What Is Singapore Math?

You may be wondering what Singapore Math is all about, and with good reason. This is a totally new kind of math for you and your child. What you may not know is that Singapore has led the world in math mastery for over a decade; its students become competent and proficient mathematicians at very early ages. Even better, they grow to be capable problem solvers who think mathematically with ease. Wouldn't it be nice if your child could enjoy the same success with math?

Well, there's good news: We're teaching Singapore Math to your child this year. So let's discover what it's all about and how you can help your child succeed. It all begins with understanding the curriculum and seeing some examples—just what we'll do today.

First, you need to know that Singapore Math takes a slightly different mathematical approach than what you may be used to. It revolves around several key number-sense strategies: (1) building number sense through part-whole thinking, (2) understanding place value, and (3) breaking numbers into decomposed parts or friendlier numbers, ones that are easier to work with in the four operations (addition, subtraction, multiplication and division).

Second, Singapore Math does something dramatically different when it comes to word problems. It relies on model drawing, which uses units to visually represent a word problem. Students learn to visualize what a word problem is saying so they can understand the meaning and thus how to solve the problem.

Third, we have mental math, which teaches students to calculate in their heads without using paper and pencil. Sure, your child will still need to commit some facts to memory, but mental math will teach him or her to do calculations using proven strategies that don't require pencil and paper.

Fourth, the strategies taught in Singapore are layered upon one another. One strategy is the foundation for another one. You'll notice this as you read through this letter. For example, students need prior knowledge of bonding in order to be successful at strategies they will learn later on (like vertical addition).

Last, Singapore Math teaches students to understand math in stages, beginning with concrete (using manipulatives such as counters, number disks, dice, and so on), then moving to pictorial (solving problems where pictures are involved), and finally working in the abstract (where numbers represent symbolic values). Through the process, students learn numerous strategies to work with numbers and build conceptual understanding.

With time and practice, they eventually master the traditional methods and algorithms. Let's take a closer look at all the layers of Singapore Math.

Place Value

Singapore Math is a base-10 system. A number's place value is determined from right to left, starting with the ones and moving through the tens, hundreds, thousands, ten thousands, one hundred thousands, to a million and beyond. In fourth grade, we add the study of decimals into the mix. In class, we use tools such as place value boards with disks and cards to help us organize, visualize, and understand what these numbers actually mean and how they relate to one another.

As we perform mathematical operations, we can move place value disks from column to column on the place value board to demonstrate regrouping (making a ten out of 10 ones).

Algorithms

An algorithm is a systematic, step-by step procedure to solve a problem using a mathematical operation. For example, with subtraction, we have learned to line our numbers up vertically so that the digits are in the correct place value columns. We've learned to subtract the digits moving from right to left, using regrouping or borrowing, in order to get the correct answer to the problem.

In Singapore, traditional algorithms are taught and mastered with the help of the place value mat. However, we also teach alternative algorithms or strategies to solving equations often before we teach the traditional ones. This helps us build and reinforce our understanding of number sense and place value. This also allows students to use a strategy that they are competent at using for any problem. Rather than having one strategy, they may have several to choose from, and they can use the one that's most intuitive for them.

In the rest of this letter, I'll be explaining some of the strategies that your child may be learning to build number sense and an understanding of place value. Please don't hesitate to call me or come and visit the classroom to see firsthand what Singapore Math is all about!

Number Bonds: Part-Whole Thinking

The beginning of number sense is viewing each digit as a part of a whole. This is very similar to fact families, where a number has specific "relatives" in its family. Let's take the number 6 as an example. 6 is 6 and 0, 5 and 1, 4 and 2, and last, 3 and 3. This understanding becomes very important when students start doing operations with the number 6.

After students learn digits 1–9, they master what combinations make 10. 10 is an anchor number in Singapore. So, in K and grade 1, students will spend a significant amount of time learning their bonds through 10. Number bonds can also be created

with multiplication and division fact families, using two factors and a product. For example, 16 is 16 and 1, 2 and 8, and 4 and 4.

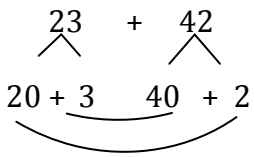
Once students know the parts that make up each number, they can add any numbers together by making 10s. For example, when students add 7 + 5, they find how many 10s they can make, and label the leftover parts as 1s. In this example, there is one 10 and two 1s remaining, so the answer is 12. Instead of memorizing just the fact, the student has a strategy to work with addition.

Decomposing and Branching

Students spend time learning how to break numbers into place value groupings on the place value board. This is called *decomposing* numbers or using *expanded notation*. After students practice breaking numbers apart into place value groupings, we teach them to add and subtract by place value. This is *branching*. The goal with branching is for students to break numbers into place value groupings and then do the operation with those place value groups.

For example, 23 + 42 would be branched into tens and ones. Then students will add each place value grouping separately, and then add the groupings together.

Take a look at how branching works.



20 + 40 = 50
3 + 2 = 5
50 + 5 = 55

The goal for branching is for students to eventually be able to look at the problem and work it out mentally. Remember that mental math?

Left-to-Right Addition

This algorithm uses expanded notation or decomposed place value groupings to add each place value separately and then together. In expanded notation, you write a number horizontally and expand or stretch it to reflect all its place value parts.

For example, the number 8,735 would be written as (8,000 + 700 + 30 + 5).

With left-to-right addition, we take our expanded parts and add them together, starting at the left and moving to the right. Let's take the equation 45 + 33. First, we decompose numbers into place value groupings.

45 + 33 =
40 + 30 = 70
  5 + 3 = 8
70 + 7 = 78

With students in fourth grade and up, we would group the numbers using parenthesis, and it may look like this: (40 + 30) + (5 + 3) = 70 + 8 or 78.

Vertical Addition

Another strategy for addition is to use a vertical strategy and work with numbers that are lined up vertically but added much differently than you and I did when we were in school. The difference is that instead of adding columns, moving from right to left, and regrouping, we add each column separately and write it down below. Then we add our partial sums together at the end.

Let's take a look at how this strategy works.

```
   124
  +152
     6
    70
   200
   276
```

It doesn't matter at all where we start: in the ones, tens or hundreds column. This reinforces the commutative property of addition in that the order in which we add doesn't matter.

Let's take a look at one more example:

```
  567
+489
   16
  140
  900
1056
```

Multiplication and Division Strategies

In Singapore Math, multiplication and division concepts (repeated addition, equal groups of, and so on) are taught starting in first grade. We build upon students' prior

knowledge with addition and subtraction with disks on a place value mat to help students visualize the groups. We also use other manipulatives, such as counters, to make groups and arrays (equal group rows and columns). This helps us conceptualize multiplication.

By third grade, we're memorizing times tables in order to automatically recall facts. Once we get to multidigit multiplication, we learn some visually helpful methods to organize numbers in order to understand how each place value grouping relates to the others.

Distributive Property for Multiplication

The distributive property allows students to calculate once complicated multiplication problems easily by breaking the multidigit number into smaller factors. We distribute the larger number into smaller, more manageable parts. Let's take a look at how this method works.

3 x 15 =

First, we look to the multidigit factor, which is 15. We break it into place value groupings, 10 and 5. Once they are broken into parts, we take each part and multiply it separately by the factor 3. Then, we add the parts together.

(3x10) + (3x5)
30 + 15 = 45

This allows students to work this problem mentally rather than write it out on paper.

Area Model or Partial Product Method

Using the area or partial product method is a fast and effective way to multiply by place value. This model uses a box design, where factors are broken into place value groupings and written outside the box. Then each grouping is multiplied separately and added together to get a final product.

For example: 45 x 26

40	5	
800	100	20
240	30	6

1100 + 70 = 1170

Or 45

x 26

30 6 x 5

240 6 x 40

100 20 x 5

800 20 x 40

1100

70

1170

This is applying the partial product method.

You multiply each partial product and then add to get your final product.

Division Strategies

Bonding and branching come in handy when we're learning division. Branching numbers into bonds to decompose them into friendlier, more manageable numbers allows students to work with parts and simpler numbers. Using place value disks and charts helps students to see division as repeated subtraction. It also allows students to trade disks (distribute them) from place value column to place value column, taking the dividend and breaking it apart into an equal quantity in order to get a quotient. Any leftover parts become our remainder.

Distributive Property for Division

You can use the distributive property with a multidigit division problem when you have a single-digit divisor. You distribute your dividend into two or more friendlier parts. The catch here is that both parts need to be a multiple of the divisor or equally divisible by the divisor.

So, when your dividend is divided up, it may not be into place value groupings. It is worth taking some time to practice breaking numbers into other parts besides place value groupings. You can use the mat to do this. For example, 45 can be broken into 40 and 5; it can also be broken into 30 and 15 or 20 and 25. Also, your child needs to have prior knowledge of divisibility rules.

Let's look at a few examples of how to use the distributive property to divide.

$52 \div 4 =$
52 needs to be broken into two or more parts with both parts being divisible by 4. 50 and 2 doesn't work, 30 and 22 doesn't work, but 40 and 12 will work.

$(40 \div 4) + (12 \div 4)$
$10 + 3 = 13$

$75 \div 5 =$

(50 ÷ 5) + (25 ÷ 5)
10 + 5 = 15

42 ÷ 3 =
(30 ÷ 3) + (12 ÷ 3)
10 + 4 = 14

Partial Quotient Division

Partial quotient division is similar to long division, but instead of having to be exact on the top with a quotient, we make partial quotients and then add them to get our final quotient. You can think of it as a successive approximations or estimates. One strategy would be to use multiples of 10s, 100s or 1,000s as your estimates because they are easy to multiply and divide by. The quotient is built through vertical steps (which resemble the game Hangman), and we don't have to get the exact quotient.

We can ask ourselves, how many times do we know for sure that our divisor can go into our dividend, or how many times can we pull it out of our dividend? We continue to find partial quotients until we have no remainder or a remainder is less than the divisor. We then add our partial quotients to arrive at the final quotient.

Let's look at an example:

```
   19 R 1
3 | 5 8          How many times do I know for sure 3 can go into 50? 10
  | 30    10
  | 28           How many times do I know for sure 3 can go into 28?  4
  | 12     4
  | 16           How many times do I know for sure 3 can go into 16?  5
  | 15     5
  | R 1    19
```

This strategy gives each student the freedom to work with the facts that they are competent at. Students can choose the multiple that makes sense to them, so each equation may look different when they turn in the work. However, the final answer should look the same.

Mental Math

Mental math is one of the cornerstones of Singapore Math as its emphasis is on helping students to calculate mathematically in their heads, thus developing number sense and place value. It encourages flexibility and speed when working with numbers. We practice mental math strategies and do lots of fun activities that support the skill. Please come to class and participate with us one day!

Model Drawing

Model Drawing is the key strategy we use to solve word problems. Starting in second grade, we use units ( ) to help us create a visual representation of a word problem. We learn a set of steps to help us internalize the process.

Read the problem to get a sense of what it is asking.
Decide who and what the problem is about.
Draw units for each who and what.
Reread the problem and adjust our units to match the word problem.
Decide what the question is asking of us and place a question mark in place.
Work our computation.
Write our answer in a complete sentence.

Summary

Well, that's Singapore Math in a nutshell. What we're finding as we teach this program is that math is math, no matter how you package it. Number sense, place value, calculations, operations, puzzles, word problems, problem solving, visuals, relationships—these are all familiar parts of math. Singapore Math just provides us with some new vocabulary and numerous strategies that enable all students to learn mathematics to mastery.

Thank you for your continued interest and support as your child discovers the curriculum of the world's math leaders.