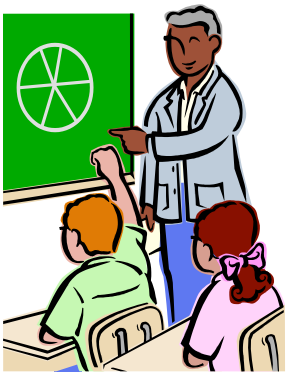
Parents as Partners:

Your Child's Math Education



by
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Content of *Parents as Partners Pamphlet*

Chapter 1
Introduction

Purpose of *Parents as Partners Pamphlet*

What does math mean to your child's future? **Everything!** Mathematics is essential for an informed public. Careers ranging from auto mechanics to electricians to architects to doctors to pilots require a sound background in math. Advances in technology are changing the workplace, and these changes mean that students need to know more math in order to adapt to these new environments. Math is critical in making decisions about health care treatments, travel routes, best buys, grocery shopping, home repairs, building fences, and payment options. Believe it or not, math can be fun! From puzzles to games to solving problems, math stretches our imaginations and allows us to reach logical conclusions.

Family involvement in learning is important. After all, you are your child's first teacher! You are critical to your child's success in school. Studies show that when there is a high level of parent involvement, students do better in school. No matter what your own experiences are with math, you can be a positive influence on your child.

Features of *Parents as Partners Pamphlet*

The *Parents as Partners Pamphlet* is written to help you encourage your child's interest and skills in math, to develop good study skills, and to explore math outside of school. It will also provide you with important information about how math and the teaching of math have changed over the last few years.

The chapters are resources to help you as you work with your child. Don't feel you have to read everything at once.

Chapter 2

Developing Positive Attitudes About Math

Do you see reading as an important everyday tool in your daily life, both at home and on the job? Step back and think about the role of reading in your home—you've probably enjoyed reading to your child since she/he was tiny. You've set an example and developed a positive attitude towards reading and shaped your child's understanding of the importance of reading as something that's fun but also important. In today's world, reading is a literacy.

Now think about math. What's your attitude about math? Do you see math as an important everyday tool in your job and in your life? Do you avoid doing things that involve math? Are you sharing your attitudes about math with your child? Your answers indicate how your attitude may be influencing your child's attitude about math. Math is also a literacy. What is math literacy? To be literate in math means to have the minimum knowledge for everyday purposes. This means using math skills without looking them up or using a calculator and then applying the skills correctly in given situations.

Everyone is a mathematician! Saying things such as, "Math is hard," or "I'm not good in math so I don't expect you to do well either," or "I didn't like math in school," undermines your child's math ability and self-confidence. However, encouraging a can-do attitude and an appreciation for the importance of learning math will go far in opening doors in education and in life. Your child doesn't have to like math, but it is important that she/he appreciates its value. In your everyday interactions try to portray positive attitudes and values about mathematics. In Chapter 13, we offer some great ideas to do math at home that promote the mathematician in your child just as reading at home has impacted your child's reading ability.

What does it mean to do math, to be a mathematician? To learn math a student must learn to solve problems, to communicate their thinking, to use appropriate math symbols and tools, to reason logically, and to make connections. Let's take a closer look at each one of these components.

Problem Solving is the cornerstone of mathematics. A problem solver asks questions, investigates and explores ideas and possible solutions, has stick-to-it-iveness, searches for more than one approach, and applies math in everyday situations.

Communicating mathematically means to write and speak about ideas, solutions, and reasons. Listening to other students explain their thinking is also valuable to understand different ways of thinking and reasoning.

Representations means using the mathematical language of numbers, charts, words, graphs, pictures, and symbols. Different forms of representations help with organization and communication. Representation can also involve using technology.

Reasoning means thinking logically, looking for patterns and asking if the pattern is accidental or if the pattern has a reason to it, looking at similarities and differences and making choices based on the differences, as well as looking for relationships among things. Reasoning also means asking if the solution is reasonable for the situation. If so, why? If not, why not?

Connecting math ideas is powerful in understanding math and making that understanding more long lasting. Math is not a collection of separate strands (such as geometry and algebra) although it is often presented that way. Math is integrated, connected. Connections take place from one grade to the next, from one strand to the next, and from one school subject to the next. Connections also occur from the math classroom to every day life.

Throughout the *Parents as Partners Pamphlet* we'll be using some math words and teacher phrases. Here's what they mean:

Algebra Readiness: To be algebra ready means to have a deep understanding of multiplication, fractions, problem solving, and critical thinking. It means understanding the basic math principles.

Basic skills: The most basic idea in mathematics is that **mathematics makes sense!** This includes understanding place value, our number system, the scale of numbers (scale means the largeness or smallness), basic fact mastery, relationships between and among numbers, as well as both fluency and flexibility with computation.

Fluency: A person fluent in the language of math is efficient, accurate, and flexible in thinking about numbers. The foundation for fluency not only involves quick recall of basic facts. It also means understanding the place value system and the meaning of mathematical operations.

Contexts: The words, phrases, and stories that a math problem is part of helps to explain the meaning of the math problem and to determine the most reasonable solution for the problem.

Number: "Number" means all kinds of numbers such as decimals, fractions, percentages, single-digit numbers, multi-digit numbers, and so on.

Operations: "Operations" in mathematics doesn't require a medical degree! Operation means how one number "operates" on another number. The four operations in mathematics are addition, subtraction, multiplication, and division. In later grades, the meaning of operations is extended to exponents, square roots, and so on.

Properties: Using the operations also includes understanding their properties. Properties are the rules of mathematics no matter what numbers are involved. The *commutative property for addition* means that it makes no difference in which order numbers are added. Example: $3 + 2 = 2 + 3$.

Represent Numbers: In math we call this composing and decomposing! For example, we want students to view the number 17 flexibly as a 10 and a 7, or a 5 and a 12, or a 15 and a 2. This flexibility is useful when combining with other numbers but also applies when working with the concepts of algebra and geometry.

Chapter 3

How to Talk Math With Your Child: Important Things to Know

You can help your child study math by helping her/him understand some important things.

1. *Problems can be solved in different ways.*

We often think that because there's usually only one solution that means that there's only one pathway to the solution. However, the beauty of math is that there may be many ways to get to an answer. Nowadays, learning math means not just finding the correct answer, but it also means recognizing more than one pathway to a solution, solving similar problems, and applying what you've learned to new problems. Too often in the past we've focused on teaching students one way to solve problems. However, that means that students with different learning styles are too often left in the dark.

2. *Wrong answers are sometimes helpful.*

You are probably re-reading that statement and asking how can that be! Making mistakes is not fun but learning from the mistakes is an extremely important part of the learning process. Analyzing wrong answers can help with understanding the math concepts within the problem. Wrong answers can also help develop reasoning skills. As a parent, you can use your child's wrong answer to help her/him figure out why a mistake was made.

3. *Take risks.*

Help your child become a risk taker. There is great value in trying to solve a problem even if it's difficult. When a student works hard to solve a difficult problem or to understand a complex idea, the child experiences a special feeling of accomplishment. This effort leads to a willingness to continue trying tough things and also contributes to self-confidence.

4. *Work with paper and pencil.*

Did you notice I didn't say, Use an eraser? Working with paper and pencil allows your student to explore ideas and to test out possible connections or solutions. Working with a pencil on paper provides practice and leaves a trail of thoughts that can spark new ideas.

5. *Math is not a spectator sport.*

In order to learn mathematics a person must do mathematics. This learning means taking notes, doing homework, attending class, paying attention to the teacher and classmates, and asking questions to deepen the understanding. It does not mean simply memorizing formulas.

6. *Stick to it.*

Research shows that effort is important and contributes to learning mathematics. When children believe their efforts to learn make them "smarter," they show greater persistence in learning math.

Chapter 4

Why Math Looks Different

Why does the math my child studies in school and brings home look different from the math I remember?

You are probably wondering why the math looks different. Research has helped us reshape the way math is taught. We know more about how students' brains function and we know better ways to help them do math and understand math based on their stages of development and their learning styles. Let's take a closer look at math classrooms of yesterday and today.

Yesterday's Classroom — Focus on Memorization

The mathematics taught years ago focused on memorized facts and specific methods for solving problems and plugging numbers into formulas. In the past, teachers thought students were good in mathematics if they could do math quickly, especially if they could do it in their heads, even though they might not have understood what they were doing. Students are still being taught the same skills you learned in school, but they are now learning them with understanding.

Today's Classroom — Focus on Understanding by Active Learners

Today, basic skills are still taught but with an emphasis on thinking and understanding. No matter how well your child can do calculations, this ability is not very useful if she/he doesn't understand them. It is also very important to know how or when to use particular math skills. National and international studies have shown that students have made steady improvement in math since 1990 with the shift towards math taught to standards combined with learning that is focused on understanding mathematics. For example, results for the 2007 National Assessment of Educational Progress (NAEP, the Nation's Report Card) show that 82 percent of fourth graders and 71 percent of eighth graders performed at or above the basic level in math, compared to only 50 percent and 52 percent in 1990.

Because society has changed, the math that students need to know has also changed. Doing math "in your head" is a valuable skill as it comes in handy in making quick calculations and estimations in restaurants, in stores, and at the gas pump. But instead of worksheets filled with problems calling only for number calculations, your child may be bringing home problems that relate to real life, such as working with salaries and the cost of living and life expectancy, and making decisions based on comparisons. Because technology is used in so many different ways today, students need to be able to reason about problems and explain mathematics. Real learning is more than just a student listening to a teacher and doing 20 similar problems on a worksheet. Think about your own learning experiences. You probably remember those times when you actively participated in a learning activity much more than when you just listened to and watched the teacher. The old Chinese proverb captures the focus in today's classroom:

I hear and I forget; I see and I remember; I do and I understand.

The goal of mathematics education today is to develop a lifelong understanding that is both useful at home, in the workplace, and in college. Whatever your child chooses to do in life, having a strong understanding of mathematics will open doors to a productive future.

Chapter 5

What Your Child Will Learn in School

In the past, math education in all grades in the United States has been criticized for having too many and too much: too many standards, too much repetition, too much rote learning, and too much memorization. The phrase "mile wide, inch deep" has been used to describe this approach. We now know, through research and through comparisons to high performing countries on international tests, that "less is more." We need fewer topics at each grade level with greater emphasis on mastering these topics.

The methods for the teaching of mathematics have changed during the past two decades as we learn more about learning and brain development. Instead of focusing only on rote learning and memorization, these new standards emphasize *understanding* the mathematical processes through problem solving. Real life applications of mathematics are an important part of learning. In addition to arithmetic, some concepts of algebra, geometry and data analysis (statistics) are now taught in the elementary grades.

As a result of poor test results by students from the United States on international tests prior to 1989, the National Council of Teachers of Mathematics (NCTM) began recommending standards for the uniform teaching of mathematics. In today's world of greater mobility families change schools within a district or move to a new school district or even to a new state. States and school districts are revising their standards for consistency from grade to grade, consistency from school to school, and consistency from state to state to better educate the mobile student. These new standards compare favorably to the standards of high achieving countries—all the students in the United States will be better prepared to compete on the global stage. In 2007, the state of Oregon used these national standards to revise the 2002 math standards.

In December 2007, Oregon's State Board of Education adopted new math standards based on *Principles and Standards for School Mathematics* and on *Curriculum Focal Points for PreKindergarten through Grade 8 Mathematics: A Quest for Coherence*, both authored by the NCTM, the national leader in standards development. For each of Grades Kindergarten to 8th there will be three core standards. These provide the major concepts that will be the primary focus of both teaching and learning at each grade. Underneath each of the core standards are from three to nine content standards that provide the details needed for instruction and assessment. Students will concentrate their learning for in-depth understanding of each core standard.

The mathematics standards for Grades 9 through 12 were revised in 2008-09 using NCTM's *Focus in High School Mathematics: Reasoning and Sense Making*. Oregon high school students are now required to take three years of mathematics. (In 2014 the bar will be raised once again for high school students by requiring them to take three years of mathematics at the algebra 1 level and above.) The standards describe what all students must understand in the areas of algebra, geometry, and data analysis.

The charts on the next two pages provide overviews of the core standards for Grades K-8 and the core standards for Grades 9-12. The first chart offers a quick study about how the earlier grades provide the foundations for the later grades. With only three Core standards elementary and middle school students will have the needed time to develop understanding and mastery of the concepts. These form the support for the study of math in Grades 9-12.

Teaching and learning with standards will develop the foundation for success for students in each of the grades that follow and for success in high school no matter where they live. Schools, districts, cities, and states will be offering high quality mathematics education to all students. The firm foundation will also prepare students for success beyond the K-12 classroom: better preparation for entering the job market, for technical training, and for college.

Vertical Articulation of the Core Standards

This chart shows the grade-by-grade progression in the core standards. It outlines a coherent progression in knowledge and skills from Kindergarten through Grade 8. The high school core standards will continue this progression.

K	**Number and Algebra** Compare and order numbers	**Geometry** Describe shapes and space	**Measurement** Compare and order objects by attributes
1	**Number** Develop an understanding of whole number relationships	**Number and Algebra** Develop an understanding of addition and subtraction	**Geometry** Compose and decompose shapes
2	**Number** Develop an understanding of base-ten and place-value	**Number and Algebra** Fluency with addition and subtraction of whole numbers	**Measurement** Develop linear measurement
3	**Number** Develop an understanding of fractions	**Number, Algebra and Data Analysis** Develop understanding o multiplication and division	**Geometry and Measurement** Analyze 2-dimensional shapes, including perimeter
4	**Number** Develop an understanding of Decimals	**Number and Algebra** Fluency with multiplication of whole numbers	**Measurement** Area
5	**Number and Data Analysis** Fluency with addition/sub of fractions and decimals	**Number and Algebra** Fluency with division of whole numbers	**Geometry, Algebra, and Measurement** Analyze 3-D shapes, including volume and surface area
6	**Number** Fluency with multiplication and division of fractions and decimals	**Number and Probability** Rate, ratio and probability	**Algebra** Writing and using mathematical expressions and equations
7	**Number and Algebra** Rational numbers and linear equations	**Number, Algebra and Geometry** Proportionality and similarity	**Measurement and Geometry** Develop and use formulas for surface area and volume
8	**Algebra** Linear functions and equations	**Data Analysis and Algebra** Analyze and summarize data	**Geometry and Measurement** Angles and the Pythagorean Theorem

Vertical Articulation of High School Core Standards

The chart shows the progression of the Core Standards for the study of mathematics in high school. These are continued from the K-8 progression. High school math classes can be taught by strand (algebra, geometry, data analysis) or they can be integrated over several years (Integrated Math 1, 2, and 3). Either approach will focus on developing deep understanding using reasoning and sense making.

	Algebra or Integrated Math	**Geometry or Integrated Math**	**Statistics & Probability or Integrated Math**
9-12	**Algebra and Numeracy** Develop understanding of Real numbers and algebraic symbols	**Geometry** Apply properties of two-dimensional figures	**Data Analysis** Analyze and interpret empirical data
9-12	**Algebra** Linear equations, inequalities, and functions	**Geometry** Apply properties of three-dimensional solids	**Probability** Apply principles of probability
9-12	**Algebra** Quadratic and exponential equations and functions	**Geometry** Transform and analyze figures	

Chapter 6

Basic Skills

Why aren't students learning to add, subtract, multiply, and divide like we did?

Many people think arithmetic is what math is all about although it's really only a small part. In today's schools, much more emphasis is placed on the *meaning* of number operations (add, subtract, multiply, divide), geometry, statistics, and so forth, than it once was. Students are still being taught to add fractions and to find the percent of a number, but they are not necessarily being taught these skills in the same way as their parents and grandparents experienced. Today, *understanding* mathematics is as much a classroom focus as is finding the correct answer. Here's an example from a recent incident:

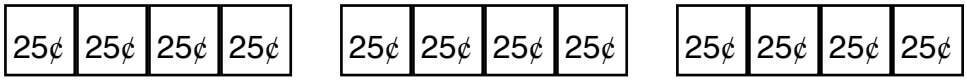
> In a restaurant, a cashier attempted to add two bills for meals, one for $4.50 and one for $5.50. The cashier carefully lined up the decimals and proceeded to "carry" like this:
>
> $$\begin{array}{r} {}^{1}5.50 \\ +\ 4.50 \\ \hline 10.00 \end{array}$$
>
> Although the procedure used was correct, the customer wondered why the cashier did not just add 4 + 5, then see that 50 cents + 50 cents is another dollar, and know that the total was $10. This method might even have been faster.

Yes, it's important to do this type of calculation mentally! But there are many people who cannot do so, partly because they lack number sense (understanding numbers, ways to represent them, relationships among numbers, and the meanings of the operations). The cashier learned the procedure in school, but may not have learned enough about the meaning of numbers to add them mentally.

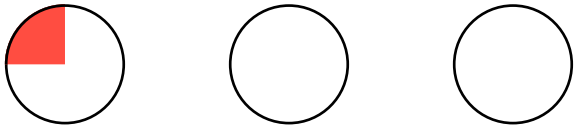
Historically, students have had difficulty with fractions and decimals. For example, when eighth graders were asked in 1977 to estimate the sum of 12/13 + 7/8, only 10 percent of them selected the correct answer on a multiple-choice national examination. When those same students were asked to add the fractions 7/15 and 4/9, only about 40 percent could do so. The difference is that in the first situation students were unable to realize that both fractions were close to 1 and estimate that their sum would be 2. In the second situation, more students were able to find the common denominator and adjust the numerator accordingly before the fractions could be added. These two examples illustrate the importance of understanding the math we do. The second example tells us that 4 out of 10 students could do the computation but only 1 out of 10 students could use the meaning of the fractions to estimate a sum.

What does learning for understanding look like? Think, for example, about how you learned to divide fractions in school. To do a problem such as 3 ÷ 1/4, you were probably taught to invert and multiply, like this: 3/1 × 4/1 = 12/1 = 12. Although this answer is correct, did you understand why you were inverting or what the answer meant? Also, could you have created a word problem that would require using this division problem to solve it? Today we ask students to solve problems that they might come across in their everyday lives. They are learning many of the same skills you learned—and more.

To help students understand division with fractions we use a context that they are already familiar with such as money. We might ask students how many quarters are needed to make $3. Students could use a picture similar to this to help them answer the question.

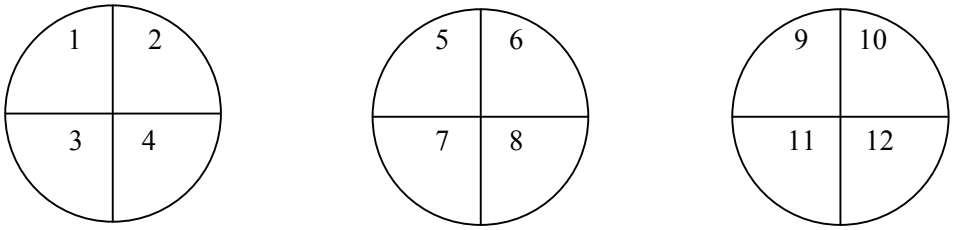


We can look at the same division problem in the following manner: Think of each of the circles below as representing 1. The shaded slice in the first circle represents 1/4. The question is, "How many one-fourths are in 3?" We can see that twelve of the one-fourth pieces, four "slices" per circle, are needed to fill all three of the circles.



We might then apply this understanding to a situation in the real world, as in the following problem:

> Javier has 3 pounds of hamburger and wants to make patties that weigh 1⁄4 of a pound apiece. How many patties can he make? They begin by drawing a model of the problem, 3 ÷ 1/4



Suppose that each circle represents 1 (one unit, or one whole—in this case, one pound of hamburger). Each circle is divided into fourths with ¼ representing one hamburger patty. How many one-fourths are in 3 wholes? Again, we can see that twelve of the one-fourth pieces will fill all three of the circles.

Putting the problem in real-life contexts helps students make pictures of it in their minds. Only after learning to understand division with fractions will the shortcut of "invert and multiply" make sense and be remembered longer.

Through this kind of thinking we not only know what the answer is but also have a picture of it in our minds with real-life applications to go with it. These connections allow us to work with more difficult problems, then to create strategies for dealing with fractions. Eventually, students will be able to perform basic operations on fractions. Through using hands-on materials, pictures, and real-life problems, they are more apt to understand why the operations work the way they do instead of memorizing quirky rules that previously made no sense. Today's students will not struggle with fraction, decimal, and percent concepts. Unlike the story of the cashier mentioned earlier, today's students will be very comfortable and versatile in performing mental math operations in these areas.

Now try this:

> The Washington Monument in Washington D.C. stands 169.294 meters in height.
> That's 555 feet $5\frac{1}{8}$ inches. However, it sinks about 1/8 inch per year.
> How long till the monument sinks out of sight?

Chapter 7

Helping Your Child With Homework

How can I help my child with the math homework that's due tomorrow?

Relax—think of yourself as more of a guide than a teacher. Your goal is to get your child to figure out as much as she/he can independently (that is, constructing meaning by taking her/his existing knowledge and use it to develop specific new knowledge). Oftentimes, simply asking your child to explain something out loud is enough to help your child figure out the problem. Encourage your child to show all work including written descriptions of all thinking processes. This written record of thinking will give your child something to look back on, either to review or to fix a mistake, and can also help both you and the teacher understand how the problem was solved.

The ancient Greek philosopher, Socrates, used questions to educate his students. That two thousand year old teaching method of asking questions is the best thing you can do to help your child make sense of mathematics, build self-confidence, and encourage mathematical thinking and communication. A good question expands a problem and supports different ways of thinking about it. Here are some questions you might try. (Notice that none of them can be answered with a simple "yes" or "no".)

1. Getting Started

- What do the instructions or directions say?
- What do you need to find out?
- What do you need to know?
- Where do you think you should begin?
- How can you get the information?
- What math terms or words do you understand or not understand?
- Have you solved similar problems that would help?

2. While Working on a Problem

- What have you done so far?
- Is there anything you already know that can help you work through the problem?
- How can you organize the information?
- Can you make a drawing (model) to explain your thinking?
- Are there other possibilities?
- What would happen if . . . ?
- Can you describe an approach (strategy) you can use to solve this?
- Can you find help in your notes or text?
- What do you need to do next?
- Do you see any patterns or relationships that will help solve this?
- How does this relate to . . . ?
- Can you make a prediction?
- What assumptions are you making?
- What did you try that did not work?

3. Reflecting About the Solution

- How do you know your solution (conclusion) is reasonable?
- How did you arrive at your answer?
- How can you convince me your answer makes sense?
- Has the question been answered?
- Can the explanation be made clearer?

4. Responding—Helping Your Child Clarify and Extend Her or His Thinking

- Tell me more.
- Can you explain it in a different way?
- Is there another possibility or strategy that would work?
- Help me understand this part.

5. Getting Unstuck

- Would it help to go on to another problem and come back to this one later?
- Is there a homework hotline at your school?
- Can you look for some help on the Internet?
- If you only do part of a problem, will the teacher give you some credit?
- Do you have a classmate you can call?
- Can you write down what you've tried and what you didn't understand?
- Remember, everyone gets stuck sometime. Shall we do something different for a while then come back to this?
- Can you go in before or after school for help from the teacher?

Remember, don't do homework for your child—support it! Math is not a spectator sport! Support your child by acknowledging that sometimes progress is made by not giving up.

Besides supporting your child with homework, show the importance of learning math by helping your child connect math with daily life. Point out your own activities that involve mathematics, such as deciding if you have enough money to buy items on a shopping list, estimating how long it will take to make a trip, determining how much carpet or wallpaper to buy for a room, or developing a schedule to complete a series of tasks. Talking about these everyday situations will give you a chance to increase your child's appreciation for the usefulness of math!

Chapter 8

Helping Your Child Get Organized

An important part of being successful in mathematics (or in other subjects) is taking responsibility for one's own learning. Students should use a notebook to record class discussions of problems and mathematical reflections. Students should also develop and record a vocabulary list. Finally, students should record all homework and assessment items. The notebook serves as a resource for the student (and for you) throughout the year. The following suggestions will help with developing good organizational and study habits.

• Provide a study place. If possible, have these materials readily available: calculator (four-operation calculator for primary grade students; scientific calculator for middle grade students; graphing calculator for high school students); graph paper and notebook paper; ruler with both metric and standard units; and a dictionary.

• Many children need help with organizing and maintaining a notebook. Help your child develop a system for organizing and expect your child to maintain the notebook and notes.

• Help your child develop a system for writing down assignments, as well as keeping track of progress. Many schools provide student planners or assignment sheets, but that does not mean students use them consistently. Check to make sure that these are being used consistently and appropriately.

• Help your child develop a system for taking meaningful notes. Frequently, note taking is taught during class, so it may just be a matter of seeing whether your child is taking and using notes. Learning to take notes that make sense even when reviewed many days later is an important skill.

• Encourage your child to identify study buddies or another math student she/he can call to work with on assignments, get clarification, find out about makeup work, and so on. Some parents/guardians have established study teams and times so that students have planned opportunities to study together after school.

• Encourage and expect your child to get work done on time, to stay caught up, to get help in a timely manner, and to correct errors in work. You may want to help your child go over incorrect or incomplete work and talk about how the work could be improved.

• By middle school, students should know the basic addition, subtraction, multiplication, and division facts as well as whole number computation. If your child is not proficient with these skills, help her/him master the needed skills.

Chapter 9

Helping Your Child Prepare for Testing

Although you cannot help your child during a test, there are many things that parents can do to make sure that a child will be successful in a testing situation. Encouragement and help in preparing for the test can build a child's confidence.

- Limit your child's absences from school.
- Schedule appointments outside the assessment period.
- Make sure your child gets a good night's sleep the night before the test.
- Get up early enough to avoid hurrying to get ready for school.
- Have your child eat a good breakfast or lunch before the test. Avoid sugary foods.
- Make sure your child has all the necessary equipment for the test (pencil, extra lead, paper, eraser, calculator)
- Arrive on time for the test.
- Avoid arguments or emotional upsets prior to the test.
- Help your child develop a positive attitude that says, "I will do my best on this test!"
- Speak positively about the test by saying things like, "It will be fun," or "I bet it's going to be interesting."
- Talk to your child about what she/he did each day, if she/he had any trouble and what can be done to avoid any problems in the future.

Test Taking Strategies for the Student

Talking about general test-taking strategies also benefits your child. Good strategies include:

- Listen carefully to directions.
- Read each test question and all of the answer choices carefully. (If you cannot read a word on a state math test, it is okay to ask a teacher to read it to you.)
- On a multiple choice test, get rid of any answers you know are not correct. Then make your best guess, even if you are not sure of the answer.
- Solve the problem using paper and pencil, a calculator and any manipulatives that are available.
- Check the signs (positive and negative) in a computation problem.
- Line up the decimals points in a computation problem.
- Use estimation to make sure the solution is reasonable.
- Always check your answer! Refer back to the original question then look at the answer. Does the answer match the original question? Is the answer in the appropriate form requested such as decimal form or percent form? This is what it means to check your answer.

When you know that a testing day is coming, there are some specific things you can do to help your child be at her or his best for the test. Planning ahead can ensure a smooth start to a testing day.

- Communication is important on tests. Even if the final answer is incorrect, communicating about your thinking will help your score.

Chapter 10

Calculators

Shouldn't students have to know how to do calculations by hand before they are allowed to use calculators?

Technology is everywhere! We may even struggle to remember life without so many technological innovations. Learning to *appropriately* use technology is incorporated into the classroom as we prepare students for their futures. Calculators are the word processor of mathematics so let's compare them. The information put into the word processor is only as good as the skills of the person using the keyboard. It's the person who decides how to string words together to make sense with sentences and paragraphs and stories. The same is true with the calculators. The student must use their problem solving skills to make sense of and determine the appropriateness of the numbers strung together.

Through recent research we've learned that calculators are important tools in the classroom as long as students already have some basic skills. Calculators should be used to help students develop mathematical knowledge and understanding while using numbers and operations. In other words, the calculator, when used appropriately, expands students' math understanding—the calculator does not replace it. Teachers help students to learn when mental calculation is the best strategy, when paper and pencil is more practical, and when a calculator or computer is the best choice.

Before calculators were readily available students had to do math procedures with large numbers using only paper and pencil. Now we can devote our time to using the answers, instead of spending our time calculating the answers. The calculations do not exist in isolation, however—they must go hand-in-hand with meanings.

What is more important than using the calculator in the classroom and at home is the greater need to develop skills of estimation and mental calculations. By using estimation and understanding students can recognize when a calculation display is not appropriate for the problem. Calculators are not foolproof. Students must have number sense to recognize when the answer displayed on the calculator does not make sense for the situation or for the numbers used. However, using a calculator to explore ideas about a problem is an excellent use of the technology tool. The students are purposely using the calculator to explore mathematical ideas and to solve problems, not engaged in mindless number pushing.

Students should become proficient at using mental math shortcuts, performing basic computations mentally, and generating reasonable estimates for situations involving size, distance, and magnitude. Students are encouraged to recognize that using a calculator can be slower than mental computation. For example, try the Calculator Versus Brain Activity activity in this chapter.

Calculator Versus Brain Activity

Try this with your child: Make a list of problems like the one below. Cover up all the problems except the first one. For each problem, have your child use a calculator and you use only mental math. The person using the calculator must enter every digit of the numbers and the operation into the calculator—no shortcuts. The first person to state the answer wins the round. Switch roles and try the list of problems again or make up new problems. Who wins each round and why?

9 + 11	¼ × 4
53 + 92	2/5 + 1/5
30 + 65	40 + 100
57 × 41	83 + 17
80 ÷ 10	6 × 0 × 12
343 ÷ 49	1 + 1 + 1
2 × 2 × 2	100 ÷ 4
38 × 78	1400 + 5000

Some real life problems to explore at home might include "How many minutes old am I?" or "How much money would I have in a year if I earned a dollar an hour for three hours each day?" Students can keep track of costs at the grocery store and compare their totals with the receipt. They can plan car trips, calculate the cost of gasoline from the number of miles to be traveled and compare their figures with the actual results.

Here's another example of a problem well suited for the calculator. Notice that practice in computing by hand is not the goal of the activity.

> Did you know that your brain had about 200 billion brain cells, called neurons, at birth? You lose about 500,000 neurons each day. How long will it take before you've completely lost your mind?

Help your child understand that to use calculators correctly and efficiently she/he will need a strong foundation in math operations and basic skills; otherwise, how will she/he know the answer displayed on the calculator is reasonable? Further, students can discover that mathematics helps them solve interesting problems when they use calculators as tools. Such exploratory activities can be fun and engaging and can motivate students to continue to take mathematics classes long after the minimum requirements have been met.

Chapter 11

Timed Tests

What happened to timed tests in math class? Isn't speed and getting right answers important?

Teaching mathematics involves guiding children to broaden their understanding and to develop persistence and flexibility as problem solvers. Did you know that adult mathematicians often spend weeks, months, or even years on a single problem! Students need to learn the value of stick-to-it-iveness as they work on a problem until they finally come up with answers that appear to be reasonable, correct, as well as useful. They need to defend their answers, justify the steps they took, and communicate their findings clearly so that others understand their thinking. All of this is a matter not of speed but of dedication. In *About Teaching Mathematics*, mathematics educator Marilyn Burns writes the following:

> "What about using timed tests to help children learn their basic facts? This makes no instructional sense. Children who perform well under time pressure display their skills. Children who have difficulty with skills, or who work more slowly, run the risk of reinforcing wrong learning under pressure. In addition, children can become fearful and negative toward their math learning.
>
> Also, timed tests do not measure children's understanding. . . . It doesn't ensure that students will be able to use the facts in problem-solving situations. Furthermore, it conveys to children that memorizing is the way to mathematical power, rather than learning to think and reason to figure out answers."

Memorizing facts has a role in mathematics. By middle school, students should have memorized the most useful single-digit addition, subtraction, multiplication, and division facts. If not, this task can be accomplished without putting students through the anxiety of timed tests. If a child loves to do timed tests trying to beat her or his previous times, this task can be enjoyed at home in the way other games and races are enjoyed, but timed tests are not important to learning and doing math and they often do more harm than good.

The study of mathematics goes well beyond getting simple answers quickly. Students learn math when they encounter problems in situations that make sense to them. Students also learn important math when they act out with physical objects, manipulatives, and models; use appropriate tools such as tables, graphs, computers, and calculators; and talk about, and reflect on, mathematical ideas sharing their thinking and their reasoning.

Chapter 12

Get Involved

How can I help my child succeed in mathematics? How can I make sure my child will be ready to take challenging math classes in the future?

Research shows that parents' attitudes toward their children's education, and their involvement in it, have a significant impact on children's success in school.

The mathematics your child learns, especially in middle and high school, can play a major role in determining her/his future education and career opportunities. It's important for you to know what the long-range plan is for your child's math classes and whether she/he is getting the same opportunities in math as everyone else. Make sure that doors aren't closing because your child isn't learning the math that will open them.

Get to know your child's math teacher and the school guidance counselor. Be sure to attend Back-to-School Night, Family Math Night, open house, parent-teacher conferences, and other scheduled events to ask questions and find out more about your child's math program and how he or she is doing and how you can help.

Questions to ask your child's mathematics teacher

- What math will be taught in this class? How can I find out what my child is learning?
- What instructional materials and other tools will you use?
- Will my child need a calculator, ruler, compass, or other tools?
- How much math homework can my child expect to have, and how long should she/he spend on homework each night?
- May my child work with other students on homework?
- How can my child make up work when she/he misses school?
- Will assignments be posted on line?
- How does my child earn grades in your class?
- Will my child's grades be sent home or are they available online?
- Will you send home a report about how my child is doing in your class?

When and how often?

- Can I schedule a conference with you about my child's progress? How?
- Will my child take any state or national tests this year?
- What can I do to help you?
- How is progress in learning math measured?

Questions to ask the teacher, counselor, or both about what mathematics is taught in your child's class

- What mathematics classes are available?
- Will these classes prepare my child for meeting the Oregon Diploma requirements?
- Do all students take the same mathematics courses?
- How are students placed in different classes or are classes open for anyone to register for? When are placements made for next year?
- Can I offer input to help make decisions about what course my child will take?
- What math course will my child take after this class?
- Will this math course prepare my child to take more math?
- When are schedules for the different classes made for next school year?
- How can I help make decisions about what course my child takes?
- Will my child use calculators or computers in mathematics classes? Are these tools and others available for all students? How are they used?
- Will I be informed if my child is having trouble? When, and how? What should I do then?
- Does the school offer any programs for extra help with math if my child needs it? Is any tutoring available before, during, or after school?
- What kinds of extra activities does the school make available in math? Is there a math club? Do some students participate in mathematics competitions?
- May I observe math classes?

Consider arranging a regular time for your child to work on math with a peer or group of students. Working with others can help students who are struggling as well as those who excel. Don't be afraid to ask for what your child needs. You'll find that teachers and counselors are happy to answer your questions and will appreciate your involvement and support.

Chapter 13

Activities at Home

Number Sense

Everyday activities can be used to develop and improve young children's number sense by counting and with addition and subtraction. Young children may not recognize numbers all around them so pointing out numbers on everyday items also increases their number sense.

Pre-School

Walk and Count

• Take your child for a walk. You can walk around the neighborhood, through a park, or just around the rooms in your home. As you walk, say fun things for her/him to do, such as the following:

- Take two big steps and three little steps
- Take three little steps, hop one time, take three big steps
- Take one little step, turn around two times
- Hop four times, turn around one time
- Take three big steps forward and two big steps backward.

• Count aloud each kind of action that your child performs—"1, 2 – 1, 2, 3 – 1, 2. That's great!"
• Let your child say silly things for you to do as you walk.

Count

• Throughout the day with your pre-schooler find ways to let your child use counting skills. For example, "How many magazines came in the mail?" "How many more letters will we need to get to have 10 letters?" "Which are there more of, magazines or letters?"

Find It

• Place several boxes, cans, and bottles of food and other household supplies on the kitchen table. Sit with your child and point out one or two numbers on each item. (Numbers can be found in the names of some products, as well as in the list of contents and in addresses. However, rather than pointing to a very large number, such as a ZIP code, point to one digit in the code—a 6 or a 3 or 8.)

• Point to one of the items and say a number that is easy to see. Ask your child to find it. Then have her/him look for that number on other items.
• Have your child choose a number for you to find on one of the containers.

Kindergarten – Grade 2

Count and Walk

• Ask your Kindergartner to "guess" (estimate) how many of her/his steps it will take, for example, to get from the tree to the corner. After she/he makes the estimate have her/him count steps to see how close the estimate is. Next ask how many of your steps it will take. Will it take you more steps or fewer steps to go the same distance? Again, have her/him count to see how close the estimate is.

In the News(paper)

• Give your child a newspaper and a set of numbers to look for—for example, from 1 to 25 (or 1 to 100 if she/he is familiar with the higher numbers). Have her/him cut out the numbers and glue them in numerical order onto a large piece of paper. Call attention to any ways in which the numbers differ—for example, some will be in a bigger font size than others, some will be in bold or italic type. Have your child read the numbers to you, then put the paper aside. Have her/him practice counting up to that number then counting down from it. Also have your child try to count by 2s or 5s.

• Next, have your child make a counting book by using pictures she's/he's cut from the newspaper. Have her/him write the page numbers at the bottom of each blank page and paste one item on page 1, two items on page 2, and so forth. Explain that all of the things glued on a page must be alike in some way—all animals, all basketball players, all cars and so on. Help your child write the name of the item on the appropriate page.

• Have your child read the book to you. Afterwards, ask her/him questions such as the following:

- How many pictures did you cut out altogether *(1 + 2 + 3 + . . . + 10)*?
- How many total pictures are on pages 1-3? on pages 1-6?
- We know that $6 = 2 \times 3$. Are there twice as many pictures on page 6 as on page 3?
- Which are there more of: pictures on pages 2, 3, and 4, or pictures on pages 5 and 6?

• Newspapers can also be used to help your child recognize numbers in different sizes and kinds of font and to understand that the way a number looks does not change its value.

Grades 2 - 3

Fraction Action

• For this activity, use a large clear container, masking tape, a marker, unpopped popcorn, and measuring cups (1/2, 1/3, or 1/4 cup measure). Invite your child to help you make popcorn for the family. Begin by having her/him put a piece of masking tape from top to bottom on one side of the large container. Choose the unit of measure and fill the measuring cup with popcorn. Give the cup to your child and ask her/him questions such as the following:

- How many whole cups do you think the container will hold?
- How many 1/2 cups (or 1/3 cups or 1/4 cups) do you think it will hold?

• Let your child pour the measured popcorn into the clear container. Have her/him continue to pour the same amount into the container until it is full. As she/he pours each equal amount, have her/him mark the level on the container by drawing a line on the tape. Then have your child write the fraction, corresponding to the unit of measure, on the line. After the container is full, have your child count up the total number of cup increments (1/2, 1/3, or 1/4) and compare it to her/his estimate.

• As you measure out the popcorn to pop, ask your child to answer questions such as the following:

- How many 1/2 cups equal a cup? Two cups?
- How many 1/4 cups equal 1/2 cup? A whole cup?

• Pop the corn and enjoy!

Grades 3 - 5

Check It Out

• As you wait in a grocery checkout lane, use the time to have your child estimate what the total cost of your groceries will be. Tell her/him that one easy way to estimate a total is to round off numbers. That is, if an item cost 98 cents, round it off to $1. Explain that the answer she/he gets won't be the exact cost, but it will be *about* that. Tell her/him that the word *about* shows that the amount you say is just an estimate.

• Using the estimated total, ask your child: "If the groceries cost $16 and I have a $20 bill, how much change should the checker give back to me? If the cost is $17.25, what coins is the checker likely to give me?"

• At the checkout counter, ask your child to watch as the items are rung up. What's the actual total cost of the groceries? How does this amount compare to the estimate? When you pay for the items, will you get change back from your $20 bill, or will you have to give the checker more money?

• If you receive change, have your child count it to make sure the amount is correct.

Sorting, Matching, Classifying, and Estimating

Sorting and matching activities introduce young children to many mathematical concepts including classification and measurement and estimation. Filling empty containers provides opportunities to explore concepts such as "more or less" and volume.

Pre-School-Kindergarten

Sort It Out

• When you're sorting and folding clean laundry, have your child join you and do things similar to the following:

- Hold up a pair of matching socks that belong to her/him and say, for example, "These socks go together because each sock is red and each one fits the same size foot—yours!"
- Pick up another sock and ask your child to look through the pile for the sock that matches it. When a sock is chosen, have your child tell you how she/he knows it's the right one. Continue holding up socks until your child has paired them all.
- After you've done this activity several times, let your child choose the socks for you to pair. (Occasionally choose a wrong sock to give her/him the chance to help you correct your mistake!)

• Have your child help you sort the laundry to be washed. Ask her/him, for example, to put all the blue things together, all the whites, all the towels and so forth. You might also ask your child to count as the sorting takes place. How many towels are there? How many shirts? Try saying, "I count five shirts. Is that right?" Then have your child count aloud the number of shirts. From time to time, give an incorrect number so that she/he can count the items one by one and show you that you've made a mistake.

A Weigh We Go!

• At the grocery store, show your child two objects, such as a five-pound bag of sugar and a 10-pound bag of potatoes, and ask her/him to guess which weighs the most. Show her/him how to use a scale to weigh the objects and see if the guess is right or wrong.

Grades 1 - 2

Fill It Up

• On a table, put four large glasses of equal size and shape in a row. Fill them with water as follows: 1/3 cup, 1/2 cup, 3/4 cup, 1 cup. Ask your child questions that encourage her/him to compare, estimate and think about measurement. Ask, for example, "Which glass has more water? Which has less?"

• Pour more water into one of the glasses to make it equal to the amount of water in another glass. Move the glasses around so that the glasses that have the same amount of water are not next to each other. Ask your child to find the glasses that have the same amount of water.

• Help your child do math in her/his head. Ask questions such as, "If I have four cups of water and I need seven, how many more do I need to pour?"

Grades 1 - 5

Put It Away

• Make a game out of putting away the groceries. As you empty the bags, group the items according to some common feature. You might, for example, put together all the items that go in the refrigerator or all the items in cans.

• Tell your child that you're going to play "Guess My Rule." Explain that in this game, you sort the items and she/he has to guess what rule you used for grouping the items.

• After your child catches on to the game, reverse roles and ask her/him to use another "rule" to group these same items. The child might, for example, group the refrigerator items into those that are in glass bottles or jars and those in other kinds of packaging, or into those with vegetables, those with fruit and those with soup. When the group is done, you get to guess what rule was used.

Shapes

Using objects that are familiar to young children can be a good way to introduce them to differences in shapes and to classification. Learning about symmetry gives children a good sense of geometric concepts and calls on their mathematical reasoning abilities. A shape is symmetrical if it can be cut along a straight line into two halves that are mirror images of each other.

Pre-School-Kindergarten

Shape Up

• Fill a bowl with snack crackers in shapes such as circles, triangles and squares. Point to a cracker and say, for example, "Look, this one's round. This one has three sides. See, 1-2-3. This one has four sides. Let's count them—1-2-3-4." Place a circular cracker on the table and ask your child to find other crackers that have the same shape. Continue with the other shapes.

• As you make sandwiches, cut the bread into circles, squares and triangles so that you have two each of each shape. Ask your child to match the pairs of shapes to make Shape Sandwiches.

• Ask your child to search for and point out different shapes on her/his clothes or in the room.

Grades 3 - 5

Simply Symmetrical

• Cut some shapes, such as a circle, a square, and a rectangle that is not a square from some heavy paper. As your child watches, show her/him the square that you've made. Fold it in half and show her/him that the two parts are exactly alike—or *symmetrical*. Do the same with the circle and the rectangle. Then give the shapes to your child and ask her/him to make the folds. Extend the activity by doing the following:

- Find as many ways as possible to fold half of the square onto the other half.
[There are four ways: two diagonals and two lines "down the middle"]
- Do the same for the rectangle that is not a square.
[There are only two ways: down the middle of the long side, then down the middle of the short side.]
- Do the same with the circle.
[Circles can fold along any diameter. You can also use this activity to introduce your child to the word "diameter"—the length of a straight line that passes through the center of a circle.]
- Ask your child to find the center of the circle by folding it in half twice.
[Any diameter passes through the center of the circle, an idea that will prepare your child for understanding more complicated geometry later on.]

• Show your child a rectangular piece of paper. Ask, "What shape will you get if you fold this piece of paper in half?" Have her/him fold the paper, then ask, "Did you get a square or another rectangle?" Using scissors to cut the paper, show her/him that a rectangle will fold to a square only if it is twice as long as it is wide.

• Fold a sheet of paper in half lengthwise. Have your child draw half of a circle, heart or butterfly from top to bottom along the fold on each side of the paper. Have her/him cut out the shapes that were drawn. Unfold the paper to see the symmetrical figure.

• With your child, explore your house for symmetrical designs—things that have equal sides. Ask your child how many she can find. Tell her/him to look at wallpaper, floor tiles, pictures, bedspreads, and appliances.

• Have your child print the alphabet. Then ask her/him to find a letter that has only one line of symmetry—only one way to be divided in half.

[B has one.]

Ask her/him to find a letter that has two lines of symmetry—two ways to be divided in half. *[H has two.]* Ask which letters look the same when they're turned upside down?

[H, I, N, O, S, X, and Z.]

Money!

Activities that involve money are a good way to develop mathematical reasoning and to reinforce what children are learning in school about numbers and addition and subtraction.

Kindergarten – Grade 1

Penny, Nickel, Dime

• You will need dice, pennies, nickels, and dimes and several family members. Have each player roll the dice and say the number. Then give the player that number of pennies. Explain that each penny is worth one cent. When a player gets five pennies, replace the pennies with a nickel. Explain that five pennies have the same value as one nickel—that is, five cents. When she/he gets five more pennies, replace the pennies and the nickel with a dime. Help her/him to see that the value of five pennies plus the value of a nickel equals 10 cents, which is the value of a dime. The first player to reach a set amount—25 or 50 cents, for example—wins.

Grade 1 – 2

Clip and Save

• You will need pennies, nickels, dimes, quarters, grocery store coupons, and pencil and paper. Show your child a grocery store coupon for a product that she/he likes to eat. Have your child count out the coins to show how much money the coupon saves on the product. For example, if the coupon is for 30 cents off a jar of peanut butter, give your child nickels and dimes and tell her/him to count out three dimes or six nickels. Give your child all the coins and challenge her/him to figure out how many different coin combinations she/he can make to total 30 cents.

• Ask your child how much money you can save with two or three 20-cent coupons. Show her/him the other coupons and ask how much money could be saved with each one. Have her/him write the amounts and then add them to show how much could be saved if all the coupons were used.

Grade 2 – 5

What Coins Do I Have?

• You will need coins of different denominations, paper, and pencil. Choose coins so that your child can't see, then hold out your closed hand and ask questions such as the following:

- I have three coins in my hand. They're worth 7 cents. What coins do I have? *[a nickel and 2 pennies]*
- I have three coins in my hand. They're worth 16 cents. What coins do I have? *[a dime, a nickel, a penny]*
- I have three coins in my hand. They're worth 11 cents. What coins do I have? *[2 nickels and 1 penny]*
- I have three coins in my hand. They're worth 30 cents. What coins do I have? *[3 dimes]* Ask your child to tell you how she/he knows the answer.

• Make the game more challenging by asking questions that have more than one answer:

- I have six coins in my hand. They're worth 30 cents. What coins could I have? *[1 quarter and 5 pennies or 6 nickels]*
- I have coins in my hand that are worth 11 cents. How many coins could I have? *[2—1 dime and 1 penny; 3—2 nickels and 1 penny; 7—1 nickel and 6 pennies; 11—all pennies]*

Again, ask your child to tell you how she/he knows the answer.

Chapter 14
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