Do you know there is a new mathematics curriculum?

There has been a *revision* in the Kindergarten to Grade 9 Alberta Mathematics Program of Studies that will be taught in classrooms. Most of what the students are learning is *as* familiar as the math you learned when you were in elementary school. The change in mathematics is not so much in what students are learning but in how students are involved with mathematics as they are learning.

It is likely that when you studied math, you were expected to complete a lot of computations accurately and quickly. The way to get better was to do more and more questions. The focus of this math curriculum has placed a greater emphasis on understanding the mathematical concepts and applying thinking skills to arrive at an answer. The way to get better is to consider various ways to find answers and be able to explain why the answer is right.

The mathematics classroom may look very different from classrooms when you were a student! Children will be talking about their math and how they try to solve problems. They will be using physical materials to test their thinking and help show how they work through problems. Children will be working with others. Students will be actively learning mathematics!

Thirty years of research into math instruction, has shown us that when the emphasis is on the student's understanding of the math concept, they learn the concept better, they remember it longer and are able to use their knowledge to solve problems more effectively.

How might I support my child in mathematics?
- Let your child know that all students can be successful in mathematics.
- Encourage your child to think of math problems as puzzles or games.
- Don't underestimate your own mathematical capabilities.
- Don't say, "I was never good at math."
- Encourage your child to restate the problem in his or her own words.
- Discuss how you use mathematics in your daily life. For example, cooking, shopping, bus schedules, or math at work.

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What are manipulatives?

In math classrooms today, teachers are using manipulatives to help students learn mathematics. Manipulative materials are any concrete objects that allow students to explore an idea in an active, hands-on approach. Manipulatives can be almost anything – blocks, shapes, spinners or even paper that is cut or folded.

The power of using manipulatives is that they let the student connect mathematical ideas and symbols to physical objects, thus promoting better understanding. For example, students in grade 5 must learn about decimal numbers. Students make a common mistake when comparing 0.7 and 0.56, thinking that 7 tenths is a smaller number than 56 hundredths. This is because students think that a two-digit number, such as 56 hundredths is larger than a one-digit number, 7 tenths. That "rule" works for whole numbers, but not decimals. If the students are asked to build these numbers using a manipulative such as base ten blocks, they can immediately see that 7 tenths is larger than 56 hundredths. They connect the model to the concept of the size of the numbers. With many experiences building and representing using manipulatives, students can deepen their understanding of abstract math concepts.

Manipulatives can also be tools to help students solve problems. By using physical models to represent their thinking, they can move and adapt the materials as they explore possible solutions to problems. In real life, many people use models to help solve problems, such as an architect who might construct a model of a building or an engineer who might build a prototype of a piece of equipment.

For many students, concrete materials provide support in dealing with a subject that can be difficult and confusing. Students begin learning about a concept using manipulatives and progress to recording their work with manipulatives. Students connect their constructions to the written record of symbols and numbers. Concrete materials are imperative for exploration and experimentation with math ideas as students develop meaning. We want all students to be confident mathematicians that can explain and represent their thinking accurately, effectively and efficiently.

How might I support my child with manipulatives?
- Manipulatives at home can include buttons, macaroni, pop can tabs, rocks, etc.
- When your child is working on math homework, ensure that materials are available for your child to use. Ask your child to show his thinking using manipulatives.
- Visit your child's classroom and have your child explain how he uses materials when working on math.

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Why is my child doing problem solving in math?

The new curriculum for mathematics in Kindergarten to Grade 9 states that "Problem solving, reasoning and connections are vital to increasing mathematical fluency and must be integrated throughout the program." As a result, your child will be involved in problem solving in every mathematics class!

When students encounter new situations and respond to questions of the type *How would you ...?* or *How could you ...?*, the problem solving approach is being used. Students develop their own problem solving strategies by listening to, discussing and trying different strategies.

A problem solver is someone who questions, investigates and explores solutions to problems. They demonstrate the ability to stick with a problem for as long as it takes to find a workable solution. They consider many possibilities and use different strategies to arrive at an answer. They are willing to try more than one way for solving a problem. They apply math to every day situations and use it successfully.

A student who uses reasoning is able to justify and explain what s/he has tried when solving a problem. They think logically and are able to explain similarities and differences about things and make choices based on those differences. They think about relationships between things and talk about them.

Some of the work your child brings home may not look like the practice questions we are used to seeing in math. The math texts have an increased emphasis on activities that get students to problem solve, communicate and reason.

How might I support my child with problem solving?
- Talk to your child about the math he is learning and remind him that if it was easy, it really wouldn't be a problem.
- Play games and puzzles with your child that deal with such things as logic, reason, estimation, direction, classification, and time.
- Involve your child in daily activities that require the use of mathematics, such as making purchases, measuring ingredients, and so on. Encourage your child to determine the process and make the actual calculations.
- Discuss your child's classroom activities on a regular basis. Listen carefully to your child's explanation of what he or she is learning.

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What is number sense?

"Develop number sense" is the general goal for mathematics in Kindergarten to grade nine. Number sense can be thought of as flexible thinking and intuition about number. In order for students to develop deep understanding of many math concepts, flexible and fluent thinking with numbers is necessary. Number sense cannot be taught – it is a result of rich mathematical tasks connected to each person's own experiences.

A true sense of number is much more than being able to write numerals, count objects, memorize facts and follow steps to solve number problems. Mastery of number facts will develop as students increase their number sense. As students learn their facts, they are able to extend their mathematical thinking to larger numbers and more complex computations. Facts should not be memorized; students should understand the affect that the different operations (+, -, x, ÷) have on numbers.

Number sense develops when students connect numbers to their own real-life experiences. When students use friendly numbers (like numbers that end in zero, such as 10, 30, or 100) or numbers that they are familiar with (for example, 27 is almost 25), this helps them to understand how numbers relate to one another. This results in students who are confident that they can make sense of mathematics. For example, students with number sense know what 10 is in a variety of situations, including how 6 and 4 or 7 and 3 make 10, or how 10 can look like this ⋮⋮⋮⋮⋮ or like this ★•★•★•★•★•.

Number sense typically comes as a by-product of learning rather than through direct instruction. Teachers can promote number sense by providing rich mathematical tasks and encouraging students to make connections to their own experiences and their previous learning.

How might I support my *older* child with number sense?

A +10 Machine	**Secret Sum**
Work together using one calculator. Press [+] [10] [=] to make a "+10 machine". One person enters any number. The other says or writes the number that is 10 more. The = is pressed for confirmation. The roles are then reversed. The same game can be played with any multiple of 10 or 100.	This calculator activity uses the memory feature. A target number is selected, such as 100. Take turns with your child entering a number and pressing the [M+] key. Each of the numbers is accumulated in the memory but the sum is never displayed on the screen. If you or your child thinks that the other has made the sum go beyond the target, he announces "over," and the [MRC] (memory recall) key is pressed to check.

Break It in Two Parts
Pick any 2-digit or 3-digit number. Challenge your child to try to make the number in two parts. For example, 453 can be 400 and 53 or 425 and 28. Try to break the same number in many different ways.

50 and Some More
Say a number between 50 and 100. Have your child respond with "50 and __." For 72, the response is "50 and 22." Use other numbers that end in 50, such as "450 and Some More."

Activities taken from Van de Walle and Folk (2005), pp. 208,210,218

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What are "mental mathematics"?

The new math curriculum expects a student to be able to do lots of math in his head, or use "mental mathematics". As adults, we do a lot of math in our heads! Most people estimate in their heads at the grocery store, fast food restaurants or department stores. Very few of us take out a pencil and paper to solve problems we might have. We are able to do this because of *many years of practice* doing mental math in real life situations.

In your child's classroom, students will be encouraged to find ways to use mental math when solving problems. For example, a teacher might pose the following problem:

> *I had some coins in my pocket that made 39¢. Fourteen cents fell out. How much money do I have left in my pocket?*

Students will be encouraged to find a way to solve it in their head that makes sense to them! Following are 3 possible strategies that students might use:

I know that 39¢ take away 4¢ is 35¢. 35¢ take away 10¢ is 25¢.	I know that 39¢ can be made up with a quarter, a dime, and four pennies. A dime and four pennies is 14¢. So, 39¢ minus 14¢ is a quarter or 25¢.	I know that 39¢ is close to 40¢. 40¢ take away 10¢ is 30¢. Take away 4¢ more and that's 26¢. Now take off the 1¢ that made 40¢.

All of these ways came up with the right answer, but they've done it different ways... in their head! Having students talk about how they think about numbers in their head will allow them to find ways that make sense for them.

Calculators and computers are only useful when people know two things: (1) what information must be entered, and (2) if they know the answer *is reasonable*. Usually people look at the answer to determine if it makes sense; this is one reason why students should do "mental mathematics" in their heads.

How might I support my child with "mental mathematics"?
- Help your child do mental mathematics with small numbers. It is most important to praise children for being accurate with their answer. As they improve, praise them for being quick to answer. Questions might be like: *If I have 4 cups, and I need 7, how many more do I need?* or *If we need to take 12 drinks for the class, how many packages of 3 drinks will we need to buy?*
- Ask often, "Is your answer reasonable?" Ask questions such as, "Is it reasonable that I added 17 and 35 and got 367? Why? Why not?"
- Allow your child to use strategies that make sense to them.
- Talk to your child about when you use estimates and when you work out the exact answer.

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Personal strategies and formal algorithms

The new mathematics curriculum for Kindergarten to grade nine calls attention to the use of personal strategies. *Personal strategies* can be explained as meaningful steps students take to solve a problem when using addition, subtraction, multiplication or division. When we learned about addition, subtraction, multiplication and division, most of us learned these through *formal algorithms*, or step-by-step procedures. We did not always understand why we did each step or why we did the steps in a specific order. The new mathematics curriculum emphasizes students understanding concepts they learn, not simply memorizing procedures or facts.

The Alberta curriculum states, "Students need to explore problem-solving situations in order to develop personal strategies and become mathematically literate. They must realize that it is acceptable to solve problems in a variety of ways and that a variety of solutions may be acceptable." In classrooms, this will be seen when students individually share how they solved a problem, when students work together to try to solve a problem, or when groups share their strategies with the whole class. For example, students may be working on the problem 645 + 230. Here are some solution methods:

645 + 230 = ?	645 + 230 = ?	645 + 230 = ?
645 + 200 = 845 845 + 30 = 875 **645 + 230 = 875**	600 + 200 = 800 40 + 30 = 70 5 + 0 = 5 800 + 70 + 5 = 875 **645 + 230 = 875**	645 +230 875 **645 + 230 = 875**

When students bring work home that involves addition, subtraction, multiplication or division, it is okay for you to share how you can solve the problem. Recognize, though, that your child may not solve the same problem exactly as you do! Be accepting of other methods your child may bring home and emphasize that the way you solve a problem is one way of solving it, not the only way.

How might I support my child with personal strategies?
- Recognize that one method may make more sense than another for your child.
- Understand that you have had many years of practice with one way of doing addition, subtraction, multiplication or division.
- Encourage your child to try to solve the same problem in more than one way.
- Encourage your child to solve the problem using one strategy and check the solution using another strategy.
- Ask your child to explain their thinking and show you the steps they have taken to solve a problem.
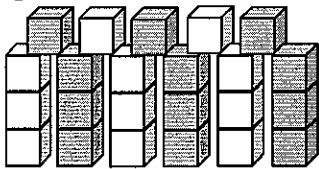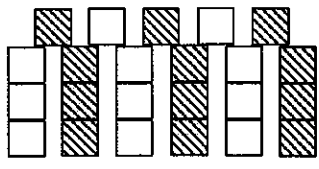

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Why are elementary students studying algebra?

As a parent, you might remember learning algebra in high school or even junior high school. We often associate the word "algebra" with "hard math" or "using letters/variables instead of numbers". Algebra is the study of relationships and change and is rooted in the study of solving equations.

Learning to work with patterns in the early grades helps students develop algebraic thinking, which is foundational for working with more abstract mathematics in higher grades. Patterns may be shown in three forms: concrete, visual, or symbolic.

Concrete form uses objects, such as buttons, toys, etc. For example, students may make a pattern with blocks using red and blue blocks.	**Visual** form could be pictures or drawings. For example, students may draw their block pattern.	**Symbolic** form includes variables, including numbers, letters or shapes. For example, students may determine an expression to explain the block pattern. **4n-1**

When students are studying algebra they will be involved in:
- Using concrete materials to display patterns.
- Investigating and describing patterns using tables and charts.
- Extending patterns, both with numbers and non-numbers.
- Using patterns to solve problems.
- Writing and solving equations.

Often when studying algebra in high school you may have thought, "When will I ever need to know this?" The processes and ideas of algebra support real-life mathematics in many areas including distribution and communication networks (telecommunications), population models, laws of physics, and statistics.

How might I support my child with algebra?
• Encourage your child to look for patterns in your home (tiles, quilts, clothing, etc.) and talk about them. Talk about how you use patterns in your daily life. • Challenge young children to sort things at home (laundry, utensils, toys, etc.) and to sort them again another way. • Talk about similarities and differences. • Talk about how you use charts/tables or spreadsheets in your work.

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How will mathematics be assessed?

Mathematics today is assessed differently than when you were a child. As parents, you might remember that what mattered in mathematics was that you had the right answer and you "showed your work". Your mark in math was based upon how many right answers you had. Today, mathematics is assessed in ways that involve the learner actively in demonstrating their understanding.

Students still need to get the right answer when working on math problems. However, the teacher looks at more than just the right answer when assessing how your child is doing with math. "Showing your work" may look different from student to student. The teacher will **observe** your child as they are involved with a mathematics problem or activity. Sometimes, a teacher will have a **conversation** with your child about a piece of work that has been completed or about one that he is working on. Finally, the teacher will examine the **product** of the math problem, which might be written work, a graph, a diagram, a model, or equations and numbers. All three of these strategies (observation, conversation, and product) are used to determine your child's abilities and limitations with the math. With so much information, sometimes even with the incorrect answer, your child can still achieve marks in math!

Parents sometimes see students working in groups and wonder how it is going to help their child achieve. In classrooms, discussion about the math, exploration of strategies and experimentation with different approaches is best done when students work together. However, these activities should not be used for assessment. These activities support students in their thinking and developing understandings. Often, students engage in group work that reflects an independent activity that students will be doing at another time. Work that is completed by your child and explained by your child is the best work to assess how your child is achieving.

How might I use assessments from school to support my child with mathematics?
- Talk to your child about what he has been learning in mathematics. Ask him what he is finding difficult or confusing.
- When an assignment comes home, ask your child to talk about the questions/problems he is <u>most proud of</u>. Ask him to explain <u>some</u> of the incorrect answers and how he figured it out. Try to find the correct answer together and "think out loud" as you both work through the problem.
- Ask your child's teacher if the assessment is a "fair assessment" – Does this assessment look about the same as work completed in class?
- Ask your child's teacher how you might support your child with math at home in a fun way! Students can apply their learning when playing games with you!

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Why is my child talking so much during math?

In the new mathematics curriculum, there is a strong emphasis on students communicating mathematically. Students will be involved in reading and writing about, listening to, representing, viewing and discussing mathematical ideas. These involvements allow students to connect their own ideas and language to the symbols and language of mathematics. Students will be talking during math class, which may be different from the math classes that you remember!

To communicate mathematically means to
- use words or mathematical symbols to explain real life.
- to talk about how you arrived at an answer.
- to listen to others' ways of thinking and perhaps alter your own thinking.
- to use pictures to explain something.
- to write about math, not just give an answer.

You might remember from math class when you were a child that you were to "show your work". Today, students are expected to "show their thinking", which is very different! Showing steps and explaining one's thinking both have a place in a mathematics class. Showing one's steps is a well-established practice, but explaining one's thinking is an important part of doing mathematics that should be included when learning any math concept. Explaining one's thinking has the following benefits:
- A student uses a strategy that makes sense to him.
- A student learns from hearing and/or watching other student strategies.
- There are often many ways to approach a math problem, so the process captures the nature of real mathematics.
- A student is in the role of mathematician rather than just an observer.
- This practice accommodates different learning styles and different backgrounds.
- A student is not imitating the teacher, but *inventing*. This higher-level thinking process involves truly "doing mathematics".

*Taken from Mathematics Teaching in the Middle School, February 2007, p. 339.

When students are showing their thinking, they are communicating mathematically!
Communicating in math takes lots of practice; students improve over time!

How might I support my child with communicating mathematically?
- Encourage your child to explain their thinking or to "think out loud" when they work on a math problem.
- Listen to your child explain math in their own words and then paraphrase what they have said using mathematical words that they may be learning.
- Ask your child's teacher for a list of math words that might be challenging for students in your child's grade.
- Use a dictionary or glossary when helping your child with homework when you don't know the vocabulary your child is using.

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How can literature support mathematics?

Your child reads books everyday. Did you know that stories can help support your child's understanding of mathematics? Stories present a common experience for you and your child to discuss the story and the mathematical ideas that are embedded within the story. When a child is reading and discussing, he is developing communication skills that will support his development in both language arts and mathematics!

Reading stories can enhance your child's math learning by demonstrating that mathematics develops out of human experience. Literature presents settings that provide real meaning for your child to connect the abstract ideas, language, and symbols of mathematics to his own personal experiences. Children who are confident readers can extend their confidence to mathematics when given opportunities to discuss the math found in books. As you read a story with your child, consider how you might address the mathematics that is in the story, pictures, or setting:

- Discuss the patterns you can find in the story (repetition, predictability) or in the illustrations (color, shape, design, etc.).
- Talk about shapes and size in the illustrations or timelines of events in the story.
- Discuss the problem presented in the story. Brainstorm or predict possible solutions.

How might I support my child with math using books?
Follow two rules:
  1. Select good literature to read with your child. Don't pick a book just because it explicitly talks about math.
  2. Enjoy the story and the time you spend together.
Start with some of the suggested books below:
  - Two Ways to Count to Ten: A Liberian Folktale by Ruby Dee
  - The Napping House by Audrey Wood
  - Rooster's Off to See the World by Eric Carle
  - Wilma Unlimited: How Wilma Rudolf Became the World's Fastest Woman by Kathleen Krull
  - Ten Black Dots by Donald Crews
  - The Greedy Triangle by Marilyn Burns
  - The Number Devil: A Mathematical Adventure by Hans Magnus Enzensberger
  - A Million Fish... More or Less by Patricia C. McKissack
  - The King's Chessboard by David Birch
  - Alexander Who Used to Be Rich Last Sunday by Judith Viorst
  - The Mitten by Jan Brett

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Why is my child using a calculator in elementary?

The new mathematics curriculum expects students to be using a calculator, even in elementary school! Calculators can contribute to the learning of mathematics; however, many of us may have fears about our children using calculators. Here are some myths about calculator use.

Myth: If my child uses a calculator, he won't learn the "basics".
The curriculum expects students to demonstrate basic fact mastery (+ - x ÷) and personal strategies, including mental mathematics, throughout elementary school. Research indicates that the availability of calculators has no negative effects on learning basic facts. If students only use calculators to provide answers to computations, rather than using the answer to think, reason or solve problems, the calculator is not a useful mathematical tool. Students must learn when it is useful to use a calculator and when it is more useful to use mental mathematics!

> _The calculator can be used as a practice tool for students working on basic facts. If a child is practicing the multiples of 8, the child can enter $\boxed{8}$ $\boxed{\times}$ $\boxed{3}$ and delay pressing the $\boxed{=}$. The child can answer the fact before pressing $\boxed{=}$ to check if the answer was correct._

Myth: If my child uses a calculator, he will become dependent on it.
When children are involved in tedious pencil and paper calculations, almost no mathematical thinking is necessary; students simply follow procedures. When children are solving problems and using calculators, they are using their mental power in more important ways – reasoning, conjecturing, and testing ideas. In realistic problems, the numbers are not always easy numbers to work with. Students who understand the operations (+ - x ÷) can use calculators as a computational tool so that they can focus on developing understanding and critical thinking. Often, students lose focus on the problem on which they are working when having to complete lengthy computations using pencil. Students still need to know if the answer a calculator provides is reasonable.

> _An activity for students that involves reasoning and testing ideas with a calculator: **What number multiplied by itself will equal 62?**_

Calculators will not always be used in the mathematics class. It is the discretion and wisdom of the teacher to determine when and how students should use calculators. The Alberta mathematics curriculum indicates that "there is to be a balance among mental mathematics and estimation, paper and pencil exercises, and the use of technology, including calculators and computers. Concepts should be introduced using manipulatives and be developed concretely, pictorially and symbolically." Calculators can enhance learning!

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How can I help my child look forward to math?

Parents are their children's first and most influential teachers. Your support and encouragement are vital to your children's success in mathematics. The attitudes toward math that you display are picked up by your child, even without you knowing!

Parents can help students see math as useful and necessary for life. Include your child in activities with you that require mathematics, such as making purchases, checking the time, measuring ingredients for a recipe, writing a cheque and paying bills. In this way your child can see the relevancy and immediacy of mathematics.

Have a positive attitude toward math!
- Let your child know they can be successful in mathematics.
- Let your child know you see math as important.
- Be curious and excited about the math activities your child is involved in at school.
- Encourage your child to be persistent when the work becomes difficult.
- Remain patient and give praise when your child shows effort.
- Avoid negative comments and criticism.
- Don't underestimate your own math abilities.
- Don't say "I was never good at math".

How might I support or promote a math environment at home?
- Play games and puzzles with your child that deal with things such as logic, reasoning, estimation, direction and classification (Concentration/Memory, Chess, Checkers, Othello, Sudoku puzzles, Crib, Clue, Card Games, etc.).
- Do math problems together! This could include problems such as mixing juice crystals with water, figuring out how long to cook a roast or turkey, determining how to set the table for a certain number of people, etc.
- Involve your child in daily activities that require the use of mathematics. This may include brushing teeth for a certain amount of time, folding or sorting laundry, feeding pets, checking the television schedule, determining driving routes for errands, etc.
- Make familiar objects (toys, blocks, buttons, measuring devices, etc.) available so that your child can use them to help solve problems.
- Provide materials such as pencils, paper, calculators, and scissors to use for study or creative play.
- Listen carefully to your child's explanation of what he or she is learning.

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