

Foundation Based Education Cycle One

Learning to Do, Learning to Be, Learning to Know, Learning to live Together



Mathematics

MATHEMATICS

Introduction

Mathematics in the Foundation Based Education (FBE) classroom is developmental. Children are actively engaged in constructing their own knowledge of mathematical concepts. Math activities are therefore integrated with other relevant projects in other domain areas. Skills are acquired through play, projects and real life experiences. Children come to each classroom with varying levels of numeracy. In order to meet the developmental needs of each child, the broad goals of the mathematics program enable children to:

- Become actively involved in organizing their own learning
- Organize their own problem solving strategies
- Develop their understanding of mathematical concepts, facts and skills
- Exchange points of view thoughtfully with others
- Enjoy learning

Mathematics instruction in the FBE classroom has three main components: Shared Math, Guided Math and Experiential Math.

- Shared Math is a 10 – 15 minute, whole class activity during which children explore a particular mathematical concept or problem. It gives children the opportunity to explain their thinking, develop understanding and gain confidence in their own level of development
- Guided Math is a small group activity where the teacher instructs small groups of children according to their needs and stage of development
- Experiential Math is achieved by allowing the children to engage in math activities in open-ended mathematics centers. Children can also be involved in projects, playing math games and ‘Daily Living Math’ such as collecting snack money; taking attendance and distributing materials.

Mathematics instruction in the FBE classroom also requires that a specific mathematics area is tackled each day. The six main areas are:

- Number and Numeration
- Operations of Whole Numbers

- Problem Solving
- Rational Numbers
- Measurement
- Geometry

When the teacher is facilitating the Guided Math session he or she plans activities that start at the **concrete level** using manipulatives only. Next he or she moves to the **transitional level** (semi- concrete) where manipulatives and drawings / diagrams are used. Finally, the teacher plans activities at the **abstract level** when the children are able to work without manipulatives.

This curriculum gives suggestions for activities for Shared Math, Guided Math and Math Centers as well as resources. It is to be used as a guide for planning instruction and as a catalyst for creating one's own instructional activities to suit the needs of the children in a particular class. It is hoped that you will use this document to plan an enjoyable, purposeful, progressive and integrated mathematics experience for the children in your class.

MATHEMATICS (BASIC SKILLS)

Standard 1: The student will develop basic skills and understand simple mathematical language.

Skills	Suggested Resources for Choice Centers, Projects or Teacher-directed Experiences
<p><i>Communication Skills:</i> attentive listening, clear and fluent speaking, writing, reading</p> <p><i>Social Skills:</i> cooperating with the group, using appropriate voice level, participating, staying on task, sharing, respecting rights, feelings and property of others</p> <p><i>Critical Thinking Skills:</i> observing, classifying, comparing, predicting, analyzing, evaluating</p> <p><i>Mathematical Skills:</i> sorting, counting, ordering, computing, predicting, measuring, estimating, problem solving (mentally and written)</p> <p><i>Manipulative Skills:</i> Cutting, drawing, folding,</p>	<p>Fully furnished Home Corner, Home Corner objects e.g. crockery/cutlery, Block Corner</p> <p>Puzzles, blocks, construction apparatus, beads and laces, plastic collections e.g. animals, fruits, water/sand tray with equipment, cubes, bears</p> <p>Books related to sorting e.g. ‘The Button Box’ – by Margaret Reid</p> <p>Collections: coins, stamps, plastic animals etc., toys, pictures, natural objects, blocks, covers, balls, buttons, beads, scraps of material, clothes, jewelry</p> <p>Attribute blocks, interlocking cubes,</p> <p>Feely Box with items</p> <p>Labeled trays for classroom apparatus</p> <p>Jigsaw puzzles, shape dominoes/lotto, giant and regular dominoes/dice, board games (commercial and teacher-made), dice, counters or place markers, paper, card, markers, colors to make board games</p> <p>Teacher made or commercial Venn/Carroll/sorting diagrams, related computer games</p> <p>Commercial anthologies such as ‘This Little Puffin’, Scholastic Teacher Handbooks ‘Language Resources’, audio tapes with number rhymes/songs, relevant CD ROMs, Copies of number rhymes</p> <p>Objects for counting, numeral cards/cut outs, magnetic numerals, flash cards with number names (in words)</p> <p>Blank and numbered number lines / tracks / sticks, 100 grid / square (class and individual), string, clothes pins or clips</p> <p>Counting materials e.g. cubes, counters, counting bears, strips of card, rubber bands, posters/ pictures with objects to count</p> <p>Art Corner with easels, paper, paint, finger-wax colors, crayons, paint, paintbrushes, pads and prick pens, scissors, play dough, (can be made by teacher) clay, plasticine, cutting tools, pastry cutters</p> <p>Cut-out shapes, gummed paper shapes</p> <p>Peg boards and pegs, beads and laces, lacing boards</p> <p>Music Corner with instruments</p> <p>Ring games</p> <p>Different types of patterned materials / paper, collections of natural objects with interesting patterns</p>

writing, tearing

Squared paper

Large sheets of paper and markers for recording group findings

Cuisenaire rods, commercial Place Value Kits or teacher made singles and tens rods; straws, popsicle sticks, rubber bands, abaci, strips of card, squared paper, dice, cubes or counters, coins (1c and 10c),

Tens	Ones

home made tens/ones cards, single and tens Cuisenaire pieces with containers holding ten singles; arrow cards (Ref.Longman Primary Math) numeral cards, recording material for small groups

Counting sticks, card strips, blank number lines, rubber bands

Cubes, counters, bears sand, water, measuring tapes, meter sticks, trundle wheel, home-made non-standard rulers, balance scales, measuring cups, scales family bears, dried peas or beans and other objects to measure various sizes of containers, funnels

Small objects for making sets, number lines/tracks, numeral cards

Partitioning Mats, string/ rulers, interlocking cubes, beans /seeds, paper plates,

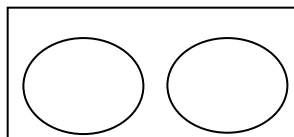
Commercial mathematical texts

Chalkboard, flip chart and markers,

Commercial addition apparatus e.g. number balances,

A wide range of counting aids such as bottle caps, beans, peas, beads, straws (*These can be collected by the children*)

Teacher made addition mats (*The teacher draws two plates on a piece of paper. The children use dried beans and place some on each plate and write corresponding number sentences*).



Flannel boards, magnetic boards with magnetic objects, overhead projector

Playing cards, flash cards

String, yarn, wool to make sets

Pegboards, Cuisenaire rods, Teacher made ¹Commutative Bingo

¹ This game needs a set of calling cards with multiplication number sentences on them and a set of bingo cards with the number sentences in reverse. One child is the caller and the others must look for the number sentence that pairs with the one the caller states. The first child to cover their card wins and becomes the new caller.

Number and Numeration
Number Concept
Target Behaviors

- 1a. Sorts objects / groups into sets and tells what the objects have in common
- 1b. Sorts and re-sorts from a general collection
- 1d. Compares groups or sets for quantity
- 1e. Identifies and recites the number names in order to at least 100, from and back to zero
- 1f. Counts reliably a set of objects to at least 100
- 1g. Complete and construct simple patterns
- 1h. Explains and completes number patterns
- 1i. Reads and writes whole numbers, to at least 100 in figures and words

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Quantity	Quantity (enough, too many, not enough, more, same, fewer) Action (take, add some, remove) Counting number words	<p>Whole Class Shared Reading / Read Aloud The teacher models the use of quantity language throughout the day.</p> <ul style="list-style-type: none"> • During art work e.g. painting family members. Are there more or less people in your family? • When threading beads e.g. put one more bead on your lace • During puzzle/construction activities e.g. Are there enough people on the bus? Put three more blocks on your house. • Snack Time e.g. Share these sweets between you and your classmate. • Water/sand play e.g. There needs to be less sand in that bucket. 	Teacher observes and records a child: <ul style="list-style-type: none"> • Using the mathematical language correctly. • Comparing sets by counting the members. • Matching (one to one correspondence).

		<p>Small group / Centers Guided Math Children use mathematical language as they work at the centers</p>	
<p>Sorting and Matching</p>	<p>Sort, set, group, pack, pair, same, alike, similar, identical, different, unlike, opposite, not the same, match color words, shape words (round, pointed, twisted ...), texture, surface words (rough, smooth, spotted, striped ...), size, use</p> <p>Curriculum Link</p> <ul style="list-style-type: none"> • Science and Technology 	<p>Whole Class Shared Reading / Read Aloud Shared Math</p> <p>Small group / Centers Guided Math Sorting everyday things Sorting items from a set of similar objects e.g. from a set of farm animals sort out the hens, cows, ... Sorting for positive and negative e.g. round / not round. Finding the odd one out e.g. a cube in a set of balls. Sorting for color; for scientific properties e.g. float/does not float; for number e.g. thread all the buttons with two holes. Give children opportunities for free sorting and let them give reasons for choices. Sort and ask children to guess the criteria. Sort using diagrams e.g. Venn, Carroll. Sorting can arise from tidying up after play, from a story e.g. clothes for Baby Bear, from outdoor activities e.g. sorting leaves, from Circle Time activities e.g. sorting shoes for style</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Making an appropriate sort. • Recognizing sameness in objects such as color, shape and size. • Explaining why items are in a set. • Sorting into adequate subsets. • Explaining the position of objects on diagrams. • Sorting and re-sorting for different reasons.

<p>Reciting numbers in sequence</p>	<p>Number Number names from zero to twenty and twenty to one hundred, thousand, count, count on, count back, count to</p>	<p>Whole Class Shared Math Let the children create patterns with numbers. Shared Reading / Read Aloud Reciting number rhymes such as ‘<i>One, Two, Buckle My Shoe</i>’, ‘<i>Ten in a Bed</i>’; ‘<i>Odds and Evens</i>’ Teacher sings/ reads number songs/stories to children e.g. ‘<i>Five Little Speckled Frogs</i>’, ‘<i>This Old Man</i>’, Reciting numbers: <ul style="list-style-type: none"> • as a chant • to a regular beat with or without the number line. ²Boston Wave ³People Numbers Teacher holds an unmarked counting stick (i.e. an unnumbered meter sectioned with decimeters of alternate colors), points to the stick and lets the class count in tens to 100. Children will identify the position of given numbers on the stick. <i>*A similar activity can be done within small groups using strips of card and rubber bands.</i> Counting members in the class Small group / Centers Counting small quantities Counting sounds such as claps</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Reciting number rhymes correctly. • Reciting some counting words in the correct order forwards. • Reciting some counting words in the correct order backwards. • Counting a few objects (teacher notes how many). • Immediately recognizing how many in a small set (less than 5 / more than 5). • Reciting numbers in sequence: <ul style="list-style-type: none"> ○ 1 – 20 forward / backward ○ To 20 and beyond
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²Ref. Longman Primary Maths, Teacher’s Handbook 1 - Children sit in a circle and count slowly in unison to 20. Once 20 has been reached, without pausing they start again. Once a regular rhythm is established the child who begins stands as ‘one’ is chanted and then sits down. As ‘two’ is chanted the next child stands and sits. This continues up to 20. No more than one child should be standing at any one time. This game can be repeated counting back from 20 or starting at any number e.g. counting on from 8 to 16 and back.

³ A) Give large numeral cards to 20 children and let them stand in a line in order. Ask individual children to change places e.g. Tom change places with a number higher than 8. Let the children without numeral cards to give directions to the children in the line so that the numbers are ordered correctly. B) Let some children in the line turn around so their backs face the class. Seated children can get up, tap a child on the back and say “I think you are numeral ...” If they are correct they change places with the child holding the numeral card and face the class.

<p>Counting reliably</p>	<p>How many...? count in ones, twos...tens..., more, less, missing numbers, number line, track, square, cards,</p> <p>Curriculum Link</p> <ul style="list-style-type: none"> • Language and Communication – ‘Reading Skill’ 	<p>Giving directions e.g. Bring me three pencils. Guessing the amount, e.g. How many dots on the domino/dice? Matching numerals to sets Sorting and ordering numbers Playing simple board games</p> <p>Whole Class Shared Math The children find ways of recording the number of children in the class. Shared Reading / Read Aloud - Number books that involve counting or are related to theme under study Using cubes let each group member grab a handful of cubes and guess how many they have and check by counting. Pairs of children can guess who has more and check by counting. Tallying e.g. the number of children in the school who travel on a particular bus route</p> <p>Small Group or Centers Guided Math groups Let the children work in pairs to count given objects e.g. beans in a jar. Count manipulatives that are spread out, close together, in rows or stacked with or without touching them. Posters can be placed in the Math Center and children can</p>	<ul style="list-style-type: none"> ○ 1 – 100 forwards and backwards ○ Starting to count on from any number ○ Reciting in tens i.e. 10, 20 ... - 100 ○ Reciting in hundreds i.e. 100, 200 ... - 1 000 ○ Skip counting in twos, fives or other small numbers. <p>Teacher observes and records a child counting:</p> <ul style="list-style-type: none"> • Up to 20 objects • Up to 100 objects • Large collections by grouping in twos, fives, tens ... <p>(*Teacher checks to see if the child can visualize small sets of objects up to 5 without counting one by one.)</p>
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		complete work cards or sheets that require counting objects on the poster. Board games also give opportunities for counting. (These games can be made by older children.)	
Simple Patterns	<p>Color words: red, blue, yellow, light red, dark red ...</p> <p>Shape words: straight, curved, pointy, square, round, spiral, zigzag, striped, spotty, wavy ...</p> <p>Position words: next to, on top, beside, start, finish, middle, underneath ...</p> <p>Comparisons: same, different, larger, smaller, longer, shorter ...</p> <p>Music words: high, low, quick, slow, loud, soft ...</p> <p>Arrangement words: side by side, upside down, turned, flipped over ...</p> <p>Curriculum Link</p>	<p>Whole Class</p> <p>Shared Reading – ‘No Roses for Harry’ by Gene Zion</p> <p>During Physical Education children copy movement patterns e.g. hop, hop, step, hop, hop, step, ...</p> <p>Outdoor walks to observe environmental designs</p> <p>Looking for patterns in the classroom or school environment</p> <p>Small group / Centers</p> <p>Making picture patterns:</p> <p>Placing shapes on top of/alongside a picture e.g. making a flower using magnetic shapes.</p> <p>Making free designs by:</p> <ul style="list-style-type: none"> ● Painting ● Printing with potatoes, sponges, leaves, covers, toothbrushes ● Making line patterns in dry/wet sand ● Using simple tools to make impressions in clay, sand, pastry ● Using a computer program <p>Makes definite patterns and designs:</p> <ul style="list-style-type: none"> ● Using lacing boards, sews in/out, up/down, and makes zigzag, crisscross, two-color patterns ● Using pegboards and pattern cards ● Makes musical patterns using one or two instruments ● Makes linear patterns (horizontal, vertical, curved, diagonal) using paint, shapes, apparatus to make patterns 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> ● Making simple pictures and patterns. ● Creating non-random patterns and designs. ● Copying or creating a musical pattern. ● Copying, continuing, completing and creating linear and cyclic patterns. ● Recognizing and describing different types of patterns. ● Arranging things to make a pattern.

<p>Number patterns and sequences</p>	<ul style="list-style-type: none"> • Cultural and Artistic Development – ‘Visual Arts’; ‘Music’ • Health and Physical Education • Language and Communication – ‘Reading Skill’ <p>odd, even, every other, number, twos, pairs, fives, tens. sequence, pattern, continue, predict, rule</p> <p>Curriculum Link</p> <ul style="list-style-type: none"> • Language and Communication – ‘Oral Linguistic Skill’ 	<p>combining color, shape and size</p> <ul style="list-style-type: none"> • Makes cyclic patterns making necklaces, bangles, crowns, ring patterns <p>Children predict subsequent shapes to continue a pattern.</p> <p>Whole Class Shared Math Find a quick way of counting the coins in this container. Reciting and counting reliably in tens, twos, fives until a given number Reciting and counting reliably in tens, twos, fives from any given number, i.e. in tens from 5 to 95, in twos from an odd number or even number Reciting number rhymes such as ‘<i>Two, Four, Six, Eight, Who do we Appreciate?</i>’ Counting in twos, fives, tens using a number line or 100 grid</p> <p>Small Group or Centers Guided Math groups Completing given number sequences or supplying the missing numbers in a given sequence created by a peer Coloring every second number on a 4 x 4 grid and explaining the pattern. (This can be done on different sized grids and patterns explained.)</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Demonstrating conservation of number. • Skip counting in 10s to 50 then 100 <ul style="list-style-type: none"> ○ Forward and back from 0 or 100 ○ Starting from a given number • Skip counting in 2s to 20 and beyond with or without a number line / track / square. • Skip counting in 5s. • Skip counting in any small number under 5.
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		<p>Making patterns of numbers with counters or with Cuisenaire rods</p> <p>Using interlocking cubes, children can make 2 color patterns using 8 cubes, (0 & 8; 1 & 7; 2 & 6; 3& 5; 4 & 4; 5 & 3; 6 & 2; 7 & 1; 8 & 0).</p> <p>Circle patterns can be made with 10 interlocking cubes using two colors. Introductory work for addition facts can be done by asking children to find all ways of combining cubes using 2 colors to make a row of a given number.</p>	<ul style="list-style-type: none"> • Identifying the rule needed to extend a given sequence of numbers. • Determining a missing element in a number sequence.
Reading and Writing Numbers	Number names	<p>Small group or Centers</p> <p>Matching numeral and number word</p> <p>Identifying given numbers on a number line Reading a sequence of numbers</p> <p>Tracing, copying and writing numerals 0 – 9 (Starting at the top)</p> <p>Writing numbers on blank number lines or clock face</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Matching numeral with number words. • Reading the numeral or number word and supplies the given number of items. • Forming numerals correctly. • Writing the correct numeral or number word for given sets.

Number and Numeration
Place Value and Ordering
Target Behaviors

- 2a. States the value of any digit in a two-digit number.
 2b. Compares and orders whole numbers to at least 100

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Place Value	Ones (units), tens, hundreds, digit, one-, two- or three-digit number, place, place value, stands for, represents, exchange, the same number as, as many as, equal to, group into tens and ones, separate into	<p>Whole Class Shared Math Find ways of recording the number that represents the number of persons in the classroom Teacher demonstrates how to represent numbers using a place value mat / card; abacus; interlocking cubes, bundles of straws / popsicle sticks and rubber bands or commercial place value manipulatives. (<i>This can also be done in guided math groups or whenever the children have conservation of numbers less than ten.</i>)</p> <p>Small Group or Centers Daily Guided Math Groups <i>In order for the teacher to assess the understanding of the children, they must verbalize any activity they are engaged in using mathematical language.</i> Separating given numbers of objects into groups or bundles of tens and ones and saying: ‘<i>Twenty-six is the same as two tens and six ones or 20 and 6</i>’ Using place value manipulatives to represent two-digit numbers Playing Place Value Bingo; Race to... Game Show numbers using an abacus Playing Exchange games</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> ● Grouping objects into sets of tens and ones. ● Describing or showing a two-digit number using concrete materials, semi-concrete drawings or diagrams. ● Stating the value of any digit in a two-digit number. ● Stating the value of any number in a three-digit number.

		Writing numbers in extended form e.g. $28 = \square + 8$ or $28 = 20 - \square$	
Comparing Numbers up to 100	Equal to, more than, less than, fewer than, greater than, smaller than, larger than, most, least, compare, smallest, largest, equal, one more, one less, ten more, ten less	<p>Whole Class Shared Math Comparing the number of children who walk or ride in a bus / car on a given day Comparing numbers of boys and girls in the class or who are doing certain activities. After making graphs, e.g. favourite colors, the children can compare the results for each color</p> <p>Small Group or Centers Comparing sets of objects using given vocabulary e.g. ‘Who has fewer / more...?’ Children answer questions such as “Which is less 15 or 19, 36 or 63? (<i>This can lead to investigations with equipment depending on the level of the child</i>) Word problems can also be presented e.g. Tom has 6 / 16 pens; Ben has 8 / 18 pens. Who has fewer pens? How many less? <i>Children will often have to solve the problem of sharing materials in centers; this can pose opportunities for comparing quantities.</i></p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Using the vocabulary of comparing when comparing numbers up to 100. Comparing quantities by sight. Comparing two given numbers and giving a number between them. Using the equal sign correctly.
Ordinals Ordering	Order, first, last, before, next, between, half way between, First, second, third... tenth... twentieth last, before, after	<p>Whole Class Teacher uses the language when the children are: - Playing outdoors that involves racing e.g. Who came third? Making patterns e.g. What color is the first, second ... bead in the pattern? Sequencing daily events at the end of the day Teacher questions children as they line up “Who is first / last / seventh in line?” Ordinal numbers can be stressed when discussing the calendar e.g. “What day was the thirteenth day of October?”</p>	<p>Teacher places several items in a row and questions children about their positions to assess understanding of ordinals. E.g. which item is first, third, last, forth ...? Teacher observes and records a child:</p>

		<p>Teacher can use ordinal numbers to give instructions e.g. 'After the fifth person enters the Art center, it will be full.'</p> <p>Small Group or Centers</p> <p>Children can find numbers between given numbers e.g. 3 & 9 or find all the odd or even numbers between two numbers. Children can use the empty number line to find 'half way' numbers in pairs.</p> <p>Children may order given numbers on a line using numeral cards.</p>	<ul style="list-style-type: none"> • Ordering a set of given numbers under 20, 50 or 100 • Using ordinal numbers correctly
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Number and Numeration
Estimating and Rounding
Target Behaviors

- 3a. Uses the vocabulary of estimation and makes reasonable estimates
3b. Begins to round numbers less than 100 to the nearest ten

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
<p>Estimation</p> <ul style="list-style-type: none"> • Position of Numbers • Quantity 	<p>More than, less than, fewer than, greater than, less than, smaller than, larger than, Most, least, smallest, largest Near, about, close</p>	<p>Whole Class Shared Math Estimate the size of the classroom.</p> <p>Small Group or Centers Daily Guided Math groups Using ⁴rubber band strips children can tell where a number is located.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Using the vocabulary of estimation. • Locating the position of given numbers on a card strip, counting stick or

⁴ Each child is given a strip of card with a rubber band loosely placed around it. The teacher gives an indication of the size e.g. 0 – 10, 0 – 100. Children can tell what number the rubber band represents or move their rubber band to the position of a given number. The strips can be sectioned in tens if the strip represents 0 – 100.

Operations of Whole Numbers
Addition and Subtraction

Target Behaviors

- 4a. Performs simple calculations by combining two sets or taking away from one set using concrete materials.
- 4b. Uses the vocabulary and symbols associated with addition and subtraction
- 4ci. Discovers that the order of adding 2 numbers does not affect the sum (Commutative Property of Addition)
- 4cii. Discovers that the grouping of 3 numbers for addition does not affect their sum (Associative Property)
- 4di. Uses mental strategies for addition and subtraction
- 4dii. Demonstrates rapid recall of addition and subtraction facts up to 20
- 4e. Recognizes the relationship between addition and subtraction

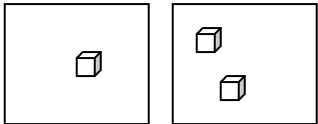
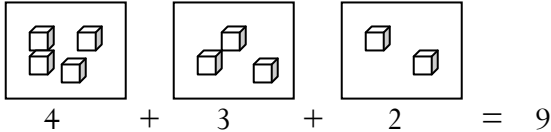
Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Simple calculations Combining sets Counting on /back Pre -adding / subtracting	Counting words: (zero, one, two ...) Action words: divide, move, put together, add, take away Number: add, makes, more, less, altogether, left, leaves, remaining, is the same as, equals, Money: coins, amount, same, change	Whole Class Finger Flash - Teacher asks children to show different numbers of fingers on each hand and then tell how many fingers altogether. Using a floor number track, the teacher asks the children to step on a certain number, take one or two steps forwards / backwards and tell the number where they stand. This can also be done with counters on a number line. Small group /Centers Children make two sets of objects and combine them and say how many they have. Count totals on dominoes/2 dice Children make a set, take some objects, take some out and tell how many are left. Guess how many are hidden. Shopping (Role play) Partitioning Sets (Each child has a length of string and a number of objects). The child divides the set into two or into as many ways as possible and records. I have 6 and split it into 4 and 2, 3 and 3 etc. Exchanging one-cent coins for five/ten cent coins	Teacher observes and records a child: <ul style="list-style-type: none"> ● Using the language involved in adding and subtracting. ● Finding one more/ one less than a given number. ● Combining two sets (later three sets) by counting how many altogether, counting on, using concrete (manipulatives), or semi-concrete (worksheets/ cards). ● Partitioning a set into

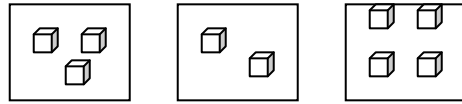
<p>Addition</p> <p>Signs '+' and '='</p> <p>Place holders □ △</p>	<p>Add, more, plus, make, sum, total, altogether, score, double, near double, addition</p> <p>One more, two more... ten more</p> <p>How many more to make ...?</p> <p>... and ... is, is the same as, equals, sign, symbol</p>	<p>Whole Class Shared Math</p> <p>The teacher gives a problem to explore, e.g. You have 10 cent and you can buy 2 things. What will be the cost of each item? Teacher introduces the '+' and '=' signs using a chalkboard, flip chart and concrete materials:</p> <p>Teacher presents 2 red crayons and 1 blue crayon and asks, "How many crayons do I have altogether?" (<i>The question contains the vocabulary that the teacher wishes to introduce</i>). The teacher then writes: 2 and 1 makes 3 and underneath $2 + 1 = 3$.</p> <p>Other ways of asking the same question are:</p> <ol style="list-style-type: none"> Add 2 to 1 2 plus 1 What is the sum / total of 2 and 1? Which two numbers make 3 altogether? What must I add to 2 to make 3? I am thinking of a number. ? add 1. The answer is 3. What is my number? <p><i>The types of questions asked depend on the level of the children.</i></p> <p>The teacher can also introduce symbols for unknown numbers based on learnt number facts up to 5 then 10 for rapid recall e.g.</p> <p>□ + △ = 4; 4 + 5 = □ or when using counters or a</p>	<p>subsets.</p> <ul style="list-style-type: none"> Subtracting by 'taking away' and counting how many are left, counting up from a smaller to larger number, counting how many more. <p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Using mathematical language consistently. Using the '+' and '=' signs correctly to write number sentences. Completing number sentences when a square or triangle is used for a missing addend. Reading number sentences correctly.
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		<p>number line or mental strategies, e.g. $11 + 4 =$ or</p> $\triangle + \square = 50$ <p>Small Groups or Centers The children can be given manipulatives and encouraged to write their own number sentences, first using words i.e. ... and ... make ..., then using $\dots + \dots = \dots$ Children can use a commercial number balance equalizer and three weights and record the sum using symbols e.g. on one side hang a 2 and a 3 and find the number weight to balance them i.e. 5. Play 'Hide under the Tub' (<i>Children take turns to take some cubes which they split between two tubs and hide them underneath. The other children can ask two questions only: How many altogether? How many under that tub? They then write down appropriate number sentences using signs.</i>)</p>	
<p>Subtraction</p> <ul style="list-style-type: none"> • Take Away • Difference Signs <p>'-' and '='</p> <p>Place holders</p> <p>\square \triangle</p>	<p>How many more is ... than ...? How much more is ... than ...? Subtract, take away, minus, leave, gone One less, two less ... ten less '-' , '='</p>	<p>Whole Class Shared Math Tell me two numbers with a difference of 5.</p> <p>Small Groups or Centers Guided Math Take away Each child makes a rod of 10 connecting cubes. The teacher asks them to 'take away 2'. The children tell how many are left. The teacher records 10 take away 2 leaves 8 and also $10 - 2 = 8$. She guides the children to record several subtraction number sentences before sending them to centers to work independently or with a partner and make up their own number sentences using a rod of a given number of cubes. Other ways of questioning are:</p> <ul style="list-style-type: none"> • Take 2 from 10 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Using mathematical language consistently • Using the '-' and '=' signs correctly to write number sentences • Completing number sentences when a square or triangle is used for a missing number

	<p>How many fewer is ... than ...? How much less is ...? Difference, between</p>	<ul style="list-style-type: none"> • 10 subtract 2 • Subtract 2 from 10 • 10 less 2 • What number must I take from 10 to leave 8? • 2 taken from a number leaves 8. What is the number? • I think of a number. I take away 2. My answer is 8. What is my number? <p>Difference</p> <p>The children make two rods of connecting cubes, one of 10 and one of 2. The children lay the rods beside each other and match the rods and tell the difference. The teacher records: The difference between 10 and 2 is 8 and also $10 - 2 = 8$</p> <p><i>(Subtraction as difference is introduced after the children have mastered subtraction as take away)</i></p> <p>Other phrases can be used e.g.</p> <ul style="list-style-type: none"> • How many fewer is 2 than 10? • How much less is 2 than 10? • How much more is 10 than 2? <p>In centers children can find the difference between given pairs of numbers and record the number sentences.</p> <p>They can also find pairs of numbers with the same difference using number lines, number tracks or rods</p> <p>Playing or numeral cards can also be used. The cards are placed face down and players take turns to turn over two cards and find the difference between the two numbers. Two dice can also be used. Players record their findings by writing number sentences using words or symbols / signs. <i>(Manipulatives are used)</i></p>	<ul style="list-style-type: none"> • Reading number sentences correctly
Commutative property of	Addition, fact, sum, is the same as,	<p>Small Group and Centers</p> <p>Guided Math – The teacher puts cubes on two sheets of paper</p>	Teacher observes and records a child:

<p>addition</p>	<p>plus, equal, altogether, total</p>	<p>and lets the children write the number sentence i.e. $1 + 2 = 3$.</p>  <p>The teacher then interchanges the sheets of paper and lets the children write the number sentence i.e. $2 + 1 = 3$. This activity is repeated several times using different numbers of cubes. Children can do similar activities independently in the Math center.</p> <p>Whole Class then Small group</p> <p>A large class number line can be used to demonstrate the commutative property using the example $1 + 2 = 2 + 1$. Discussion can follow on the relationship between the examples using sets and those using the number line. The children can be given pairs of number sentences to illustrate on number lines. During another whole class or guided math activity the children can be asked to generalize the commutative property of addition i.e. <i>the order of two addends does not affect the sum e.g. $2 + 3 = 3 + 2$.</i></p>	<ul style="list-style-type: none"> Identifying the commutative rule after investigating number sentences such as $3 + 7 = 10 / 7 + 3 = 10$ Writing the reversal for addition sentences without manipulatives
<p>Associative property of addition (Using 2 – 3 single-digit numbers)</p>	<p>Plus, equal, add, altogether, total, is the same as, sum, number sentence</p>	<p>Small Group and Centers</p> <p>Guided Math – The teacher puts sets of cubes or other manipulatives on sheets of paper, flannel boards, magnetic boards or an overhead projector.</p> 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Identifying the associative property of addition after several comparisons of number sentences such as $2 + 4 + 1$ and $4 + 1 + 2$

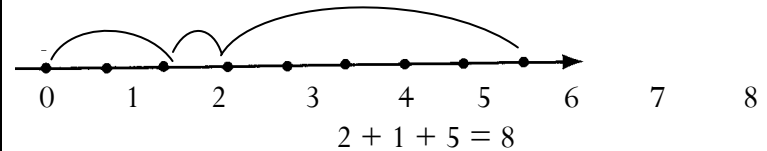
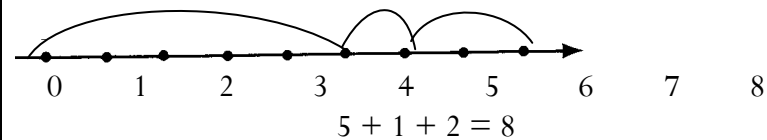
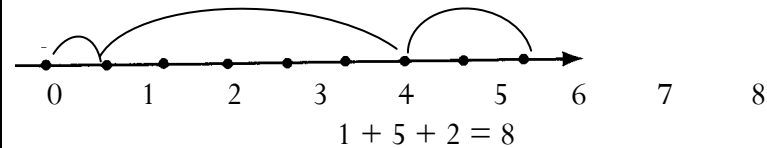


$$3 + 2 + 4 = 9$$

The children can then discuss the similarity and differences between two number sentences. After giving many examples the children can then verbalize the associative property of addition i.e. *When 3 or more numbers are added together, the order in which the addends are grouped does not affect the sum.*

Whole Class then Small Group

The teacher uses number lines to model the associative property



The children can choose 3 numbers using a dice and then write 3 different number sentences using the same numbers, then illustrate them on number lines. *(If number lines are drawn on sheets of paper and then laminated they can be used several times using dry*

- Using the associative property of addition to solve number sentences without manipulatives.

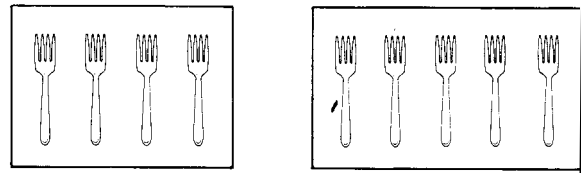
<p>Mental Mathematics: Addition and subtraction number bonds (up to $9 + 9$) Addition and subtraction facts</p> <ul style="list-style-type: none"> • 3 single –digit numbers • 2-digit numbers and ones without regrouping • 2-digit numbers and tens • two 2-digit numbers without regrouping 	<p>Plus, equals, what is..., double..., how many..., double, pairs of numbers that total..., near double, half of...</p>	<p><i>erase markers.)</i></p> <p>Whole Class or Small Group and Centers The teacher can use a variety of different methods to demonstrate mental computation including verbalization of thought processes. <i>(Children will only work mentally when they have had enough practice with manipulatives)</i></p> <ul style="list-style-type: none"> • After using dominoes for counting, the children should be able to internalize addition of doubles to $6 + 6 = 12$ and the corresponding subtraction $12 - 6 = 6$ • The use of interlocking cubes of two colors will help children to find pairs of numbers that total 10 / 20. • Children can be encouraged to use known number facts and knowledge of place value to solve other additions e.g. <i>Known fact</i> $4 + 3 = 7$ and $4 - 3 = 1$, therefore: <ul style="list-style-type: none"> • $14 + 3 = 17$ $14 - 3 = 11$ • $24 + 3 = 27$ $24 - 3 = 21$ • $34 + 3 = 37$ $34 - 3 = 31$ • $14 + 13 = 27$ $14 - 13 = 1$ <i>Known fact</i> $3 + 5 = 8$, therefore $30 + 50 = 80$ • The strategy of using doubles plus 1 or doubles subtract 1 should be used to solve sums such as $5 + 6$ or $6 + 7$. Teacher verbalizes the thought process for the children; “I know $5 + 5 = 10$; 6 is 1 more than 5 so $5 + 6 = 11$; I know $7 + 7 = 14$ and $6 + 7$ is 1 less therefore $6 + 7 = 13$” <p>The use of commercial games such as Addition and Subtraction Bingo and flash cards also help children to memorize number facts.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Using different mental strategies to tell or record the answers to a series of addition and / or subtraction sums within a given time frame <ul style="list-style-type: none"> ○ Using doubles ○ Using addition facts. (up to $9 + 9$) ○ Using facts and knowledge of place value ○ Using near doubles ○ Counting on or back mentally when adding or subtracting 1, 2 or 3
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		<ul style="list-style-type: none"> The strategy of counting on or back mentally needs to be taught. The teacher tells a number story e.g. 6 birds are in a tree, 3 more come to roost. How many birds are there now? She then verbalizes counting on and says, '6 ... 7, 8, 9'. At a later stage the children will be able to add up to three single-digit numbers e.g. $3 + 2 + 1$; '3 ... 4, 5, ... 6, as well as a two-digit number and a single-digit number e.g. $12 + 4$; 12 ... 13, 14, 15, 16 using this strategy. The same method can be applied for subtraction e.g. $18 - 3$, verbalize 18 ... 17, 16, 15 	
<p>Exploration of the relationship between addition and subtraction in contextual settings</p>	<p>Add, more, plus, make, sum, total, altogether, addition One more, two more... ten more How many more to make ...? ... and ... is, is the same as, equals How many more is ... than ...? How much more is ... than ...? Subtract, take away, minus, leave, gone One less, two less ... ten less How many fewer is ... than ...?</p>	<p>Whole Class Shared Math Once the children have mastered addition and subtraction, they can be given sets of 3 single-digit numbers and asked to write 4 related number sentences, (2 addition and 2 subtraction). e.g. 2, 7, 9; ($7 + 2 = 9$); ($2 + 7 = 9$); ($9 - 7 = 2$); ($9 - 2 = 7$) The numbers can be included in a story form.</p> <p>Small groups or Centers Children can be given sets of objects to partition and write the addition number sentences. After which they can list the matching subtraction number sentences.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Writing mathematical number sentences for given situations. involving addition and subtraction e.g. $7 + 2 = 9$; $9 - 2 = 7$

How much less is
...?
Difference,
between

Number Sentences		
Set of objects	Addition	"Take away"
	$7 + 1 = 8$	$8 - 1 = 7$
	$6 + 2 = 8$	$8 - 2 = 6$
	$5 + 3 = 8$	$8 - 3 = 5$
	$4 + 4 = 8$	$8 - 4 = 4$
	$3 + 5 = 8$	$8 - 5 = 3$
	$2 + 6 = 8$	$8 - 6 = 2$
	$1 + 7 = 8$	$8 - 7 = 1$
	$0 + 8 = 8$	$8 - 8 = 0$

Practice can be given in writing the number sentences if two sets of objects are given to the children and they are asked to write the corresponding addition and subtraction number sentences.



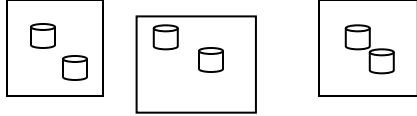
$4 + 5 = 9; 5 + 4 = 9$ $9 - 4 = 5; 9 - 5 = 4$

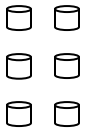
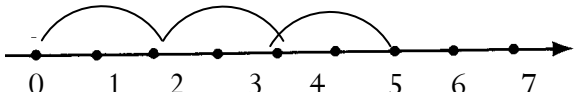
A table of basic addition facts can also be used to find corresponding subtraction facts.


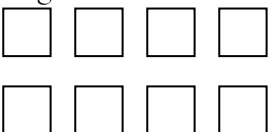
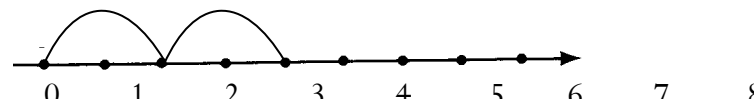
The teacher can also use number lines to model the relationship between addition and subtraction.

Multiplication and Division
Target Behaviors

- 5a. Uses the vocabulary and symbols associated with multiplication
- 5b. Recognizes the relationship between addition and multiplication
- 5c. Discovers that the order of multiplying two factors does not affect the product
- 5d. Writes number sentences for given situations involving multiplication
- 5e. Uses mental strategies for rapid recall of multiplication facts
- 5f. Uses the vocabulary associated with division
- 5g. Partitions sets into equal subsets and uses the symbol associated with division to record partitioning
- 5h. Recognizes the relationship between: multiplication and division and division and subtraction



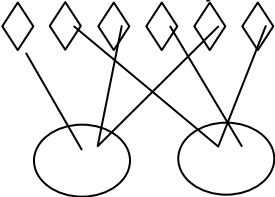
Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
<p>Multiplication Within the 2, 3, 4, 5 and 10 times tables Sign 'x'</p>	<p>Sets of, groups of Times, multiply, multiplied by, multiple of, once, twice, three times, four times, five times ... ten times Repeated addition, array, row, column, double, half</p>	<p>Whole Class Shared Math Give a word problem for the class to solve e.g. A farmer has 12 plants to plant. He plants the same number of plants in each row. How many rows does he need?</p> <p>Small Group or Centers <i>(Children must be able to make equal sets before introducing the concept of multiplication)</i> The children are asked to make equal sets e.g.</p> <div style="text-align: center;">  </div> <p>The teacher records; '3 sets of two is the same as 6'. The multiplication sign can be introduced and the equation $3 \times 2 = 6$ written. It should be read as 'three times two is equal to six'</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Skip counting in twos, fives, tens • Skip counting in threes and fours • Adding equal groups to explore products (up to 40) • Uses the multiplication sign to record <ul style="list-style-type: none"> ○ Addition of equal sets ○ Arrays ○ Equal jumps on

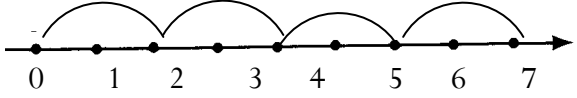
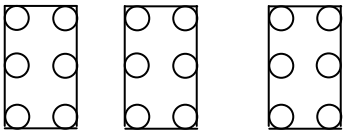
		<p>Peg boards or counters can also be used to make arrays.</p>  <p>The number line can also be used to introduce multiplication.</p>  <p><i>(The children need to practice skip counting and build the multiplication tables with manipulatives.)</i></p>	<p>a number line or track</p> <ul style="list-style-type: none"> • Building the multiplication tables using manipulatives (2 times table, 5 times table, 10 times table and then the three and four times table).
Multiplication as Repeated Addition	Sets of, groups of Times, multiply, multiplied by, multiple of, Repeated addition, array, row, column, double, half	<p>Whole Class Shared Math The teacher writes a number on the chalkboard and asks the children to write addition and multiplication number sentences for that number. The addends for the addition sentences must be the same and the multiplication sentence must be related to the addition sentence.</p> <p>Small group or Center Guided Math The teacher asks the children to put out four sets of two cubes and then asks the total. She records $2 + 2 + 2 + 2 = 8$ and also $4 \times 2 = 8$. Discussion follows and many other examples are demonstrated before the children are sent to work independently. Questions such as: ‘How many wheels are on three cars?’ will also help the children to understand the relationship if manipulatives are used.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Recording addition and multiplication number sentences for given situations. • Explaining that multiplication is another way of recording repeated addition.
Commutative Property of	Times, multiply, multiplied by,	<p>Small Group or Center The teacher can demonstrate a game using Cuisenaire rods.</p>	<p>Teacher observes and records when a child:</p>

<p>Multiplication (using 1, 2, 3, 4, 5 and 10 times tables)</p>	<p>multiple of, lots of, groups of, same as</p>	<p>A rectangle is made using two yellow '5' rods and five red '2' rods. The teacher records</p>  <p>The children can then find other pairs of sets and record the number sentences from known multiplication tables. The children can also write number sentences to describe arrays e.g. $1 \times 8 = 8$ or $8 \times 1 = 8$ or</p>  <p>$4 \times 2 = 8$ or $2 \times 4 = 8$ Squared paper can be used to draw arrays for given pairs of sums.</p>	<ul style="list-style-type: none"> Identifying the commutative rule after investigating number sentences such as $2 \times 3 = 6 / 3 \times 2 = 6$. Writing the reversal for multiplication sentences without manipulatives.
<p>Multiplication Facts a. Products not greater than 50 b. Products > 50 but < 100</p>	<p>Sets of, groups of Times, multiply, multiplied by, multiple of, once, twice, three times, four times, five times ... ten times</p>	<p>Small group or Center Guided Math The teacher shows the children a chair or a picture of a chair and asks 'How many legs?' then 'How many legs will be on 6 chairs?' The children record a number sentence to solve the problem. The children can also write number sentences for given arrays, pictures of sets or number lines</p> <p>e.g. $\square \times \square = \square$</p> 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Solving one step multiplication problems involving products no greater than 50. Solving one step multiplication problems involving products no greater than 100. Completing multiplication number sentences within the 1, 2, 5 and 10 tables. Completing multiplication number

			<p>sentences within the 3 and 4 tables.</p> <ul style="list-style-type: none"> Identifies missing factors in multiplication number sentences. 																					
<p>Mental Mathematics Multiplication tables</p> <p>2 up to 2×10 10 up to 10×10 5 up to 5×10 3 up to 3×10 4 up to 4×10</p> <p>Strategy of doubling</p> <p>Numbers 1 to 20 Multiples of 5 or 10 up to 50</p>	<p>Examples of phrases:</p> <ul style="list-style-type: none"> Six twos 6 times 2 6 multiplied by 2 Multiply 6 by 2 Double 2 Twice 2 	<p>Whole Class</p> <p>Shared Math</p> <p>The children can be asked to fill in all the multiplication number pairs for given numbers on a chart up to 10 or another number.</p> <p>Recitation of tables</p> <table border="1" data-bbox="690 594 1283 805"> <thead> <tr> <th colspan="5">Multiplication Number Pairs</th> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>→</td> </tr> </thead> <tbody> <tr> <td>1×1</td> <td>2×1 1×2</td> <td>3×1 1×3</td> <td>1×4 4×1 2×2</td> <td></td> </tr> </tbody> </table> <p>Small Group or Center</p> <p><i>Games can be demonstrated and placed in the math center so that the children can internalize facts in a fun way e.g. Multiplication Bingo or Factor Bingo or the Egg Carton Game</i></p> <p>Use an egg carton with a cover and place numbers in each hole. Two counters or pebbles are placed in the box and the lid closed. Each player shakes the box and opens it. The player's score is the product of the two numbers. For each round the player with the highest score gains 1 point. At the end of 10 rounds the player with the highest number of points is the winner.</p> <table border="1" data-bbox="690 1240 846 1325"> <tbody> <tr> <td>1</td> <td>0</td> <td>4</td> </tr> <tr> <td>2</td> <td>5</td> <td>3</td> </tr> </tbody> </table> <p>Flash cards can also be used.</p> <p>The children can also learn the doubles of numbers up to 20 and</p>	Multiplication Number Pairs					1	2	3	4	→	1×1	2×1 1×2	3×1 1×3	1×4 4×1 2×2		1	0	4	2	5	3	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Responding rapidly to oral or written questions given in different ways and in a given time frame.
Multiplication Number Pairs																								
1	2	3	4	→																				
1×1	2×1 1×2	3×1 1×3	1×4 4×1 2×2																					
1	0	4																						
2	5	3																						

		beyond if numbers are multiples of 5 or 10.	
<p>Division</p> <p><i>*Children's understanding of division should begin on a concrete level if they are to learn the meaning of division.</i></p> <p>Signs -, =</p> <p>Placeholders</p> <p>△ and □</p>	<p>Share, share equally, one each, two each, three each ..., groups in pairs, threes ..., tens, equal groups of, divide, divided by, divided into, left, left over, remainder, sets</p>	<p>Whole Class</p> <p>Shared Math</p> <p>The children can be asked to find ways of sharing a given number of items between two people (<i>do not use the phrase 'share equally'</i>)</p> <p>Small Group or Centers</p> <p>Sharing fairly</p> <p>Children place 12 cubes or other manipulatives on work mats and are asked to share them into 2, 3 or 4 equal sets. The teacher guides the process with the following types of prompts: <i>Share twelve into two equal sets/groups. How many are there in each group? Now share twelve into three/four equal sets/groups; how many in each? Now share twelve into five equal groups. How many in each? Is there a remainder? How many? Is it a fair share? Why? Why not?</i></p> <p>This type of activity needs to be repeated with other amounts before the division symbol is introduced.</p> <p>Tower Snap</p> <p>Children make a tower of interlocking cubes, count how many cubes are used and then snap the tower in half. The halves are compared and adjusted for equality. They can record: <i>18 makes 2 sets of 9; 19 makes two sets of 9 remainder 1.</i></p> <p>In paper plate shares, the children count out some cubes and share them between two plates. Recording is done in the same way as Tower Snap. For variation children can also share the same amount of cubes into three, then four groups and record.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Using mathematical language associated with division. • Using the – and = signs correctly to write number sentences. • Reading the number sentences correctly.
<p>Division</p> <p>Dividing a quantity not greater than 20 into equal sets</p>	<p>Share, share equally, one each, two each, three each ..., groups in</p>	<p>Whole Class</p> <p>Shared Math</p> <p>A teacher has 20 children in her class. She has decided to divide them into equal groups. How many groups will she have?</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Partitioning a given number of objects into

	<p>pairs, threes ..., tens, equal groups of, divide, divided by, divided into, left, left over, remainder, sets</p>	<p>Small Groups or Centers</p> <p>The children are given concrete objects and asked divide them into subsets e.g. How many equal sets of 2 can I make out of 10? How many subsets of 2 spoons can we make from a set of 10 spoons? The teacher can make transitional work cards to facilitate independent work, e.g.</p>   <p><input type="checkbox"/> Bananas in each box</p> <p>Teachers should help the children to understand division as: Sharing equally e.g. If 6 sweets are shared equally between 2 children. How many sweets will each child get?</p>  <p>Grouping e.g. (repeated subtraction) There are 18 apples in a box. How many bags of 3 can I get? Count from zero in tens to 60. How many tens did you count? $8 - 2$ "how many 2s make 8?"</p> <p><input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/></p> <p>In pairs one child can pick up a handful of cubes and count them then predict how many equal subsets they can make, 'I think 12 will make 4 groups of 3'. The prediction is tested and if correct they gain a point. The next child tries. The first child to gain 10 points wins.</p> <p>Using plates or mats or hoops the children are given</p>	<p>equal subsets.</p> <ul style="list-style-type: none"> • Using the $-$ and $=$ signs correctly to write number sentences. • Associating number sentences with the partitioning of sets. • Recording division number sentences for given situations.
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		<p>opportunities to find out which amounts will share equally without leaving remainders and record their findings e.g. $10 \div 2 = 5$</p>	
<p>Relationships between:</p> <ul style="list-style-type: none"> • Multiplication and division • Division and subtraction 	<p>Share, share equally, take away, group in pairs, equal groups of ...</p>	<p>Small Groups or Centers</p> <p>In helping children to recognize the relationships between division and subtraction or multiplication the number line is an effective tool.</p> <p>If we want to show $8 - 2$, we can begin at 8 and make jumps of two until we get to 0</p>  <p>The teacher records $8 - 2 = 6$, $6 - 2 = 4$, $4 - 2 = 2$ and $2 - 2 = 0$ and says 2 has been taken from 8 four times therefore $8 - 2 = 4$.</p> <p>The children can be asked to find the missing number in this multiplication number sentence $2 \times ? = 8$. In order to do this they must divide or say how many subsets of 2 can we make from a set of eight?</p> <p>A pegboard can also be used. The teacher places 18 pegs on each child's pegboard and gives each child 3 elastic bands with which to enclose 3 equal sets of pegs,</p>  <p>They record $18 \div 3 = 6$ because $6 \times 3 = 18$</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Identifying the relationship between <ul style="list-style-type: none"> ○ Subtraction and division ○ Multiplication and division • Recording division and subtraction number sentences for the same given situation. • Recording division and multiplication number sentences for the same situation. • Using multiplication facts as a check for solving division number sentences.

MATHEMATICS (BASIC SKILLS)

Standard 1: The student will develop basic skills and understand simple mathematical language.

Skills	Suggested Resources for Choice Centers, Projects or Teacher-directed Experiences
<p><i>Communication Skills:</i> attentive listening, clear and fluent speaking, writing, reading</p> <p><i>Social Skills:</i> cooperating with the group, using appropriate voice level, participating, staying on task, sharing, respecting rights, feelings and property of others</p> <p><i>Critical Thinking Skills:</i> observing, classifying, comparing, predicting, analyzing, evaluating</p> <p><i>Mathematical Skills:</i> sorting, counting, ordering, computing, predicting, measuring, estimating, problem solving (mentally and written)</p> <p><i>Manipulative Skills:</i> Cutting, drawing, folding, writing, tearing</p>	<p>The resources are dependent on the type of problem presented however paper, writing tools, and a variety of manipulatives should be available.</p> <p>Different kinds of manipulatives, containers, commercial or teacher-made games, number grids of various sizes</p> <p>Large posters, squared paper, cut-out shapes or Logi Blocks, puzzle work cards</p> <p>Copies of numbergons, pegboards or geoboards and rubber bands</p> <p>The Math Center materials</p> <p>Lego pieces, paper, colors, items for counting e.g. M&Ms, plastic animals, flowers etc.</p> <p>Copies of graph types, squared paper, colors or markers, pencils, stamps for making picture graphs</p> <p>Yarn, scissors, flip chart paper, markers, tape</p> <p>Spinners, copies of the graph, pencils, paper clips</p>

*Problem Solving*⁵ Target Behaviors

- 6a. Uses appropriate strategies to solve problems
- 6bi. Represents a verbalized story problem using real or semi concrete materials and records a mathematical sentence⁶ to solve that problem
- 6bii. Solves simple word problems, including money, measures⁷ and time, set in ‘real life’ contexts and explains the problem solving process
- 6c. Solves mathematical problems or puzzles by recognizing simple patterns or relationships
- 6d. Investigates a general statement about familiar numbers or shapes by finding examples to satisfy it


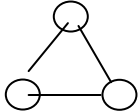
Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Problem Solving Strategies Estimate and check Dramatization Demonstration Verbalization Drawing / diagrams Using patterns Using mental math Counting on / back / in groups Modelling with manipulatives	The teacher encourages children to use mathematical language that is appropriate to the problem being solved and is age related. <i>(Reference can be made to other sections of the curriculum.)</i>	Problem solving happens throughout activities involving data or comparisons. The teacher through planned provision, observation and intervention challenges children’s thinking, e.g. sharing during birthday celebrations, moving tables and chairs to make room for extra children. Use of diagrams, pictograms & charts The teacher can pose problems to a small group or the whole class. The problem must be open-ended. E.g. The children are asked to seat 24 children in equal groups. The following strategies can be used in the problem solving process: estimate and check; dramatization; demonstration; verbalization; drawing / diagrams; using mental math (addition and multiplication facts); counting on / back / in groups and modeling with manipulatives.	Teacher observes and records a child: <ul style="list-style-type: none"> • Choosing an appropriate strategy to solve the problem. • Explaining thinking process for solving the problem. • Recording a mathematical sentence (when appropriate).

⁵ Problem solving describes the process used by an individual to solve a problem when a method of solution is not immediately obvious.

⁶ A mathematical sentence follows a pattern e.g. numeral – relation symbol – numeral i.e. $6 < 9$ or $2 = 3 = 5$

⁷ Measures refer to capacity, length, mass and time

		The teacher facilitates and guides the process through monitoring, using prompts and questions. The children may suggest their own strategy which might be a combination of those suggested.	
Writing mathematical sentences to solve problems	What could we try next? How did you work it out? Number sentence, sign, operation, symbol Vocabulary relevant to the problem	<p>Whole Class or Small Groups</p> <p>The teacher can display a poster and ask the children to write as many mathematical sentences as they can from information displayed on the poster.</p> <p>Calculate, answer, right, correct, wrong, <i>(If the children are not writers, drawings can be used or verbalization).</i></p> <p>During discussion sentences can be shared.</p> <p>Playing shop offers many opportunities for problem solving.</p> <p>The teacher can also tell a story that provides opportunities for problem solving. E.g. <i>Kevin wanted to buy a DVD movie cassette for 40 guilders. He was given 10 guilders as a birthday gift. To get the rest of the money he decided to...</i> (Teacher can pause and ask the children how they would raise the money), <i>wash his relatives' cars for 10 guilders a car. He washed his dad's car and his uncle's car. Does he have enough money to buy the cassette?</i> The teacher facilitates discussion about how to solve the problem and also asks questions such as how much more does Kevin need? How will he get the balance? The children can explain how they solved the problem and justify their choice of strategies.</p> <p>Other word problems involve measures, e.g. It is now 10:30 how much time is left until school closes? The washing machine holds 50 liters of water. You are using a ten-liter bucket to fill it. How many buckets do you need?</p>	Teacher observes and records a child: <ul style="list-style-type: none"> • Writing an appropriate mathematical sentence for a given problem.
Problem Solving Recognition of simple patterns and relationships	Pattern, puzzle, answer, what could we try next? How did you work it out?	<p>Whole Class, Small Groups or Centers</p> <p>Games such as Checkers, Dominoes, Bingo and Tic-Tac-Toe all give opportunities for identifying patterns and relationships.</p> <p>The use of various sizes of number grids allows children to discover number patterns.</p>	Teacher observes and records a child: <ul style="list-style-type: none"> • Solving and extending a pattern or puzzle.

		<table border="1" data-bbox="667 232 810 355"> <tr><td>1</td><td>1</td><td>1</td></tr> <tr><td>2</td><td>2</td><td>2</td></tr> <tr><td>3</td><td>3</td><td>3</td></tr> </table> <p data-bbox="667 399 1461 472">The children are asked to rearrange the digits so that the sum of each row, column and diagonal is the same.</p> <p data-bbox="667 480 1476 586">The children are asked to put the numbers 1 to 5 in the circles so that the difference between each pair of joined numbers is more than 1. </p> <p data-bbox="667 638 1476 711">Using pegboards or geoboards with rubber bands children can be asked to make given shapes symmetrical</p> <p data-bbox="667 719 1476 792">Using pegboards or geoboards with rubber bands children can be asked to make given shapes symmetrical</p> <p data-bbox="667 800 1077 833">Completing given shape patterns</p> <p data-bbox="667 841 1476 946">Numbergons can be used for solving operational problems e.g. simple division – investigate numbers that can be split up so that the number in each circle is the same.</p> <p data-bbox="667 954 1476 1060">Numbergons can be triangular, square or five-sided (like a pentagon). The number in the center of this numbergon could be 9 with 3 in each circle.</p>  <p data-bbox="667 1195 1476 1341">Children can also be asked to share 15 buttons in 3 boxes so that each box has in one more than the box before. Younger children can be asked to investigate different ways of sharing a small amount of buttons into the three boxes</p>	1	1	1	2	2	2	3	3	3	<ul style="list-style-type: none"> Explaining patterns or relationships observed.
1	1	1										
2	2	2										
3	3	3										
Problem Solving Finding examples to	Is this statement true /false?	<p>Small group or Centers</p> <p>The teacher can give the statements to the children or place them</p>	Teacher observes and records a child:									

prove a mathematical statement	Example Other vocabulary as appropriate	<p>on work cards in the centers so that children can find examples to satisfy them.</p> <p>Examples of statements:</p> <ul style="list-style-type: none"> • I can make four different numbers using only two numerals. • I can make 8 by adding two numbers. • I can add on nine by adding 10 and subtracting 1. • If a number ends in 2 it is even. • All triangles have three sides but not always of equal length. <p><i>*This activity can be used as a form of assessment.</i></p>	<ul style="list-style-type: none"> • Consistently giving examples to satisfy mathematical statements based on a particular math concept.
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Problem Solving
Handling Data
Target Behaviors

- 7ai. Collects and sorts data
- 7aai. Sorts objects and data by common attributes and justifies the sorting rule
- 7b. Reads, constructs and interprets simple tables, picture and block graphs
- 7c. Represents, compares and shares data using pictures, block graphs, tally marks and picture graphs
- 7d. Explores the concept of probability and practices predicting

Collecting, sorting and sharing data (information)	Data, information, collect, sort	<p>Whole Class</p> <p>The teacher can involve the children in collecting information about the class e.g. number of family members. This can be linked to other domain areas such as Social Studies or Science.</p> <p>Small Group or Centers</p> <p>Guided Math</p> <p>Children can make simple graphs with teacher guidance e.g. egg carton graphs, favorite colors, weather graphs.</p> <p>In pairs, children use Lego pieces to make a graph that shows the results of gathered data. They first decide on five areas they would</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Collecting and organizing information numerically. • Collecting and sorting data by common attributes.
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<p>Sorting data by common attributes</p>		<p>like to collect data on, e.g. favourite ice-cream, favourite type of pet, favourite cartoon show, favourite fruit, and favourite subject in school. They use the blocks to build a visual graph according to the information that they gathered.</p> <p>They must then record how the blocks represent the answers so that they can explain their graph to the whole class.</p> <p>Each child is given a small bag of M&Ms. They first guess how many colors of each would be in the bag. Have them open their bags and complete a block graph, using graph paper, according to M&M colors. Teacher poses questions such as: Which color is there more of? If all of the M&Ms were put back in the bag and one was taken out, which color would it most likely be? If you combined your M&Ms with a friend's would the shape of your graph change?</p>	
<p>Displaying and interpreting data through the use of sorting and creating graphs</p>	<p>Sort, set, list, count, tally, represent, group, table, block graph, picture graph, title, most popular, least popular, most common, less common</p>	<p>Small Group or Centers</p> <p>The children talk to five classmates and find out how many of them have bikes, skateboards or Game Boys. Have them write down their totals or use tallies. After which they then complete a graph using simple graph paper with large squares. Ask them how they can solve the problem by looking at the graph to see which items have more shaded blocks. Teacher can then pose questions such as: Do more children have bikes or skateboards? Which item do most children have? Students can write a sentence to tell what their bar graph shows.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> ● Using tallies when collecting and recording numerical information. ● Creating a graph, table or list from information collected. ● Interpreting information shown on a graph, table or list

			and make number sentences.
Comparing data	Table, block graph, picture graph, title, most popular, least popular, most common, less common	<p>Small Group or Centers</p> <p>Children collect a strand of hair from the head of 10 persons in class. They can be a mixture of boys and girl. Have them cut a piece of yarn the same length as each strand of hair. Tape the yarn to a line and label it with the name of the person. Ask the children to tell you what they notice about their chart. How does it compare to a block graph? What can you say about the length of boys' hair compared to girls?</p>	Teacher observes and records a child: Comparing and sharing data represented by a chart, table or graph.
Probability Predicting	Probability Most often, least often	<p>Whole Class</p> <p>Predicting</p> <ol style="list-style-type: none"> 1. Give each child a copy of a graph and a spinner. Also give each child a pointer made with a pencil and a paper clip. The sections of the graph can be referred to as 'polka dot', 'solid black' and 'striped'. Ask the children what section they think the pointer might land on when they use the spinner. 2. Explain that the children will spin and then record what the spinner lands on by coloring one block in the graph in the appropriate row. 3. Children are to spin 10 times. They can put an X in a box for each spin (next to the color that comes up on the spinner) to keep track of their spins. 4. Discuss class results. Which section did the spinner land on most often? Least often? Discuss why. 	Teacher observes and records a child: <ul style="list-style-type: none"> • Making reasonable predictions.

MATHEMATICS (PROPORTIONS)

Standard 3: The student will calculate ratios, proportions, fractions, decimals and percentages.

Skills	Suggested Resources for Choice Centers, Projects or Teacher-directed Experiences
<p><i>Communication Skills:</i> attentive listening, clear and fluent speaking, writing, reading</p> <p><i>Social Skills:</i> cooperating with the group, using appropriate voice level, participating, staying on task, sharing, respecting rights, feelings and property of others</p> <p><i>Critical Thinking Skills:</i> observing, classifying, comparing, predicting, analyzing, evaluating</p> <p><i>Mathematical Skills:</i> sorting, counting, ordering, computing, predicting, measuring, estimating, problem solving (mentally and written)</p> <p><i>Manipulative Skills:</i> Cutting, drawing, folding, writing, tearing</p>	<p>Shape tiles, card cut- outs, pegboards or geo- boards and rubber bands, construction paper and scissors</p> <p>Cubes, counters, counting bears</p> <p>Cuisenaire rods</p>

Rational Numbers
Fractions

Target Behavior

Recognize, find and compare simple fractions in practical situations.

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Fractions Whole, half, third and quarter of objects and sets of objects	Part, equal parts, fraction One whole, one half, two halves One quarter, two... three... four quarters	Whole Class Shared Math Find ways to share a pizza equally Collect examples for whole and whole sets e.g. a bunch of bananas or grapes Small Group Guided Math Identifying given fractions e.g. half a glass of water Folding and cutting cut out shapes into halves / quarters / thirds Finding equivalents by manipulating halves and quarter pieces of shapes Using half pieces of shapes to create new shapes or designs Finding different ways to cut rectangles, squares and circles into halves Finding half / quarter of sets of up to 20 members Using Cuisenaire rods to find half / quarter of given numbers Completing symmetrical patterns on a pegboard / geoboard	Teacher observes and records a child: <ul style="list-style-type: none"> ● Identifying one whole object or set of objects. ● Showing one half of an object. ● Showing one half of a set of objects up to 10 / 20. ● Showing an understanding that two halves equal one whole. ● Showing one quarter of an object, then show two or three quarters. ● Showing one third of an object, then two thirds.

MATHEMATICS (MEASUREMENT)

Standard 4: The student understands the process of measurement.

Skills	Suggested Resources for Choice Centers, Projects or Teacher-directed Experiences
<p><i>Communication Skills:</i> attentive listening, clear and fluent speaking, writing, reading</p> <p><i>Social Skills:</i> cooperating with the group, using appropriate voice level, participating, staying on task, sharing, respecting rights, feelings and property of others</p> <p><i>Critical Thinking Skills:</i> observing, classifying, comparing, predicting, analyzing, evaluating</p> <p><i>Mathematical Skills:</i> sorting, counting, ordering, computing, predicting, measuring, estimating, problem solving (mentally and written)</p> <p><i>Manipulative Skills:</i> Cutting, drawing, folding, writing, tearing</p>	<p>Liter measures, $\frac{1}{2}$ liter measures, containers of different size and shape, plastic bottles, measuring cups, cans, plastic cups, bucket, sand, water, peas or beans, salt, rice, shells, buttons, macaroni, cubes, funnels, scoops, spoons</p> <p>Meter sticks, tape measures, rulers, paper clips, erasers, pencils, string, ribbon, items to use as non-standard measures, measuring wheel</p> <p>Different types of scales, balances, a kilogram weight, gram weights (The plastic cubes weight one gram), items to measure</p> <p>Paper cut from magazines to make snakes</p> <p>Construction Kits, plasticine/ clay / dough, ribbons, strips of cloth, paint, colors, crayons</p> <p>Size collections (of hats, coins, buckets etc.)</p> <p>Story Books (stories containing size words)</p> <p>Ingredients for cooking</p> <p>Material for measuring that is suitable for solving problems given</p> <p>Class calendar, clocks/watches, timers</p> <p>Stories that have time sequences e.g. 'The Hungry Caterpillar by Eric Carle, The Enormous Turnip</p> <p>Sequencing cards and jigsaws, material for making clocks and clock booklets</p> <p>Calendars, analogue and digital clocks, timers, stop watch, watches, large teaching clock, small clocks, alarm clocks</p> <p>Time Bingo, time flash cards</p> <p>Coins (<i>it is advisable to use real coins</i>) and notes of different currencies, dollar and guilder coins, toy cash registers, items to sell, price lists, items for a class shop</p>

Capacity, Length and Weight

Target Behaviors

- 1a. Uses and demonstrates an understanding of the vocabulary related to capacity, length and weight
- 1b. Compares and measures the capacity, length and weight of various items using non-standard and standard units
- 1c. Solves problems and suggests suitable units and measuring devices to estimate capacity, length and weight

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
<p>Comparing Mass and Capacity Measurement Vocabulary</p>	<p>Action Words for filling: nearly full, nearly empty, empty, full, half full ... Comparisons capacity: about the same, holds more/less, half as much, most, least How much more? Capacity, full, fill, half full, empty, holds, contains, container Liter, half liter, volume</p>	<p>Whole Class Shared Reading / Read Aloud – ‘Heavy is a Hippopotamus’ by Miriam Schlein Teach children the social aspects of filling things e.g. cleaning up spills, using the appropriate tools, avoiding spilling things, sharing fairly Tidying up also gives opportunities to use vocabulary e.g. Will all the blocks fit? Capacity Shared Math The teacher asks the children to <i>estimate</i> how many of these (Teacher can name the measuring device) can <i>fill</i> a plastic soda bottle (2 liters). Small Group or Centers Cooking activities. Playing shop. Children can estimate and then measure. Children can fill containers (nearly full) using funnels, spoons, scoops and ladles Building different models using the same amount of interlocking cubes. Experimenting with different water levels and displacement</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> ● Demonstrating an understands that objects take up different amounts of space ● Demonstrating conservation of volume ● Responding appropriately to instructions involving descriptive language ● Using a wider vocabulary than ‘big’ and ‘little’ when describing size ● Using measurement vocabulary consistently and correctly

Science activities and Sand/water play also provide opportunities for conservation of volume. (Use rubber bands when comparing capacities of different size bottles)

Teacher uses the vocabulary that he /she wants to introduce when asking questions or directing small group activities.

Children are given a variety of containers to fill with materials such as sand, water, salt, rice, shells, buttons, lentils, peas, macaroni etc. The teacher can ask questions such as:




Do you think that the jar *holds more* sand *than* the box?

Will all the water from the jug *fill* this bowl?

Which *container holds less*?

The children can record their estimates and findings in graphic form.

Using large containers such as a bucket, the children can estimate and then check how many liters each container holds. Results can be recorded graphically or in sentences e.g. My estimate was 6 liters. I found that the bucket holds between 7 and 8 liters.

Cupfuls needed to fill each container		
A box	A can	A jug
		
4	2	5

Size words: big, little, large, long, short, tall, thin, wide, same, longer, shorter, taller, wider, and

Whole Class

Shared Reading of books such as:

‘Jack and the Beanstalk’,

‘The Three Bears’ and

‘The Enormous Turnip’

Length

	<p>thicker ... Same, nearly the same, more, fewer, as long/short as ... Length, width, height, depth, high, low wide, narrow, deep, shallow, thick, thin, longest, shortest, tallest, highest ... etc. meter, centimeter, ruler, meter stick, tape measure, more, less, about nearly the same length, estimate Weigh, Comparisons weight: the same, balances, heavy/light, heavier/lighter Heaviest/lightest Quantity: too much/little, not</p>	<p>Shared Math The teacher poses the question ‘How can we <i>measure the height</i> of the classroom?’ and solicits suggestions.</p> <p>Small Group or Centers Painting, drawing, modeling, sorting and building; Teacher gives directions that include size words e.g. draw a large giant with long hair, make a short, thick, wiggly worm, build a tall tower, and sort out the tiny buttons. Children can: Order objects by size e.g. stacking boxes, Russian dolls, nesting boxes. Make houses for the three bears. Compare pairs of objects. Compare their body measurements. Compare the length of their names when each letter is written in a block of squared paper. Compare strips of paper. Measure body parts with string and find classroom objects the same length. Children find items that are <i>taller or shorter</i> than themselves and report their findings</p> <p>Whole Class <i>Weight</i> Shared Mathematics Children are asked to find out how many children <i>balance the weight</i> of the teacher</p> <p>Small Group or Centers</p>	
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	<p>enough, half ...</p> <p>Balance, scales, weight, kilogram, gram</p>	<p>Comparing the weight of two objects with hands.</p> <p>Using simple balances with same materials, with different materials.</p> <p>In small groups the children can find things that are <i>heavier or lighter</i> than themselves</p>	
<p>Measurement of capacity, length, and weight by:</p> <ul style="list-style-type: none"> ● Direct comparison ● Using non-standard units ● Using standard units 	<p>Capacity, full, fill, half full, empty, holds, contains, container liter, half liter, volume how much more? holds more/less than</p> <p>Longer, shorter, taller, higher ...etc., longest, shortest, tallest, highest ... etc. meter, centimeter, ruler, meter stick, tape measure, more, less, about</p>	<p>Small Groups or Centers</p> <p>Capacity - Children are given a wide range of containers to compare:</p> <ul style="list-style-type: none"> ● By sight to see which holds more or less ● By using non standard units such as cubes, marbles, beads for filling. Children can estimate first and then check. Results can be recorded with a table or pictogram. ● By using liter or ½ liter beakers and water or sand <p><i>Conservation of volume can be assessed by filling a short wide glass with water and pouring the water into a tall narrow glass, then asking the children if there is now more or less water than there was before. If they answer 'no, it is the same amount' they understand conservation of volume.</i></p> <p>Length –The children can be given different lengths of ribbon and:</p> <ul style="list-style-type: none"> ● Compare the lengths by placing them side by side for direct comparison ● Measure using non-standard units such as pencils, rulers, erasers, chips etc. The results can be ordered from shortest to longest ● Measure with a centimeter ruler or tape measure 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> ● Measuring by: <ul style="list-style-type: none"> ○ Direct comparison ○ Using non-standard units ○ Using standard units

	<p>nearly the same length, estimate</p> <p>Weigh, balances, heavy/light, heavier/lighter heaviest/lightest balance, scales, weight, kilogram, gram</p>	<p>Weight</p> <ul style="list-style-type: none"> • Compare the weight of pairs of objects, e.g. an apple and orange or a sack of peas and a sack of rice, by using their hands • Weigh using balance scales to find items that have equal weight or find out how many cubes/bears balance given items. • Using standard weights to measure 	
<p>Decision Making Choosing suitable measuring devices and given standard units for measuring Solving simple word problems</p> <p>Curriculum Links</p> <ul style="list-style-type: none"> • Science and Technology • Social Studies 	<p>Language of measurement applicable to the problem being solved Guess, estimate, roughly, nearly, close to, about the same as... too many, too few, enough, not enough</p>	<p>Whole Class Shared Math The children are asked to discuss and choose suitable uniform units of measure or instruments to measure or estimate, e.g.:</p> <ul style="list-style-type: none"> • If a red parcel is heavier than a blue parcel • How far you can jump from a given line • How many ... of water can fill a ...? • How to identify which of a given collection of containers holds a liter • The height of a table • The height of a flower • The capacity of a paddling pool • What would you use to measure your height or weight if you did not have a scale, tape measure or other measuring device? <p>Small Group or Centers One step problems in classroom context can be given, e.g.:</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Suggesting suitable units to estimate or measure capacity, length or weight. • Suggesting and using simple measuring equipment, reading scales with accuracy. • Choosing and using mental strategies to solve measurement problems. • Explaining methods and reasoning orally and where appropriate writing a number sentence using numbers and signs to show how the problem was solved.


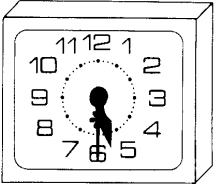
		<ul style="list-style-type: none"> • The classroom is 18 meters long. The library is 15 meters long. Which is longer and by how much? • There are 5 kg of apples in a box. How many kilograms of pears are in 3 boxes? • A full jug holds 6 cups of milk. How many children will get milk if we have 2 jugs of milk? 	
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Time
Target Behaviors

- 2ai. Demonstrates an understanding of the concept of time
- 2aii. Uses the vocabulary related to time and demonstrates an understanding of the relationships between time units
- 2bi. Tells time by the hour, half hour, quarter hour and five-minute intervals on analogue clocks
- 2bii. Reads the time on digital clocks
- 2biii. Records the time in figures and words
- 2c. Estimates time intervals
- 2d. Solves problems related to time

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
Measurement Vocabulary (Time)	Time Speed words: quick/ly, slow/ly, fast, slow ... Days of the week: Monday, Tuesday... Months of the year: January,	Whole Class Shared Reading / Read Aloud – Books like ‘The Grouchy Ladybug’ by Eric Carle; ‘What Time Is It Jeanne Marie’ by Francoise Seignobosc; ‘Bear Child’s Book of Hours’ by Anne Rockwell Reciting nursery rhymes such as ‘Hickory Dickory Dock’ Completing the class calendar. Teacher refers to specific times e.g. its ten o’clock, snack time. Child identifies activities done in the morning etc. Shared Mathematics The children can discuss the following scenario:	Teacher observes and records a child can: <ul style="list-style-type: none"> • Using the vocabulary of time with understanding.

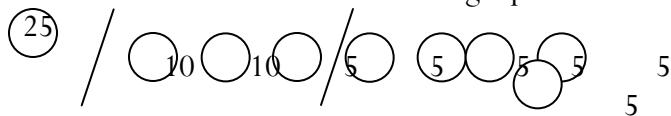
	<p>February... Season, day, week, month, year, weekend, Clock words: numbers, hands, hour, minute, second, calendar, birthday, holiday (vacation), morning, afternoon, evening, night, midnight, bedtime, recess Today, yesterday, tomorrow, day after tomorrow, the day before yesterday, before, after, next, last, now, soon, early, late, how long ago? How long will it be /take?</p>	<p>On Saturday Tom’s family is having guests for dinner. Tom’s mother has prepared the food and wants to cook it so that it is ready to serve at 1 o’clock. The menu and cooking times is as follows:</p> <ul style="list-style-type: none"> ● Baked Chicken 2 hours ● Rice and Peas ½ hour ● Plantains 5 minutes ● Bread pudding ½ hour <p>What time will Mother start to cook each item so that they are hot and ready to serve? (<i>More items can be added according to the level and abilities of the children</i>)</p> <p>Small Group or Centers Drawing day/night pictures. Sequencing pictures of story events. Making clocks The teacher poses questions using the vocabulary of time.</p> <ul style="list-style-type: none"> ● What <i>time</i> does this <i>clock</i> show? ● What time will it be <i>2 hours later</i>? ● If the hurricane <i>season</i> lasts from <i>June to November</i>, how many <i>months</i> does it <i>last</i>? ● <i>How long</i> is it from the start of school to <i>recess</i>? ● How many <i>minutes</i> is first recess? ● What <i>day / month</i> is it? ● What day was it <i>yesterday</i>? ● What day will it be <i>tomorrow / in two days time</i>? ● How many <i>days</i> in two <i>weeks</i>? ● Which takes up <i>less/more</i> time? ● <i>How long will it be before</i> Christmas? 	
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<p>Telling and Reading the time</p> <ul style="list-style-type: none"> • By the hour • By the half hour • By the quarter hour • At 5-minute intervals <p>Recording the time in figures and words</p> <p>Telling and recording the date</p>	<p>Months of the year: January, February...</p> <p>Season, day, week, month, year, weekend, hour, minute, second, calendar, o'clock, half past, quarter past, quarter to, minutes past, Short / hour hand, long / minute hand</p>	<p>Whole Class A time keeping display can be made of different clocks, timers and watches Candle, water and sand clocks can be made</p> <p>Small group or Centers Games such as Time Bingo and Dominoes Flash cards with times written on them can be held up as children show the time on individual clocks. In pairs, one child can show a time on a clock face and the other child can read and tell the time. Matching analogue and digital clocks and written times</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Half past five</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;"> <div style="text-align: center;">  </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">$\frac{1}{2}$ past 5</div> </div> <p>This can be done as a card game. Completing the calendar or calendar chart and recording the date</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Sequencing familiar events. • Reciting days of the week in order. • Telling which day of the week it is • Telling the time on an analogue clock: <ul style="list-style-type: none"> ○ To the hour ○ To half past ○ Quarter to / past ○ Minutes past (5-minute intervals) • Stating the date.
<p>Time Intervals</p>	<p>Months of the year: January, February... day, week, month, year, hour, minute, second, calendar, o'clock, half past,</p>	<p>Whole Class Children can be made aware of intervals of time at different times in the day e.g. they can estimate how much time it will take to clean up after an activity and check by using the classroom clock. An alarm clock can be set to ring after one hour to help the children have an idea of the passing of 1 hour. Children can then suggest activities that last for an hour or more or less than an hour. Older children can use stop watches and write down what each</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Estimating time intervals. • Calculating time intervals.

	<p>quarter past, quarter to, minutes past, takes less / more time, lasts</p>	<p>class/group member can do in one minute e.g. count to ..., draw ... squares, walk ... steps. The results can be ordered or placed on a block graph.</p> <p>The children can learn the rhyme '<i>Thirty Days Hath September</i>'.</p> <p>Small Group or Centers</p> <p>Using small clock faces the children can find what the time will be 4 hours after 1 o'clock, 3 o'clock, 7 o'clock etc. Similar activities can be done with the calendar months, e.g. Today is ..., Yesterday was ..., Tomorrow will be ...</p> <p>In 4 days time it will be ...</p> <p>Children can order the time it takes for familiar activities or write the birth months of their group in order.</p>	
Problem Solving	<p>How long will it take? What time was it ... hours ago?</p>	<p>Small Group or Centers</p> <p>Discuss the suitable units of time to measure the recess, the telling of a story, walking to school, traveling to Holland, the length of a vacation...</p> <p>Ordering events in their day or a story</p> <p>Sequencing given lengths of time</p> <p>Using the calendar to find out how many Tuesdays in a month / year</p> <p>Ordering annual holidays</p> <p>A birthday chart can be used for problem solving e.g. Which month has the most / least birthdays? How many children have birthdays in the vacations?</p> <p>Simple word problems;</p> <ul style="list-style-type: none"> • How long is it from 6 o'clock to 10 o'clock? • Jack got on the bus at 8 o'clock. The bus ride was half an hour. What time did he get off the bus? • You ate dinner at 1 o'clock. How long ago was that? • If you leave for school at 7:30 and arrive at 7:45, how long does it take you to get to school? 	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Deciding which time unit can be used to measure different activities. • Ordering and sequence time units correctly. • Interpreting time data. • Solving simple word problems and explaining how the problem was solved.

Money
Target Behaviors

- 3ai. Determines the value of different coins and notes and records using appropriate symbols.
 3aai. Makes different sets of coins with equivalent values
 3b. Solves problem involving money

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities
<p>Money Coin / Note value</p> <p>Equivalent values</p>	<p>Money, coin, note, currency, dollar, nickel, dime, penny, quarter, guilder, cents, euro, price, list, buy, bought, sell, sold, spend, spent, pay, change, total, expensive (dear), costs, Equivalent, same amount as</p>	<p>Whole Class The children will be asked to collect coins beforehand. Similarities and differences will be discussed in terms of size, color, weight, shape, value and symbols on the faces. If the coins are restricted to local currencies then a guessing game can be played. The teacher will give clues such as; ‘I am gold and round. I have the Antillean crest on one side and a picture of the Queen’s head on the other. A 5 and capital G are on either side of the crest. What coin am I?</p> <p>Small Group or Centers The children can also do coin rubbings and write the values underneath. Children can be given sets of coins and asked to calculate the total amount. Children can make sets of coins having equivalent values.</p>  <p>If real coins are not available they can be drawn. Children can be asked to find coins for a stated amount of money.</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> Identifying different coins and state their value. Exchanging coins for other coins of equivalent value.

<p>Money Problem solving</p>	<p>Coins, costs more / less, change, total, pay, how much?</p>	<p>Small group or Centers A Shop, Post Office, Supermarket or Movie Center could be set up to allow children to solve problems such as finding totals, estimating the price of more than one of the same item, giving change, deciding what to buy for the money that one has and what coins to use to pay. The children can also go shopping for a particular class project such as making cupcakes for a class party. Making the children responsible for collecting money for buying snacks at the school canteen also gives opportunities for ‘real life’ problem solving. Simple word problems can also be given, e.g. Rose had 15c. She spent 6c. How much does she have left? Rayette spent 23c. She spent 7c more than Kate. How much did Kate spend? Which three coins make 15c, 16c, 12c? Randy has 3 coins of the same value. How much might he have altogether?</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Solving simple word problems relating to money and telling how the problems were solved.
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MATHEMATICS (GEOMETRY)

Standard 5: Based on the level of development, the student will know simple notions and concepts and order, describe and reason geometrically.

Skills	Suggested Resources for Choice Centers, Projects or Teacher-directed Experiences
<p><i>Communication Skills:</i> attentive listening, clear and fluent speaking, writing, reading</p> <p><i>Social Skills:</i> cooperating with the group, using appropriate voice level, participating, staying on task, sharing, respecting rights, feelings and property of others</p> <p><i>Critical Thinking Skills:</i> observing, classifying, comparing, predicting, analyzing, evaluating</p> <p><i>Mathematical Skills:</i> sorting, counting, ordering, computing, predicting, measuring, estimating, problem solving (mentally and written)</p> <p><i>Manipulative Skills:</i> Cutting, drawing, folding, writing, tearing</p>	<p>Plasticine/clay/dough, Attribute tiles, mosaics, Construction kits such as Multi-link, construction straws Folding/construction paper, prick pins and mats, gummed shapes</p> <p>Commercial sets of 3D shapes, puzzles (Insets/jigsaws) Attribute blocks, cut-out shapes, geoboards, pegboards, elastic bands, tangrams, shape tiles, shape templates, interlocking cubes, wooden blocks</p> <p>Commercial construction kits such as ‘Lego’, ‘Polydron’, ‘Clixix’, cardboard boxes, paper, scissors, glue Relevant computer software</p> <p>Paper, paint, scissors, mirrors, square folding paper, pegs, pegboard, shape stamps</p> <p>Some commercial moveable, battery-operated toys may be used.</p> <p>Large outdoor climbing apparatus (climbing frames, slides, swings, seesaws) and small gym equipment</p>

Shape and Space Target Behaviors

- 1a. Describes and classifies common 2-D and 3-D shapes according to their properties.
- 1b. Makes models, shapes and patterns and describes their features.
- 1c. Identifies and makes figures with line symmetry
- 1d. Uses the vocabulary of position and direction.

Content	Mathematical Language	Suggested Experiences	Assessment Opportunities																		
<p>Shapes 2-D (flat/plane) circle, triangle, square, rectangle, star, pentagon, hexagon, octagon 3-D (solid) cube, cuboid, pyramid, sphere, cone, cylinder</p> <p>Shape Drawing, building and making patterns</p>	<p>Much of the vocabulary for patterns will be used as shapes are often used to make patterns Names of shapes Circle, square, triangle, rectangle, oval, star, heart, arrow, crescent, edge, face, curved, straight, flat, corner, cube, cylinder, cone, cuboid Shape, pattern, flat, curved, straight, round, hollow, solid, corner, point, pointed, face, side, edge, end,</p>	<p>Whole Class The class can go on a ‘Shape Walk’ and identify shapes in the environment. ‘Guess the Shape’ can be played. The teacher or a child can give verbal clues. Small Group or Centers Children can be asked to identify solid shapes in a ‘Feely Box’ by touch. Children can sort 2-D shapes according to properties such as number of sides, edges of faces, length of sides etc. 3-D shapes can be identified by the properties of their faces or the type of face. Children can use wooden blocks to discover the properties of solid shapes and tabulate their results e.g.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">Will slide</td> <td style="text-align: center;">Will slide on all faces</td> <td style="text-align: center;">Will roll</td> <td style="text-align: center;">Will roll on all faces</td> <td style="text-align: center;">Will roll in a straight line</td> </tr> <tr> <td></td> <td style="text-align: center;">*</td> <td style="text-align: center;">*</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">*</td> <td></td> <td style="text-align: center;">*</td> <td></td> <td style="text-align: center;">*</td> </tr> </table> <p>Small Groups or Centers Children make shape collections e.g. leaves, pebbles, seeds Children follow instructions when the teacher uses shape words.</p>		Will slide	Will slide on all faces	Will roll	Will roll on all faces	Will roll in a straight line		*	*					*		*		*	<p>Teacher observes and records when the child can:</p> <ul style="list-style-type: none"> • Describing the shape of an object. • Making a collection of things with common features (shape). • Using a wide vocabulary to describe the features of environmental shapes. • Describing shapes or models/properties. • Naming 2-D and 3-D shapes. • Identifying 2-D and 3-D shapes in the environment. • Classifying shapes according to their properties. <p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Drawing shapes accurately. • Building models of shapes.
	Will slide	Will slide on all faces	Will roll	Will roll on all faces	Will roll in a straight line																
	*	*																			
	*		*		*																

	<p>surface, sort Roll, slide, move, direction</p> <p>Make, build, draw, size, bigger, larger, smaller, symmetrical, fold, match, mirror, pattern, repeating pattern</p>	<p>Children can make 3D shape models. Paper folding Folding and Unfolding Experimenting with 3D blocks to discover properties of 3D shapes Measuring by covering the item with smaller objects and counting Shape patterns Matching shapes and environmental objects (cube-dice) Guess the Shape / I Spy games. Children can build models using 3-D shapes and describe their models in terms of the shapes used, or build skeletons of 3-D shapes using straws and plasticine or construction kit materials. 2-D shape cut-outs can be used to make pictures, figures or patterns. Patterns can also be made with irregular shapes. Squares can be put together to form other shapes. Using geoboards and rubber bands, children can make shapes with a given number of sides or complete shapes. <i>*There is computer software that requires students to draw or design using shapes.</i></p>	<ul style="list-style-type: none"> • Completing patterns of shapes. • Creating patterns with shapes.
Symmetry	<p>Line of symmetry, fold, match, mirror line, reflection, symmetrical</p>	<p>Small Group or Centers Using pegs and a pegboard one child in a pair can make half a pattern or shape and the other child complete it. A mirror can be used as an aid. Children can find and draw the line of symmetry in given letters or shapes. Children can complete the other half of a drawing or draw reflections. Making paint blob patterns or doing paper folding activities provides a means of introducing symmetry. <i>If the children are not ready to use the term 'symmetrical' they can be encouraged to make shapes that can be cut in half or are alike on both sides.</i></p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Identifying symmetrical shapes. • Identifying lines of symmetry. • Drawing symmetrical shapes.
Space Position / Direction Vocabulary	<p>Position, in/out, under/over, between, beside, next to, on, into, up / down, above / below, around, through, high / low, near / far front / back,</p>	<p>Whole Class The teacher uses the developing physical skills to develop an understanding of distance, position, sequencing, time and movement. 'Follow the Leader' or 'Simon says' games give opportunity for using position vocabulary e.g. hands on head, jump up high. Many action rhymes and songs such as 'My hands upon my head I place' also provide opportunity. Teacher gives instruction for uses of outdoor P.E. apparatus e.g. climb through / higher/between. Formal and informal movement activities as well as playground/ring games such</p>	<p>Teacher observes and records a child:</p> <ul style="list-style-type: none"> • Using appropriate language to describe position, speed, distance, direction and movement. • Demonstrating the ability to follow instructions when moving and turning in a space. • Demonstrating the ability to remember sequences of movements.

	<p>first / last, left / right, inside /outside underneath,, in, in front, behind, after, n opposite, close, far, apart... Middle, center, edge, corner, top, bottom, side... Direction / Movement, left, right, up, down, forwards, backwards, sideways, across, along, around, through, to, from, towards, away from quickly, turning, twisting</p>	<p>as 'Hopscotch', 'Farmer's in his Den', 'Hokey Pokey', 'Lobby Loo. Obstacle courses can be set up by the teacher during outdoor play. Outdoor 'Math' walks</p> <p>The teacher can give instructions on how to draw a picture using positional vocabulary e.g. Draw a pond <i>in the middle</i> of the paper <i>between</i> two trees. Put the sun <i>above</i> the pond.</p> <p>A game can be played outside. The children are grouped in pairs. A path is drawn on the playground. One child is blindfolded and the other must give directions so that the blindfolded child can walk along the path:- Go <i>forward</i> 3 steps, <i>turn left</i>, <i>forward</i> 6 steps <i>turn right</i>...</p> <p>In the Block Center, two children can be seated with a partition in between them. Each child has identical sets of blocks. As one child builds he gives instructions to the other child so that he/she can build in the same way. The same type of activity can be done with drawing pictures or creating sequential patterns.</p> <p>During the Physical Education lesson, instruction can be given using the vocabulary e.g. Stand <i>in front of</i> your partner Run <i>between</i> the posts; run <i>forwards</i> Crawl <i>under</i> the bench; Hop <i>around</i> the hoop. Stand <i>beside</i> me; Try to get <i>away from</i> the catcher.</p>	
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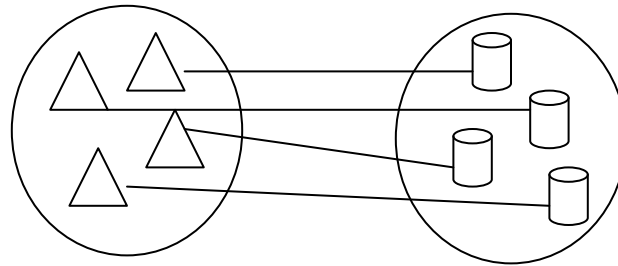
GLOSSARY

- **Addend** – One of a set of numbers to be added. In $3 + 5 = 8$, 3 and 5 are **addends**.
- **Array** – An arrangement of rows and columns of objects
- **Associative property for addition** – The grouping of three **addends** does not affect the sum: $3 + 1 + 2 = 3 + 2 + 1$
- **Associative property for multiplication** – The grouping of three **factors** does not affect their **product**:
 $3 \times 2 \times 4 = 3 \times 4 \times 2$
- **Board game** – Any game where dice are thrown and markers are used to track progress along a numbered track e.g. Snakes and Ladders
- **Carroll diagram** – A rectangular diagram used for sorting.

Round	Not Round
- **Capacity** – The amount of space a solid container will hold. The liter is the unit for measuring liquid capacity.
- **Common attribute** – A characteristic that belongs to two or more objects, e.g. a **black** cat and a **black** shoe.
- **Commutative property for addition** – The order of two numbers does not affect their sum: $5 + 4 = 4 + 5$.
- **Commutative property for multiplication** – The order of two numbers does not affect their **product**: $5 \times 4 = 4 \times 5$.

- **Conservation** – The realization that if nothing is added or taken away, the amount stays the same regardless of any change in shape or arrangement.
- **Construct** – To take many separate pieces of information and use them to build an overall understanding
- **Data** – A collection of numerical facts (Information)
- **Even number** – A whole number that is a multiple of 2 (0, 2, 4, 6, 8, 10, 12...)
- **Expanded notation** – A written form of a number showing its numerical value and place value in words or numerals e.g. 34 = 3 tens and 4 ones or $(3 \times 10) + (4 \times 1)$
- **Face** – One of the geometric planes making up a 3D-shape; e.g. a cube has six **faces**, each one a square.
- **Factor** – Numbers that are multiplied to get a **product**; e.g. in the sum $2 \times 3 = 6$, 2 and 3 are **factors**.
- **Graph** – A form of pictorial representation that shows the relationship among data.
- **Hexagon** – A six-sided 2D-shape
- **Inverse operation** – An operation that reverses another; e.g. subtraction is the **inverse** of addition, division is the **inverse** of multiplication
- **Number** – The abstract property of a set.
- **Numeral** – A symbol denoting a number, e.g. 3.
- **Octagon** – An eight-sided plane (flat) 2D-shape

- **Odd number** – A whole number that is not a multiple of 2 (1, 3, 5, 7, 9, 11, 23...)
- **One-to-one correspondence** – It occurs when each member of one set is matched with each member of another set

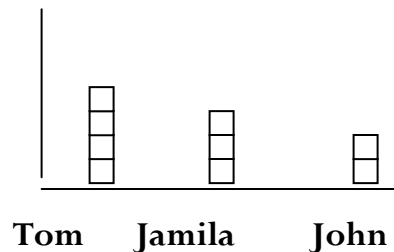


- **Ordinal number** – A number that indicates which position a certain object occupies.
- **Pentagon** – A 2D-shape with five sides.
- **Pictogram** – A graph in which pictures are used to represent items.
- **Pictorial Representations of Mathematical Data**

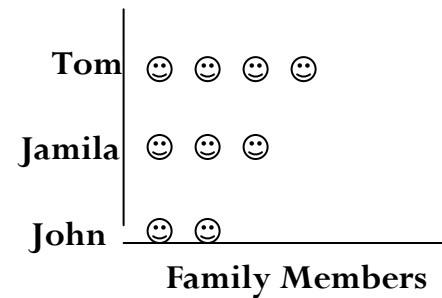
Table

NAME	FAMILY MEMBERS
Tom	4
Jamila	3
John	2

Block Graph




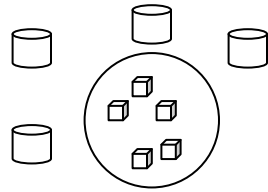
Picture Graph/Pictogram



Tally

Tom	
Jamila	
John	

- **Problem solving** –The process of reaching a solution when the method of solution is not immediately obvious.
- **Symmetrical** – Having a regular or balanced form that is equal on both sides of a center line; e.g. a heart  is symmetrical.
- **Tallying** – A method of recording totals that involves a one to one correspondence
- **Venn diagram** – A circular diagram used for sorting. The circle holds objects with the same attributes.



APPENDIX

(Checklist taken from Netherlands Antilles Curriculum Frameworks)

Mathematics Number Sense Process Checklist

Name: _____ Year: _____

Cycle One

Development of number sense with regard to:	DATES			
<p>1. Ordering Place 8 -12 objects randomly on a table. Ask the child to count the objects. If he can count them without counting objects twice, then he understands "ordering" number sense.</p> <p>OBSERVATIONS OF CHILD:</p>				
<p>2. One-to-One Matching Have the child match one item to another item. Put out five blue chips and five red chips. Have the child pair them. The child may touch or move the objects as he matches them. If he can pair the red chips with the blue chips, then he understands "one-to-one matching" number sense.</p> <p>OBSERVATIONS OF CHILD:</p>				
<p>3. Conservation Have the child match five blue chips with five red chips. Place the blue chips in a row and have the child match the red chips beneath the blue chips. Next, move the red chips apart and ask the child if there are more blue chips or red chips, or if there is still the same amount. The child who is "conserving" number will realize that the amount remains constant even if they are spread out.</p> <p>OBSERVATIONS OF CHILD:</p>				
<p>4. Total Number Ask the child to count a number of objects and then to tell you how many objects are in the group. If the child understands total number, he will be able to say that the last number counted indicates how many there are in the group.</p> <p>OBSERVATIONS OF CHILD:</p>				
<p>NOTE: Each of these number tasks helps the teacher to assess the child's understanding of number. If the child does not understand these tasks, then the teacher should provide the child with many experiences in counting, classifying, comparing, ordering, and patterning in order to help the child develop number sense. Without "number sense" the child will not understand addition or subtraction.</p>				

STANDARD I Kerndoelstellingen		Assessment-Toetsen				
STANDARD I		Emergent Numeracy (4-6 yrs)				
Standard 1: Basic Skills <i>Develop basic skills and understand simple math language.</i>						
GOALS (Benchmarks)						
*recognize, name, arrange, count, count backward, compare and write numbers to 20	Count objects to 20					
*knows adding and subtraction tables to 10	Recognize, read and write the numbers up to 20					
*explore addition and subtraction using concrete objects of numbers through 10	Knows the counting row to 20					
	Count by two's up to 10 and in groups 5-25					
	Can do structured counting 1 up until 10					
*knows to do estimation (to 20)	Can use concrete objects to add to 5					
	Same as with subtraction.					
	Recognizes and group ones to tens using concrete material.					
	Compares an amount of objects to 20 using the concepts: more, less and same amount.					
	Estimate amounts up to 20.					
	Estimate, count and sort objects and report verbally.					
	Use common numbers first to the fifth.					
	Reflect and discuss mathematical problems using pictographs.					
STANDARD II		Not applicable in cycle 1				
Standard 2: Calculations						
STANDARD III						
Standard 3: Proportions <i>Understanding ratios, fractions, decimals and percentages</i>						
GOALS (Benchmarks)						
*understand that you can create a whole from fractional parts	create and dissemble fractional parts in simple situations to form a whole;					
	making use of: observation, comparison, mosaics, puzzles,					
	folding, cutting and pasting					

STANDARD IV						
Standard 4: Measurements <i>Understand the process of measurement</i>						
GOALS (Benchmarks)						
*knows to use money in simple situations	- recognize the relationship between money and purchasing.					
	- recognize certain coins					
*understands the time factor, through practical activities and daily experiences	- can apply time factor such as morning, midday, evening, night.					
	early, late, on time, too late.					
	- know days of the week					
	- understand the hour concept					
	- simple calendar concepts such as: today, tomorrow.					
* know to measure length and weight using non-standard units	- distinguish commonness such as: short, long, slow, fast, light, heavy.					
	- measure and compare using non-standard units.					
	- recognize and discover patterns in the immediate environment.					
STANDARD V						
Standard 5: Geometry <i>Based on level of development, will know simple notions and concepts, and can order, describe, and reason geometrically.</i>						
GOALS (Benchmarks)						
*understand the qualities, similarities and differences of simple geometric figures	- distinguish measurements, form and color;					
	- understand/demonstrate spatial concepts such as: in, out, under, above, behind and in front.					
*understand general use of spatial language	- sort and structure objects with guidance.					

STANDARD I		Emergent Numeracy (6-8 yrs)					
Standard 1: Basic Skills <i>Develop basic skills and understand simple math language.</i>							
GOALS (Benchmarks)							
*demonstrate place value concepts 0-100 by naming, ordering, counting, counting backwards		recognize, read, apply, order, count,					
comparing and writing		compare and write numbers 0-100					
*knows the structure of the numbers below 100 and can identify the place value of numbers up to 100		can position the numbers up to 100 on the line of numbers.					
*knows the facts of addition and subtraction up to 100		count backwards from 20					
		recognize and use the symbols +, -, x, :, =					
*knows to add and subtract under 100		apply strategies of repetitious adding and subtraction.					
*knows to do estimation up to 100		indicate what is more, less, difference of 1 or 2 more or less.					
*knows the time tables 1, 2, 3, 4, 4, 5 and 10		- use a short story to illustrate an addition or subtraction. - identify the place value of units and tens. - Use a given amount of tangible material to establish different grouping. - Identify ordinal numbers 1st to 10th					
*knows to convert everyday problems using mathematical terms		- recognize and solve the problem in simple solutions.					
*knows to solve simple mental mathematic problems by applying the basic operations		- can verbalize solutions using pictographs and written language. - using steps of 2, 5, 10 to 100 can add and subtract with accuracy.					
		- can do automation with number facts up to 10. - can do automation duplicating and dividing to 20.					
		- demonstrate the commutative and associative properties of addition. - add and subtract mentally up to 20					
*understands that dividing means sharing equally (concrete level)		- understand the relation between adding and subtracting. - can verbalize the concept of division using manipulatives.					
STANDARD II							
Standard 2: Calculations		Not applicable					

STANDARD III							
Standard 3: Proportions <i>Understanding ratios, fractions, decimals and percentages</i>							
GOALS (Benchmark)							
*knows simple proportions		- understand relationships between part and whole.					
		- share and divide and name simple fractions					
		- can work with objects using 1/2 - 1/3 - 1/4					
STANDARD IV							
Standard 4: Measurements <i>Understand the process of measurement</i>							
GOALS (Benchmarks)							
*masters the concepts: length weights and time		- can use non-standard and standardized measurements; to measure and compare; lengths-rule; clock; weight; scales/weights.					
		- can tell time by quarter of hour and read the calendar.					
*count using coins in simple situations		- can identify local coins up to one guildler, cent, five cents, ten cents, 25 cents.					
		- can use these concepts					
		- can solve simple money problems					
STANDARD V							
Standard 5: Geometry <i>Based on level of development, will know simple notions and concepts, and can order, describe, and reason geometrically.</i>							
GOALS (Benchmarks)							
masters the qualities, similarities and differences of geometric figures		- can identify geometric diagrams such as: side, corner, line- and curves figures.					

CHECKLIST FOR MATHEMATICAL DEVELOPMENT

Behaviors	Names of Children												
Write date when skill is mastered													
NUMBER AND NUMERATION													
Sorting													
Sorts out one general set													
Sorts for 'positive' and 'negative' reasons													
Sorts for a specific sameness e.g. color, size, texture, number, shape and describes reasons for sorting													
Sorts for more than one property													
Uses simple sorting diagrams													
Sorts only with one criterion, does not re-sort													
Sorts a collection (> one criteria) giving reasons, then re-sorts for a different reason													
Matches and compares sorted sets													
Sorts and resorts consistently using more than one criteria using mathematical language to explain reasons for sorting													

Can make sets of things that go together but are not the same, e.g. cup and saucer													
Number													
Begins to use mathematical language when talking about quantity in response to teacher questioning e.g. Have you enough...? Are there lots of flowers in the...?													
Changes the size of a set when directed by teacher using mathematical language, e.g. Put more beads on the lace. Take some toys out. Give me another book.													
Compares sets by putting items side by side or matching on a one-to-one basis													
Uses and understands mathematical language e.g. more, less, same, few													
Demonstrates conservation of number													
Compares sets by counting and one-to-one correspondence													
Counts objects that can be touched, moved or rearranged													
Counts objects that can be touched but not moved.													

Counts objects and sounds that cannot be moved or touched													
Recognizes numerals 1 – 5													
Writes numerals 1 – 5													
Counts forwards to 10 orally													
Matches numerals to sets (less than or equal to 5)													
Recognizes and writes numerals 1 – 10 and 0													
Matches numerals to sets (to 10)													
Recognizes and writes numerals more than 10													
Identifies odd and even numbers 0 - 9													
Recognizes and writes numerals up to 20													
Recognizes and writes numerals more than 20 up to 100													
Writes numerals for given number words from 20 - 100													
Writes number words for given numerals from 20 - 100													
Matches numerals to sets (20+)													
Counts reliably forwards to + 20 and backwards from 10 in 1s													
Counts reliably forwards and backwards in 1's to + 50													

Counts reliably forwards and backwards in 1's to 100													
Counts in 1's from any number													
Skip counts in 2's to 20 starting at 2													
Skip counts in 2's to 19 starting at 1													
Skip counts in 2's to 50 or more starting at any one-digit number													
Skip counts in 5's													
Counts in 10's to 100													
Identifies first and last positions													
Identifies first to fifth positions													
Identifies first to tenth positions													
Identifies ordinal numbers first through tenth													
Pattern													
Makes simple patterns and pictures													
Copies and/or completes definite patterns and designs													
Completes copies or makes linear or cyclic patterns													
Identifies and describes patterns in the environment and in other areas e.g. music, writing, number													
Identifies a rule needed to extend given number patterns /													

sequences													
Supplies missing numbers in given number sequences													
Place Value													
Groups objects into 'tens' and 'ones'													
Groups objects into 'hundreds', 'tens' and 'ones'													
Uses expanded notation to describe two-digit numbers													
Models any two-digit number using manipulatives, drawings or diagrams													
Models any three-digit number using manipulatives, drawings or diagrams													
Renames two- and three-digit numbers in different ways													
Rounds numbers to the nearest 10													

OPERATIONS OF WHOLE NUMBERS													
Behaviors	Names of Children												
Date when skill is mastered													
Addition and Subtraction													
Uses the language of addition													
Can tell one more than a given													

number													
Can combine two sets to form a total of 10 by counting altogether													
Can partition a given number into two subsets													
Can combine two sets to form a total of 10 by counting on													
Can combine two sets to a total of 10 by use of manipulatives													
Uses the + and = signs													
Uses the language of subtraction													
Can tell one less than a given number													
Subtracts by 'taking away'													
Subtracts by 'counting up' or 'down'													
Finds the difference between two numbers by matching													
Uses the '-' and '=' signs													
Uses and understands the commutative property of addition													
Uses and understands the associative property of addition													
Models addition and subtraction on the number line													

Memorizes basic addition facts													
Uses different strategies to memorize basic addition facts													
Memorizes basic subtraction facts													
Recognizes that subtraction is the inverse of addition													
Supplies missing addends in addition / subtraction number sentences													
Adds /subtracts two one-digit numbers total to/from 20													
Adds one two-digit number and a one-digit number without regrouping													
Adds one two-digit number and a one-digit number with regrouping													
Adds two two-digit numbers without regrouping													
Adds two two-digit number with regrouping													
Subtracts without regrouping													
Subtracts with regrouping													
Problem solves using addition and subtraction of whole numbers													

Multiplication and Division													
Uses manipulatives to model multiplication													
Recognizes multiplication as repeated addition													
Uses the 'x' sign													
Uses and understands the commutative property of multiplication													
Recites 2, 5 and 10 times tables													
Recites the 3 & 4 times tables													
Uses the number line to demonstrate multiplication													
Uses language of multiplication													
Solves one step multiplication problems (product to 50)													
Identifies missing factors in multiplication number sentences (2, 5, 10, 3 & 4 times tables)													
Uses manipulatives to model division													
Uses the number line to model division													
Identifies the relationship between division and repeated subtraction													

Recognizes that division is the inverse of multiplication													
Uses the ' - ' sign													

PROBLEM SOLVING													
Behaviors	Names of Children												
Write date when skill is mastered													
Chooses appropriate strategies to solve word problems													
Explains thinking process to solve number problems													
Writes an appropriate number sentence for given problems													
Identifies simple patterns and relationships and extends them													
Gives examples to prove a mathematical statement													
Handling Data													
Collects and organizes information numerically													
Records data using tallies													
Creates graphs, and tables													
Interprets graphs and tables													
Makes predictions based on probability													

RATIONAL NUMBERS													
Behaviors	Names of Children												
Write date when skill is mastered													
Fractions													
Identifies one whole or one whole set of objects													
Recognizes that a fraction is part of a whole or set of objects													
Divides circles, rectangles and squares into halves													
Divides circles, rectangles and squares into quarters													
Divides circles, rectangles and squares into thirds													
Divides regular plane shapes into equal parts													
Finds one half of a set (up to 10) of objects													
Finds one half of a set (up to 20) of objects													

MEASUREMENT													
Behaviors	Names of Children												
Write date when skill is mastered													
Capacity													
Uses the vocabulary of capacity / volume													
Measures capacity / volume by direct comparison													
Measures capacity / volume with non-standard units													
Measures capacity / volume with standard units													
Mass / Weight													
Uses the vocabulary of mass / weight													
Measures mass / weight by direct comparison													
Measures mass / weight with non-standard units													
Measures mass / weight with standard units													
Length													
Uses the vocabulary of length													
Measures length by direct comparison													

Measures length with non-standard units													
Measures length with standard units													
Suggests suitable units and instruments to measure capacity / volume													
Suggests suitable units and instruments to measure mass / weight													
Suggests suitable units and instruments to measure length													
Solves measurement problems													
Time													
Uses the vocabulary of time													
Sequences events													
Recites and sequences days of the week and months of the year													
Tells the date													
Reads the time on analogue clocks to the hour													
Reads the time on analogue clocks to the half hour													
Reads the time on analogue clocks to the quarter hour													
Reads the time on analogue clocks in five-minute intervals													
Records the time in figures and													

words													
Matches the time on digital and analogue clocks													
Estimates time intervals													
Calculates time intervals													
Solves time related problems													
Money													
Identifies Antillean coins and states their value													
Identifies US coins and states their value													
Exchanges coins for other coins of similar value													
Makes change for amounts up to one guilder / dollar													
Solves problems related to money													

GEOMETRY													
Behaviors	Names of Children												
Write date when skill is mastered													
Shape													
Names 2-D shapes													
Names 3-D shapes													
Identifies properties of 2-D shapes													
Identifies properties of 3-D shapes													
Uses shape vocabulary													

Classifies objects according to their shape													
Draws / models geometric shapes													
Creates patterns with shapes													
Identifies symmetrical shapes													
Draws symmetrical shapes													
Identifies line of symmetry													
Space													
Uses language of position, speed, distance, direction and movement in space													
Responds to instructions based on space vocabulary													

Division

Research has shown that division is the hardest operation to teach. It is usually taught when the children have an understanding of the other operations of addition, subtraction and multiplication. However teaching division as the inverse operation of multiplication has advantages because it provides the child with a means to transfer learning. In Cycle one the child is taught the concept of division through sharing.

There are two types of sharing; **measure** and **partitive**. The measure aspect is usually taught first because it is easier understood by children.

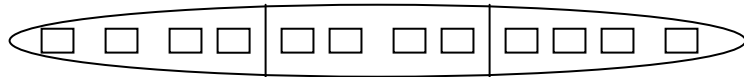
Measurement Division (Sharing)

The following facts are known:

- The product or number of items to be shared
- The number of members to be put in each subset

We have to find the number of equal subsets.

E.g. Teacher has 12 blocks. How many children will get 4 blocks?



We partition the set of 12 into subsets of 4. The number of equal subsets is 3. We can record $12 \div 4 = \square$ because $\square \times 4 = 12$ or $4 + 4 + 4 = 12$

Some children will partition by placing 4 blocks in one subset and 4 in another until the 12 are used and relate division as successive subtraction i.e. $12 - 4 = 8$, $8 - 4 = 4$, $4 - 4 = 0$ therefore 3 sets of $4 = 12$.

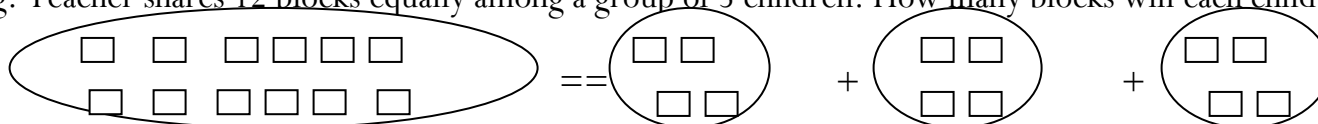
Partitive Division (Sharing)

The following facts are known:

- The product or number of items to be shared
- The number of equal subsets

We have to find the number of members in each equal subset.

E.g. Teacher shares 12 blocks equally among a group of 3 children. How many blocks will each child get?



We share each block into one of the 3 subsets until all the blocks are moved. We can record $12 \div 3 = 4$ because 3 sets of 4 = 12. Both methods of division must be modeled and developed in a variety of ways so that division as sharing is fully understood. **The symbol for division will be used after sharing into equal sets has been mastered.* When children thoroughly understand the basic multiplication facts and the inverse relationship of division they can easily derive the basic division facts.

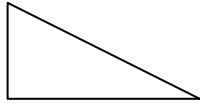
Questioning

The use of questioning is crucial in helping children to understand mathematical concepts. It is important to ask different types of questions that cover the range and level of thinking. The following types of questions develop low to high levels of thinking:

Recalling Facts	Applying Facts	Hypothesizing or Predicting
What is 4 add 6? How many days in this month? How many cents are equal to guilder? Is 36 a multiple of 5?	Tell me two numbers with a difference of 5? What unit would you use to measure the capacity of a paddling pool? What are the factors of 24?	Guess the number of M & Ms in this packet. If we collected data on Friday, do you think the results will be the same as today? What number will I get when I throw the dice?
Suggesting Strategies	Interpreting Results	Applying Reasoning
How do you think we should count this pile of books? How can we measure the height of the classroom? How can we test if a number is even?	What does this pattern tell us about numbers that end on 5 or 0? What does this graph show us about traveling to school? What can we say about this shape?	If I have 3 coins that total 16 c. what can they be? Why is the sum of two odd numbers always even? How many ways can 16 children be seated in equal groups?

Closed questions can be answered in one way and open questions have a number of alternative answers. Open questions provide a challenge and enhance critical thinking.

Closed Questions	Open Questions
Count these cubes	How can we count these cubes?
A candy costs 3c and ice-pop costs 7c. How much do they cost altogether?	A candy and an ice-pop cost 10c what could be the price of each item?
What is $10 - 6$?	Tell me two numbers with a difference of 4.
Is 18 an even number?	What even numbers lie between 10 and 20?



What is this shape called?	Draw different triangles.
How many centimeters are there in a meter?	Tell me two lengths that together make 1 meter.
Continue this number pattern: 1, 2, 4...	Find different ways of continuing this number pattern: 1, 2, 4...
What are four threes?	Tell me two numbers with a product of 12.

Some times questions can be used to extend children's thinking:

Questions for children who are getting started	Questions for children who are stuck
What information do you have? What do you need to find out or do?	Can you say the problem in your own words?
What operation are you going to use (add, subtract, multiply, divide)?	What did you do last time? What is different this time?
What method (strategy) are you going to use? Why?	What about putting things in order?
What equipment will you need?	Why not make a guess and check if it works?
How are you going to record what you are doing?	Would it help if you drew a picture, table or graph?
What do you think the answer / result will be?	Did you talk to anyone in your group?
Can you estimate or predict?	Why don't you try smaller numbers or use a number line?
Questions for checking progress	Questions to ask at the end of a Guided Math or Whole Class session
Can you explain what you have done so far? What else is there to do?	

<p>Why did you decide to do it this way?</p> <p>Is there a quicker way of doing this?</p> <p>What did you notice when...?</p> <p>Are you beginning to see a pattern or rule?</p> <p>Do you think this will work with other numbers?</p> <p>Can you think of another way to do this?</p>	<p>How did you get your answer?</p> <p>Can you describe your strategy / pattern / rule to us all and explain why it works?</p> <p>Will it work with different numbers?</p> <p>How did you check?</p> <p>Is it a reasonable answer? What makes you say so?</p> <p>If you were doing it again, what would you do differently?</p> <p>What are the key facts or ideas that you have learnt today?</p>
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Adapted from *The National Numeracy Strategy - Mathematical Language*. DfEE Publications (UK). 1999

Problem Solving

Problem Solving describes the processes whereby an individual reaches a solution when **a method of solution is not immediately obvious**.

Mathematical problem solving requires the following:

- An understanding of numbers and counting
- An understanding of basic mathematical concepts and principles
- The ability to ‘encode’ (i.e. recognize what sort of problem it is) the problem appropriately
- Mastery of a variety of problem solving strategies
- The ability to relate problem solving procedures to known mathematical concepts and principles
- The ability to relate mathematical principles to everyday life
- The development of effective metacognitive processes and beliefs

A child’s ability to solve any problem will be affected by his or her conceptual style, organizational ability, techniques of processing information, mathematical background, desire to look for a solution and self-confidence. In order to help children to problem solve one can:

- Make sure that the children have a good understanding of what numbers are
- Use concrete situations to illustrate abstract ideas
- Give the children practice in encoding problems correctly by
 - Presenting the problem in a concrete way using manipulatives, drawings or diagrams
 - Encouraging children to make the problem concrete by drawing a picture or diagram or by dramatization
 - Pointing out the parts of the problem that the student can solve
 - Letting the students work together to identify different ways of solving a single problem e.g. Shared Math experiences and peer tutoring
- Make sure that the children automatize essential mathematical facts and skills e.g. number bonds, multiplication tables, counting on / back
- Help children to understand **why** certain steps are used to solve problems
- Apply mathematics to ‘real life’ situations

- Teach children strategies for monitoring their problem solving efforts
- Present situations that contradict inaccurate beliefs about mathematics e.g. there is only one way to solve a problem.
- Presenting varied opportunities for problem solving (not just word problems)

In addition we can teach the following problem solving strategies:

- Look for patterns
- Create tables to show information
- Organize data
- Dramatization
- Writing mathematical sentences
- Estimate and check
- Make a diagram

In order for children to become successful problem solvers, they must be taught problem solving techniques continuously during the elementary school beginning in Year One of Cycle One as the children develop mathematical language (numerals and number operation symbols), understand the structure of mathematical sentences and master basic mathematical skills and concepts.