

**HELPING
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**
- **UNDERSTANDING THE MATH STANDARDS**
- **HELPING WITH MATH HOMEWORK**
- **BUILDING A MATH TOOL-KIT**
- **ENGAGING ENGLISH LEARNERS IN MATH**
- **MEETING THE ALGEBRA CHALLENGE**
- **PREPARING FOR COLLEGE AND CAREER**

*A public service publication of the
Sonoma County Office of Education and
North Bay Mathematics Project*

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, pgiganti@berkeley.edu. Suzanne Gedney served as editor. Art design services were provided by Sue Schreiner, with photography by Patty Bernstein. The publication was first distributed in 2001, then revised, expanded, and reissued in 2010 through a partnership of the Sonoma County Office of Education and the North Bay Mathematics Project.

SONOMA COUNTY OFFICE OF EDUCATION

The mission of the Sonoma County Office of Education (SCOE) is to foster student success through service to students, schools, and the community. As one of 58 county offices of education in California, SCOE functions as an educational service agency and strategic partner to the



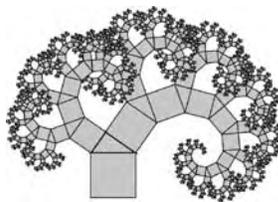
40 school districts in Sonoma County and their 175 schools.

SCOE supports local districts in building strong, effective educational systems. The agency designs and develops services to help districts operate cost-effectively, provides assistance to schools so that all students receive the best possible education, identifies new program opportunities that will benefit Sonoma County students, and works in partnership with schools and the community to improve public education. Under the direction of the elected county superintendent of schools, the Sonoma County Office of Education:

- Assists schools in improving instruction and raising student achievement;
- Provides classroom instruction for groups of students not served by local districts, including severely disabled students, wards of the court, pregnant and parenting teens, and youth who are seriously at risk of school and/or societal failure;
- Offers centralized services to districts, including fiscal accounting, library and technology resources, and staff development;
- Provides leadership and support for middle school and high school career education;
- Supports and supervises districts in complying with state law and maintaining financial solvency;
- Leads and organizes efforts to bring increased educational resources to Sonoma County;
- Initiates projects to engage parents and the community in the education of children.

NORTH BAY MATHEMATICS PROJECT

Established in 2001 with a mission of deepening teachers' understanding of mathematics and strengthening their ability to communicate mathematical concepts, the



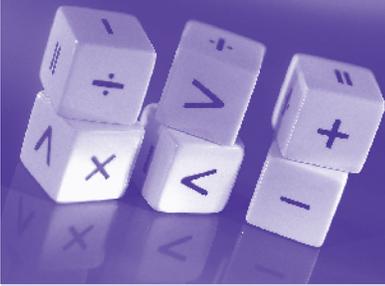
North Bay Mathematics Project (NBMP) is now an integral part of mathematics education in Northern California's kindergarten through grade 12 schools. NBMP is led by Sonoma State University mathematics faculty

and SCOE mathematics specialists, joined by faculty at Humboldt State University, elementary and secondary school administrators, and teachers from every grade level. The Project serves Sonoma, Lake, Mendocino, Humboldt, and Del Norte counties.

The goals of the North Bay Mathematics Project are to:

- Provide opportunities for teachers to increase their knowledge and understanding of mathematics;
- Design programs that meet the unique mathematics needs of schools, teachers, administrators, students, and parents;
- Provide assistance and materials that support mathematics and literacy learning among English learners;
- Assist teachers in developing effective strategies to help students understand the mathematics in the content standards;
- Identify, develop, and sustain mathematics leadership in education communities;
- Develop regional opportunities for mathematics professional development;
- Support schools and districts as they examine student data, develop assessment tools for mathematical knowledge, and work to improve instructional practices that heighten math learning.

MATH *at* HOME



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MATHEMATICS

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 and North Bay Mathematics Project bring 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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MATHEMATICS

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.

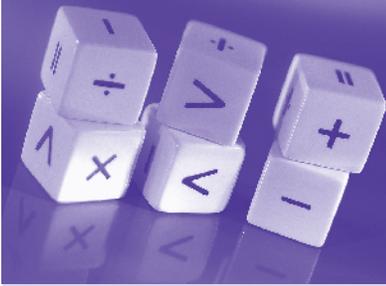
Find opportunities to explore math together.

□ **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.



MATH *at* HOME



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MATHEMATICS

GIVING YOUR CHILD A GOOD START IN MATH



Young 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 children 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. Children

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 touches

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! |

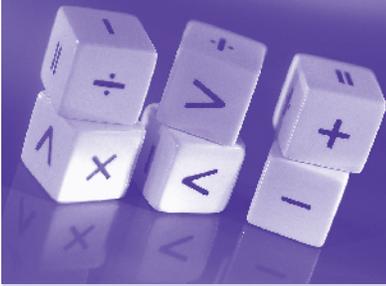
At first glance, the game seems like a simple way for young counters to practice—but there's actually more to it than that. If you play this game with an older child, you'll both start to see number patterns and discover that there's a strategy for winning. (Hint: it has to do with the multiples of 4.)

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.

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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MATHEMATICS

DISCOVERING THE MATH IN YOUR HOME

Math 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.

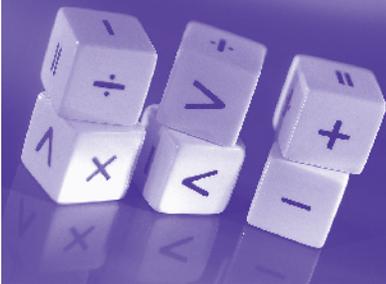
AROUND THE HOUSE, YOUR CHILD CAN:

- 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.





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MATHEMATICS

CONNECTING MATH AND READING

All parents understand the importance of reading, but have you ever combined math and reading at the same time? It's possible to put math and reading together in a meaningful way and have fun doing it. Reading books with math themes will enhance your children's enjoyment and pique their interest of both subjects simultaneously.

Reading a math-focused children's book is especially effective when you take the time to encourage your child to think about the math in the story. This means you may need to modify your approach to reading together when you choose a book with a math theme.

For example, *The Doorbell Rang* by Pat Hutchins is a delightful story about sharing cookies. You and your child will enjoy reading it from cover to cover, but you can also use it as an opportunity to do mathematics together in a comfortable, relaxed setting. Take advantage of the math situations embedded in the story by following these suggestions.

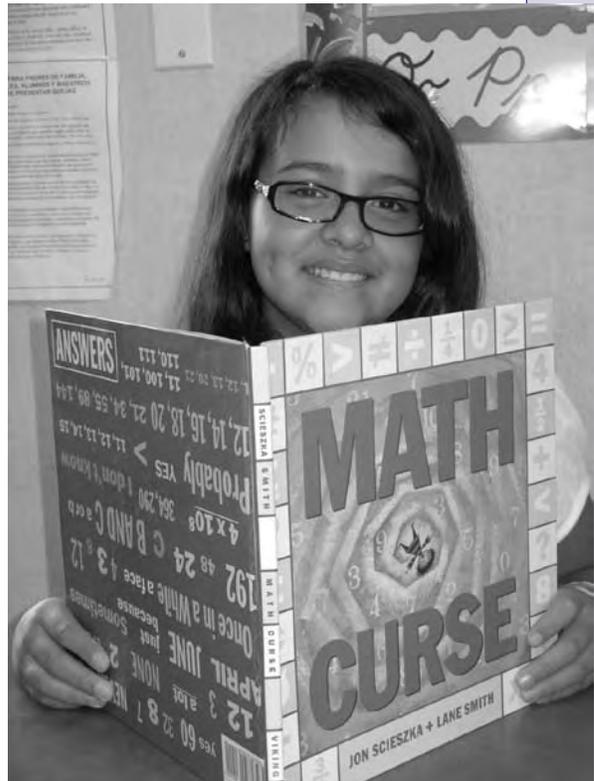
- Before beginning the book, it might be fun to bake some cookies or have a plate of store-bought cookies nearby to help your child visualize the math problems you'll be reading about—just don't eat them until the end of the story!
- Read a few pages, then pause when you come to the first math situation in the book. Ask a math-related question that anticipates what happens next. For example, "How many children have to share the cookies now?"
- Once your child solves the problem, continue reading. Stop and ask other math-related questions as long as your child stays interested. (Don't stop too often or your child may lose the story line.)
- Sometimes it's wise to skip over information that's in the book. For instance, the first math situation in *The Doorbell Rang* occurs when two children must share 12 cookies. The book reads, "That's six each" Instead of immediately reading this line, you might say, "If there are 12 cookies to begin with, how many cookies will each child get?"
- Let your child do the math (or sort the cookies you have on hand) and answer the question. Be patient and allow time to solve the problem before continuing to read. "You're right! That's six each"

This is just one example of how to combine math and reading. Children's books with math themes will give you many opportunities to stop and do math.

CHILDREN'S LITERATURE WITH MATH THEMES

When children's books have math themes, reading becomes an opportunity to enjoy a good story and think about math at the same time. 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
Amanda Bean's Amazing Dream, by Cindy Neuschwander
Anno's Counting Book, by Mitsumasa Anno
Anno's Magic Seeds, by Mitsumasa Anno
Anno's Mysterious Multiplying Jar, by Masaichiro and Mitsumasa Anno
The Button Box, by Margarete S. Reid
A Cloak for the Dreamer, by Aileen Friedman
Counting on Frank, by Rod Clement
The Doorbell Rang, by Pat Hutchins
Each Orange Had Eight Slices, by Paul Giganti, Jr.
Frog and Toad are Friends, by Arnold Lobel
G is for Googol, by David M. 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 Johnston Hamm
How Many Snails?, by Paul Giganti, Jr.
How Much is a Million?, by David M. Schwartz
If You Made a Million, by David M. Schwartz
Incredible Comparisons, by Russell Ash
The King's Chessboard, by David Birch
Math Curse, by Jon Scieszka and Lane Smith
One Grain of Rice, A Mathematical Folktale, by Demi
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
Sir Cumference and the First Round Table, by Cindy Neuschwander
Ten Black Dots, by Donald Crews
The Twenty-One Balloons, by William Pene du Bois
The Very Hungry Caterpillar, by Eric Carle
What Comes in 2's, 3's & 4's?, by Suzanne Aker





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MATHEMATICS

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 them in greater depth.

Because of our 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 attend. 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 them in schools, at your county office of education, or on the Internet (www.cde.ca.gov/be/st/ss). Grade-level standards with related examples of math problems are included in the *Mathematics Framework for California Public Schools*, which is available online at www.cde.ca.gov/ci/ma/cf.

While the standards are much too long to include in this booklet—there are hundreds, 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 understanding of mathematical concepts and ideas;
2. Develop fluency in basic computational skills;
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 with ideas in other subjects.



Photo by Ross Hause

The standards require all students to study five mathematics topics—sometimes called “strands”—as they move from kindergarten through middle school. Each topic area, described below, is rich with learning opportunities. Students delve deeper into the strands as they advance through the grade levels, then concentrate on specialized areas of mathematics in high school.

- **NUMBER SENSE:** Students develop an understanding of numbers and how they are affected by computation. Adding, subtracting, multiplying, and dividing are examples of number sense skills.
- **GEOMETRY AND MEASUREMENT:** Learning concepts in two- and three-dimensional geometry and measurement helps students visualize and explain the world around them.
- **ALGEBRA AND FUNCTIONS:** Through algebra, students learn to translate concrete experiences into equations and formulas that can be broadly applied in science, business, and a wide variety of real-world situations.
- **STATISTICS AND PROBABILITY:** Statistics and probability are the mathematics of prediction, which enables students to interpret data and draw conclusions from it.
- **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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LEARN AND ENJOY
MATHEMATICS

HELPING WITH MATH HOMEWORK

Many 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.

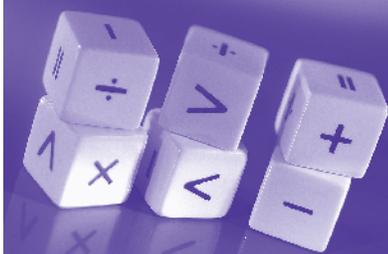


When questions alone just won't do, another strategy for helping your child is to identify a friend or relative who knows more mathematics than you do. Find out if that person would be willing to answer an occasional phone call from your son or daughter.

The Internet can also be a resource when your child needs homework assistance, although some sites charge a fee for this service. One free website that's worth exploring is Ask Dr. Math, www.mathforum.com/dr.math, which is a project of the Math Forum at Drexel University. This site has a large searchable archive of math questions and answers for students of all ages. It also invites students to submit questions if they aren't able to find the help they need.

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



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MATHEMATICS

BUILDING A MATH TOOL-KIT

When 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.



Photo by Ross Hause

- **A CARDBOARD OR PLASTIC BOX THAT CLOSSES.** A box about a foot long 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.

- **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.

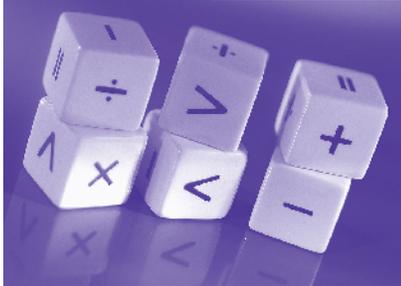
PICKING THE BEST MATH TOOL

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. 500×30
 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. 312×7
 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
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MATHEMATICS

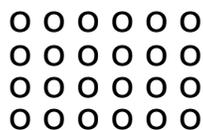
ENGAGING ENGLISH LEARNERS IN MATH

Teachers have discovered a number of techniques to supplement spoken and written math instruction in order to help English learners grasp mathematical concepts. These hands-on strategies work just as well at home as in the classroom and are great resources for parents looking to support their children's math learning. If you are the parent of English-language learners, encourage your children to use techniques like the ones described below. Remember, the more opportunities that your children have to hear, see, and respond to math situations and problems, the more likely they are to learn mathematics quickly and correctly.

DRAW PICTURES AND DIAGRAMS

Pictures and diagrams can build understanding while minimizing the language needed to communicate mathematical ideas. Many math concepts can be pictured clearly and easily in drawings that require few, if any, words. This makes using diagrams an excellent way for students with limited English to “see” math and share their mathematical thinking with others. Drawing diagrams also helps students organize their work and find solutions to math problems with greater ease.

Children don't automatically draw pictures to learn math, so it helps if adults suggest using this approach. You can also show them how to do this by drawing pictures yourself as you solve math problems. The concept of multiplication, for example, can be illustrated by drawing equal rows of circles. This drawing represents 4×6 :



The number of rows (4) multiplied by the number of circles in each row (6) tells you the number of circles (24). Children can verify that $4 \times 6 = 24$ by actually counting all of the circles in the diagram.

PRACTICE WITH BLOCKS AND BEANS

Objects that children can handle and sort can create hand-to-eye-to-brain connections that make a positive difference in learning math. In the classroom, teachers often use small blocks and plastic counters (known as manipulatives) to show students how math concepts work. At home, your children can practice simple addition, subtraction, multiplication, and

division problems using similar objects. Something as simple as dried beans can help your children learn a math concept at the kitchen table, giving them the opportunity to see what they didn't quite grasp when it was explained in words. Other objects, shapes, and puzzles can help them learn more advanced concepts, like those in geometry.

Ask your children's teachers to suggest how objects found at home can be used to reinforce what's being taught in school. You may find that your children enjoy mathematics more, and learn more, if both their hands and minds are involved.

BUILD MEANING IN REAL SITUATIONS

For many students, mathematics seems too abstract. When it can be related to things they see and do in everyday life, the concepts become real and meaningful.

The interplay of money and mathematics provides a great example. Thinking in terms of dollars, dimes, and pennies can help students learn addition, subtraction, and the base 10 system as they're used in the real world. Changing 10 pennies into a dime and 10 dimes into a dollar teaches children about "regrouping."

Learning about geometry by taking a walk around town and looking for geometric shapes is another real-world math lesson. After all, traffic signs, buildings, clocks, automobiles, and playing fields all have geometric shapes.

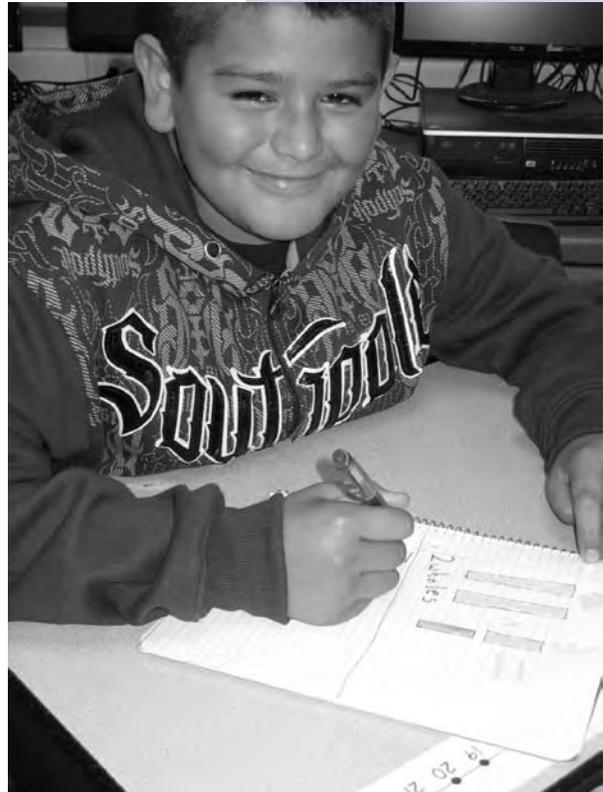
TALK AND WRITE ABOUT MATH

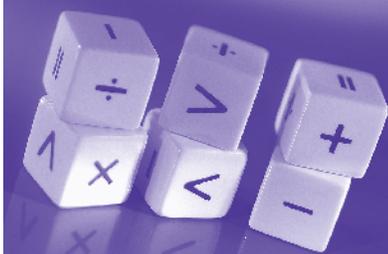
Putting math concepts into words is the most advanced math-learning strategy for students who are also learning English. Talking and writing about math may be difficult at first, but it can be rewarding! When students learn to express their mathematical ideas in words, it builds math and language skills at the same time.

Encourage your child to start slowly, then expand a little bit at a time. Here's one example, which can be done in English or your home language. Begin by asking your child draw a picture of a math situation or problem, such as "How many wheels do three tricycles have?" Then, ask your child to make up a title for the picture, like "3 Tricycles," and write it at the top of the page. If your child is young, start by simply talking about the drawing, doing the writing yourself, or taking turns writing. Gradually transition your child to doing all the explaining and writing him/herself.

Next, identify each part of the drawing and say or write a sentence to explain it: "My drawing shows that there are 9 wheels on 3 tricycles." (Make sure to use a complete sentence.) If you do activities like this regularly, your child will soon be talking and writing about every math situation!

The secret to putting math into words is that the more often children do it, the more comfortable they become in expressing their mathematical thinking. This is a very important skill for success in math throughout all grade levels.





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LINKING TECHNOLOGY TO MATH

Calculators and computers were invented to save time and allow us to solve challenging problems with greater ease. These tools are so good at this that they've become essential for doing mathematics at home and in the workplace. Technology gives us visual images of mathematical ideas, helps us organize and analyze data, and allows us to make calculations quickly, efficiently, and accurately.

Technology can also help students learn and understand mathematics. It can stimulate interest, increase problem-solving abilities, and—when used wisely—give all students increased access to math. With proper guidance, your children can use technology tools to solve difficult mathematical problems, build computational skills, and tackle real-life math problems like planning a family road trip, building a budget, or saving for a purchase.

But technology is not a replacement for learning and doing mathematics. As much as we might like technology to provide magic solutions to math problems, it doesn't do that. For technology to help us with math, we must still know how and when to add, subtract, multiply, and divide. We must understand numbers, know how to make calculations, and be familiar with problem-solving strategies. This is true for both children and adults.

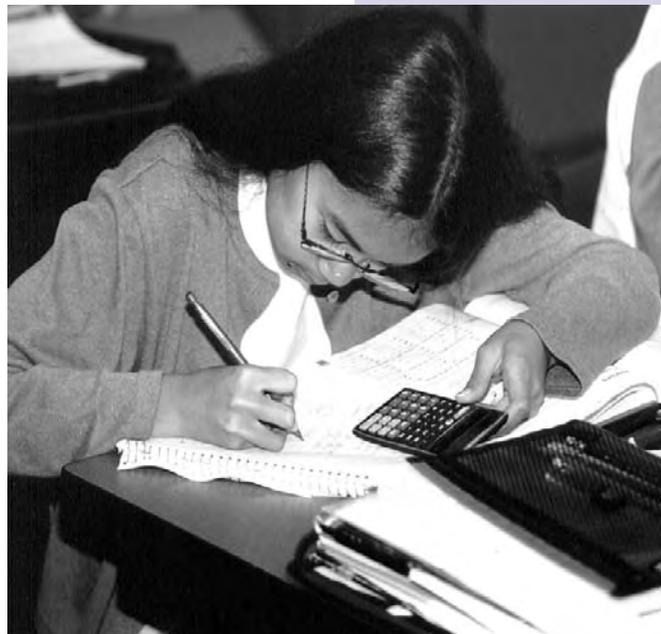
A calculator won't help your children find the solution to a "story problem" if they don't know whether it requires multiplication or division. Technology can support and develop student learning of mathematics, but it does not replace basic skills or understanding of math concepts.

Here are some thoughts about how technology might figure in your children's mathematics learning.

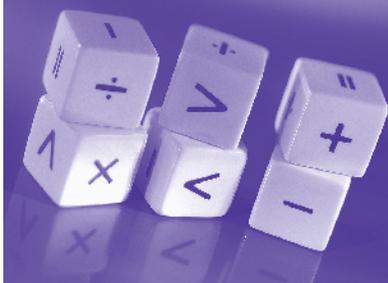
- Help your children decide which math tool is best for a given problem—technology, paper and pencil, mental math, or estimation. Help them

think and talk through the process of solving the problem. Writing the problem on paper first may make it easier to choose the best tool for solving it.

- If you have a calculator, computer, or other math tools at home, guide your children in exploring the kinds of tasks they can perform. Help them experiment, then let them play! When the time comes to choose a tool for a real math task, they'll be more likely to select the best one.
- When using calculators and other technology, determining if 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 children do that.
- Sometimes a calculator or computer can help children focus on problem-solving procedures or see number patterns without getting bogged down by calculations. These tools and other specialized technologies can also assist students who have special needs or physical challenges become more engaged in math.
- For children struggling to learn math facts, software and online programs can provide extra drill and practice. Most of these programs are engaging, move at the student's pace, and give immediate feedback. They can be very helpful, but parents are cautioned not to put too much emphasis on math drills.
- High-tech tools can give older children opportunities to see visual representations of complex mathematical ideas. For example, spreadsheet software can help students organize statistical information, turn numbers into visual charts and graphs, identify patterns in science and math, and make predictions based on the information they compile.
- Graphing calculators are great tools for high school students, allowing them to pose "what if" questions and see what happens when a single variable is changed and everything else remains the same. Because these calculators can produce 20 graphs in the time it takes to plot just one with paper and pencil, it encourages students to thoroughly explore mathematics situations.
- Internet websites can provide students of all ages with math instruction, homework help, or challenging interactive math-focused games and puzzles. The Internet resources listed on page 27 are a good place to start looking for educational math websites.



MATH *at* HOME



HELPING
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MEETING THE ALGEBRA CHALLENGE

Algebra is important! Right now, this course represents the greatest challenge in mathematics education for students, teachers, schools, and districts. That's because the goal for California is for *all students* to learn algebra and master the new way of thinking about mathematics that it requires.

Reaching the goal of “algebra for all” means that students and teachers will have to work hard, but that’s not all. Parents and guardians must provide active support for algebra learning, beginning in kindergarten and continuing through high school.

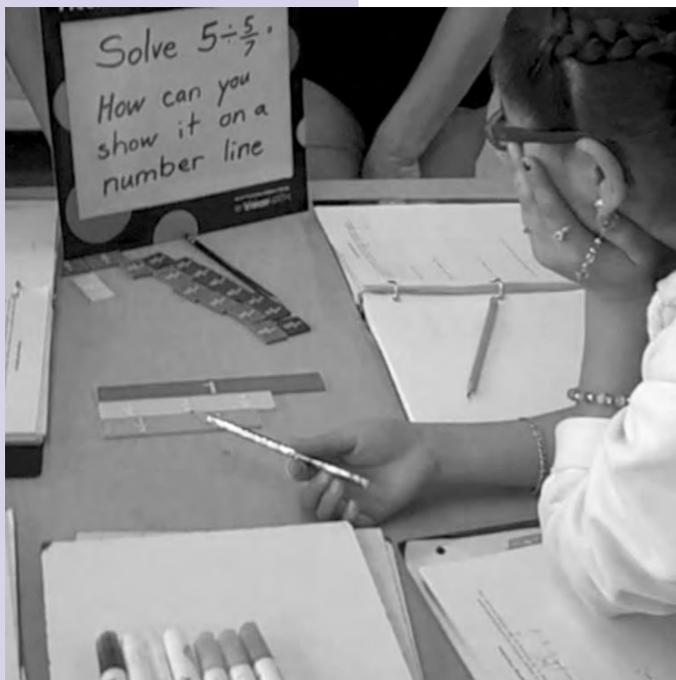
Because of increased international competition and a growing body

of research about college readiness, our state’s mathematics standards specifically require that all students be taught algebra. This instruction starts in kindergarten, when “pre-algebra” ideas are first introduced. Students continue to develop pre-algebra skills through seventh grade, then take the rigorous and comprehensive algebra I course in grade 7, 8, or 9. All students must pass this course before advancing to most other high school math classes—and before they can graduate. Completion of algebra I is a high school graduation requirement.

Algebra is only one aspect of mathematics that students are required to study, but it presents a unique challenge for many learners. Although it can be a struggle, succeeding in algebra I is crucial. Students who master algebra are more likely to go

to college, so it is well worth the extra study time it may require.

Algebra is used in almost all other areas of mathematics, including measurement, statistics, probability, problem solving, and geometry. Just as important, you’ll find it plays a part in most careers, from engineering,



research, and architecture to business, computer technology, and all of the sciences—even plumbing and auto repair. This is why high schools and colleges view algebra as essential for every student.

While teaching algebra is the primary responsibility of mathematics teachers, parents also play a significant role. You aren't expected to teach algebra yourself, but you can help by understanding its importance, supporting your children as they learn pre-algebra skills in elementary and middle school, and giving them encouragement and moral support when they advance to algebra I.

BUILDING A STRONG FOUNDATION FOR ALGEBRA

What do your children need to learn in elementary and middle school to ensure later success in algebra? Mathematics educators have identified three areas of study that provide a critical foundation.

- **FLUENCY WITH WHOLE NUMBERS:** This means that your children should develop a strong “number sense” and be able to add, subtract, multiply, and divide whole numbers with ease. They should also be able to quickly recall math facts, estimate calculations, and solve whole-number problems.
- **PROFICIENCY WITH FRACTIONS:** Your children should learn to work with and compare fractions, decimals, and percentages. This includes being able to add, subtract, multiply, and divide fractions and use them in problems involving rates, proportions, and probability.
- **UNDERSTANDING OF GEOMETRY AND MEASUREMENT:** Preparation for algebra should also include the ability to analyze two- and three-dimensional shapes, understand proportional relationships, and find unknown lengths, angles, and areas.

These three broad topics don't represent the complete mathematics curriculum leading up to algebra, but they are essential components. As your children are introduced to these concepts and study them in greater depth throughout the grade levels, you can assist by making sure they grasp key ideas and learn to solve related problems. If they struggle, seek assistance as soon as possible as each step of math instruction builds on previous knowledge and skills.

WHAT IS ALGEBRA?

Algebra generalizes mathematical ideas by using letters or symbols for numbers in equations. It is a language of variables, operations, and formulas.

$3 \times 4 = 12$ IS NOT ALGEBRA.

This is not an algebraic equation because 3 and 4 are specific numbers that give one and only one correct answer when multiplied.

$X + Y = 100$ IS ALGEBRA.

This is an algebraic equation where X and Y can represent many different numbers that, when added together, total 100.

Algebra is often used to state mathematical generalizations, such as the laws of physics that determine whether bridges and buildings stand or fall. Algebra allows us to discover important patterns in nature and express those patterns in equations that are universal and can be used in problem-solving situations.

MATH *at* HOME



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TAKING A LOOK AT HIGH SCHOOL MATH

Beginning 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,

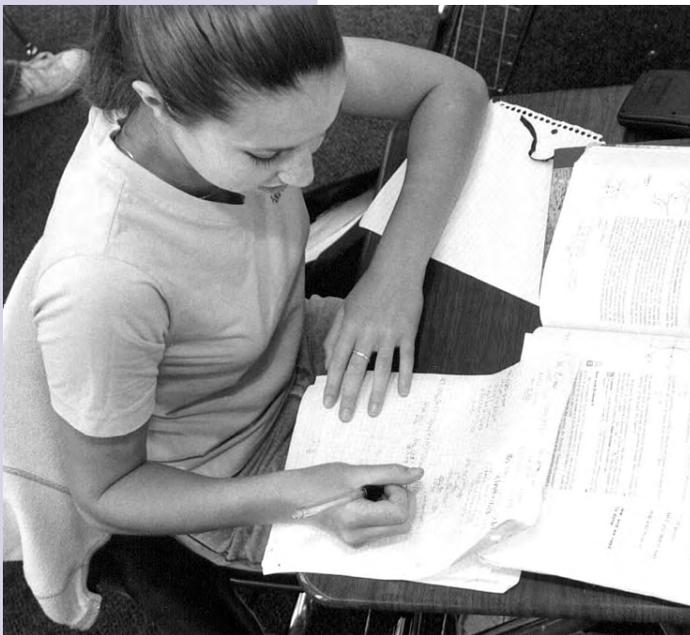
and print and web resources designed to provide student assistance.

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

THERE ARE STANDARDS FOR HIGH SCHOOL MATH

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/be/st/ss).

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. Most colleges require a full three years of high school math.

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. Many schools require students to take algebra in eighth grade.

AP COURSES PROVIDE ADDITIONAL CHALLENGES

If your child 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 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 is available from your local high school or on the Internet at www.cde.ca.gov/ta/tg/hs.

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.

MATH *at* HOME



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PREPARING FOR COLLEGE AND CAREER

Who needs high school math? Everyone! Research has shown that taking mathematics courses in high school can open doors to more opportunities. Higher-level math—that is, coursework beyond algebra I—is essential for getting into college and for most careers, even careers that don't directly involve math.

For students who want to attend a four-year college or university, three years of high school math is generally required, and four years is recommended. This means that your children should probably take a math class in each year of high school. Following algebra I, most students take geometry, algebra II, and trigonometry and/or calculus. These classes prepare them for college entrance exams and college-level math.

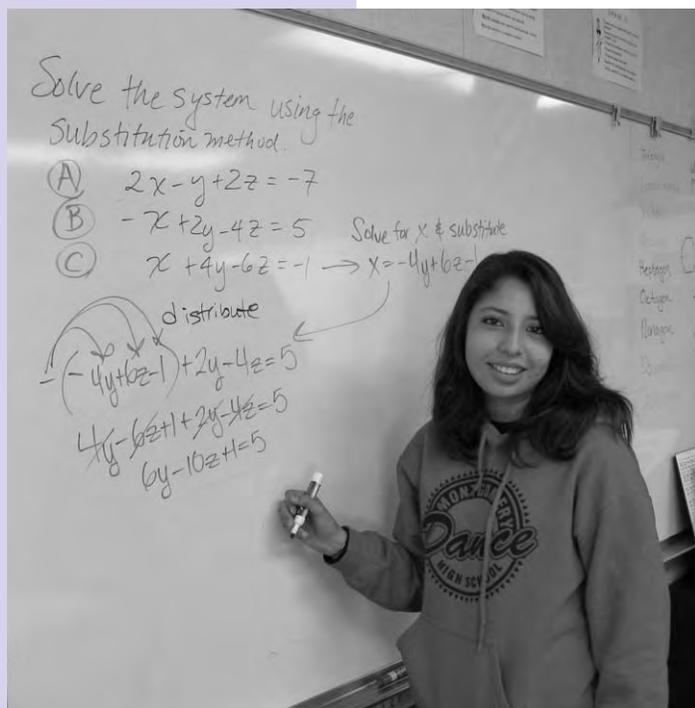
Completing these high school math courses is closely associated with

future college success. A federal study completed in 2006 found that students who complete algebra II in high school more than double their chances of earning a four-year college degree.

Two-year colleges also require rigorous math. Although higher-level math is not an admission requirement, students planning to attend junior college should also consider taking the progression of classes leading to algebra II. If their goal is to transfer to a four-year college or university, the reasoning is obvious: they'll be better prepared for the demands and requirements leading to graduation and a four-year degree. But even two-year junior college programs usually require at least one college-level math course.

Whether they're in a two-year or four-year college program, students who haven't taken higher-level high school math will usually need

to enroll in remedial classes before advancing to the required college math



classes. Unfortunately, students in remedial courses are more likely to drop out or leave college without earning a degree. This is a strong argument for doing the hard work that’s needed in high school math classes.

Students who aren’t college-bound will also benefit from more high school math. Due to advances in technology and the changing nature of the workplace, most jobs that pay a good wage and allow for career advancement now demand strong math skills. For students directly transitioning to careers or career training after high school, higher-level math classes provide a foundation of logic, problem solving, and reasoning skills that can translate to more highly paid positions.

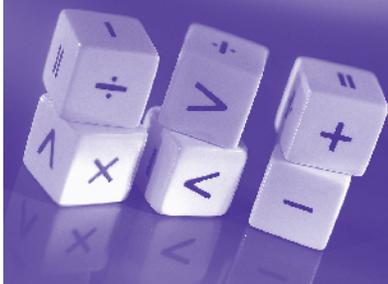
No matter which direction your children are headed, if they take more demanding math courses in high school, they’ll be better prepared for future success.

COLLEGE ADMISSIONS REQUIREMENTS

In order to attend a four-year college or university, your children must fulfill what’s known as the “a-g” requirements. This is a series of 15 to 18 courses that prepare high school students for advanced study at the college level. If your children complete each of the a-g courses with a C or better, they will be prepared to attend most colleges and universities in the United States. The a-g courses are *required* for admission to both the University of California and California State University systems.

| Area | Subject | Years |
|-------------------------------|---|-----------|
| a | History and Social Science One year of U.S. history (or one semester of U.S. history and one semester of civics and American government) and one year of social science | 2 |
| b | English Four years of college-preparatory English composition and literature | 4 |
| c | Mathematics Algebra I, geometry, algebra II, or higher mathematics—take one each year | 3* |
| d | Laboratory Science One year of biological science and one year of physical science | 2* |
| e | Language other than English Two years of the same language | 2* |
| f | Visual and Performing Arts One year of dance, drama or theatre, music, or visual arts | 1 |
| g | College Preparatory Elective One additional year selected from the subjects listed above or another approved course | 1 |
| Total required courses | | 15 |

* This is the required number of years, but an additional year is recommended in these subject areas.



HELPING
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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 and Internet websites helpful.

PUBLICATIONS

Adding It Up: Helping Children Learn Mathematics (National Academies Press, 2001). This 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 Dávila 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 age 4 to 8.

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.

A Family's Guide: Fostering Your Child's Success in School Mathematics (National Council of Teachers of Mathematics, 2004). This guide summarizes what today's mathematics classroom is like, offers tips on how parents can help their children have a positive attitude about mathematics, and presents practical ways to discuss and do math at home together.

Helping Your Child Learn Mathematics (U.S. Department of Education, 2004). This publication, available in both English and Spanish, may be downloaded for free at www.ed.gov/parents/academic/help/hyc.html. It highlights activities that parents can do with children from preschool age through grade 5 to strengthen math skills and build strong, positive attitudes toward math.

Math On Call (Great Source Education Group, 2004). Short definitions, examples, and lessons on over 300 mathematics concepts studied in kindergarten through eighth grade are included in this small handbook for middle school students and parents.

INTERNET SITES

Calculation Nation (<http://calculationnation.nctm.org>), developed by the National Council of Mathematics Teachers, uses interactive games organized around content from the upper elementary and middle grades math curriculum. Students must establish an account to play online math strategy games that promote learning about and practice with fractions, factors, multiples, symmetry, and much more.

Figure This! (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 (www.mathforum.org) hosts “Ask Dr. Math” and has weekly/monthly math challenges, Internet math hunts, and math resources organized by grade level.

Math Playground (www.mathplayground.com) offers fun ways to practice math. Games, puzzles, and videos help support and enhance student understanding of mathematics.

The *National Library of Virtual Manipulatives* (<http://nlvm.usu.edu>) promotes three key areas of mathematics: procedural skills, conceptual understanding, and problem solving. Over 100 virtual manipulatives are sorted by grade level, providing interactive tutorials that engage students in number sense, algebra, geometry, measurement, and probability learning. The site offers a free trial version; there is a modest charge for an individual license.

Thinkfinity (www.thinkfinity.org) is a project of the Verizon Foundation. The site has over 55,000 resources—including many math-focused ones—that have been screened by educators to ensure that content is accurate, up-to-date, unbiased, and appropriate for students. Resources are grouped by grade level and subject area.

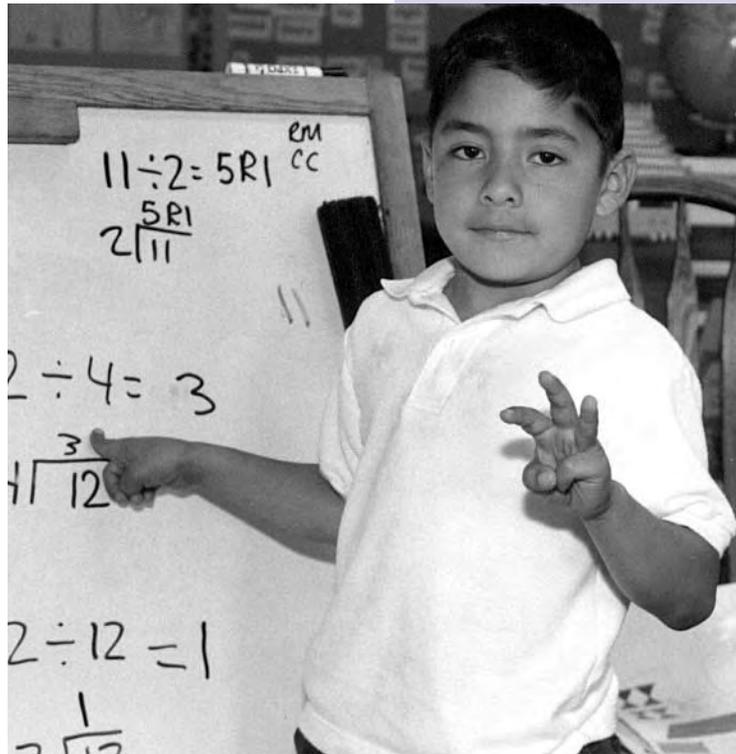
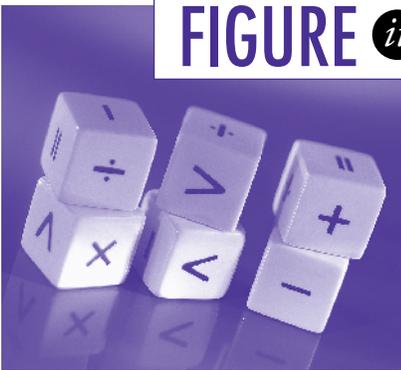


FIGURE *it* OUT



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?

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.

IF A STATE'S LICENSE PLATES CONSIST OF ONE DIGIT followed by three letters, followed by three digits—such as 1ABC123—how many unique license plates can be issued?

HOW MANY DIFFERENT SHAPES, not counting reflections or rotations, can be cut from a 3-inch by 3-inch grid if cutting is allowed on the grid lines only?

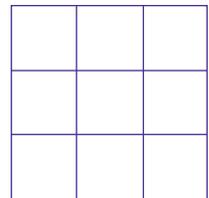
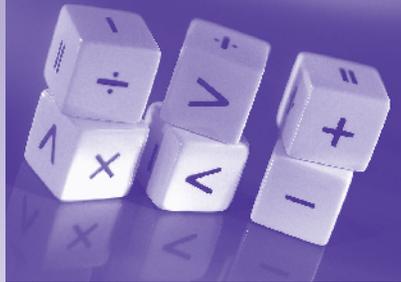
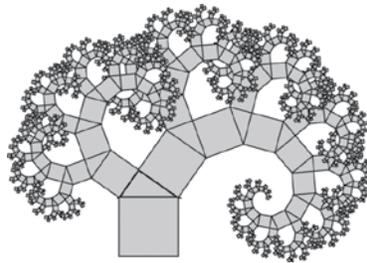


Photo by Ross Hause

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