

# KINDERGARTEN MATH #1

## ORIENTATION & SPATIAL SENSE

*Orientation and Spatial Sense* forms the foundation of the subject of GEOMETRY. It introduces the elements of space and how these elements may relate to the student.

<u>Index</u>	<u>Page</u>
K1.1 Identify left and right hands.....	3
K1.2 Identify directions and distances .....	4
K1.3 Move or place objects in relation to each other.....	6
K1.4 Identify basic shapes .....	8
K1.5 Sort basic objects .....	10
K1.6 Explore symmetry of objects.....	12
K1.7 Match objects to outlines of their shapes.....	14
K1.8 Explore slides and turns with objects.....	16
K1.9 Sort real-world objects or models of solids .....	17
K1.10 Know the parts of basic shapes .....	18
Summary .....	20
Glossary .....	21

This is the first of the seven levels of the troubleshooting guide for KINDERGARTEN MATH. See **Summary** for details on all seven levels.

These lessons are designed for 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, 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) *Always encourage the student to ask questions.*
- (e) *Carefully listen to what the student has to say, and let the student know that you have heard him (or her).*
- (f) *Answer all questions matching the interest and understanding of the student.*
- (g) *Always talk to the student at his (or her) level. Use only those terms and words that the student can easily understand.*
- (h) *When teaching a new concept, ask the student to think examples of his own. Allow enough time even days to let that happen.*
- (i) *Get the student involved and thinking with mathematical principles.*
- (j) *In the final analysis, make sure that the student can apply mathematics with confidence.*

Researched and written by Vinay Agarwala  
Edited by Ivan Dorskocil

**PLEASE PRINT DOUBLE-SIDED**

## DIAGNOSTICS & LESSONS

### ☺ Diagnostic K1.1 Identify LEFT and RIGHT hands

*To pass, the student should be able to recognize the LEFT and the RIGHT hand correctly, and with confidence.*

**"Raise your LEFT hand."**

**"Raise your RIGHT hand."**

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

### Lesson & Exercise

*In this lesson the student identifies the LEFT and RIGHT hands.*

- (a) Write the student's name in big letters in English, and place it in front of student.  
**"Your written name starts from the LEFT and ends on the RIGHT."**
- (b) Point to student's LEFT hand.  
**"The name starts from this side. This is your LEFT hand side. "**
- (c) Point to student's RIGHT hand.  
**"The name ends on this side. That is your RIGHT hand side. "**
- (d) Make sure that you give enough time to the student to become certain of his LEFT and RIGHT sides. Have the student establish the hand he uses to write with. Indicate it to the student.  
**"You are writing with your \_\_\_\_\_ hand."**
- (e) Place a toy on the LEFT of the chair the student is sitting on.  
**"This toy is on the LEFT side of the chair."**
- (f) Place a toy on the RIGHT of the chair the student is sitting on.  
**"This toy is on the RIGHT side of the chair."**
- (g) Have the student get up from the chair and identify the left and right sides of the chair.
- (h) Point alternately to at least three things on the LEFT and three things on the RIGHT of a chair facing the student.  
**"That \_\_\_\_\_ is to the LEFT of the chair."**  
**"That \_\_\_\_\_ is to the RIGHT of the chair."**
- (i) Have the student identify the LEFT and RIGHT hands of another person.  
**"Touch my LEFT hand."**  
**"Touch my RIGHT hand."**
- (j) Have the student ask you to identify his left and right hands.
- (k) Continue with this lesson until the student can comfortably identify left and right hands.
- (l) Repeat the diagnostic test.



## ☺ Diagnostic K1.2      Identify directions and distances

*To pass, the student should be able to recognize the basic directions and distances correctly, and with confidence.*

**"Point to something that is in FRONT of you."**

**"Point to something that is BEHIND you."**

**"Point to something that is ABOVE you."**

**"Point to something that is BELOW you."**

**"Point to something that is to your LEFT."**

**"Point to something that is to your RIGHT."**

**"Point to something that is NEAR you."**

**"Point to something that is FAR from you."**

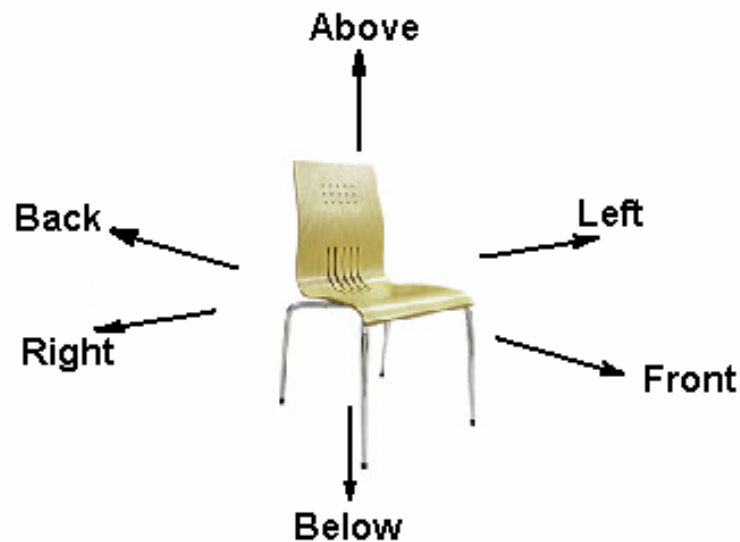
If the diagnostic fails, then do the Lesson & Exercise.

### Lesson & Exercise

*In this lesson the student learns to recognize the basic DIRECTIONS and DISTANCES, which are the factors required to determine a location in space.*

(a) Seat the student in a chair.

**"We are going to learn about directions and distances."**



(b) Place a toy in FRONT of the student, and explain,

**"This toy is in FRONT of you. You can look at it directly."**

(c) Place a toy at the BACK of the student. Explain,

**"This toy is at the BACK of you. You must turn all the way to look at it."**

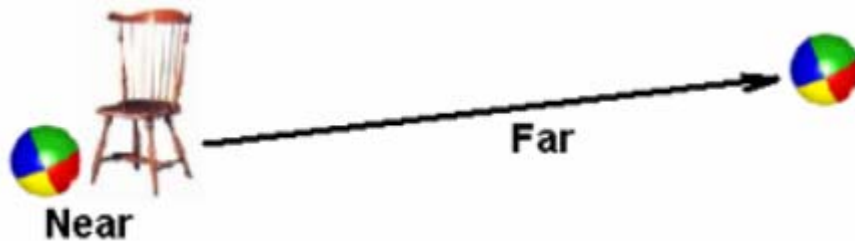
(d) Point to the ceiling.

**"That ceiling is ABOVE you. You have to look up to see it."**

(e) Point to the floor,

**"That floor is BELOW you. You have to look down to see it."**

- (f) Write the student's name in big letters and place it in front of student.  
**"Your name starts from the LEFT and ends on the RIGHT."**
- (g) Place a toy on the LEFT of the student.  
**"This toy is to your LEFT."**
- (h) Place a toy on the RIGHT of the student.  
**"This toy is to your RIGHT."**
- (i) Place a toy NEAR the student. Explain,  
**"This toy is NEAR you. You can touch it easily."**
- (j) Place a toy FAR from the student. Explain,  
**"This toy is FAR from you. You cannot touch it easily."**



- (k) Have the student identify the six directions and near and far distances.
- (l) Have the student check you out on the knowledge of directions and distances.
- (m) Continue with this lesson until the student can comfortably identify basic directions and distances.
- (n) Repeat the diagnostic test.

### ☺ Diagnostic K1.3      Move or place objects in relation to each other

*To pass, the student should be able to move or place an object in relation to another correctly, and with confidence.*

- "Place something in FRONT of a chair."
- "Place something BEHIND the chair."
- "Place something ON the chair."
- "Place something UNDER the chair."
- "Place something to the LEFT of the chair."
- "Place something to the RIGHT of the chair."
- "Place something IN a bucket."
- "Take something OUT of the bucket and place it OUTSIDE of the bucket."
- "Place two things NEXT TO each other."
- "Place something in the MIDDLE of two other things."
- "Place some thing AWAY FROM another thing."
- "Hold something ABOVE the table."
- "Hold something BELOW the table."
- "Place a book OVER a pencil."
- "Make a stack of three books (or, blocks) and,
  - "Touch the TOP book."
  - "Touch the BOTTOM book."
  - "Touch the MIDDLE book."

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

### Lesson & Exercise

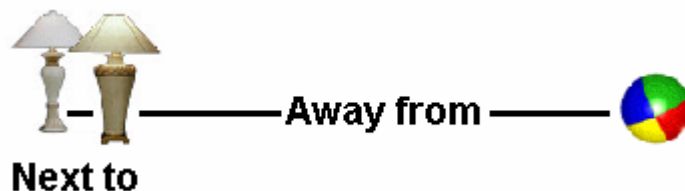
*In this lesson the student learns to recognize the relative positions among objects.*

- (a) Place a doll on the table and ask the student to place objects in different directions from the doll. Correct by gently demonstrating the action asked for.

- "Place a pencil in FRONT of the doll."
- "Move it to the BACK of the doll."
- "Move it to a position ABOVE the doll."
- "Move it to a position BELOW the doll."
- "Move it to the LEFT of the doll."
- "Move it to the RIGHT of the doll."

- (b) Ask the student to place objects in different distances from the doll. Correct by gently demonstrating the action asked for.

- "Place a pencil NEAR the doll."
- "Move it to a position FAR from the doll."



- (c) Place a book on the table and ask the student to place objects in different relations to the book. Correct by gently demonstrating the action asked for.

“Place a pencil **ON** the book.”  
“Place the pencil **UNDER** the book.”  
“Place the pencil **IN** the book.”  
“Take the pencil **OUT** of the book and place it **OUTSIDE**.”  
“Place the pencil **NEXT TO** the book.”  
“Place the pencil **AWAY FROM** the book.”  
“Place the book **OVER** the pencil.”  
“Place two books side by side.”  
“Place the pencil in the **MIDDLE** of those books.”  
“Place a book on **TOP** of another book.”  
And so on.



**TOP**



**MIDDLE**



**BOTTOM**



**LEFT**



**MIDDLE**



**RIGHT**

- (d) Have the student check you out on relative positions.
- (e) Continue with this lesson until the student can comfortably recognize relative positions among objects.
- (f) Repeat the diagnostic test.

## ☺ Diagnostic K1.4 Identify basic shapes

*To pass, the student should be able to identify the basic two-dimensional shapes correctly, and with confidence.*

Draw the following shapes on a piece of paper and show them to the student.

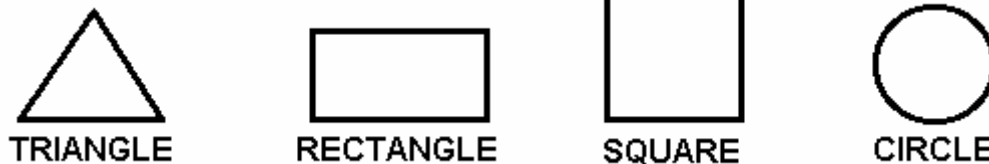
**"What are these shapes? Can you name them?"**



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

### Lesson & Exercise

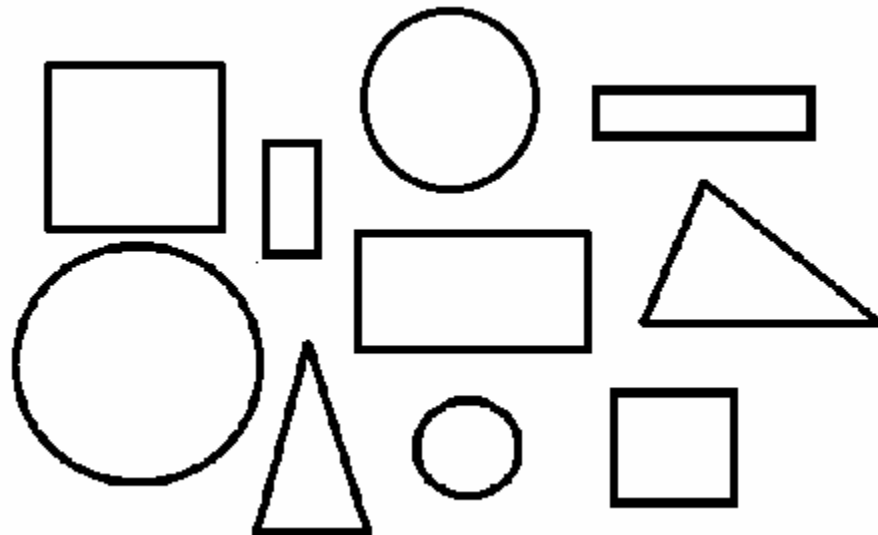
*In this lesson the student learns about basic shapes and the similarities and differences among them.*



- (a) Introduce a TRIANGLE by pointing to its 3 corners and 3 sides.  
**"This shape is called a triangle. A triangle has 3 corners and 3 sides."**
- (b) Introduce a RECTANGLE.  
**"This shape is called a rectangle. A rectangle has 4 corners and 4 sides. Two of the rectangle's sides are straight up from the other two sides."**
- (c) Introduce a SQUARE.  
**"This shape is called a square. A square is a special type of rectangle that has all its four sides equal."**
- (d) Introduce a CIRCLE.  
**"This shape is called a circle. A circle has no corners or straight sides. It has a curved boundary as shown."**
- (e) Gently explain any concepts, such as, straight and curved lines, that a child does not understand.
- (f) Ask the student to color the shapes below (see next page).  
**"Color the Circles YELLOW."  
"Color the Rectangles BLUE."  
"Color the Triangles GREEN."  
"Color the Squares RED."**

(g) Have the student check you out on the names of these shapes.

(h) Continue with this lesson until the student can comfortably identify basic shapes.



(i) Repeat the diagnostic test.

## ☺ Diagnostic K1.5      Sort basic objects

*To pass, the student should be able to sort three-dimensional objects correctly, and with confidence.*

Get at least 5 pieces each of CUBE, SPHERE, CYLINDER and CONE. You may make them out of modeling clay. Mix them up in one pile and place it before the student.

**"Sort these objects in different piles by their shape."**



**CUBE**



**SPHERE**



**CYLINDER**



**CONE**

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

### Lesson & Exercise

*In this lesson the student sorts basic objects by their geometric shapes.*

- (a) Have the student examine a CUBE as you speak.

**"This object is called a CUBE. It has six flat surfaces.**

**"You may place a cube over another cube without it falling.**

**"You may make a cube slide on a smooth floor, but you cannot make it roll."**

- (b) Have the student examine a SPHERE as you speak.

**"This object is called a SPHERE. It has only one curved surface.**

**"You cannot place spheres one on top of another.**

**"You may make a sphere roll, but you cannot make it slide by itself."**

- (c) Have the student examine a CYLINDER as you speak.

**"This object is called a CYLINDER. It has two flat surfaces at either end.**

**"There is a curved surface in between.**

**"You may place it one on top of another. You may make it slide.**

**"You may also make it roll."**

- (d) Have the student examine a CONE as you speak.

**"This object is called a CONE. It has one flat surface and one curved surface.**

**"You cannot place cones one on top of another.**

**"You may make it slide, and also make it roll."**

- (e) Place a number of these objects mixed in a pile on the table, and sort them.

**"I am going to sort these objects by shape."**

**"This CUBE goes to the pile for the CUBES."**

**"This SPHERE goes to the pile for the SPHERES."**

**"This CYLINDER goes to the pile for the CYLINDERS."**

**"This CONE goes to the pile for the CONES."**

(f) Continue till all the objects are sorted out.

**"The objects are now sorted by their shape."**

(g) Have the student to identify the shapes by their characteristics.

**"Identify the shapes that can be placed on top of each other without falling.**

**"Identify the shapes that can slide on a smooth floor.**

**"Identify the shapes that can roll on a smooth floor.**

(h) Have the student mix the objects in one pile and ask you to sort them out.

(i) Continue with this lesson until the student can comfortably sort basic objects.

(j) Repeat the diagnostic test.

## ☺ Diagnostic K1.6      Explore symmetry of objects

*To pass, the student should be able to recognize something symmetrical correctly, and with confidence, three times in a row.*

**“Show something that is symmetrical.”**

**“Show something that is not symmetrical.”**

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

### Lesson & Exercise

*In this lesson the student learns about symmetry in the environment and uses concrete materials to make symmetrical figures.*

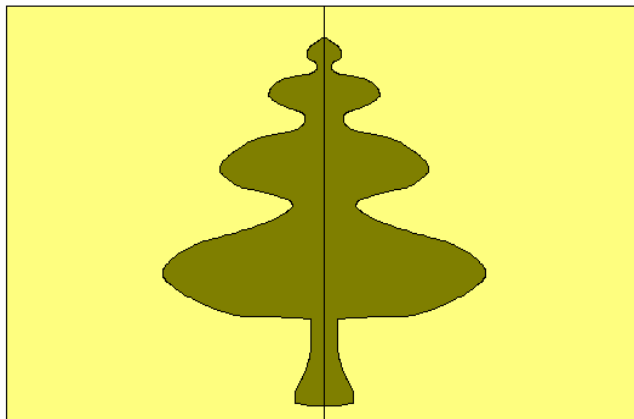
(a) Start the lesson.

**“Two shapes are SYMMETRICAL when they can be folded on each other exactly.”**

(b) Create symmetrical patterns with ink blots.

**“I am going to put some paint on this paper and then fold it in two.”**

**“When I unfold this paper you will see a symmetrical pattern.”**



(c) Have the student make some symmetrical patterns.

**“Now you make some symmetrical patterns with paint blots.”**

(d) Create symmetrical pattern with a mirror.

**“When you place a mirror next to a letter you get a symmetrical reflection.”**

(e) Have the student make some symmetrical patterns with a mirror

**“Now you make some symmetrical patterns with mirror.”**

(f) Fold your two hands on each other. Have the student mimic it.

**“My two hands match exactly. They are symmetrical”**



(g) Point to your ears.

**“Look at the two ears. They are symmetrical.”**

(h) Show a butterfly, or a picture of it.

**“Look at this butterfly. The patterns on the wings are symmetrical.”**



(i) Have the student indicate which of the following would be symmetrical.

- (a) Two halves of an apple
- (b) A triangle and a circle next to each other
- (c) Two equal circles next to each other
- (d) A big and a small book next to each other
- (e) The pages of an open book
- (f) Two eyes on the face
- (g) The two halves of a leaf

(j) Have the student demonstrate the understanding of symmetrical shapes.

**“Show something that is symmetrical.”**

**“Show something that is not symmetrical.”**

(k) Have the student ask you to show symmetrical and unsymmetrical shapes.

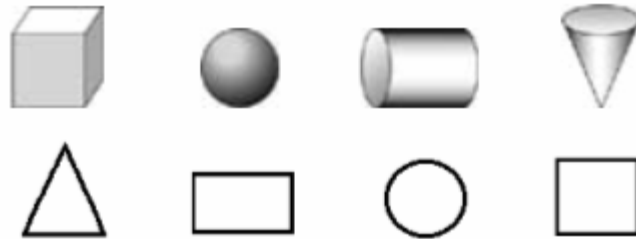
(l) Continue with this lesson until the student can comfortably identify symmetry among shapes and objects.

(m) Repeat the diagnostic test.

☺ Diagnostic K1.7      Match objects to outlines of their shapes

*To pass, the student should be able to match these objects to their outlines correctly, and with confidence.*

**“Match the following objects to the outlines of their shapes.”**



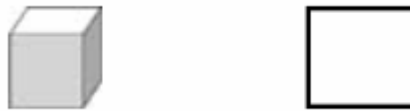
If the diagnostic fails, then do the Lesson & Exercise.

**Lesson & Exercise**

*In this lesson the student matches objects to outlines of their shapes. An outline is what you see in the shadow of an object.*

- (a) Place a cube oriented straight under a lamp and show its shadow.

**“The shadow of a CUBE can be a SQUARE.”**



- (b) Place a sphere under a lamp and show its shadow.

**“The shadow of a SPHERE can be a CIRCLE.”**



- (c) Place a CYLINDER upright under a lamp and show its shadow. Then place it horizontally and show the shadow

**“The shadow of a CYLINDER can be a CIRCLE or a RECTANGLE depending on which side is facing the light.”**



- (d) Place a CYLINDER upright under a lamp and show its shadow. Then place it horizontally and show the shadow

**"The shadow of a CONE can be a CIRCLE or a TRIANGLE depending on which side is facing the light."**



(e) Have the student identify some objects in the surroundings as follows.

**"Find some objects whose shadow can be a SQUARE."**

**"Find some objects whose shadow can be a CIRCLE."**

**"Find some objects whose shadow can be a RECTANGLE."**

**"Find some objects whose shadow can be a TRIANGLE."**

(f) Have the student ask you to match the outlines of objects to basic shapes.

(g) Continue with this lesson until the student can comfortably match objects to outlines of their shapes.

(h) Repeat the diagnostic test.

## ☺ Diagnostic K1.8      Explore slides and turns with objects

*To pass, the student should be able to SLIDE and TURN objects correctly, and with confidence, three times in a row.*

**"SLIDE an object."**

**"TURN an object."**

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

### Lesson & Exercise

*In this lesson the student uses concrete objects to explore slides and turns*

- (a) Introduce SLIDE by sliding an object on the table without changing its orientation.

**"I am going to move an object from one location to another like this..."**

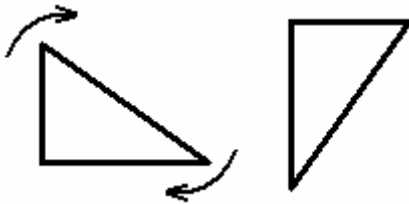


**"This is called SLIDE"**

- (b) Demonstrate SLIDE with at least three different objects.

- (c) Introduce TURN by turning an object on the table without changing its location.

**"I am going to move an object at the same location like this..."**



**"This is called TURN"**

- (d) Demonstrate TURN with at least three different objects.

- (e) Have the student demonstrate SLIDE with different objects

**"SLIDE some objects."**

- (f) Have the student demonstrate TURN with different objects

**"TURN some objects."**

- (g) Continue with this lesson until the student can comfortably demonstrate slides and turns.

- (h) Have the student ask you to show slides and turns.

- (i) Repeat the diagnostic test.

## ☺ Diagnostic K1.9      Sort real-world objects or models of solids

*To pass, the student should be able to sort objects by KIND correctly, and with confidence.*

Get at least 5 pieces each of different kinds of objects, such as, pencil, eraser, paper clip, chalk, and marker. Mix them up in one pile and place it before the student.

**"Sort these objects in different piles by the kind of things they are."**

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

### Lesson & Exercise

*In this lesson the student recognizes, compares, and sorts real-world objects or models of solids.*

- (a) Mix at least five kinds of objects, such as, erasers, paper clips, pennies, bottle caps, and chalks in a pile.

**"I am going to sort these objects by kind."**

- (b) Pick out an ERASER and put it in a separate location.

**"This is an eraser used to erase pencil marks. All erasers go in a pile here."**

- (c) Pick out a PAPER CLIP and put it in a separate location.

**"This is a paper clip used to clip papers together. All paper clips go in a pile here."**

- (d) Pick out a penny and put it in a separate location.

**"This is a penny. All pennies go in a pile here."**

- (e) Pick out a bottle cap and put it in a separate location.

**"This is a bottle cap. All bottle caps go in a pile here."**

- (f) Pick out a chalk and put it in a separate location.

**"This is a chalk. All chalks go in a pile here."**

- (g) Pick out subsequent objects.

**"This eraser goes in the pile for ERASERS."**

**"This paper clip goes in the pile for PAPER CLIPS."**

And so on.

- (h) Continue till all the objects are sorted out.

- (i) Mix pennies, nickels, dimes and quarters in one pile on the table.

**"Here are some pennies, nickels, dimes and quarters in a pile."**

- (j) Have the student Sort them out in different piles.

**"Sort them out in different piles."**

- (k) Continue with this lesson until the student can comfortably sort out real objects by kind.

- (l) Have the student mix the objects in one pile and ask you to sort them out.

- (m) Repeat the diagnostic test.

☺ **Diagnostic K1.10 Know the parts of basic shapes**

*To pass, the student should be able to recognize the parts of these shapes correctly, and with confidence.*

"Look at the following shapes."



"Point to the sides."

"Point to the corners."

"Point to the curves."

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

**Lesson & Exercise**

*In this lesson the student learns the parts, such as, edges, corners and curves, of a circle, square, triangle, and rectangle.*

(a) Point to the lines that make the shapes.

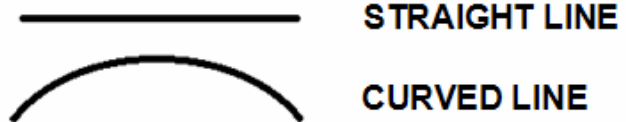
"These shapes are bound by lines."



(b) Draw a straight and a curved line.

"This is a straight line."

"This is a curved line."



(c) Point to the TRIANGLE.

"This shape is called A TRIANGLE. These straight lines are called SIDES. The sides meet at corners."

(d) Point to the RECTANGLE (see next page).

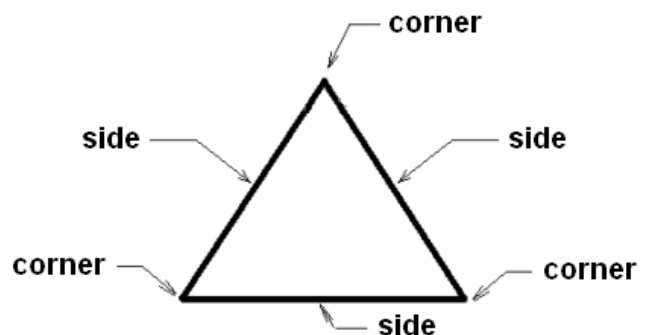
"This shape is called a RECTANGLE. Note the sides and corners of the rectangle."

(e) Point to the SQUARE (see next page).

"This shape is called a SQUARE. It is similar to the rectangle except all its sides are equal."

(f) Point to the CIRCLE (see next page).

"This shape is called a CIRCLE. It has a curved boundary only. It does not have any sides or corners."

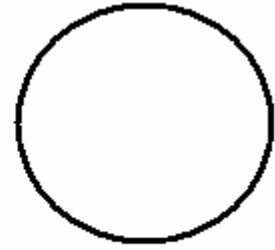




**RECTANGLE**



**SQUARE**



**CIRCLE**

(g) Have the student...

**"Point to a curved boundary."**

**"Point to the sides of a square."**

**"Point to the corner of a rectangle."**

(h) Have the student identify some shapes in the surroundings.

**"Point to some shapes similar to a circle."**

**"Point to some shapes similar to a square."**

**"Point to some shapes similar to a triangle."**

**"Point to some shapes similar to a rectangle."**

(i) Have the student ask you to identify the sides, corners and curves in basic shapes.

(j) Continue with this lesson until the student can comfortably identify the sides, corners and curved boundaries in basic shapes.

(k) Repeat the diagnostic test.

## SUMMARY

This is the first of the seven levels of the Troubleshooting Guide for KINDERGARTEN MATH. The Troubleshooting Guide for Kindergarten introduces the concept of UNIT, and explores ways to measure length, weight, capacity and time. It further develops the concept of counting into the concepts of addition and subtraction.

The Kindergarten troubleshooting guide is divided into the following levels:

### **(1) 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 us.

### **(2) NUMBERS & PLACE VALUES**

Numbers and Place Values form the foundation of the subject of ARITHMETIC. It introduces a system of whole numbers to represent quantities in a simple manner.

### **(3) UNITS & FRACTIONS**

Units & Fractions addresses ways to represent quantities, which cannot be represented by whole numbers.

### **(4) COUNTING & MEASUREMENTS**

Counting & Measurements provides ways to determine the various magnitudes. It helps to bring familiarization with the use of numbers.

### **(5) NUMBERS & OPERATIONS**

Numbers & Operations introduces the basic operations with numbers and how such operations may be executed with skill.

### **(6) 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.

### **(7) DATA ANALYSIS & PROBABILITY**

Data Analysis & Probability shows how to display quantitative comparisons graphically. It introduces the estimation of likelihood.

Though these lessons are designed for the kindergarten level, these diagnostic actions may be used for students at higher grades to help discover and resolve missing basics.

## GLOSSARY

<b>Direction</b>	A <b>direction</b> is the line or course along which something is directed. For example, when you look out, your sight follows a direction. The six main directions are: FRONT, BACK, ABOVE, BELOW, LEFT and RIGHT.
<b>Distance</b>	A <b>distance</b> is the separation between two locations or objects. For example, things in the same direction from you can be at different distances, such as, NEAR or FAR.
<b>Geometry</b>	<b>Geometry</b> means, literally, “to measure earth.” It provides an understanding of relationships in space so one can measure distances and construct things of different shapes and sizes.
<b>Math</b>	See <b>Mathematics</b> .
<b>Mathematics</b>	The subject of <b>Mathematics</b> provides a systematic way of learning. It starts with counting, and develops into addition, multiplication and so on.
<b>Orientation</b>	<b>Orientation</b> is the process of getting adjusted to (or aligned in) space.
<b>Position</b>	A <b>position</b> tells us how something is located in relation to other things, such as, IN, OUT, ON, UNDER, MIDDLE, and NEXT TO.
<b>Spatial sense</b>	<b>Spatial sense</b> is the sense of directions, distances and locations.