Many American adults can't explain how to compute miles per gallon, interest paid on a loan or a 15 percent tip.

Some -- even college graduates -- aren't too embarrassed to confess: "I can't do math."

But as the school year begins, it's time to do the math.

Today's children are growing up in a world where basic math calculations can be done by a $3 calculator and the ability to earn a living and make sound consumer decisions increasingly will depend on more than simple addition and subtraction.

They need help -- from schools and from parents, even those who are math-challenged.

And the earlier the better.

"I think all children start thinking logically and mathematically before 2 years of age," said Roberta Schomburg, associate dean in the School of Education at Carlow University and director of its graduate programs in early childhood education.

"It's not the traditional math we think of in terms of calculations and memorization of algorithms and things like that. In the early years, they're really learning concepts of number, space, passing
of time, volume. They're experiencing those at a very physical level. They are building those concepts. That's very critical."

When children begin school without having learned these concepts, their teachers in kindergarten and first grade must lay that foundation, she added, "or the kids will just get further and further behind."

Just as parents have been encouraged to read to their children in the preschool years, the Committee on Early Childhood Mathematics of the National Research Council made a similar push for math with a report issued this summer, "Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity."

"The bottom line is that we are saying that little kids, starting at the age of 3 even and certainly 4, in preschools ought to be doing more math," said Herbert Ginsburg, a member of the Committee on Early Childhood Mathematics and Jacob H. Schiff Foundations professor of psychology and education at Columbia University.

Young children are good at and enjoy doing everyday math activities, he said.

"It's not at all like a lot of school math they don't enjoy," he said.

This doesn't mean the tykes are jotting down equations, but they can deal with numbers -- and talk about them -- in ways that lay the foundation for future math skills.

Talking is important. Some low-income children who didn't have opportunities to talk about math at home as preschoolers had trouble in school even though they knew some basic numbers, according to the recent early childhood study.

At Shady Lane School in Point Breeze, preschoolers learn math skills through play, naturally gravitating to making patterns with blocks, investigating how many items can fit in a circle and putting colored plastic dots in a grid to sort colors and design patterns, such as the one 4-year-old Uma Simhan called her rainbow.

"I'm putting new reds in," said Uma, who attends the school with her twin sister, Jayanthi. "I like this."

Dr. Ginsburg said children "enjoy counting as high as they can, shapes and patterns and all those kinds of things."

He said preschools usually cover counting to 10 or 20 and recognizing shapes, such as a circle, a square and a triangle.

But he said preschool teachers need to go beyond naming numbers and shapes to include concepts -- such as why a circle is a circle and why triangles can be both fat and skinny.

They also can have children count beyond 20 because that's when patterns -- a key mathematical point -- emerge and things get interesting, he said.
Dr. Ginsburg said the panel isn't talking about pushing down the fifth-grade curriculum but rather teaching preschoolers in a deep, interesting and systematic way, with lots of activities and without textbooks.

Providing children with plenty of practice in measuring and counting is important, said Alan Lesgold, dean of the School of Education at the University of Pittsburgh.

"We build knowledge on top of old knowledge," he said. "The way we learn math is we connect it to our experience."

As for what parents can do to help children learn math, Dr. Ginsburg advised "rich and interesting stimulation" at home, but not a formal curriculum.

"I know that a lot of parents are obviously concerned. They go out and they buy various materials, like workbooks at Walmart or K-Mart or whatever. A lot of these are really terrible. They're just drill-oriented kind of things.

"Research has shown board games can help. There are good television shows like 'Sesame Street' and 'Blue's Clues' and some others. There are storybooks that cover math issues, 'Anno's Counting Book' and many others," Dr. Ginsburg said.

But early math computer software needs to go beyond games of shooting down rockets, he said.

"They enjoy some of that and may learn some number facts, but it's not very deep math and they're not going to get very far with that."

Making math fun may be critical to student success, whatever the age.

Jo Boaler is Marie Curie professor of mathematics education at the University of Sussex in England and author of "What's Math Got to Do with It?" a book on how parents and teachers can help children love math.

"Math needs to be fun for children because when it is not, they disengage and their performance goes down," she said.

Her research shows that an interest in math is the most important factor in children continuing with the subject, even more so than achievement.

"When children enjoy math, they do well in the subject and they become powerful," she said.

That doesn't mean Dr. Boaler thinks math has to be easy to be enjoyable.

"Math is fun when we get to engage in the real version of the subject -- when we can ask our own interesting questions, explore patterns, make connections between different areas, solve real problems, use logic, explain reasons and discussion methods with others," Dr. Boaler said.

Her own childhood love of math grew from solving problems and puzzles, including making patterns with Cuisenaire rods -- a set of different-sized rods -- that her mother bought.
Math-challenged parents -- or anyone who has spent too much time staring blankly at math problems on a sheet of paper -- may have difficulty believing math can be fun.

"Most of us learned mathematics in ways that didn't make any sense at all," Dr. Schomburg said.

Today, she said, there is much more teaching for understanding. Some changes have been spurred by the results of the Trend in International Math and Science Study, given every four years to fourth- and eighth-graders since 1995 around the world, most recently in 2007.

The study shows that American students are behind their counterparts in some of the highest-achieving countries.

That may reflect in part different attitudes students in America and some other countries have about math.

Melissa Boston, assistant professor of mathematics education at Duquesne University, said some Americans view having math skills as they view having blue eyes: either you have them or you don't.

"In the United States, we see mathematics as an ability, where other countries which are very successful mathematically see it as an effort. As long as you try hard, you can be good at math," Dr. Boston said.

Kenneth Koedinger, a Carnegie Mellon University professor who is CMU director of the Pittsburgh Science of Learning Center, agreed.

"If you want to do it, you can. You just have to put in an effort," he said.

"It's not easy. It won't come easily to everybody, but it's a myth, 'I'm not a math person.' "

The most recent National Assessment of Adult Literacy in 2003 found nearly a quarter of adults age 16 and older scored at the below-basic level in quantitative literacy, and about a third were just at the basic level.

While the questions asked in 2003 haven't been released yet, the questions about mileage, interest and tips from the previous study in 1992 show the practical impact of such a deficit.

People learn math at different rates. But Kurt VanLehn, professor in computer science and engineering at Arizona State University, said, "There are no inherent limits. It's not like you can learn math up to a certain point and then you can't learn any more."

Even math-phobic parents can help by teaching their children good learning strategies, Dr. Koedinger said.

"That may be the best time to say, 'When I don't know how to do something, I look it up. Let's go to the Internet or to the textbook or to Google for examples.' "

Nancy Bunt, program director of the Math and Science Collaborative based at the Allegheny Intermediate Unit, said struggling is part of learning.
"Encourage [the child] to stick with it. What do you know? What don't you know? How can you find out what you don't know?"

Dr. Ginsburg said parents also can help by not conveying "the idea that learning math is awful. A lot of parents start right away with, 'Oh, math, I hate it.'"

While many young children have fun doing early math, the math achievement gap between children begins to widen around second and third grades as fractions and other more difficult concepts are introduced.

"There is evidence of a lot more math anxiety around second and third grade. The kids find it harder. They get turned off. The gap between those doing well and not so well widens," Dr. Ginsburg said.

"If they don't have the real basics in terms of what does it mean to add and subtract, what does this written math mean on a page, if it's rote, mechanical, then in math the difficulty starts to build," he said.

Math Activities for Preschoolers

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By Eleanor Chute, Pittsburgh Post-Gazette

Sorting blocks. Setting the table. Filling glasses with water.

These activities don't require writing equations or learning formulas, but they can help preschoolers learn basic math concepts so that they are ready for school.

Here are some easy activities suggested by Roberta Schomburg, associate dean in the School of Education at Carlow University and director of its graduate programs in early childhood education:

• Setting the table to teach preschoolers one-to-one correspondence.

• Counting while touching one item with each number to show that numbers have meaning.

• Arranging blocks first in a circle and then in a line to show that how they are arrayed doesn't change their number.

• Smashing a ball of Play-Doh to show that its volume remains the same, whether it's fresh from the can or flat as a pancake.
• Filling different-shaped glasses with the same amount of water, so children can begin to observe that the same volume does not look the same in different containers. Thus, they learn about volume and equivalency.

• Sorting objects, such as putting all red items together, so children can explore classifications. A simple activity could involve using baskets while cleaning up, assigning one for balls and another for blocks.

• Arranging objects by size, which requires the skill of putting things in an order. Children can make various arrangements, such as shortest to tallest.

• Using stacking rings that help children put items in order.

• Pretending a block is something it's not, which can help children understand the symbol system of math.

Dr. Schomburg said play and pretending can be important to learning math because they help build the foundation. Some adults may not recognize the value of play.

"That's the current dilemma. Yes, mathematics is important. Yes, literacy is important, but play, just pretending, is the foundation for both of those things. It's another symbolic system," she said.

Alan Lesgold, dean of the School of Education at the University of Pittsburgh, gave examples of how parents can talk about math as they play with their children.

" 'How many Cheerios are on your plate? Let's take a look here. I counted 10. Is that enough or would you like five more?' It gets kids thinking. It gets them to see how paying attention to how much something is goes beyond I see a lot and a little."

Or, if a child wants a drink, he said, " 'You want a big glass of Kool-Aid? How many cups is that? How many spoonfuls?' All kinds of little things like that give a sense of number."

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