QUANTITY AND NUMBER SENSE

Quantity and Number Sense forms the foundation of the subject of ARITHMETIC. It introduces a system to represent quantities in a simple manner.

This is the second of the three levels of the troubleshooting guide for pre-kindergarten math. See *Summary* for details on all three levels.

These lessons are designed for pre-kindergarten, but they may be applied to anybody to fill earlier blanks in understanding.

Start with the Diagnostic. If the diagnostic fails, then do the Lesson & Exercise.

Follow these guidelines.

(a) When helping, make sure you have the attention of the student.

(b) If you lose the attention of the student, then go back to the point in the lesson where the student was attentive. Then come forward checking student's understanding.

(c) Always approach any situation in an affectionate and relaxed manner.

(d) Carefully listen to what the student has to say and acknowledge it appropriately.

(e) Answer all questions matching the interest and understanding of the student.

(f) Encourage the student, and make sure that the student can apply the materials with confidence.

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DIAGNOSTICS & LESSONS

☺ Diagnostic P2.1   Identify one and two objects

To pass, the student should be able recognize the quantities ONE and TWO correctly, and with confidence.

1. Ask the student:

    "Place ONE penny on the table."
    "Place TWO pennies on the table."
    "Point to ONE thing in the room."
    "Point to TWO things in the room."
    And so on.

2. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

In this lesson the student learns to identify ONE and TWO objects.

(a) Explain to the student,

   "I am going to show 'ONE' and 'TWO' of things."

(b) Place one toy on the table,

   "This is ONE toy."

(c) Place two toys next to the previous toy,

   "These are TWO toys."

(d) Raise a finger. Have the student mimic your action.

   "This is ONE finger."

(e) Raise two fingers. Have the student mimic your action.

   "These are TWO fingers."

(f) Indicate the following and have the student repeat it.

   "I have ONE nose."
   "I have TWO eyes."
   "I have ONE mouth."
   "I have TWO ears."
    And so on.

(g) Have the student ask you to identify quantities of ONE and TWO.

(h) Repeat the diagnostic test.
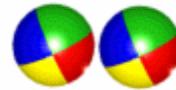
☺ Diagnostic P2.2   Identify three, four, and five objects

To pass, the student should be able recognize the quantities THREE, FOUR and FIVE correctly, and with confidence.

1. Ask the student:

   "Pick 5 pennies from the table."
   "Pick 3 pennies from the table."
   "Pick 4 pennies from the table."
     And so on.

2. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

In this lesson the student learns to identify THREE, FOUR and FIVE objects.

(a) Explain to the student,

  "I am going to show 'THREE', 'FOUR' and 'FIVE' of things."

(b) Place THREE toys on the table.

  "These are THREE toys."

(c) Raise THREE fingers. Have the student mimic your action.

  "These are THREE fingers."

(d) Place four toys next to the three toys.

  "These are FOUR toys."

(e) Raise FOUR fingers. Have the student mimic your action.

  "These are FOUR fingers."

(f) Place five toys next to the four toys.

  "These are FIVE toys."

(g) Raise FIVE fingers. Have the student mimic your action.

  "These are FIVE fingers."

(h) Continue indicating THREE, FOUR and FIVE using pennies, beads, chairs, etc. until the student can comfortably mimic and identify the numbers THREE, FOUR and FIVE.

(i) Place some toys on the table in groups containing one, two, three, four, and five respectively. Have the student recognize them correctly.

(j) Have the student ask you to identify quantities of ONE, TWO, THREE, FOUR and FIVE.

(k) Repeat the diagnostic test.

THREE

FOUR

FIVE

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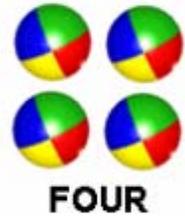
☺ Diagnostic P2.3   Count from one to five

To pass, the student should be able to count up to five, and recognize a number immediately from the pattern of the fingers raised.

1. Raise five fingers on one hand.

   "Count these fingers one at a time."

2. Raise 4, 2 and 3 fingers respectively on one hand. Have the student answer just by recognizing the pattern.

   "How many fingers?"

3. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

In this lesson the student learns to count from one to five sequentially. Focus is on learning to recognize the pattern of fingers for the respective number.

(a) Explain to the student,

   "We count to find out how many things there are."
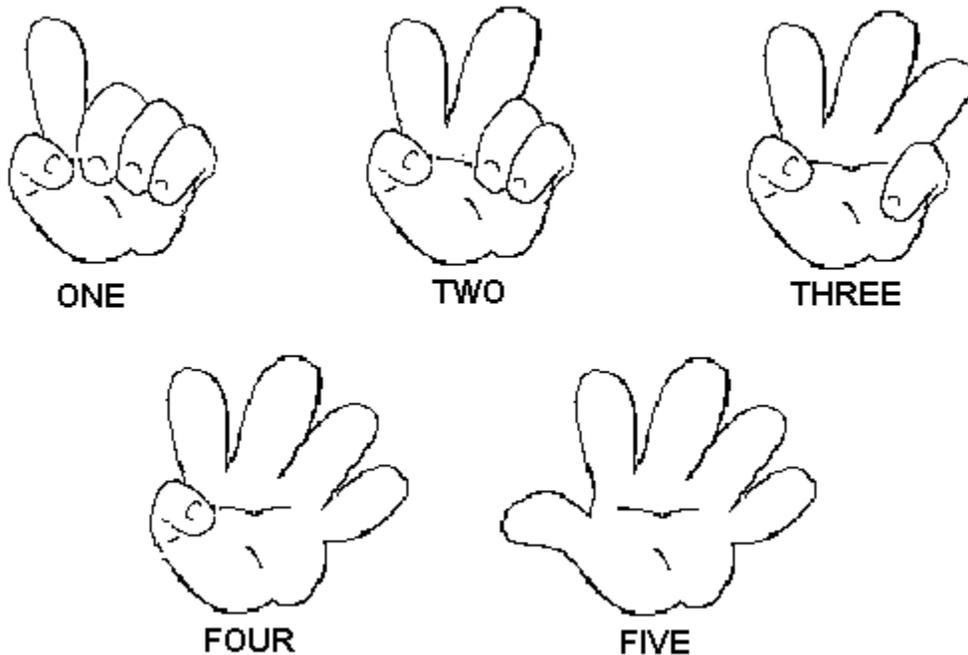
(b) Count the fingers by raising them as shown above.

   "I am going to count my fingers from ONE to FIVE.

   "ONE... TWO... THREE... FOUR... FIVE."

(c) Have the student mimic your action of counting on fingers from one to five using the same configuration on one hand.

"Count he fingers on your hand from ONE to FIVE.

(d) Count a group of objects up to five.

"Let's count some chairs. ONE... TWO... THREE... FOUR... FIVE."

(e) Have the student mimic your action.

"Count the fingers on your hand by raising them one at a time."

(f) Walk five steps while counting them. Have the student mimic your action.

"Let's count the steps while walking. ONE... TWO... THREE... FOUR... FIVE."

(g) Knock on the table five times while counting them. Have the student mimic your action.

"I am going to count the knocks on the table. "ONE... TWO... THREE... FOUR... FIVE."

(h) Go around the room (or the house) counting tables, chairs, windows, doors, etc., up to five until the student knows how to count from one to five.

(i) Raise your fingers for the student to tell you how many.

"Tell me how many fingers are raised."

(j) Call out a count up to five. Have the student raise that many fingers.

"Show me _____ fingers."

(k) Have the student ask you to count from one to five.

(l) Repeat the diagnostic test.

☺ Diagnostic P2.4   Count from six to ten

To pass, the student should be able to count up to ten, and recognize the number immediately from the pattern of the fingers raised.

1. Raise ten fingers on both hands.

    "Count these fingers one at a time."

2. Raise 5 fingers on one hand, and 4, 2 and 3 fingers respectively on the other hand (a total of 9, 7, and 8 respectively). Have the student answer without counting one at a time.

    "How many fingers?"

3. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

In this lesson the student learns to count on all ten fingers sequentially, and to recognize the pattern of the fingers for the respective number.

(a) Explain to the student,

   "We are going to count the fingers on both hands."

(b) Count from one to five using the same finger configurations as in the previous lesson. Have the student mimic your action.

   "This is ONE... TWO... THREE... FOUR... FIVE."

(c) Count from six to ten using the finger configurations as shown below. Have the student mimic your action.

   "This is SIX... SEVEN... EIGHT... NINE... TEN."

(d) Count the fingers from one to ten on both hands by wiggling them.

   "ONE... TWO... THREE... FOUR... FIVE... SIX... SEVEN... EIGHT... NINE... TEN."

(e) Have the student mimic this action until he/she has memorized the first ten counts.

SIX   SEVEN

EIGHT   NINE

TEN

THREE FOUR   SEVEN EIGHT

TWO   NINE

ONE   FIVE   SIX   TEN
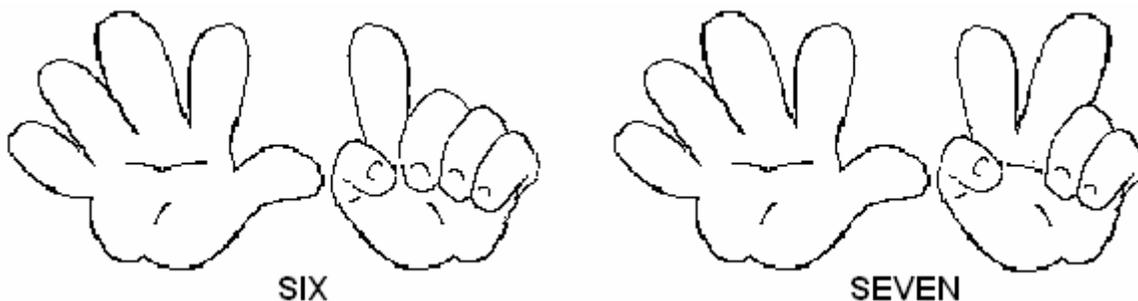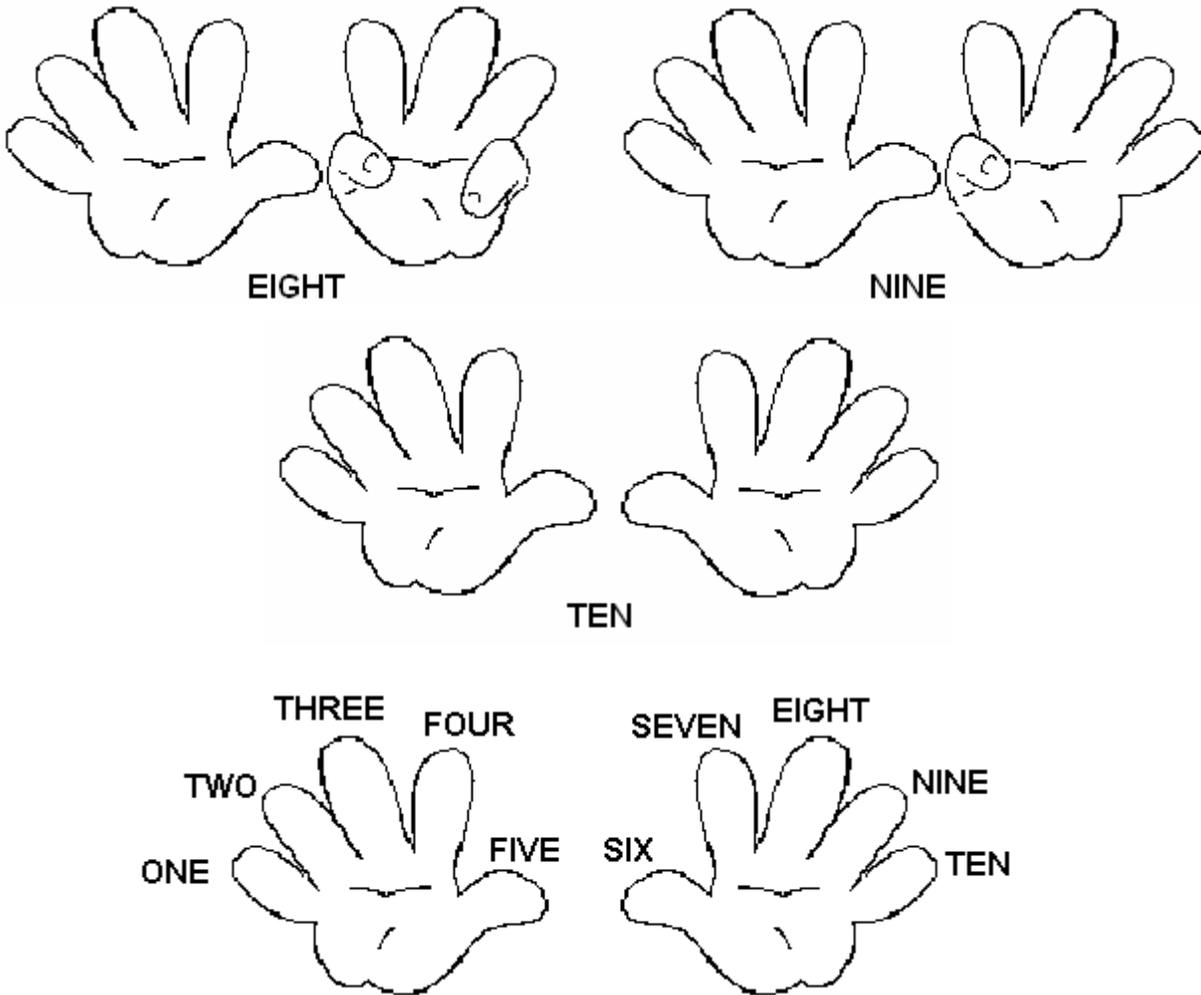
(f) Have the student count objects in the room.

"How many chairs are there?"
"How many light bulbs are there?"
"How many people are there?"

(g) Raise 5 fingers on one hand and some fingers on the other. Have the student answer without counting one at a time.

"Tell me how many fingers are raised."

(h) Have the student ask you to count from six to ten.

(i) Go around the room (or the house) counting tables, chairs, windows, doors, etc., up to TEN until the student knows how to count from one to ten.

(j) Repeat the diagnostic test.

☺ Diagnostic P2.5   Count up to ten on abacus

To pass, the student should be able to count up to ten on the first wire of abacus correctly, and with confidence.

1. Ask the student:

    "Count up to ten on the abacus."

2. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

In this lesson the student learns to count up to ten on abacus. Familiarity with abacus is important because it will be used later to visualize place values.

(a) Introduce the student to a simple version of abacus as shown below.

   "This is a COUNTING BOARD called Abacus."
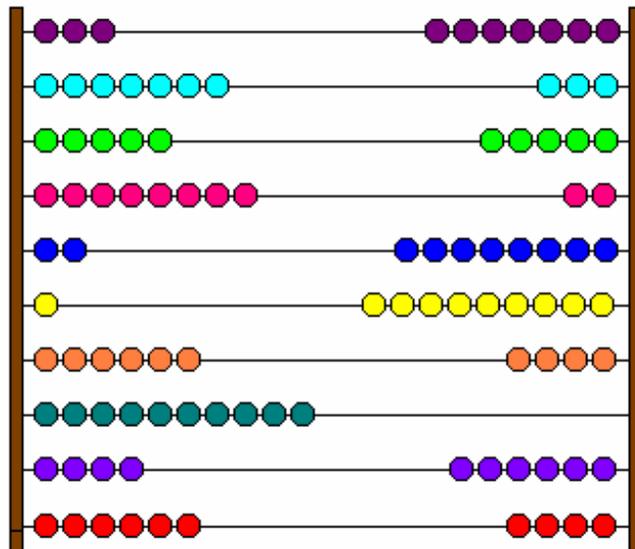
   NOTE: You may access a "virtual abacus" at the following link
   http://www.mathfundamentals.org/Abacus.htm

(b) Have the student touch the parts of abacus as you explain what they are.

   "This is the frame of the Abacus."
   "This is a wire in the frame."
   "This is a bead on the wire."

(c) Slide a bead from left to right on the first (top) wire.

   "You count a bead by sliding it from left to right."
   "Beads on the right are counted."
   "Beads on the left are in storage."

(d) Move all the beads to the left. Point to the empty part of the wire on the right. *NOTE: On virtual abacus use RESET.*

"No beads are called ZERO beads. This is ZERO position."
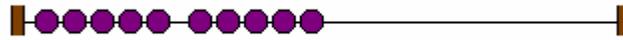
(e) Move the beads to the right one at a time while counting out loud.

"We count as follows."

"ONE."

"TWO."

"THREE."

"FOUR."

"FIVE."

"SIX."

"SEVEN."

"EIGHT."

"NINE."

"TEN."
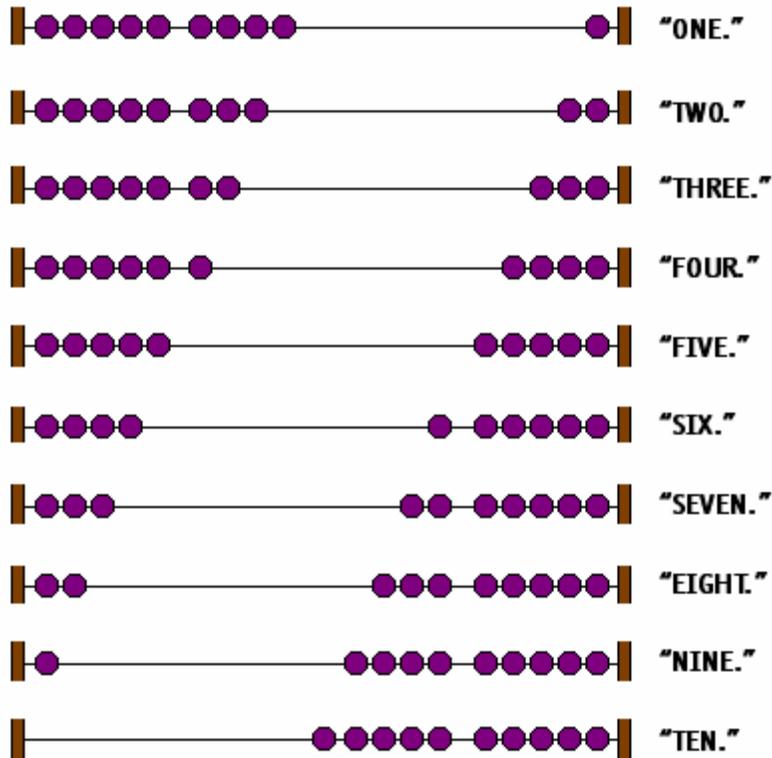
NOTE: In the figure above, there is some extra space between fifth and sixth beads to show "groupings by five."

(f) Have the student count from one to ten on abacus.

"Count up to ten on the abacus."

(g) Have the student ask you to count up to ten on abacus.

(h) Have the student do the above repeatedly until he/she can count from one to ten on abacus.

(i) Repeat the diagnostic test.

☺ Diagnostic P2.6   Show the concept of numbers

To pass, the student should be able to understand that a number, such as three, may be applied to any object.

1. Ask the student:

    "Show me three fingers."
    "Show me three pennies."
    "Show me three chairs."
      And so on.

2. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

This lesson attempts to provide the concept of numbers to young students. A child can understand three spoons, three cups, and three plates much before he can grasp what THREE means. Understanding always starts from the concrete and then proceeds toward the abstract.
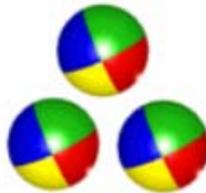
Three Clocks   Three Balls   Three Chairs

(a) Start the lesson. Demonstrate the number THREE.

    "I am going to show THREE."
    "These are THREE fingers"   (Extend your hand showing THREE fingers)
    "These are THREE beads"   (Move THREE beads to the right on the abacus)
    "These are THREE pennies"   (Place THREE pennies on the table)

(b) Invite the student to demonstrate the same number using different objects.

(c) Demonstrate other numers using different items the same way until the student gets the idea. Invite the student to demonstrate those numbers.

(d) Point to the objects in the room.

    "Numbers tell you how many things there are."

(e) Continue with this lesson until the student gets the concept of numbers as an idea that can be applied to any object. Then Repeat the diagnostic test.

(f) Have the student ask you to show a "numbers."

(g) Repeat the diagnostic test.

☺ Diagnostic P2.7   Gain familiarity with basic shapes

To pass, the student should be able to count correctly, and with confidence.

1. Ask the student:

    "Count the number of sides in the following shapes."
    "Count the number of corners in the following shapes."

TRIANGLE   RECTANGLE   SQUARE   CIRCLE
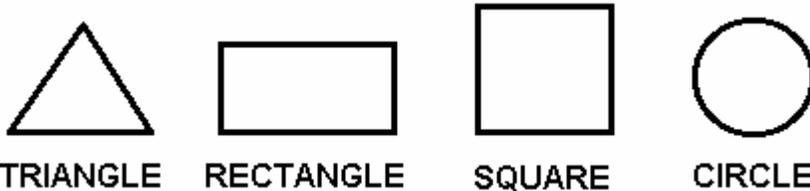
2. If the diagnostic fails, then do the Lesson & Exercise.

Lesson & Exercise

This lesson is designed to show to the student that he/she can count not only objects but also parts of objects. In this lesson one counts the sides and corners of some basic shapes.

TRIANGLE   RECTANGLE   SQUARE   CIRCLE
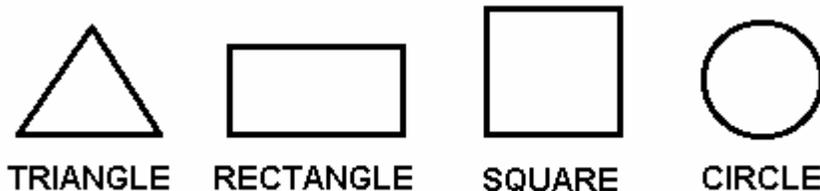
(a) Draw a TRIANGLE and introduce it by pointing to the corners and the sides.

"Here is a TRIANGLE with 3 corners: One... two... three."
"And 3 sides: One... two... three."

(b) Draw a SQUARE and introduce it by pointing to the corners and the sides.

"Here is a SQUARE with 4 corners: One... two... three... four."
"And 4 sides: One... two... three... four."

(c) Draw a RECTANGLE and introduce it by pointing to the corners and the sides.

"Here is a RECTANGLE. It also has 4 corners. One... two... three... four."
"And 4 sides. One... two... three... four."
"But it is stretched more to one side."

(d) Draw a CIRCLE and introduce it by pointing to it.

"Here is a CIRCLE. It has a boundary. But it has no corners or sides.

(e) Ask the student to color the shapes to gain familiarity with them.

"Color the Circles YELLOW."
"Color the Rectangles BLUE."

"Color the Triangles GREEN."
"Color the Squares RED."
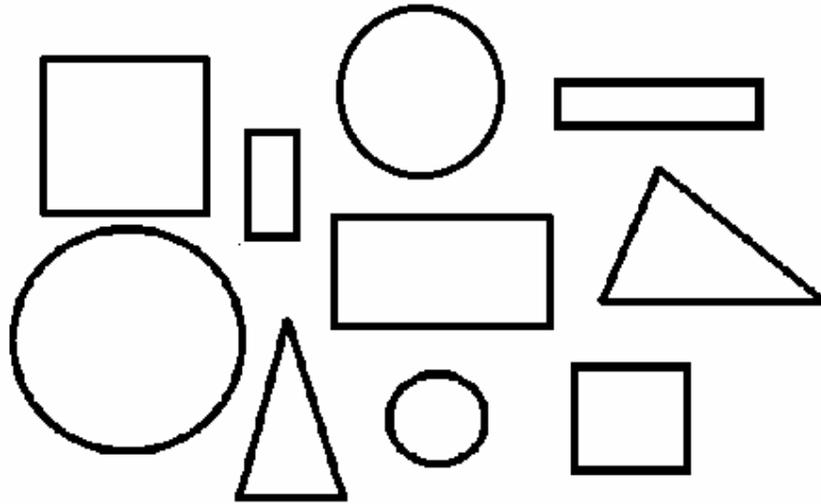
(f) Have the student count sides and corners of the various shapes.

"Count the number of sides in the following shapes."
"Count the number of corners in the following shapes."
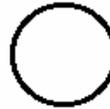
TRIANGLE   RECTANGLE   SQUARE   CIRCLE

(g) Have the student ask you to count sides and corners of different figures.

(h) Continue with this lesson until the student can recognize that the idea of numbers may be applied to parts of objects..

(i) Repeat the diagnostic test.

SUMMARY

This is the second of the three levels of the Troubleshooting Guide for PRE-KINDERGARTEN MATH. This guide introduces the concept of numbers, and explores the ability to recognize differences, similarities and identities. This is the ability on which subsequent mathematical concepts are built.

The three levels of this guide are as follows:

P1. ORIENTATION & SPATIAL SENSE

Orientation and Spatial Sense forms the foundation of the subject of GEOMETRY. It introduces the elements of space and how they relate to observation.

P2. QUANTITY AND NUMBER SENSE

Quantity and Number Sense forms the foundation of the subject of ARITHMETIC. It introduces a system to represent all quantities in a simple manner.

P3. PATTERNS & RELATIONAL SENSE

Patterns and Relational Sense forms the foundation of the subject of ALGEBRA. It is a study of patterns underlying numbers, and quantitative relationships.

Though these lessons are designed for the pre-kindergarten, the diagnostic actions in this guide may be applied to students in higher grades.

GLOSSARY

Abacus	An **abacus** is a counting board on which one can count to very large numbers. (See Lesson 2.5)
Counting	The purpose of **counting** is to find out how many things there are. One counts by sequentially calling out one, two, three, four, ... and so on, for each item. (See Lesson 2.3)
Digits	The **digits** are symbols like letters in an alphabet. Digits are used to write numbers, much like letters are used to write words. For example, the number FIVE is written with the digit 5. There are ten different digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. All possible numbers can be written just with these ten digits. (See **Place value**)
Math	See **Mathematics**.
Mathematics	The subject of **Mathematics** provides a systematic way of learning. It starts with counting, and develops into addition, multiplication and so on.
Number	In counting, each count is given a different name called a **number**, such as, one, two, and three. A number answers the question, "How many?" (See Lesson 2.6)
Quantity	**Quantity** is "how many" or "how much" of something.

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