



**H**ELPING  
YOUR CHILDREN  
LEARN AND ENJOY  
MATHEMATICS

# MATH *at* HOME

- **MAKING MATH PART OF YOUR FAMILY'S LIFE**
- **GIVING YOUR CHILD A GOOD START IN MATH**
- **DISCOVERING THE MATH IN YOUR HOME**
- **UNDERSTANDING THE MATH STANDARDS**
- **HELPING WITH MATH HOMEWORK**
- **BUILDING A MATH TOOL-KIT**
- **TAKING A LOOK AT HIGH SCHOOL MATH**

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## **ABOUT THIS PUBLICATION**

*Math at Home: Helping Your Children Learn and Enjoy Mathematics* was developed by the Sonoma County Office of Education. The text was written by Paul Giganti, Jr. of Paul Giganti & Associates, Mathematics Professional Development and Consulting. Suzanne Gedney served as editor. Art design services were provided by Sue Schreiner, with photography by Patty Bernstein. The publication was first distributed in September 2001, then reissued in March 2002 in both English and Spanish.

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## **ABOUT THE SONOMA COUNTY OFFICE OF EDUCATION**

“Fostering student success is a key phrase for our county office of education,” says Sonoma County Superintendent of Schools Tom Crawford. “It describes who we are, what we do, and why we exist.”

As one of 58 county offices of education in California, the Sonoma County Office of Education (SCOE) provides leadership, support, and fiscal oversight to all school districts in Sonoma County. In these 40 districts, there are 163 schools and over 73,000 students.

The Sonoma County Office of Education supports local districts in building strong, effective educational systems. In particular, the County Office offers services to help districts operate cost-effectively and provides assistance to schools so that all students receive the best possible education. Under the direction of the elected county superintendent of schools, the Sonoma County Office of Education:

- Provides classroom instruction for students with special needs;
- Assists schools in improving instruction and achievement;
- Offers centralized services such as budget management, media and technology resources, staff development, and legal services;
- Supports and supervises districts in complying with state law;
- Leads and organizes efforts to bring increased educational resources to Sonoma County.

The Sonoma County Office of Education also initiates projects to engage parents and the community in the education of children. Increasing public awareness of what students are learning in schools today has been a particular priority.



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## A MESSAGE TO PARENTS

It's common knowledge that young children whose parents read to them have a tremendous advantage in school. But did you know that you can also help your children learn mathematics by doing and supporting math at home?

Today, mathematics is more critical to school success than ever before. The mathematics students need to learn and the state tests they are required to take are very demanding. The high standards our state has set for mathematics education reflect the importance of math in both college and careers. Modern occupations now require a firm foundation in mathematics—and that's true for almost any type of job your children will consider in the future.

How you encourage and promote your children's math learning, from preschool to high school, can be pivotal to their attitude toward mathematics and their achievement in this subject area. Even if you haven't studied mathematics in depth yourself, you *can* assist your children. Something as simple as expecting your children to be capable in math can make a difference in their mathematics learning.

This booklet is designed to give you ideas and resources to support your role in your child's math education. The information you'll find in the pages that follow comes from a variety of sources and represents today's best thinking about how to help children learn mathematics. The goal in publishing the booklet is two-fold: to encourage stronger, more informed parent support for math education and to increase the mathematics achievement of our region's students.

The Sonoma County Office of Education brings this booklet to you in the hope that you and your family will find it to be a valuable, informative, and useful resource.



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## MAKING MATH PART OF YOUR FAMILY'S LIFE

Every child and adult needs to know and understand mathematics. It's part of our everyday life. We all “do math.” We count money, measure things, sort from biggest to smallest, know how many miles it is into town and how long it takes to get there. At work, we may use spreadsheets, a calculator or adding machine, a cash register, or a precision measuring tool. The list goes on and on.

Children are taught mathematics in school, but research shows that families are an essential part of this learning process. In other words, by doing math with your children and supporting math learning at home, you can make a great difference.

There are many ways to make math part of your family's life. As you establish your own traditions for supporting your children's math learning, consider the following checklist of key ideas.

**ALWAYS TALK ABOUT MATH IN POSITIVE WAYS**

Regardless of your own mathematics background, let your children know that learning math is very important. Communicating a positive, can-do attitude about math is the single most important way for you to ensure that your children are successful in mathematics. Always be positive when you talk about math—never tell your children that math is too hard or that you hated it when you were in school. Let them know how critical math is by pointing out how people use math in everyday life. Encourage them to always do their very best in this subject area.

**KNOW WHAT YOUR CHILDREN ARE STUDYING IN MATH**

Be aware of the math your children are learning each year and know the standards they're required to meet. Ask them what they're studying in math class, regularly check in with them about math homework, and help them with school projects when it's appropriate. If your children experience difficulties in their math learning, work with them to overcome these trouble spots. (Some strategies for helping with math are provided on page 12.) Don't hesitate to talk with your child's teacher if you need more information or assistance.

□ **HAVE HIGH EXPECTATIONS FOR YOUR CHILDREN**

Research shows that when you believe your children can learn challenging concepts, they will rise to the occasion—so expect a lot from them! Be confident that your children can learn mathematics and then actively support them as they do so. Seek out math-focused programs and activities for them. As they get older, encourage them to study algebra and to take as many advanced mathematics courses in high school as possible.

□ **ENCOURAGE YOUR CHILDREN TO USE TECHNOLOGY IN MATH**

Help your children use calculators, computers, and the Internet to do math at home. Mathematics and technology are great partners. Tasks such as long and complex calculations, charts, tables, graphs, and spreadsheets show the power of using mathematics and technology together. Doing tasks that involve math and technology helps prepare your children for the future.

□ **MAKE MATH AN EVERYDAY PART OF YOUR FAMILY**

Find math at home. (The information on page 6 provides some ideas on how to do that.) Spend time with your children on simple board games, puzzles, and activities that involve math. Involve your children in activities like shopping, cooking, and home fix-it projects to show them that math is practical and useful. Encourage your children to solve problems that involve math. Engage your children in conversations about what they're thinking about when they solve math problems. Find opportunities to explore math together.



*Sandy Ngaophasy*

□ **NOTICE MATHEMATICS IN THE WORLD**

You can help your children see the usefulness of mathematics by pointing it out wherever you see it—not just in your home, but *everywhere*. Tell your children about the math you do in your job and why it's important. When you're outside your home, look hard for ways to point out math: What shape does that tree look like? How many more miles before we get there? How does mathematics figure in sports, music, car building, or the design of a Ferris wheel? If you start looking for math in the world, you'll find more and more of it—and so will your children.



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## GIVING YOUR CHILD A GOOD START IN MATH



*Steven Allen*

**Y**oung children begin learning math before they take their first step into a kindergarten classroom. When toddlers hold up three fingers and ask for “this many cookies,” they are already doing math and ready to learn more.

As a parent, it may be tempting to think you don’t need to worry about helping your child learn mathematics until elementary school, but the seeds of many important math concepts are planted when children are very young. In fact, early experiences can determine how your child looks at mathematics for the rest of his or her life. It’s never too early to start learning—and liking!—math.

Children between the ages of two and four generally experience mathematics through simple counting. Counting is a basic and very important concept that helps children bring order to the world around them. Early counting and “how many” experiences introduce children to math concepts that become deeper and more complex in elementary school. For example, counting three dimes becomes a way of understanding 30 cents.

The more opportunities young children have to count, the better they understand the meaning and use of numbers—and the more confidence they’ll have with mathematics later on. By reading your young child counting books, singing counting songs, and playing counting games, you’re having fun with numbers and giving them a foundation for success in math.

### HERE ARE SOME TIPS FOR PARENTS OF YOUNG COUNTERS:

- Count frequently. Find things to count every day, everywhere, and in every way. Start slowly with just a few things. As your child’s ability to count grows, find bigger and bigger collections of different things to count.
- Count real objects: cookies, coins, toys, etc. Child-

ren discover that counting is more than a sing-song repetition when they count real objects. Encourage your child to say one number as he or she

## THE COUNTING GAME: A FUN ANYTIME MATH ACTIVITY

The Counting Game is so simple it can be played by young children, yet so mathematically intriguing it can challenge older children as well. It's a perfect "anywhere, anytime" game. Anyone who can count to 20 can play it. Here's how it goes:

1. Two people take turns counting aloud. The first person starts at ONE and the game is over when the counting reaches TWENTY.
2. Each player counts aloud by saying one, two, or three numbers *in order* from where the other player stopped counting.
3. Whoever says the number TWENTY, by itself or in a group of numbers, is the winner.

For example:

<i>Player One</i>	<i>Player Two</i>
1, 2, 3	4
5, 6	7, 8
9, 10, 11	12
13, 14	15, 16
17	18, 19, 20!

At first glance, the game seems like a simple way for young counters to practice—but there's actually more to it than that. If you play this game with an older child, you'll both start to see number patterns and discover that there's a strategy for winning. (Hint: it has to do with the multiples of 4.)

You can play four or five rounds of the Counting Game quickly—so play it often to give your child a chance to figure out the winning strategy. Later on, try modifying the rules of the game by having a different winning number, such as TWENTY-ONE, and see what happens.

touches each object. Arrange objects in different ways for counting—for example, in piles, rows, and circles.

- Reinforce your child's counting. When your child finishes counting, you could say, "One, two, three cookies. You counted three cookies." To correct a mistake, gently count again along with your child, holding a finger and touching each cookie as you say the number.
- Sometimes children forget which cookies they've counted. If this happens, have your child move each cookie into a "counted" pile as he or she counts. If your child gets frustrated or continues repeating the same mistake, be patient. For the moment, you could simply stop counting and try it again another day.
- Don't worry if your child uses his or her fingers for counting. Fingers are the best mathematical tools children have! They're always handy and ready to use. You can also encourage your child to use other objects to keep track of their count: one bean for every letter in their name or one popsicle stick for each door in your home.
- Once your child has mastered basic counting, start practicing how to count by twos, fives, and even tens. This will give your child a great start for learning math in school.



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## DISCOVERING THE MATH IN YOUR HOME

**M**ath is everywhere! It's in the world that surrounds us, it's in nature, and it's in your home, both inside and out. By pointing out the math in everyday life, you can help your young child learn some basic concepts and understand why math is so important.

If your child is in kindergarten or one of the early primary grades, you can really reinforce the math they're being taught in school with practice at home. Math at home doesn't have to happen sitting at a desk. During playtime, on a walk, while you're fixing dinner, or when your child is just looking for something to do—these are all great opportunities to suggest a math activity. Here are a few ideas that will help your children discover—and use—the math around them.

### **IN A PLAY AREA, YOUR CHILD CAN:**

- Count blocks as he or she builds a tower.
- Sort toys by size, kind, or color.
- Put dolls, cars, or blocks in order from largest to smallest.
- Play “What am I thinking of?” by describing a toy's size and shape.
- Play make-believe “store” with toys and favorite objects.

### **IN THE KITCHEN, YOUR CHILD CAN:**

- Look for familiar two-dimensional shapes—circles, squares, triangles, etc.—like a round plate or square napkin.
- Put cans of food in order by size or type.
- Sort silverware from the dishwasher to the drawer.
- Count plates, utensils, cups, or even olives.
- Divide a plate of cookies evenly so that each family member gets an equal share.
- Find how many glasses of milk are in a full milk carton.
- Help you double a recipe, or cut one in half.

**AROUND THE HOUSE, YOUR CHILD CAN:**

- Count the days on a calendar until a special event.
- Find the length and width of a room by pacing it off.
- Draw a diagram of how to rearrange furniture in a room.
- Make a “map” of the whole house.
- Create a family TV schedule and track the amount of time watched.

**OUTSIDE THE HOUSE, YOUR CHILD CAN:**

- Set up and operate a lemonade stand.
- Plant a garden with rows and columns of seeds.
- Count the petals on different flowers.
- Measure a sunflower or bean plant daily, keeping track of how it grows.
- Count how many times he or she can jump rope or shoot baskets in a row.
- Keep a daily chart of the temperature.
- Find triangles, squares, circles, and rectangles around the neighborhood.



*Rebecka Craig*

## CONNECTING MATH AND READING

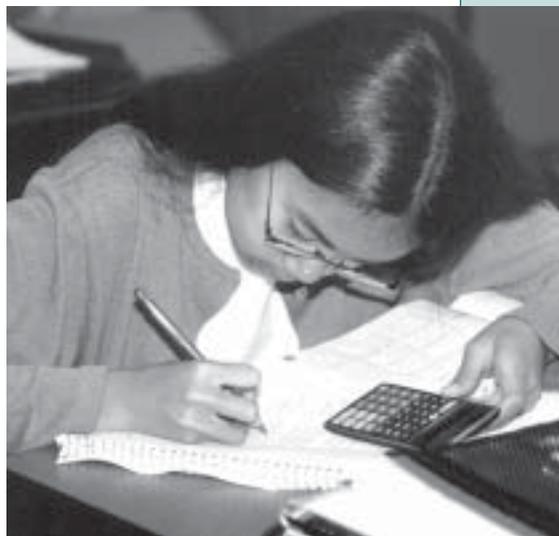
When children's books have math themes, reading becomes an opportunity to both enjoy a good story and think about math. Take the opportunity to explore math concepts while reading together at home! The books listed here artfully combine reading and math. They are appropriate for kindergarten through fourth-grade readers.

*12 Ways to Get to 11*, by Eve Merriam  
*17 Kings and 42 Elephants*, by Margaret Mahy  
*Alexander, Who Used to Be Rich Last Sunday*, by Judith Viorst  
*Anno's Counting Book*, by Mitsumasa Anno  
*Anno's Math Games*, by Mitsumasa Anno  
*Anno's Mysterious Multiplying Jar*, by Mitsumasa Anno  
*Bunches and Bunches of Bunnies*, by Louise Mathews  
*The Button Box*, by Margarete S. Reid  
*Caps for Sale*, by Esphyr Slobodkina  
*A Cloak for the Dreamer*, by Aileen Friedmann  
*Counting on Frank*, by Rod Clement  
*The Doorbell Rang*, by Pat Hutchins  
*Each Orange Had Eight Slices*, by Paul Giganti  
*Eating Fractions*, by Bruce MacMillan  
*Frog and Toad are Friends*, by Arnold Lobel  
*G is for Googol*, by David Schwartz  
*A Grain of Rice*, by Helena Clare Pittman  
*Grandfather Tang's Story*, by Ann Tompert  
*The Greedy Triangle*, by Marilyn Burns  
*How Big is a Foot?*, by Rolf Myller  
*How Many Feet in the Bed?*, by Diane Hamm  
*How Many Snails?*, by Paul Giganti  
*How Much is a Million?*, by David Schwartz  
*I Can Count the Petals of a Flower*, by John and Stacey Wahl  
*If You Made a Million*, by David Schwartz  
*The King's Chessboard*, by David Birch  
*Math Curse*, by Jon Scieszka and Lane Smith  
*Mr. Archimedes' Bath*, by Pam Allen  
*One Hundred Hungry Ants*, by Elinor J. Pinczes  
*Only One*, by Marc Harshman  
*The Phantom Tollbooth*, by Norton Juster  
*A Remainder of One*, by Elinor J. Pinczes  
*Rooster's Off to See the World*, by Eric Carle  
*Round Trip*, by Ann Jonas  
*Socrates and the Three Little Pigs*, by Mitsumasa Anno  
*The Tangram Magician*, by Lisa Campbell Ernst and Lee Ernst  
*Ten Black Dots*, by Donald Crews  
*The Very Hungry Caterpillar*, by Eric Carle  
*What Comes in 2's, 3's & 4's?*, by Suzanne Aker

## LINKING TECHNOLOGY TO MATH

Technology and mathematics can be great partners! When used appropriately, technology can extend and develop your child's math learning. Here are some thoughts about how technology might figure in your child's mathematics learning.

- Calculators, adding machines, and computers are routinely used as math tools by adults and your child will, at some point, want to use these tools. But there's a correct time and place for technology. Children must learn how to decide when technology is the right tool for a given math problem—and when paper and pencil should be used. They should not use technology to perform basic math. For example, if your child needs a calculator to multiply  $80 \times 4$ , he or she needs more work on basic math.
- When using calculators and other technology, determining whether or not the answer makes sense is critically important. Learning basic math facts, knowing how to estimate, practicing math procedures, and understanding the math behind real-life situations will help your child do that.
- Sometimes technology can help children focus on problem-solving procedures or see number patterns without getting bogged down by calculations. Of course, this doesn't mean that technology should be used for every math task—or that children don't need to learn how to do calculations “by hand.”
- Using technology to solve math problems is only effective if your child understands mathematical processes. In other words, a calculator doesn't help children find the solution to a “story problem” if they don't know whether the problem requires multiplication or division.
- Calculators and other technology can be helpful for children who want to check the work they've done using paper and pencil. Going back over their work and finding where errors occurred, redoing calculations as appropriate, is a great learning strategy.
- Using common software applications, like spreadsheets, can help teach children how to organize statistical information—a skill they'll use throughout their lives. The ease with which technology can turn numbers into visual charts and graphs often helps children see and understand mathematical concepts.
- For children experiencing difficulty learning math facts, software programs can provide extra drill and practice. These programs can be engaging and encourage children to enjoy math—and they are infinitely patient!
- High-tech tools can give older children new opportunities to see visual representations of complex mathematical ideas. For example, Geometer's Sketchpad helps middle and high school students learn about geometric relationships and explore geometry concepts. High school students may use graphing calculators to identify patterns in science and mathematics, then make models and predictions based on those patterns.
- Internet websites can provide students of all ages with homework help or challenge them with interactive math-focused games and puzzles. The Internet resources listed on page 19 are a good place to start looking for educational math websites.



*Amanda Gonzalez*



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## UNDER- STANDING THE MATH STANDARDS

The California mathematics standards specify the math concepts your child is expected to learn in each grade. As your child progresses through school, you'll probably find it helpful to know a bit about the standards—or, if you're interested, to explore the standards in greater depth.

All public schools are required to “teach to the standards” so that students receive a firm foundation in mathematics. School textbooks, state tests, and high school graduation requirements are now determined by the standards. They are *that* important.

Because of the state standards, the study of mathematics is now more uniform from school to school. Students at the same grade level are learning similar math skills no matter what public school they are attending. For parents, the standards provide an opportunity to know exactly what your child should be studying each year and what's required for advancement from one grade to the next.

The California mathematics standards are readily available to parents. You'll find copies of the standards in schools, at your county office of education, or on the Internet ([www.cde.ca.gov/board](http://www.cde.ca.gov/board)).

Grade-level standards with examples of math problems related to the standards are included in the *Mathematics Framework for California Public Schools*. This document is available from the California Department of Education or online at [www.cde.ca.gov/cfir/](http://www.cde.ca.gov/cfir/).

While the standards are much too long to include in this

booklet—there are hundreds of standards, grouped by grade level—knowing a little about them will help you understand their importance to your child's education. The standards are based on the belief that every student should:

1. Develop fluency in basic computational skills;
2. Develop understanding of mathematical concepts and ideas;



Photo by Ross Hause

*Olivia Kennett,  
Mitchell Monroy,  
Maurice Marchbanks,  
Terence Brown*

3. Become a mathematical problem-solver;
4. Learn to communicate using mathematical language, symbols, and graphs;
5. Reason mathematically by gathering and analyzing data and information;
6. Connect mathematical ideas and ideas in other subjects.

The standards require all students to study five mathematics topics—sometimes called “strands”—as they move from kindergarten through seventh grade. Each topic area, described below, is rich with learning opportunities. Students delve deeper into the strands as they advance through the grade levels.

- **NUMBER SENSE:** Number sense means learning to compute—add, subtract, multiply, and divide—and to understand the concepts behind those skills.

- **GEOMETRY AND MEASUREMENT:** Concepts in two- and three-dimensional geometry and measurement help students visualize and explain the world around them.

- **ALGEBRA AND FUNCTIONS:** Through algebra, students learn to translate concrete experiences into abstract equations and formulas.

- **STATISTICS AND PROBABILITY:** Statistics and probability are the mathematics of prediction, which enables students to use mathematics to plan ahead.

- **MATHEMATICAL REASONING:** Using mathematical reasoning, students bring together a variety of skills, strategies, and knowledge to solve new and unfamiliar problems in mathematics and other subject areas.

## STANDARDS: MORE THAN ARITHMETIC

Recent national and international studies have shown that students need to learn more than paper-and-pencil arithmetic to thrive in our increasingly complex and technology-rich world. Learning to use and understand step-by-step procedures to solve a variety of problems is an important part of standards-based mathematics instruction today. It is also important for students to learn how to communicate with others about numbers.

These key ideas have changed the way mathematics looks in school—so if you don’t recognize the math your child is learning, don’t be surprised.

Arithmetic skills, although still critical, are no longer enough for students who will graduate into a world marked by advances in science and technology and by changing workplace expectations. So in addition to learning arithmetic in math class, your children will be asked to:

- Solve real-life problems;
- Explain their thinking to others;
- Identify and analyze trends from data;
- Create graphs, charts, and other representations of information;
- Use modern technology to solve mathematical problems.

Instead of math worksheets, your child may have homework that is related to real life—investigating salaries, charting life expectancy, or creating a fictional personal budget. This kind of learning is strongly tied to the six key ideas that frame the state’s mathematics standards. It builds on and develops student learning in the five strands that are outlined in the standards.



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## HELPING WITH MATH HOMEWORK

**M**any parents worry about helping their children with math homework, especially as their children get older and the mathematics becomes more complex. If that's the case, here's something you'll be happy to learn: you don't have to be a mathematics expert to help with math homework.

Providing a well-lit table and comfortable chair is an important place to start. Remember, the best location for homework is not necessarily your son or daughter's bedroom. If your child studies at the kitchen or dining room table instead, you can help without having to sit down the entire time. You can assist when help is needed and still go about your own tasks. At the same time, you'll have the opportunity to keep homework time focused by giving your child support, encouragement, and gentle reminders.

A good strategy is to pass by your child's work area and periodically "check in." A quick glance will often tell you if it's time to stop and provide some extra support. When it's clear that your assistance is needed, sit down and give your child your full attention. Although it's sometimes difficult, maintaining a calm demeanor and being patient can really help your child when he or she is struggling with math.

Many parents worry about not knowing the math their children are studying. In this case, the way to provide homework help is actually quite simple: ask questions and practice careful listening. Simple generic questions can help your child gradually make sense of math, build confidence, and encourage mathematical thinking and communication. When given the opportunity to talk about math, children are often able to remember what they learned in class and see the solution themselves. A good question can open up your child's thinking about the problem at hand.

Here are some useful questions for parents to try. Remember that listening to your child's answers—and providing calm responses—is as important as the questions you ask.

**WHEN YOUR CHILD ISN'T SURE HOW TO BEGIN A PROBLEM, ASK:**

- Can you tell me what you know now? What math facts do you have?
- What do you need to find out? Can you estimate the answer?
- How might you begin? What can you try first?
- Can you make a drawing or picture to get started?

**WHILE YOUR CHILD IS WORKING ON A PROBLEM, ASK:**

- How can you organize your information? Will a list or table help?
- What would happen if ...? Show me what you did that didn't work.
- Can you explain the strategy you're using to solve this? Why did you ...?
- What could you do next? Do you see any patterns?

**WHEN YOUR CHILD FINDS AN ANSWER, ASK:**

- Does that answer make sense? Why do you think that?
- How did you get your answer? Do you think it's right?
- Convince me that your solution makes sense. Explain it in a different way.

When questions alone just won't do, another strategy for helping your child is to identify a friend or relative who knows more mathematics than you do. Find out if that person would be willing to answer an occasional phone call from your son or daughter.

The Internet is also a great resource. Here are three websites that offer homework assistance in mathematics. Explore these sites with your child and see if they provide the kind of support you need.

- BigChalk.com, [www.bigchalk.com](http://www.bigchalk.com)
- The Math Forum's Ask Dr. Math, [www.mathforum.com/dr.math](http://www.mathforum.com/dr.math)
- Tutor.com, [www.tutor.com](http://www.tutor.com)

## PROBLEM-SOLVING STRATEGIES

1. Guess and check
2. Look for a pattern
3. Make a diagram or model
4. Act it out
5. Work backwards
6. Simplify the problem
7. Eliminate possibilities
8. Make a systematic list
9. Get advice or do research
10. Sleep on it



*Jane and Steven Mathew*

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## BUILDING A MATH TOOL-KIT

**W**hen elementary and middle school students work on math, they sometimes need a little help getting organized. Math requires a few basic tools, and it can be frustrating when children are doing math homework and those tools aren't readily available.

You can encourage and support math learning at home by building a “math tool-kit” with your child. A tool-kit is a collection of just about every tool your child will need for math homework—all contained in a handy box.

To create the tool-kit, you'll want to find or purchase the following list

of supplies. All of these items can be purchased cheaply at discount or drug stores.

- **A cardboard or plastic box that closes.** A box about half the size of a shoebox will hold all the tool-kit items.
- **A couple of sharpened pencils**—one never seems to be enough.
- **Small plastic pencil-sharpener.** It's amazing how long it can take to find a sharpener if there's not one in the box.
- **One large pink eraser.** In math, mistakes are part of the learning process and the small eraser on the end of a pencil just doesn't last long enough.

- **Small pad of scratch paper.** This is helpful for figuring things out and writing down calculations that don't need to go on your child's homework paper.
- **Plastic or wooden ruler.** Make sure to get one that's marked in *both* inches and centimeters.
- **Pair of scissors.** The ones with plastic handles and metal blades are best.



Photo by Ross Hause

*Maria Rivas*

- **Glue stick.** You'll be surprised how often your child uses this for math projects.
- **Compass for drawing circles.** Get the kind that holds a real pencil. This tool is used by students in grades 4 to 8.
- **Plastic or metal protractor** for measuring angles. This tool is also used by grade 4-8 students.
- **About 20 “counters” for solving problems.** Counters can be buttons, pennies, lima beans, or any other small objects.
- **Solar-powered pocket calculator** (no batteries needed) that adds, subtracts, multiplies, and divides. This is helpful for checking work and doing complex calculations. Your child will probably begin using a calculator in fourth grade.

The math tool-kit will be more meaningful if you enlist your child's help finding the tools on a “math shopping trip.” Once home, your son or daughter can make the tool-kit their own by decorating it with stickers and cut-out pictures.

By the way, another great idea is to suggest that your child occasionally use the math tool-kit *just for fun* to draw a math picture or write a math story—even when there's no assigned homework.

## PICKING THE BEST MATH TOOL

Part of being “good” at math is choosing the right math tool for the job. What would be the best math tool (estimation, mental math, calculator, or pencil and paper) to solve each of these math problems?

1.  $3256.98 \div 78$   
 Estimation                       Mental math  
 Calculator                         Paper and pencil
2.  $500 \times 30$   
 Estimation                       Mental math  
 Calculator                         Paper and pencil
3. Which is closer to 1,000?  
 $398 + 607$  or  $292 + 655$   
 Estimation                       Mental math  
 Calculator                         Paper and pencil
4.  $312 \times 7$   
 Estimation                       Mental math  
 Calculator                         Paper and pencil

*Answers:*

1. A calculator is often the best tool for a complex division problem such as this, although upper grade students should be able to find the correct answer using paper and pencil.
2. Whenever a problem can be done quickly in your head, there should be no need for a calculator or pencil and paper. In this problem, basic knowledge of multiplication is all that's needed, so mental math is a good tool.
3. Since an exact calculation of these addition problems isn't required, this problem can be done using estimation. By “rounding off” the numbers, it's easy to tell that  $398 + 607$  is closer to 1,000.
4. For most people, pencil and paper is probably the best tool for this problem. The multiplication is not so difficult that a calculator is needed to get a correct answer quickly. Mental math would probably not be successful since most people can't hold this many numbers in their head. Finally, because an exact answer is required, estimation would not be appropriate.



HELPING  
YOUR CHILDREN  
LEARN AND ENJOY  
MATHEMATICS

## TAKING A LOOK AT HIGH SCHOOL MATH



*Stephanie Rich*

**B**eginning with the graduating class of 2004, every high school student must pass a state “exit exam” in order to graduate. The mathematics section of the High School Exit Exam is demanding—and all students will need to understand and be able to do the mathematics that is covered on this test. The test includes statistics, data analysis and probability, number sense, measurement and geometry, mathematical reasoning, and algebra.

You can help high school students be successful in math by understanding what they are required to learn and stressing the importance of working hard. Be sure your children know you have confidence in their ability to succeed in high school math classes. Continue to speak positively about math and actively support their learning.

If your child is having difficulty in a high school mathematics course, talk to the teacher, school counselor, or principal. They can recommend strategies or provide resources your child may find helpful. You might also want to explore tutoring options, after-school programs, summer school, and print

and web resources designed to provide student assistance.

To help you understand the new requirements and challenges of high school math, some key ideas are highlighted below.

### **THERE ARE NEW HIGH SCHOOL MATH STANDARDS**

High school students now experience mathematics classes that are based on new state standards. The high school standards are focused on specific *courses* rather than on the five broad topics, or strands, that frame math learning in the lower grades. There is a detailed set of standards for algebra, geometry, statistics, probability, calculus, and other courses. These standards are listed in the publication *Mathematics Content Standards for California Public Schools* and on the Internet ([www.cde.ca.gov/board](http://www.cde.ca.gov/board)).

Courses that incorporate the new standards are more rigorous and demanding of students. They're designed to prepare students for the chal-

lenges they'll face in college and careers, both of which routinely require knowledge of higher level mathematics.

### THREE YEARS OF HIGH SCHOOL MATH IS THE GOAL

Today, the traditional sequence of high school mathematics courses is algebra I, geometry, algebra II, and pre-calculus. "General mathematics" courses, which many parents remember from their high school years, are no longer offered.

All high school students must complete at least two years of math from the courses listed above. This is a graduation requirement. It's expected that the majority of schools will require a full three years of math in the very near future.

### ALGEBRA IS A REQUIRED COURSE

Satisfactory completion of an algebra course is now required by state law for graduation from high school. Algebra is considered the foundation for all higher-level mathematics, so students must master it for advancement to other classes, as well as for graduation. To ensure that students are successful in algebra, many of the beginning concepts of algebra are now introduced in the elementary and middle school years.

### AP COURSES PROVIDE ADDITIONAL CHALLENGES

If your child works hard and is successful in mathematics, he or she may have the opportunity to take Advanced Placement (AP) mathematics courses in high school. These courses offer the highest level of mathematics study available in high school and can even be counted as college credits. Taking AP math courses provides an advantage to college-bound students. Colleges and universities often give special consideration to applicants who have successfully completed these courses.

### MATH LEARNING IS TESTED PRIOR TO GRADUATION

Your child will be required to take the state's High School Exit Exam in tenth grade. Students who don't pass this test the first time will have the opportunity to take it again, in both the eleventh and twelfth grades. The mathematics portion of the test is designed to test students' grasp of the concepts outlined in the state standards through algebra I.

The High School Exit Exam is a demanding test, as these samples of the exam's math section demonstrate:

- What is the  $y$ -intercept of the line  $2x - 3y = 12$ ?
- What is the length of the hypotenuse of a right triangle with a base of 5 and a height of 12?
- Identify the graph of  $y = x^3$ .

More information about the High School Exit Exam, including additional sample problems, is available from your local high school or on the Internet at [www.cde.ca.gov/statetests/hsee/](http://www.cde.ca.gov/statetests/hsee/).

## EXERCISES, PROBLEMS, AND INVESTIGATIONS

Students don't study math exclusively by completing worksheets filled with numbers anymore. Although great emphasis is placed on learning mathematical facts and procedures, schools are also teaching students to think and communicate mathematically.

Math exercises, problems, and investigations are examples of the kinds of work students are doing in school to foster mathematics learning. The samples below illustrate how each approach leads to a different type of learning.

- **A MATH EXERCISE:** Find the area and perimeter of a rectangle with a length of 7.5 inches and a width of 4.75 inches.
- **A MATH PROBLEM:** The perimeter of a rectangle is 36 inches. What are all the possible whole number dimensions of this rectangle?
- **A MATH INVESTIGATION:** What is the relationship between the area of a rectangle and its perimeter? For a rectangle with an area of 48 square feet, what are its possible dimensions—that is, what lengths, widths, and perimeters are possible? Do all rectangles with the same perimeter have the same area? Prepare a report describing your work and your findings. Provide any charts, tables, or graphs that help explain your thinking.



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## RESOURCES TO HELP YOU AND YOUR CHILD WITH MATH

If you'd like more information about family math activities, mathematics education, or strategies for supporting your child's math learning, you'll find the following list of publications helpful. Internet websites with a math focus are also a great source of information for parents.

### PUBLICATIONS

*Adding It Up: Helping Children Learn Mathematics* (National Academy Press, 2001). This new report from the National Research Council of the National Academies will be of interest to parents who want to explore current research about mathematics education in the United States.

*Algebra To Go* (Great Source Education Group, 2000). This reference book is designed to help students when they're not clear about a math topic and need someplace to look up definitions, procedures, explanations, and rules. The book uses lots of graphics and charts, and includes test-taking strategies, tips for using graphing calculators, and more.

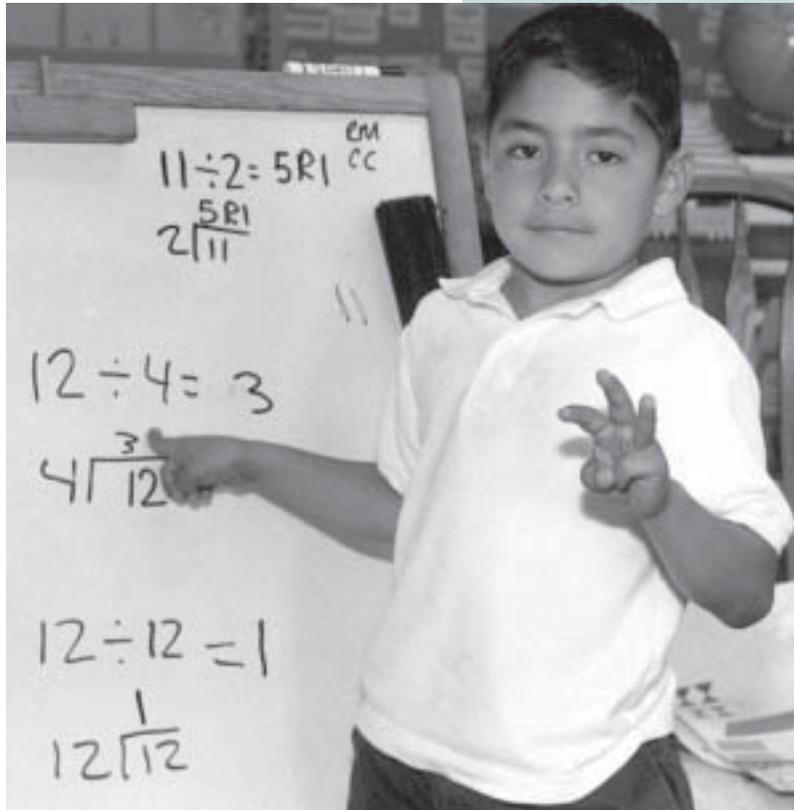
*Family Math*, by Jean Stenmark, Virginia Thompson, and Ruth Cossey (Lawrence Hall of Science, University of California, Berkeley Press, 1986). *Family Math* is a popular book with dozens of math activities that parents and children, age 8 to 12, can do together. Included are activities related to number sense, geometry, probability and statistics, and algebra. A Spanish version of the book, *Matemática Para La Familia*, is also available.

*Family Math for Young Children*, by Grace Coates and Jean Kerr Stenmark (Lawrence Hall of Science, University of California, Berkeley Press, 1997). A sequel to the first *Family Math* publication, this book was developed for families with children between the ages of four and eight.

*Family Math—The Middle School Years*, Virginia Thompson and Karen Mayfield-Ingram (Lawrence Hall of Science, University of California, Berkeley Press, 1998). The activities in this book cover algebraic reasoning and number sense and are appropriate for students in grades six, seven, and eight.

*Math On Call* (Great Source Education Group, 1998). Short definitions, examples, and lessons on over 300 mathematics concepts studied in kindergarten through eighth grade are included in this small handbook for students and parents.

*Mathematics Framework for California Public Schools, Kindergarten to Grade 12* (California Department of Education, revised 2000, available online at [www.cde.ca.gov/cfir/](http://www.cde.ca.gov/cfir/)). Grade-level standards, examples of math problems related to the standards, and information on how schools can build successful mathematics programs are included.



*Bryan Roman*

#### **INTERNET SITES**

The California Department of Education's *Standards and Assessment Division* ([www.cde.ca.gov/statetests](http://www.cde.ca.gov/statetests)) has up-to-date information about the state High School Exit Exam and sample questions from the exam.

*The California State Board of Education* website ([www.cde.ca.gov/board](http://www.cde.ca.gov/board)) provides access to the Board-adopted academic content standards in mathematics.

*Figure This!* ([www.figurethis.org](http://www.figurethis.org)) includes a collection of math challenges for middle school students and their families. Each challenge comes with a hint and the complete solution, along with related information and questions to think about.

*The Math Forum's Student Center* ([www.mathforum.com/students](http://www.mathforum.com/students)) hosts "Ask Dr. Math" and has weekly/monthly math challenges, Internet math hunts, and math resources organized by grade level.

*Math is Power* ([www.mathispower.org](http://www.mathispower.org)), from the National Science Foundation, provides an arcade of math problems for students and resources for parents.

*The Sonoma County Office of Education* ([www.scoe.org](http://www.scoe.org)) links students to Internet sites that provide homework help and web-based math resources. Go to the Resources section of the SCOE site.

## FIGURE *it* OUT



# A FEW MATH CHALLENGES FOR YOUR FAMILY

**THIRTY-TWO PEOPLE ENTER A PING-PONG TOURNAMENT.** When a person loses a game, he or she is eliminated from the contest. How many games must be played to figure out who is the best Ping-Pong player?

**A HOLLOW BOX IS MADE ENTIRELY OF ONE-INCH CUBES GLUED TOGETHER.** All of its sides and its top and bottom are formed by these cubes. The walls of the box are only one block thick. If the box measures 6" x 5" x 4", how many one-inch cubes are needed to build it?

**AT A FIRE SCENE, A FIREMAN STOOD ON THE MIDDLE STEP OF A LADDER** to shoot water onto the flames. When the smoke cleared, he went up three steps. A sudden burst of flames forced him to go down five steps. A few minutes later, he climbed up seven steps and worked there until the fire was out. Then he climbed the seven remaining steps and entered the building. How many steps does the ladder have?

**A RANCHER HAS 48 METERS OF FENCING TO BUILD A CORRAL FOR HIS COWS.** Since his property is bordered by a river, what is the biggest rectangular area he can fence if he uses the river as one side of the corral?

**AT A PARTY ATTENDED BY 12 FRIENDS,** the activities begin with every person shaking every other person's hand once (and only once). How many handshakes take place?

**OSGOOD SMART GLUED TOGETHER 125 SMALL CUBES** to make one big solid cube, then he painted all six sides of the big cube bright red. Later on, he broke the big cube back into small cubes and found that some cubes had three sides painted, some cubes had two sides painted, some cubes had one side painted, and some cubes had no paint on them at all. How many of each color variation did he have?

**A 200-POUND MAN AND HIS TWO DAUGHTERS** (each of whom weigh 100 pounds) are standing on the bank of a river teeming with piranhas. They want to get to the other side, but their canoe can hold no more than 200 pounds. How can they get across?

**A GIANT HERO SANDWICH HAS BEEN CREATED THAT IS 30 FEET LONG.** It has been divided into four parts so that each part is one foot longer than the previous one. What are the lengths of the four pieces?

**IF YOU HAVE CHOCOLATE, STRAWBERRY, AND VANILLA ICE CREAM,** how many *different* double-dip cones can you make? Remember, some people like to eat their strawberry *before* they eat their chocolate, and some like it the other way around.



Photo by Ross Hause

Terence Brown

# MATH *at* HOME



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## **SONOMA COUNTY OFFICE OF EDUCATION**

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