after, between': - number/washing line - number track or ladder - number cards

	ТОРІС	TERM 1	TERM 2	TERM 3	TERM 4
	Ordinal numbers	Incidentally develop an awareness of first, second, third last, next Introduce during: - refreshment/snack time and toilet routine - in everyday contexts, across subjects, lining up, e.g. 'Who was first/ last/second to come in the door'	Incidentally develop an awareness of first, second, third, fourth, last, next In everyday contexts: daily routine – lining up, snack time, toilet routine Integrate: Life Skills, physical development and art activities (where appropriate), outdoor activities, e.g. races Line up objects or manipulatives and discuss position	Incidentally develop an awareness of first, second, third, fourth, fifth, last, next Reinforce ordinal numbers in the daily routine and integrate during the day and in outdoor activities, e.g. races Place learners and objects in a row and identify ordinal position in one direction, e.g. left to right	Incidentally develop an awareness of first, second, third, fourth, fifth, sixth, last, next Reinforce ordinal numbers in the daily routine and integrate during the day and in outdoor activities, e.g. races Place learners and objects in a row and identify ordinal position in both directions, e.g. left to right and right to left
1.5	Place value	No CAPS content for G	rade R (focus on number	r concept of numbers 1–9	9 and zero, 1.1 and 1.4)
SOLVE	PROBLEMS IN COI				
1.6	techniques	Solve problems in everyday contexts Uses the following techniques: - concrete apparatus, e.g. counters - counting all in ones	Number range: 1–5 Solve problems in everyday contexts Uses the following techniques: - concrete apparatus, e.g. counters - physical number ladder - ten structure beads - counting all in ones Number range: 1–4	Number range: 1–8 Solve problems in everyday contexts Uses the following techniques: - concrete apparatus, e.g. counters - physical number ladder - ten structure beads - counting all in ones - counting on Number range: 1–7	Number range: 0–10 Solve problems in everyday contexts Uses the following techniques: - concrete apparatus, e.g. counters - physical number ladder - ten structure beads - counting all in ones - counting on Number range: 0–10
1.7	Addition and subtraction Orally solve word problems (story sums) and explain own solutions to problems involving addition and subtraction with answers up to 10	Investigate addition and subtraction in everyday activities through the use of manipulatives and stories Orally solve problems that involve numbers 1–3 using counters, stories, pictures	Orally solve problems that involve numbers 1–5 using objects, stories, pictures Use counters and orally solve problems that involve the numbers 2, 3 and 4 Reinforce the solving of problems that involve numbers 1 to 4	Orally solve problems that involve numbers 1–8 using objects, stories, pictures Introduce terminology (add to/add, take away/ subtract) Use counters and orally solve problems that involve the numbers 5, 6 and 7 Reinforce the solving of problems that involve numbers 1 to 7	Orally solve problems that involve numbers 0–10 using objects, stories and pictures Use terminology (add and subtract) Use counters and orally solve problems that involve the numbers 8, 9 and 10 Reinforce the solving of problems that involve numbers 1 to 10
1.8	Repeated addition leading to multiplication	No CAPS content for G	Grade R	·	·



	ΤΟΡΙΟ	TERM 1	TERM 2	TERM 3	TERM 4				
1.9	Grouping and sharing leading to division (equal sharing and grouping with whole numbers up to 10 with answers that incl. remainders)	Introduce concept of equal sharing: - during daily activities - stories and pictures - one-to-one sharing	Equal sharing: - during daily activities - stories and pictures - one-to-one sharing	Equal sharing: - grouping - half - use concrete objects	Equal sharing: - grouping - half and double - use concrete objects				
1.10	Sharing leading to fractions	No CAPS content for G shared, 1.9)	No CAPS content for Grade R (focus on problem solving with remainders that can be shared, 1.9)						
1.11	Money		Develop an awareness of South African coins: 10c, 20c, 50c, R1, R2, R5 Identify colour and animals Identify similarities and differences Sort play money according to colour and size Provide play money in the house corner	Develop an awareness of South African bank notes: R10, R20, R50, R100, R200 Identify similarities and differences between notes Sort play money according to colour and size Provide play money in the house corner	Provide play money in the house corner				
CONT	EXT-FREE CALCULA	TIONS: OPERATIONS							
1.12	Techniques	No CAPS content for G	irade R (focus on counti	ng all and counting on,	1.1 and 1.6)				
1.13	Addition and subtraction: solves verbally- stated addition and subtraction problems		Number range: 1–5 Orally solves addition and subtraction problems with solutions up to 5 Number range: 1–4	Number range: 1–8 Orally solves addition and subtraction problems with solutions up to 8 Number range: 1–7	Number range: 1–10 Orally solves addition and subtraction problems with solutions up to 10 Number range: 1–10				
1.14	Repeated addition leading to multiplication	No CAPS content for G	irade R						
1.15	Division	No CAPS content for G	irade R (focus on equal s	sharing, 1.9)					
1.16	Mental maths	Begin each whole class where incidental learn Counting everyday obj Counting forwards and Ordinal counting Estimating Problem solving Memory games	s and teacher-guided ac ing opportunities arise ects backwards	tivity with mental maths	s and do mental maths				
1.17	Fractions	NO CAPS content for G	rade K (tocus on equal s	snaring, 1.9)					



2. PATTERNS, FUNCTIONS and ALGEBRA								
ΤΟΡΙΟ	TERM 1	TERM 2	TERM 3	TERM 4				
2.1 GEOMETRIC PATTERN	IS							
Identify patterns	Identify patterns in familiar everyday environment, e.g. clothes, objects and environment Recognise the 'repeat' in patterns							
Copy and extend simple repeating patterns using physical objects and drawings	Copy and complete patterns Copy patterns using body percussion Copy, complete and create own patterns Introduce language: What comes next? What comes before? How is it the same? How is it different?	Copy and extend patterns with pictures Copy a given pattern using coins Describe the repeat in patterns Copy a given pattern using 3-D concrete objects and 2-D shapes, coins, beads, etc.	Copy and extend own pattern with pictures Copy vertical and horizontal patterns using concrete objects Extend simple repeating patterns	Copy and extend own patterns with pictures Copy a noise (sound/ auditory) pattern Use physical objects and draw patterns				
Creates own repeating patterns	Create own pattern using physical objects, drawings, geometric patterns Explain own pattern (repeating rule): - one colour, two shapes - one shape, two colours	Create own pattern with pictures Explain own pattern (repeating rule): - two colours, two shapes - two shapes, two colours	Create own pattern with pictures Explain own pattern (repeating rule): - three/four colours, different shape, etc.	Create own pattern Explain own pattern (repeating rule): - three/four colours, different shape, etc.				
2.1 Number patterns	No CAPS content for G	rade R (focus on counti	ng: ordering numbers in	ones and twos, 1.2)				

3. SI	PACE and SHAPE (GEO	METRY)			
	ΤΟΡΙϹ	TERM 1	TERM 2	TERM 3	TERM 4
3.1	Position, orientation and views Describes one 3-D object in relation to another (e.g. in front and behind)	Spatial relationships Position of the child in relation to their surroundings Position of two or more objects in relation to the learner: - in front of and behind - on, on top, under, below - in and out, inside and outside - up and down - next to and between	Spatial relationships Position of the child in relation to their surroundings Position of two or more objects in relation to the learner: - on and under - on top of and underneath - in front of and behind	Spatial relationships Position of two or more objects in relation to each other and to one another: - in front of and behind - on, on top, under, bottom and below - next to - middle - left and right - pegboard work Describe objects from different perspectives, e.g. a doll house from the front, the back, the side depending on where you stand	Spatial relationships Position of two or more objects in relation to each other and to the learners and in relation to one another: - in front of and behind - on top of, under, above, below - top and bottom - next to, between and middle - left and right The position of two or more objects in relation to each other
	Follow directions (alone and/or as a member of a group or team) to move/ place self within a specific space (directionality)	Directionality – forwards and backwards Up and down Games such as tracking the train Obstacle course – following a direction Physical Education and music	Directionality – forwards and backwards Obstacle course – following a direction Outdoor activities Incidental: left and right	Forwards and backwards Arrow chart Left and right	Forwards and backwards Up and down Upwards and downwards Left and right Where does the sound come from?
3.2	3-D objects	1		1	
	Recognise, identify and name three- dimensional objects in the classroom	Introduce and explore Compare and sort: - balls - boxes with square and rectangular faces (sides)			

	ΤΟΡΙΟ	TERM 1	TERM 2	TERM 3	TERM 4
	Describe, sort and compare 3-D objects	Introduce Tidy-up chart (sorting toys) Sort 3-D objects according to (one attribute): - size (big/small) - colour - shape Identify and explore 3-D objects: flat, round, square or rectangular shape Objects that roll Objects that slide	Sort 3-D objects according to similarities and differences: - size - colour - shape	Sort 3-D objects according to similarities and differences (two attributes): - size - colour - shape Explore 3-D objects: flat, round, square or rectangular shape	Sort 3-D objects according to (two or more attributes): - size - colour - shape Explore 3-D objects: flat, round, square or rectangular shape
	Build 3-D objects	Ongoing Provide building blocks and construction materials during free play inside on a daily basis Explore with building blocks	Ongoing Provide building blocks and construction materials during free play inside on a daily basis Explore with building blocks Use building blocks and recycled materials to build own constructions	Ongoing Provide building blocks and construction materials during free play inside on a daily basis Build own construction by copying from a given construction example Copy the same construction from a design or picture card	Ongoing Provide building blocks and construction materials during free play inside on a daily basis Ongoing during free play inside
3.3	2-D shapes				
	Recognise, identify and name two- dimensional shapes in the classroom	Introduce Tidy-up/ Helper's chart Recognise learner symbol and name Introduce 2-D shapes: circle, square, triangle, rectangle Puzzles (minimum 6 pieces)	Recognise learner symbol and name Recognise, identify and name 2-D shapes: circle, square and triangle Puzzles (minimum 12 pieces)	Recognise and identify learner name Reinforce: circle, square, triangle Compare rectangles and squares Puzzles (minimum 18 pieces)	Identify learner name Reinforce: rectangle Recognise, identify and name 2-D shapes: circle, square, triangle, rectangle Puzzles (minimum 24 pieces)
	Describe, sort and compare 2-D shapes	Sort 2-D shapes according to: - colour - shape Circle: curved line Square: 4 sides, straight lines, corners Triangle: 3 sides, straight lines, corners	Sort 2-D shapes according to similarities and differences: - shape Reinforce triangle Reinforce circle and square	Sort 2-D shapes according to: - colour - shape (curved line, three or four lines) Reinforce circle, square and triangle	Sort 2-D shapes according to: - size - colour - shape

	ΤΟΡΙϹ	TERM 1	TERM 2	TERM 3	TERM 4
	Figure-ground perception Geometric shapes	Introduce figure- ground perception (identify objects and shapes – 'I spy with my little eye') Introduce circle, square and triangle	Reinforce figure- ground perception through sorting, matching and grouping activities and tidy-up routine Reinforce triangle Shape conservation (form constancy of triangle)	Reinforce figure- ground perception through sorting, matching and grouping activities and tidy-up routine Reinforce square Shape conservation (form constancy of shapes learnt to date)	Reinforce figure- ground perception through sorting, matching and grouping activities and tidy-up routine Reinforce circle, triangle, square and rectangle Shape conservation (form constancy of shapes learnt to date)
3.4	Symmetry (Recognise line of symmetry in self, and own environment)	Identify body parts Awareness of body in terms of: - one's body has two sides - the one side, the other side, leading to left and right - top/bottom - back/front - crossing midline (physical activities) Activities to be done during physical development – using rhymes and songs, and during Creative Arts	Crossing midline – performing actions Applying crossing the midline during Life Skills (physical development) – using rhymes and songs, and during Creative Arts	Crossing midline (chalkboard activities) Applying crossing the midline during Life Skills (physical development)	Develop an awareness that there is symmetry in objects Applying crossing the midline during Life Skills (physical development)

4. M	4. MEASUREMENT						
	ΤΟΡΙΟ	TERM 1	TERM 2	TERM 3	TERM 4		
4.1	Time	Introduce both concepts day/night, light/dark, morning/ afternoon/night (tonight) Introduce daily programme with pictures displayed from left to right and arrow to show the activities as the day progresses Introduce weather chart (daily) with name of the day, date and month with song and rhyme, flash cards and display labels and symbols and pictures on a calendar representing the week Days of the week (daily) sequence learnt through a song or rhyme Indicate birthdays, outings, special days, holidays during the week Sequence months of the year through a song Develop an awareness of the time concept Introduce the birthday chart and own age, date of birth (day and month) Develop an awareness of reading direction	Daily programme (ongoing) Reinforce the sequencing of recurring events in one day Weather chart (daily) with day, date and month song and rhyme, flash cards and display labels, symbols and pictures on a weekly calendar Days of the week (ongoing) repeat song or rhyme daily Develop an awareness of what the learner does from the time he/she wakes up until going to school Develop an awareness of what happens between suppertime and bedtime Birthday chart continuous whenever a learner has a birthday Seasons chart summer, autumn, winter, spring	Daily programme (ongoing) Reinforce the sequencing of recurring events in one day Weather chart (daily) with day, date and month song and rhyme, flash cards and display labels, symbols and pictures on a weekly calendar Days of the week (ongoing) Seasons chart (ongoing) Birthday chart continuous whenever a learner has a birthday	Daily programme (ongoing) Reinforce the sequencing of recurring events in one day Weather chart (daily) with day, date and month song and rhyme, flash cards and display labels, symbols and pictures on a weekly calendar Days of the week (ongoing) Seasons chart (ongoing) Birthday chart continuous whenever a learner has a birthday		

	ΤΟΡΙϹ	TERM 1	TERM 2	TERM 3	TERM 4
4.2	Length Concretely compare and order objects using appropriate vocabulary to describe length	During daily routines introduce the concept of length: long and short, tall, taller and tallest Introduce a height chart Learners can compare their heights against something in the class, e.g. cupboard: - measure with hands (visual and incidental) - measure with footprints/feet	During daily routines explore the concept of length: long and short, tall, taller and tallest Compare and order two or more objects by placing them next to each other Use appropriate vocabulary to describe length: longest and shortest, longer and shorter Height chart comparison: learners discover whether they have grown since last term	Estimate the length of different objects Estimate and measure the length of different objects using feet, hands, a piece of string, a stick Height chart comparison: learners discover whether they have grown since last term	Measure the height of learners with a tape measure Height chart comparison: learners discover whether they have grown since last term
4.3	Mass Works concretely comparing and ordering objects using appropriate vocabulary	Incidental learning indoors and outdoors Continuous during water and sand play	Incidental learning indoors and outdoors Continuous during water and sand play	Introduce concept of mass by comparing the masses of different objects: - light/heavy - lighter/heavier - lightest/heaviest	Reinforce the language of mass during indoor and outdoor activities
4.4	Capacity/Volume Works concretely comparing and ordering objects using appropriate vocabulary	Incidental learning indoors and outdoors: empty/full, more than, less than Continuous during water and sand play	Incidental learning indoor and outdoor activities Water/sand play Use containers to compare amounts using familiar containers	Introduce the measuring concept of capacity by comparing how much various containers hold: - empty/full - more than/less than	Continuous during water and sand play Reinforce the language of capacity/ volume during indoor and outdoor activities
4.5	Perimeter and Area	No CAPS content for Grade R			

5. DATA HANDLING						
	ТОРІС	TERM 1	TERM 2	TERM 3	TERM 4	
5.1	Collect and sort objects Collect and sort physical objects according to one attribute, e.g. size of leaves	Introduce the concept of data handling: - collect and sort data, e.g. How many boys/girls in the class? - sort the data by letting learners stand in a boy/girl row	Collect objects (twigs of different sizes/ lengths) Sort the collected objects (twigs)	Pose a question: 'Are names with six letters the most popular?' Collect data to answer the question using the learners' name cards Sort the name cards according to the number of letters in each name	Collect data: Whose birthdays are in which month? Sort the data according to the relevant birthday month of each learner Collect data: e.g. What is your favourite playdough colour? Select one block representing the colour of his/her choice of playdough for the week Collect data: Which mode of transport do learners use to come to school? Sort the collected data (walk, with parent's car, taxi or bus)	
5.2	Represent sorted collections of objects	Represent the graph using concrete objects Make a graph representing the data using blocks or shapes Make a pictograph	Draw a graph to display data (twigs) Draw a picture as a record of collected objects	Draw a graph by pasting each name card below the relevant column Make a pictograph	Draw a graph representing the learners' birthdays in each month Use real objects to make a graph, such as blocks to represent the colour of playdough you plan to make, e.g. blue, yellow, green Draw a pictograph representing the learners who walk and come by taxi, car, bus	
5.3	Discuss and report on sorted collections of objects	Read and interpret data by using playdough to make a representation of the number of boys and girls in the class Answer questions based on own sorting of objects How many big leaves did you draw? Which are the most: the big leaves or the small leaves? How many/more/ less/same as?	Read and interpret graphs using questions Answer questions based on own picture or own sorted objects	Read and interpret data by counting the number cards in each column and coming to a conclusion	Read and interpret graphs using questions to determine which month has the most birthdays According to the choice of the learners, the colour of the playdough for the week will be, for example, yellow Read and interpret graphs (How many walk, come by taxi, bus, etc.?)	



Numbers, Operations and Relationships

Understanding number

Children develop a sense of number and counting through their everyday experiences. They use these to begin to make connections between the different meanings of number. They discover that numbers can be used differently in different situations. For example, 'five' can be used:

- * to express an amount ('how muchness'): 'I have five sweets.'
- * to express the order of things: 'She is the fifth person in the row.'
- * as a measure: 'He is five years old.'
- * as a label: 'We live at number five.'
- ✓ in a calculation: '2 + 3 = 5'

Numbers are ideas or concepts of quantity (how much). Learners begin to understand that 'five' means that there are five of something, and that five can be the fifth position in a row, or 'five' can tell us how many things there are. Numbers communicate specific, detailed information about collections and quantities of objects, events or actions.



Figure 42 Different meanings of 'five'

Numbers are abstract concepts. They are not objects themselves. They describe something about other objects. For example, just like the word 'green' can be used to describe the colour of an apple, the number 'six' can be used to describe the number of apples in a collection. If someone asks you to give them a plate you can hand them the physical object, but if someone asks you to give them 'five' you can't pick that up and

hand it to them. You might think of giving them the numeral '5' written on a card or you might give them five sticks, or show five fingers. It is impossible to show the number itself because it is an idea in our heads, so we find ways of showing or representing the number, such as using a collection of objects, a picture or a symbol, such as a numeral or a word.



Help learners build new maths knowledge and concepts based on their everyday experiences:

- Draw on learners' prior knowledge when introducing new maths concepts.
- Wake links between everyday activities and concepts.
- Plan activities that build on and deepen learners' understanding of a maths concept.

Figure 43 illustrates a simple progression from everyday activities to more complex concepts of number in Grade R. It starts with everyday activities that have links to numbers and initial number concepts and progresses to more complex concepts of number.



Figure 43 Progression

Representing number

During Grade R, learners use symbols to **represent** words, images and ideas. Children first learn to represent ideas or actions through fantasy play, for example, a learner's arms are the aeroplane wings as she zooms around the room, or a learner might use a plastic lid as a steering wheel to drive a car.

Learners begin to represent numbers using their fingers and then gradually start to use other methods, such as objects, drawings, pictures or symbols. Learners progress:

- from using actual objects to represent numbers, e.g. lemons, sweets, pencils, leaves
- to using pictures or drawings to represent the objects, e.g. a drawing of a lemon, person, car
- to using counters to represent the objects or pictures, e.g. plastic discs to show the number of lemons
- to using marks to represent the physical objects and pictures, e.g. circles, dots, tally marks
- * to using written number symbols and number words, e.g. '2' or 'two'.

Here are some different ways of representing 'five'.



5 * *

Figure 44 Different representations of 'five'

Different kinds of numbers

There are different kinds of number in the number system. In Grade R we focus only on understanding and using whole numbers (counting numbers).

In higher grades, learners will learn that:

- integers include whole numbers and negative numbers
- rational numbers include whole numbers, negative numbers, decimals and fractions.

GLOSSARY

represent to use objects, symbols or actions to stand for an idea or concept





Subitising

Subitising involves immediately recognising, without counting, the number of items in small collections. Subitising is an early skill that exists before learning number names and symbols or learning to count. Subitising forms a strong foundation for counting collections of objects and for early calculation.

Perceptual subitising

Perceptual subitising is the ability to immediately perceive the number of objects in a small collection. Young children are able to perceive or recognise the difference between a number of objects in a collection, without counting, and can say which is more or which is fewer without knowing number names or symbols. Often, they can use their fingers to match and show the same number of objects. Gradually they learn to match number names to the collection and will be able to say, without counting, that there are one, three, two, five objects in a collection. This form of subitising is only possible with a small number of objects and most children and adults can accurately do this up to five.



Figure 46 Dot arrangements for two, three and four

Conceptual subitising

In Grade R the learners' ability to recognise 'how many' objects there are in a collection increases. It can extend to amounts larger than five by making use of number images, such as the arrangement of the dots on dice, dominoes and ten-frames.

GLOSSARY

subitising

the cognitive ability to immediately recognise the total number of objects in a collection without counting


In the examples below, by using conceptual subitising, learners can immediately recognise that these cards each show seven objects.



Figure 47 Dot arrangements for seven

This extended form of subitising is called conceptual subitising. It is based on part–whole knowledge and enables learners to quickly identify numbers larger than five.



Learners enjoy playing games that involve quickly showing a small number of objects before hiding them, then asking how many there were. Matching and counting games will consolidate subitising, for example, recognising a number of objects without counting. This will help the learners with memorising number combinations to ten and early calculations (addition and subtraction).

Dot cards can be used to:

- 🖐 present different number arrangements from one to five
- 🖐 support the development of recognition of small numbers
- 🖐 associate number names with small collections
- $\overset{\scriptstyle{\Downarrow}}{\overset{\scriptstyle{\lor}}{\overset{\scriptstyle{\leftarrow}}}}$ match counters to the dots.



Activities such as dominoes and dice games provide fun opportunities to practise subitising skills.

Counting

Counting is a complex skill that needs lots of practice. Learners develop it as they practise counting real objects. Often they begin by imitating the counting of older learners and adults.

There are two activities that involve counting. The first is oral or rote counting that involves memorising the names and order of the counting numbers, often in a rhyme or song. The second is counting objects one by one to find out 'how many'.

Oral counting

In Grade R, learners learn the correct order of number names and repeat the sequence daily, counting out loud. This kind of **oral counting** is also called **rote** or **acoustic counting**. The purpose of counting out loud is to help learners understand that when we count, there is a set order for the number names, beginning at one, and then following with two, three, four. Initially, learners do not fully understand the meaning of the number names and might skip numbers in a counting sequence.

Reciting a rhyme or series of numbers orally means repeating the numbers from memory. Even when learners count in steps of two, five and ten they are using their knowledge of this number order. Learning number names and repeating them in the correct order does not necessarily mean that learners can count. This is different from counting to find out 'how many'.

Counting objects

Counting objects is also called **rational** or **resultative counting**. This means that objects or events are matched with a number name. To count 'how many', learners need to realise that each object in a collection gets a number name ('one, two, three, four ...') and that you count each object only once.

With plenty of hands-on activities and guidance from the teacher, learners begin to understand and apply the following counting principles:

- 1. One-to-one correspondence principle: Matching one, and only one, counting word to each object in the collection being counted. Initially learners might count the same object twice, skip an object or forget which objects have been counted. It is useful for learners to touch and move objects as they count.
- 2. Stable order principle: Number names are always arranged in the same fixed order, e.g. one is followed by two, two is followed by three, three is followed by four, and so on.
- **3. Cardinal principle:** The last number name said when counting a collection, represents the total number in the collection.
- 4. Abstraction principle: Learners understand that even if groups with the same number of objects look very different (e.g. five grapes, five people, five houses) they have the same numerosity, i.e. 'fiveness'. They realise that counting can be applied to objects, pictures, colours, shapes, or even actions or sounds.
- **5. Order-irrelevance principle:** The order of counting the objects in a collection does not matter. Learners need to understand that however we arrange the objects, the total number of objects in the collection remains the same.

GLOSSARY

oral counting/ rote counting/ acoustic counting counting out loud, saying the numbers in the correct order rational counting/

resultative counting

counting objects to find out 'how many'



Figure 49 Example of the abstraction principle

Once learners have understood and can apply all five of these counting principles, we can confidently say that they can count.



Estimation

Although counting is about finding the exact number of objects in a collection, learners also need to develop estimation skills so that they can say 'about' how many objects there are in a collection. They need to be able to use terms such as 'a lot', 'few', 'more', 'too many' or 'the same as'. Estimating is about learners using their understanding of number to make sensible and accurate guesses about quantities and amounts while realising that an estimate does not need to be exactly right. Learners are often reluctant to make a guess in case it is incorrect.



Although learners may not yet be able to count a number of objects precisely, they can find an answer by estimation.

- Based on the visual image, learners can see that there are more objects or items in a picture. They can say which has more or which has fewer.
- Learners can find the answer by using one-to-one matching of the objects from two collections to compare which collection has the most and which has the least.
- Learners can compare the number of items in two pictures by drawing a line around the same number of items in each picture.
- Learners can also use their hands to cover a number of items, for example, four ice creams in each picture. It would be clear that there are more ice creams uncovered in the first picture.









Figure 51 Estimating based on the visual image that is seen

Ordinal numbers

Ordinal numbers are used to describe the place or position of a person or object, for example, in a line or row. Learners understand that if they run a race they don't come 'three' they come 'third'. In the same way, they know that they don't stand 'one' in line but rather 'first'.





Figure 52 First, second and third positions

Calculating

A good understanding of number and counting is important for learning how to calculate. Learners first need to understand the relationship between numbers: comparison, ordering and partitioning numbers (breaking down and building up) in order to learn number operations, such as addition, subtraction, multiplication and division.

Activities and experiences that involve breaking down and building up numbers, adding to and comparing collections are the beginning of the concept of combining (addition) and separating (subtraction). Grade R learners are also exposed to addition and subtraction during their everyday games and activities, e.g. when they play 'shop' together or have to share toys. For subtraction, learners need to take part in practical activities that involve 'taking away', in other words, finding how many are left in a collection of objects when some have been removed. Initially learners will use counting strategies to solve problems involving addition or subtraction, e.g. counting all the objects in two collections to reach a total amount when the two collections are combined, or counting how many coins are left when some have been given away.

Multiplication, division and fractions are not formally taught in Grade R, but learners use these concepts when they solve problems that involve making groups of objects and when they share something equally. Activities that involve repeated addition and repeated subtraction lay the foundation for the concepts of multiplication and division. These activities also help to establish relationships between addition and multiplication, and subtraction and division, which need to be understood later on at school.



Present learners with problems that explore making equal groups and equal sharing, for example:

Ask three learners to each take two counters. Together count the total number of counters, e.g. two and two is four and two is six (repeated addition).

- Place six counters on the mat. Remove two at a time as you say, 'six take away two is four, take away two is two and take away two leaves nothing' (repeated subtraction).
- Give learners cut-out circles. Ask them to make equal groups on each circle using counters, e.g. two in each circle.
- Ask learners to share objects equally between them, e.g. share 15 counters between three learners.
- Ask learners to share objects where the remainder must be shared, e.g. share two apples equally between three learners.



Questions to ask for Numbers, Operations and Relationships

- Can you arrange these in a different way?
- How many are there?
- How many can you count?
- Who has more/fewer?
- What number comes before ...? What number comes after ...? What number is between ... and ...?
- How many more are in this group?
- If we share these equally between us, how many will we each have?
- If I cover some of these, how many are hidden?
- What number is this? (showing a number card or written numeral)
- Can you put the number cards in order?
- Who is standing first, second, ...?
- If you have two of these and I give you two more, how many will you have?
- If I have three of these and I give you one, how many will I have?



Vocabulary for Numbers, Operations and Relationships

Count and recognise numbers

- match, sort, compare
- number
- one, two, three ... twenty and beyond
- none, nothing, empty, nought, zero
- how many ...?
- count (up) to
- count on (from, to)
- count back (from, to)
- count in ones, twos ... tens ...
- more, many, few, fewer
- fewer than, greater than, most, least
- too many, too few, enough, not enough
- every other
- group, collection
- nearly, close to, about the same as
- how many left over, remaining
- just over, just under

Compare and order numbers

- match, sort, compare, order
- the same number as, as many as
- one more, two more, ...
- one less, two less, ...
- in front of, behind, next, next to, between
- first, second, third ... tenth
- last, before, after

Of **two** objects/amounts: greater, more, larger, bigger, less, fewer, smaller Of **three** or more objects/amounts: greatest, most, biggest, largest, least, fewest, smallest

Operations with numbers

Addition and subtraction

- match, compare
- add, more, and
- together, altogether
- double/half
- one more, two more, ...
- how many more to make ...?
- how many more is ... than ...?
- take away, subtract
- one less, two less, ...
- how many are left/left over?
- difference between

Multiplication and division

- bundles, groups of two, three, ...
- share fairly/equally
- share, share between/among
- share one/more than one at a time
- is the same as, different from
- how many left over, remaining

Equivalence

- match, compare
- exactly the same
- same as, different from
- makes
- equal to
- equal groups

Estimate

- match, compare
- guess how many; estimate
- nearly, close to
- about the same
- just under, just over
- too many, too few, enough, not enough

Patterns, Functions and Algebra

Pattern is all around us. Children encounter patterns and **sequences** in people's behaviour, in daily routines, days of the week, months of the year, in weather cycles, in music and art, and in their built environment. For example:

✓ clothes







GLOSSARY

pattern

the regular sequence of objects, movements or events that are repeated in a predictable way

sequence

the particular order in which objects, movements or events follow each other

Figure 54 Patterns in clothes

✗ buildings



Figure 55 Patterns in buildings

\star nature



Figure 56 Patterns in nature

Identifying patterns

Young children tend to focus on the colour and attractiveness of a picture or object, e.g. a piece of wrapping paper, and will say it has a 'pretty pattern'. Most of these patterns are **irregular patterns**. We can see that there is a repetition of objects, colours or shapes, but we cannot tell how the repetition works.



Figure 57 Irregular patterns



Teachers should draw learners' attention to patterns inside and outside the classroom. For example, point out how the bricks in a wall are arranged, the paving tiles in a path or the markings on animals.



Figure 58 Patterns around us

In a **regular pattern** we can see how the **elements** in a pattern are repeated and we can predict the order or sequence that the pattern will follow, e.g. in the pattern below we can see that the circle and square are repeated and we can predict that the next shape in the sequence will be a circle, followed by a square, and so on.



Figure 59 Circle, square pattern

In Grade R, learners may be able to recognise a pattern, but they may not be able to identify or describe 'what makes the pattern'. Teachers can help learners identify patterns by asking them what makes a particular pattern and how the elements are sequenced. For example, in the pattern above: 'Which shape is first? Which shape is next? What shape do you think will come next?'

Different types of patterns

Geometric patterns

A geometric pattern is a pattern that is made of lines and geometric shapes that are arranged in a repeated order, for example, a rhombus, rectangle, square or pentagon. Geometric patterns can be found all around us, e.g. on floor tiles and wrapping paper.



Figure 60 Geometric patterns

GLOSSARY

elements the objects, movements or events in a pattern

Repeating patterns

Repeating patterns are made up of a repeated sequence of elements, for example, shapes, colours, sounds, objects, movement or events. In a repeating pattern, the same elements are repeated regularly.



Figure 61 AB pattern

Start by introducing learners to patterns with only one **attribute** that differs, e.g. colour or shape, and provide a long enough repeat sequence so that learners can work out the pattern.

Learners can then recognise more challenging patterns, such as ABB or AABB patterns.



GLOSSARY

attribute a feature or characteristic of something, for example, colour or shape



Figure 63 AABB pattern

Figure 62 ABB pattern

Gradually introduce learners to patterns that have two or more attributes, such as colour and shape.



Figure 64 ABC pattern

Growing patterns

Growing patterns are different from repeating patterns in that the pattern increases or decreases in size in each sequence. In the pattern in Figure 65, the number of coloured blocks increases by one in each sequence of blocks.



Figure 65 Growing pattern



Learners can associate the pattern with the sequence of numbers and recognise that the number increases by one each time.



Figure 67 Growing pattern

In the pattern below, the sequence increases by two each time.



Figure 68 Growing pattern

Patterning skills - what learners need to know

Learners' skills will vary, but generally Grade R learners will work towards being able to:

- match and sort objects according to one or more attribute, e.g. shape, colour, sound
- * compare similarities and differences in two or more objects
- * talk about patterns that arise from daily experiences
- * recognise patterns in their environment, e.g. fence posts, bricks, paving
- identify patterns
- ★ copy patterns that others have made
- * extend patterns that others have started



* create their own patterns at various levels of difficulty such as:



Figure 69 Creating patterns

tell what is missing if part of a pattern is hidden.



Teachers should guide learners to recognise and make patterns and provide opportunities for them to observe, describe and discuss patterns, focusing on activities that involve:

- 🖐 talking about 'what makes the pattern'
- exploring patterns using objects, pictures and rhythm, such as clapping, in the maths focus time as well as in creative art, music and physical activities outdoors
- where we way the sequenced elements in a particular way
- drawing patterns and using different colours and shapes, and to talk about the way the pattern is repeated.

Questions to ask for Patterns, Functions and Algebra

- Can you see a pattern? Tell me about it.
- What comes first, last, next, after, before?
- Are these two patterns the same? What is different? How could you make them the same?
- Can you copy this pattern? What will come next in the pattern?
- What must I do to extend this pattern?
- Can you tell me what your pattern is? Could you make a different pattern? What is missing in this pattern?

Vocabulary for Patterns, Functions and Algebra

- match, compare, order, sequence
- start, beginning
- first, middle, last
- before, after, end
- which is next ...?
- size
- big, bigger, biggest
- small, smaller, smallest
- same, different, difference
- colour names
- build the pattern
- recognise
- show, identify
- continue, carry on, extend
- copy
- repeat, again
- describe, explain
- what comes before/after?
- follows, between
- in a line, in a row
- space, spaced

Space and Shape (Geometry)

Young children explore shape and space during their everyday activities as they try to make sense of the forms and shapes around them, such as their mother's face, objects that move and their own bodies. They explore spatial concepts related to shape and space when they play with balls or get in and out of boxes and climb onto and under objects. They have observed different shapes in things in their homes and outside, such as clouds, buildings, leaves and vehicles.

Many children come to Grade R with some knowledge of different shapes and may be able to identify and draw shapes, such as circles and triangles. They may also have played with blocks, construction toys and puzzles. In Grade R, learners build on these experiences as they learn about space, shape, position, **orientation**, views and direction. They need plenty of opportunities to investigate and explore different everyday objects. These experiences of space and shape help to lay a solid foundation for understanding **geometry** in later grades.

GLOSSARY

orientation

how objects are placed in relation to each other

geometry

an aspect of mathematics that deals with properties, measurement and relationships of points, lines and angles of shapes in space

Space

Children orientate themselves in space using their own bodies. First they explore the relationship between themselves, other people and objects. Babies reach and grasp objects near to them, and then gradually start to move around and explore their environment using all their senses. They explore what happens when they push, pull, roll or turn different objects as they play with them, and when they do this they develop a sense of themselves in relation to the objects. They also learn the limitations of their own physical movement as they climb over and under chairs, into boxes, hide behind trees or look down from steps.

Position

Position in Grade R starts with the positions of objects in relation to the learner, and progresses to the position of objects in relation to other objects. Position vocabulary includes in, on, above, in front of, behind, in between, next to, and so on.

With the help of adults at home and teachers at school, Grade R learners can develop the vocabulary to describe space, position and direction as they play, look for objects or climb into and onto things.



Figure 70 Exploring position



Direction

Learners in Grade R initially begin to show direction by pointing, then by using simple phrases like 'over there'. The concept of direction progresses from being about the position of where children are to where they are in relation to other things, e.g. go straight, turn, and so on.



Use direction vocabulary:

- 🖐 during snack and tidy-up time
- When giving instructions about where to put things and how to get from one place to another
- 🖐 when going on outings.

Perspective

In Grade R, as learners' gain an increased understanding that when things are far away they look smaller, their concept of **perspective** develops.



- Observe people and objects outside the classroom and talk about why they look smaller.
- Close one eye and measure how big a person or object looks and talk about whether they are really that small.
- Focus attention on objects in pictures that appear to be small and talk about why this is so.

GLOSSARY

perspective the effect of distance or depth on the appearance of objects

Shape

In Grade R, learners focus on recognising, identifying and naming **3-dimensional (3-D)** objects and **2-dimensional (2-D)** shapes. In everyday language, learners will say that they can look at the object from all sides, the top and the bottom. Mathematically we describe the **properties** of 3-D objects by their length, breadth (width) and height. In everyday language, learners will talk about 2-D shapes as pictures, but mathematically we talk about shapes as having length and breadth (width) to describe two dimensions.

Three-dimensional (3-D) objects

In Grade R, learners explore the properties of everyday 3-D objects. They build constructions using recycled household materials, such as boxes, cans, tubs, toilet roll inners and balls. They investigate and describe box-and ball-shaped objects. They compare and sort objects, and talk about similarities and differences.

These all have flat faces.





These will all roll.









These all have triangles on some of their faces.







2-dimensional (2-D)

a shape has two dimensions: length and breadth (width)

3-dimensional (3-D)

an object has three dimensions: length, breadth (width) and height

property

the characteristics of a 2-D shape or 3-D object, e.g. length, width, height, sides (faces), edges, corners





Learners can:

- Play with collections of 3-D objects including blocks, tins, boxes and balls.
- Describe objects. They can choose one object at a time. You can prompt their thinking through questioning, and introduce them to the correct names and properties of each object.
- Sort 3-D objects according to a particular property, such as straight edges or whether they can roll. This will allow learners to become familiar with, and to explore the properties of the objects.
- Describe these objects using everyday language, such as flat, smooth, pointy. As learners notice more properties they learn the appropriate names, e.g. edge, corner, surface or base, face. Sorting activities and discussions about objects are important because they help learners to understand, for example, that although a cardboard tube is tall and thin, while a drink can is much shorter, they are both cylinders.

Learners should be guided to recognise that it is the property of an object, such as the length, breadth or height, that we are focusing on when sorting and not the colour, size or other features.

Grade R learners may ask what the name of an object is, e.g. a cube, cylinder or cone. In higher grades learners learn about the 3-D solids shown in Figure 73.



Figure 73 3-D solids



Two-dimensional (2-D) shapes

In Grade R, learners recognise, identify and name 2-D shapes: circles, triangles, squares and rectangles. Inside and outside the classroom they see shapes and can explore the properties of these shapes in pictures and look for objects that 'look like' shapes, e.g. a road sign might look like a circle, the windowpane like a square, the door like a rectangle.



- Look for objects that have a 'square' shape, referring to the side or face of a box, or a 'circle' shape, referring to a road sign or the base or edge of a cup.
- ${}^{igsymbol{\&}}$ Describe 2-D shapes of various sizes and orientations in pictures.

Learners need to see a variety of 2-D shapes, e.g. different triangles (not just equilateral ones), and rectangles of different sizes. This helps the learners realise what particular shapes have in common, for example, that all triangles have three sides and three corners, but may not look exactly the same, and that rectangles have four sides regardless of the orientation.



Figure 74. Shapes with three sides



Figure 75 Shapes with four sides

Give learners opportunities to explore 2-D shapes during independent play activities. Make a variety of materials available – plastic shapes (attribute blocks) and cardboard shapes of different colours and sizes – and then encourage learners to use them to create patterns, pictures and simple representations. During these activities, teachers can discuss with learners what they are doing and ask encouraging questions such as: 'Tell me about the pattern you are making.' 'That is a lovely house, how did you make it? Describe the steps to your partner.'

When Grade R learners begin to investigate and describe shapes and objects, they often use everyday language, such as flat, smooth, pointy. Gradually teachers can help them learn to focus on the lines of a shape or object and use maths terms to replace the everyday ones – sides, curved, straight, corner.

Learners' understanding of the properties of shapes develops as they are able to recognise **differences** and **similarities** between shapes. This can be done through sorting and classifying activities as well as through matching activities, such as deciding whether a shape will fit in a jigsaw or a construction, or playing shape lotto.



Figure 76 Differences and similarities of shapes



Go from 3-D to 2-D

Trace around learners and other objects in the classroom to see and talk about the 'picture' that is formed. Learners can dip objects in paint and press them on paper to make prints. They can also trace around the edge of objects and talk about the line and shape they create. Bowls, building blocks, toilet roll inners, and almost any recycled materials can be used to create shape pictures in this way.

Shape games

Learners play in pairs. One learner hides a shape or object behind her/his back and the other learner asks questions about it until she/he can guess what it is. 'Is it flat? Does it have three sides?'

Teachers can challenge learners to make as many different shapes as possible on a geoboard.

Build and take apart shapes

Once learners can identify 2-D shapes (square, circle, triangle, rectangle) and 3-D objects (boxes and balls), they are ready to build and then take apart shapes:

🖐 Straws, sticks and other similar materials can be used with playdough to make shapes.

🧩 Ask learners to make a shape and discuss it. 'That's a square. Can you turn it into a triangle?'



Figure 77 Building shapes

Construct shape pictures

Learners can use attribute blocks to create a picture.



Figure 78 A shape picture

They can glue cut-out shapes onto paper to form other shapes or pictures.

They can roll, pinch and press playdough to make shapes and combine these to make new shapes.

Transformations

Learners slide, flip and turn shapes as they solve problems involving shapes, such as matching shapes in pictures, and copying shape patterns using attribute blocks.

In higher grades learners will learn about a range of 2-D shapes. Learners in Grade R will often ask teachers and adults what a shape is called and the diagrams below provide a reference for these instances.





Symmetry

Learners can notice symmetrical patterns all around them, in nature, in buildings, in paintings and objects. In the early years, **symmetry** is easiest understood as 'reflection' or 'mirroring'. Learners can explore this concept by folding and cutting shapes and pictures in half, or by drawing a picture on one half of a piece of paper using wax crayons, then folding the paper and rubbing the area behind their drawing and seeing the exact copy of what they have drawn reproduced on the other half of the page.

GLOSSARY

symmetry

when a shape or object can be divided into two equal halves along a central line

Symmetrical patterns can be found on our bodies, in nature, in the built environment and in pictures. Line symmetry divides the shape into two identical parts. The line can be horizontal or vertical.



Figure 80 Line symmetry divides the shape into two identical parts.

In Grade R, learners explore symmetry by comparing objects and pictures. They learn that symmetry is not about being 'the same as', but rather about being identical, for example, a butterfly is symmetrical, but a hand is not.





Figure 81 Symmetrical

Figure 82 Not symmetrical





Figure 83 Folded piece of paper with image cut out and copied opposite to show symmetry.

Questions to ask for Space and Shape (Geometry)

- Where are you standing?
- What is in front of/behind you?
- Can you tell me how to get from ... to ...?
- Can you show me how to move around the box, over the chair and under the table?
- What shape is this?
- How do you know it is a triangle/square/rectangle/circle?
- How many sides does this shape have?
- How many corners/points does this shape have?
- What can you tell me about the sides of this shape?
- What can you tell me about the line?
- What is the same/different about these two shapes?
- Why do they belong together?

- Can you see anything in the classroom that looks like this shape?
- What would happen if I flipped this shape? What would happen if I turned this shape around?
- Can you use these shapes to make a model of that picture?
- Which of these objects can roll/slide?
- Can you put these objects on top of each other?
- Can these shapes fit together?
- Can you find an object with flat sides?
- Can you find an object with curved sides?
- How many edges/corners/points does the box have?
- What is the same/different about these two boxes?

Vocabulary for Space and Shape (Geometry)

Position and direction

- in, on, off, on top of, over, under, out, into, out of, top, bottom, above, below, between, in front of, behind, next to, upside down
- near, far, beside, side, inside, outside
- close, closer
- far, further
- near
- straight, turn
- around, along, through
- to, from, towards, away from
- opposite
- forward, backwards, sideways
- left, right

2-D shapes

- circle, square, rectangle, triangle
- line, side, edge, corner, point, sharp
- curved, straight

3-D objects

- block, box, bottom, top, sides, flat
- lines, straight, edge
- corner, sharp, point
- ball, round, curved

Symmetry

- same as
- left, right
- top, bottom

Measurement

Children are involved in **measurement** when they play and explore in their everyday lives. They come to Grade R with their own ideas of measurement, for example, that an adult is 'big', that something is too high to reach, that they need many things to fill a box, that it takes a long time to walk to the shop. They will compare which of two sweets is the biggest, which is the tallest block tower or which of two boxes is the heaviest. Conceptual understanding of different kinds of measures develops gradually and grows out of children's practical, day-to-day experiences and conversations with adults and friends, when, for example, they might take the biggest piece of bread or compare height or find out who has the smallest foot or who has made the tallest tower. They make decisions about which of two toy cars will fit into a garage and how many blocks they would need to make the garage bigger or smaller. They may measure out ingredients for cooking, pouring water or sand from a jug to see how many cups can be filled, or compare how heavy a bag of sugar and a box of oranges is.

Measurements and the units we use to measure are about finding 'how much' there is of a particular thing. Measurement links with other maths areas, such as numbers, patterns, shape and data. Learners count how many units are needed to measure physical quantities, such as height, capacity, volume, length, weight, or non-physical quantities, such as time, money or temperature. They may estimate which of something is 'more' or 'less', for example, the scoops of ice cream in a bowl. They will base their estimation on the amount of space the ice cream takes up, not on the weight of the bowls or the number of scoops.



Figure 84 Estimating the amount of ice cream

In Grade R, measurement is practical and learners should do many handson activities that are meaningful to them. To understand measurement concepts, for example, how 'heavy' something is, learners need to pick up objects and compare their weight. Measurement is about determining the size or amount of one thing by comparing it with a non-standard unit, such as hands, feet, a pencil or a piece of string, or a standard unit of measurement, such as a centimetre or litre.

GLOSSARY

measurement 'how much' of something, e.g.

height, length, mass,

volume, capacity

Teachers need to observe learners during the activities and talk with them about their ideas. Teachers can introduce new vocabulary while learners are comparing, for example, how long things are. When learners talk about something being 'big' or 'small' the teacher can model the use of the correct vocabulary by rephrasing their words. For example, when a learner says that someone is big or small teachers should encourage them to say what it is about the person that makes them big or small. Is it the height or the width or the weight of the person?



Figure 85 Using maths vocabulary

Once learners have decided what they want to measure (the attribute) they need to decide how they will measure a particular attribute, such as height.



Figure 86 Using hands to measure height

In this way, learners will begin to understand 'big' things aren't just large objects, and that they can look at them in terms of their length, height or weight.





Learners also add or subtract when they solve measurement problems that involve number, for example, when they:

- & compare amounts when pouring water or sand into different containers, they will realise they need 2 cups to fill a jug
- work out how many objects to place on either side of a balance scale to make the sides balance, they will realise that they need one more or fewer and count the total number
- construct block towers and add, subtract and count the number of blocks to make a tower taller or shorter.

Developing the concept of measurement

Learners should have plenty of opportunities to solve problems involving measurement and should have a range of appropriate containers that they can use in informal activities to investigate and find solutions for themselves. Learners need hands-on activities that involve comparisons by picking up, pouring, touching and talking about what they experience.



Figure 87 Containers for measurement activities

Different ways of measuring

Direct comparison

The focus of measurement is on comparing the attribute of something 'directly'. For example, measuring the length of a pencil against another pencil or comparing the height of two learners standing back to back.



Figure 88 Comparing the height of two learners

'Max is taller than Lola.' 'How much taller is he?'

Comparisons can also involve ordering: 'Max is taller than Lola, but shorter than Elton.'



Figure 89 Tallest to shortest

Informal measuring

We measure informally, using **non-standard units** to measure, for example, when we use an arm's length to measure a piece of string, or use our feet to measure the size of a carpet.

GLOSSARY

non-standard unit a unit of measurement that uses an object, such as a shoe, paper clip or cube; it can also be an informal item, such as a hand span, foot or body length

Standard measuring unit

We use standard units, such as millilitres, litres, centimetres, metres, grams, kilograms, minutes and hours to compare the length of something, how heavy something is or how long it takes to do something. We use standard units to measure more accurately.

Estimation

Learners need to develop estimation skills during their informal measurement activities, for example, they should estimate how heavy they think something is before measuring, or how long they think something is based on the number of blocks they think they will need to measure it, or how long they think it will take to finish tidying up the classroom. They then use measuring instruments to find out how accurate their estimation was.



Learners begin to understand what measurement means and why we need to measure. They understand that:

- Weasurement involves direct comparison and the use of non-standard units, such as hands and feet, and other units that are exactly the same size or length, such as blocks, string, counting straws.
- Each unit is a different size; they realise that each measure produces a different result.
- We use one standard unit to measure so that we all have the same outcome when comparing an attribute.

Learners need plenty of opportunities to make decisions themselves about what to measure and how to measure. They should compare the results of their measurements and use different units to measure the same objects.

In higher grades, when learners have acquired comparison and estimation skills, they begin to use standard units. Some Grade R learners may be exposed to measuring tools at home and these can be discussed informally at school, for example:

- measuring jugs, measuring spoons to measure millilitres, litres
- rulers, tape measures to measure centimetres, metres
- \star scales to measure grams, kilograms
- watches and clocks to measure minutes, hours.

Time

The practical aspects of measurement – distance, capacity, weight – can be presented to learners through familiar activities and events, but time is a difficult abstract concept for learners to understand. This is partly because adults do not always use the language of time accurately, and use everyday expressions like, 'I will be there in a minute,' but then take much longer than that. Also, young children tend to live 'in the moment' and therefore recalling past events in order or predicting future events is more difficult for them. Learners need to understand how time passes in their own lives, so teachers need to relate time to the learners' daily experiences and events that are familiar to them.

- Sequencing events: Learners need to understand the language of time so that they can talk about the order in which a sequence of events occurs. Use the daily routine and stories to talk about the order of events during the day and the sequence of actions to complete a task – 'what happened next/before/after'.
- Units of time: Compare different units of time: school time is in the morning, home time is in the afternoon, bedtime is at night, two 'sleeps' until your birthday. Make a weather chart, keep a monthly calendar and record important events on a pictorial timetable. Talk about 'yesterday, today, tomorrow'. Gradually learners begin to understand how time builds into days of the week, months of the year and seasons.
- Rates of speed: Run and race outside. Use plastic guttering to make tracks to roll marbles along and ramps to push cars up and down.
 Dance to slow and fast music. Ask learners how long it takes them to brush their teeth or walk around the school. Talk about fast, quick and slow movements and activities.

Length

In Grade R, the focus is on estimating, measuring, comparing and ordering length and distance. Learners need to understand that in order to find out the length of something they need to measure it from one end to the other end. For example, they can measure and compare the length of a pencil using paper clips as non-standard units. The illustration below shows how the same pencil can be measured using two different units of measurement. In the first picture there are five paper clips and in the second picture there are three larger paper clips.







Learners can also measure from top to bottom to find the length of something, for example, to find out how tall the learners in the class are. Then you can arrange them in order from the tallest to the shortest.

- Direct comparison: Find things that are longer than/shorter than ... Sort objects according to length and height. Talk about and describe why the objects are sorted in a particular way.
- Attributes: Talk about the length, height or width that is to be measured.
- Non-standard units: Use hands, leaves, pencils to measure and compare objects.
- Uniform non-standard units: Use the same size unit, for example, blocks. Place these along the whole length of the object being measured. Later use one block and move it along, counting the number of moves.

Mass

In Grade R the focus is on estimating, weighing, comparing and ordering objects according to how heavy or light they are. It takes time for learners to understand the concept that size and mass (or weight) are different. Learners need to explore small heavy objects, small light objects, big heavy objects and big light objects and make comparisons between them. Teachers should help learners focus on how heavy the object is, not on its size.

- Direct comparison: Hold an object and estimate its mass. Find things that are heavier or lighter than the object.
- Attributes: Talk about the shape, size and mass of the object being measured.
- Non-standard units: Use a balance scale to compare the mass of objects. Place an object to be weighed on one side of the scale. Add another (or more than one) object on the other side of the scale to make it level.
- Uniform non-standard units: Use the same size unit, for example, a large block or a book to compare the mass of objects using the balance scale.

Capacity

The **capacity** of an object is how much it can hold, for example, a onelitre milk bottle can hold one litre of liquid. In Grade R, the focus is on estimating, measuring, comparing and ordering containers according to how much they can hold. Teachers need to provide many opportunities for learners to use the concepts of empty and full, for example, when they are filling or emptying containers with water or sand and during snack time. Learners can fill containers with different substances and talk about their capacity: 'How many cups of water do we need to fill this jug? Why do we need fewer milk bottles of water to fill the jug?'

GLOSSARY

mass how heavy something is

GLOSSARY

capacity the maximum or greatest amount that something (such as a bucket or a box, or a stadium) can hold

- Direct comparison: Fill, empty and pour between similar containers using water or sand to find out if they hold the same amount. Initially, learners are likely to estimate that the taller of two containers will hold more water.
- Non-standard units: Experiment with how much water or sand different containers can hold. Compare which holds 'more' or 'less'.
 Fill one container and then pour the water or sand into another to see if it overflows or if there is room left for more to be added. Fill tall and wide containers and put them in order from the one that holds the most to the one that holds the least.
- Uniform non-standard units: Count the number of spoons or cups that fill containers of the same and different sizes.

Volume

Volume is about how much of something an object is holding, such as water, sand, rice or sugar. In Grade R, the focus of measuring should be on how much a container can hold (capacity) rather than the amount of space a container takes up (volume). Volume can change according to the amount of contents at any given time, but capacity is always the same, for example, the capacity of the jug is 1 litre regardless of how much it contains at the moment. This is a difficult concept for learners in Grade R to grasp.



Figure 91 Exploring capacity and volume

- Direct comparison: Learners experiment with different-shaped containers to find out how big the container is and how much they think it could hold.
- Non-standard units: Float containers like plastic lunchboxes, plastic peanut butter jars, milk jugs in water. Fill them with counters or sand and discuss what happens. Ask questions such as: 'Do they still float? What happens to the water in the bucket? Does it spill over?'

GLOSSARY

volume the amount something is holding or the space the contents take up

Questions to ask for Measurement

- What did you do when you woke up?
- What did you do next?
- What happened after that?
- What did we do before ...?
- What will we do after ...?
- Which moves the fastest/slowest?
- What day is ...? What day will be ...?
- Which one is longer/shorter?
- Which one is heavier/lighter?
- How many cups/spoons/bottles does ... hold?
- Which container can hold more than this container?
- Whose container has the most capacity? How do you know?
- I am really thirsty. Which cup should I use? Why?

Vocabulary for Measurement

- match, sort, compare, order
- measure, same as

Time

- before, after, next, now, then
- quickly, slowly
- day, night, morning, afternoon
- today, yesterday, tomorrow
- week, days of the week
- month, months of the year
- calendar
- year, date
- autumn, winter, spring, summer, seasons

Length

- how long, short, wide, tall
- taller, longer, shorter, wider
- shortest to longest, longest to shortest

Mass

- heavy, heavier, heaviest
- light, lighter, lightest

Capacity

• more, less, empty, full

Volume

• big, little, large, small, tiny

Data Handling

Young children ask questions as they try to make meaning of the world they live in. Teachers need to encourage learners in Grade R to ask questions and seek explanations. These questions can be used as the basis for collecting information (data) and finding out about things and events.

Sorting and classifying

Learners constantly sort and **classify** objects around them in different ways. They put objects into groups of different colours and sizes, they pack and unpack items at home and at school, sorting them into piles of different shapes and uses, for example:

- sorting and matching groups of objects: socks, shoes, plates, cups
- packing objects: cans, boxes, bottles, counters
- ✓ sorting counters or toys by attribute: colour, size, type
- tidy-up time: books, blocks, puzzles, games, crayons.

Objects can be sorted and classified according to their similarities, such as colour. The more learners know about the properties of objects, such as plants and animals, and their similarities and differences, the more they are able to classify them into different groups.

Data Handling involves collecting, sorting and organising, representing and interpreting information in order to solve a problem or answer a question, for example, 'How many learners like eating apples?' In order to answer this question, learners would need to collect information, sort it and represent it in a way that would make it easy for them to interpret the information in order to answer the question.



Figure 92 Collecting, sorting and organising into groups

Data Handling can link to other areas of learning, for example, finding out about:

- the world around us, by observing and recording the daily weather or collecting different kinds of leaves
- personal preferences, like favourite colours
- healthy foods, like fruit and vegetables.

GLOSSARY

classify the process of grouping similar things in a systematic way, e.g. separating clothes by winter and summer

Identifying attributes

Initially, learners sort and classify objects according to one attribute, such as colour, size or shape. Gradually they can give reasons for why they have grouped objects in a certain way. They can also think of other ways of grouping the same objects, based on a different attribute. As learners explore and talk about how they are gathering, organising and sorting 'things' around them, they begin to organise objects into groups based on more than one attribute, such as the colour and shape of objects.



A teacher could ask learners to sort a collection of different coloured shapes:

- 🖐 Find all the green shapes.
- \checkmark Find all the squares.
- 🖐 Find the green squares.

Sorting by two attributes is challenging for learners because they have to understand conceptually the difference between the three groups. Two of the groups have only one attribute while the third group has attributes that make it fit into both groups.

The Data Handling cycle

People often refer to the process of Data Handling as a cycle because the events or activities that are involved are repeated in the same sequence for each new question that is answered.



Figure 93 The Data Handling cycle

- Ask a question: Learners decide what they want to find out about, e.g. 'I wonder how many learners come to school by bus and how many come by car?' The thread that holds data together is the reason for collecting specific data or information. This means that the data collected or groups generated through sorting should feed into answering a question that the learners have decided they want to find answers to.
- 2. Collect data: Learners decide how they want to collect data based on the question or problem, e.g. by asking other learners how they come to school and drawing a picture for each.
- **3. Sort data:** Learners organise and sort the data into groups according to the attribute. In order to answer questions and decide how to represent data they have collected, decisions need to be made about how things could be sorted.
- Represent data: Learners explore different ways of showing or displaying the information they have collected, e.g. by placing real objects on the mat or constructing pictographs.
- **5. Analyse data:** Learners describe and compare the data that is represented, e.g. which is the most or least used form of getting to school.



pictograph a way of representing data using pictures



Figure 94 A pictograph
6. **Report on data:** Learners answer the question that was initially asked, 'I wonder how many learners come to school by bus and how many come by car?' They can easily see that four learners come to school by bus and five learners come to school by car. They can also compare other information, such as how many learners come to school in other ways and which mode of transport is used the most or least.

Questions to ask for Data Handling

- Which group has the most/least? Can you tell without counting?
- Which group has more/fewer?
- What do you think the answer will be?
- How should we find out?
- Why did you put these things together?
- Could you organise these another way?
- Do these belong here?
- Are oranges or bananas the most popular fruit?
- How many days were: sunny, windy, rainy, ...?
- What would happen if ...?

Vocabulary for Data Handling

- match, sort, compare
- same, different, belongs, does not belong
- more than, fewer than, same as
- always, sometimes, never
- row, column
- maybe, possible, sure

Glossary

abstract an idea, a thought or a feeling

- **acoustic counting** counting out loud, saying the numbers in the correct order (also known as oral or rote counting)
- applications different ways of using maths concepts and skills, e.g. checking your change in a shop, counting out your taxi fare, or dividing a packet of peanuts between three friends
- **attribute** a feature or characteristic of something, for example, colour or shape
- **capacity** the maximum or greatest amount that something (such as a bucket or a box, or a stadium) can hold
- **classify** the process of grouping similar things in a systematic way, e.g. separating clothes by winter and summer
- **comparing** looking for similarities and differences between two or more objects, e.g. 'these are both animals, but one of them is blue and the other one is red'. Comparing is about finding the relationship between objects based on specific features. This skill leads to the ability to classify objects.
- **concept** an idea or thought. In other words, it cannot be touched. Maths concepts include number, counting, space, addition and subtraction.
- **developmental progression** order in which skills and concepts build on one another
- **diversity** a range of people with a variety of differences of, for example, identity, personality, capabilities, interests and background
- elements the objects, movements or events in a pattern
- exact precise, accurate
- **formative assessment** assessment that provides information while learning is taking place and measures learners' progress
- **geometry** an aspect of mathematics that deals with properties, measurement and relationships of points, lines and angles of shapes in space
- **inclusivity** the practice of ensuring that all children, regardless of their differences, are included in all classroom activities
- interact communicate with other people; do activities with other people
- mass how heavy something is
- **matching** identifying the same attribute in two or more objects, e.g. all the yellow objects. Matching is an important skill for learning one-to-one correspondence.
- **measurement** 'how much' of something, e.g. height, length, mass, volume, capacity
- **mediation** a joint activity where a person who knows more or has more highly developed skills guides others to learn something new
- **non-standard unit** a unit of measurement that uses an object, such as a shoe, paper clip or cube; it can also be an informal item, such as a hand span, foot or body length

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- **observing** using our senses to find out about objects, events and attitudes. We need to observe to gather information about the world, e.g. looking and listening carefully to what is happening around us.
- **oral counting** counting out loud, saying the numbers in the correct order (also known as acoustic or rote counting)
- ordering lining up three or more objects or events in a sequence, e.g. the daily classroom routine, the learners' morning routine ('after I wake up I get out of bed, wash my face, eat my breakfast ...') or the events in a story
- orientation how objects are placed in relation to each other
- **pattern** the regular sequence of objects, movements or events that are repeated in a predictable way
- **perspective** the effect of distance or depth on the appearance of objects

pictograph a way of representing data using pictures

- predict to say or estimate what will happen in the future
- principle a general rule that is accepted to be true
- prior knowledge what learners know from before and can already do
- **property** the characteristics of a 2-D shape or 3-D object, e.g. length, width, height, sides (faces), edges, corners
- **rational counting** counting objects to find out 'how many' (also known as resultative counting)
- reasoning the thinking behind an idea or statement
- relate how objects and ideas are connected to each other
- represent to use objects, symbols or actions to stand for an idea or concept
- **resultative counting** counting objects to find out 'how many' (also known as rational counting)
- **rote counting** counting out loud, saying the numbers in the correct order (also known as acoustic or oral counting)
- sensory perceptual skills using your senses to gather information about your environment, for example: seeing, hearing, touching, smelling and tasting
- **sequence** the particular order in which objects, movements or events follow each other
- **sorting** finding things that are the same, or alike, and grouping them by specific features. First sort by one feature, such as colour, e.g. 'all the green shapes'. Then sort by two features, such as colour and size, e.g. 'all the small, green shapes'.
- **subitising** the cognitive ability to immediately recognise the total number of objects in a collection without counting
- **symbols** things that represent or stands for something else, such as a number symbol, logo or road sign
- **symmetry** when a shape or object can be divided into two equal halves along a central line
- **3-dimensional (3-D)** an object has three dimensions: length, breadth (width) and height

2-dimensional (2-D) a shape has two dimensions: length and breadth (width) **volume** the amount something is holding or the space the contents take up

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