

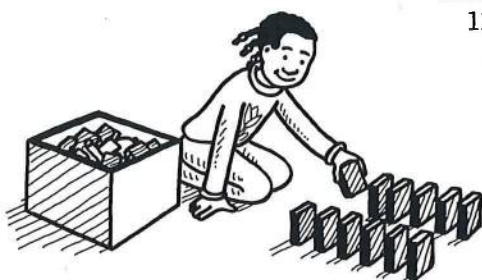
# Fun with Multiplication and Division

Mastering multiplication and division will help your child now and give her a strong foundation for higher math later on. Make practice enjoyable with these ideas.

## Hooray, arrays!

Creating arrays is a good way for your youngster to see "groups" in multiplication. (Note: An array is an arrangement of objects or symbols in rows and columns.)

Name a number, and ask your child to organize a group of toys into as many different arrays as possible to represent that number. For



12, she might put blocks into 6 different arrays:

- 1 row of 12;
- 12 rows of 1;
- 2 rows of 6;
- 6 rows of 2;
- 3 rows of 4;
- and 4 rows of 3. As she makes each

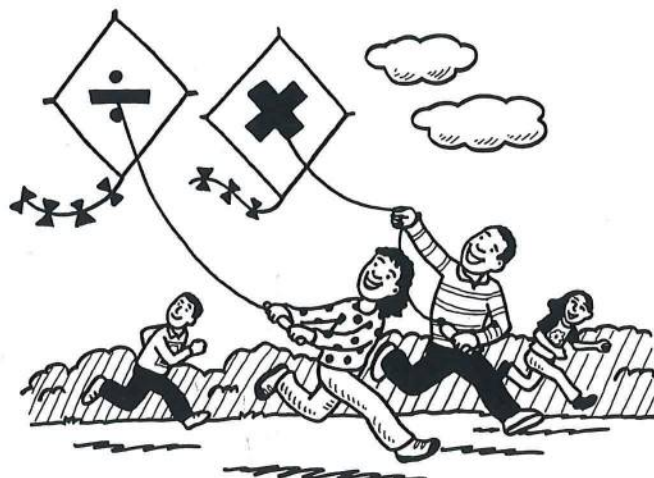
one, she can say the multiplication problem ( $1 \times 12$ ;  $12 \times 1$ ;  $2 \times 6$ ;  $6 \times 2$ ;  $3 \times 4$ ;  $4 \times 3$ ). Then, let her pick a number for you to turn into arrays.

**Idea:** Have your youngster think of a division problem using the numbers from her array ( $12 \div 2 = 6$ ). You'll help her understand the idea that multiplication and division are *inverse* (opposite) operations.

## Equation hunt

Encourage your child to use times tables to beat boredom with this activity perfect for a waiting room (or anywhere else).

Ask him to pick a number from 1 to 12. Take turns finding something to represent each multiplication fact in the times table for that number. For example, if he chooses 7, you might



spot  $7 \times 1 = 7$  people in a waiting room,  $7 \times 2 = 14$  shoes on their feet, or  $7 \times 3 = 21$  for the page number in a magazine.

Keep going until you can't come up with any more equations. The last person to find one gets to pick the next number.

## A simple math tool

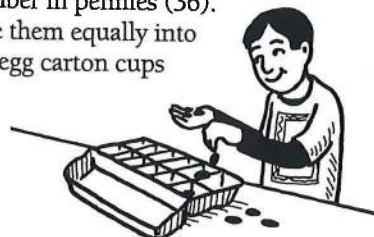
Understanding that  $6 \times 4$  means 6 groups of 4, and that  $15 \div 3$  means breaking 15 into 3 groups of 5, is easier when your youngster can see it for himself. Here's how to use an egg carton and pennies to help.

For multiplication, suggest that he fill the egg carton according to the equation. The first number tells how many cups to use, and the second tells how many pennies go in each cup. For  $7 \times 6$ , he would fill 7 cups with 6 pennies each. Counting the pennies—or skip counting by 6s (6, 12, 18)—will give the answer to the equation (42).

For a division problem, such as  $36 \div 4$ , your child can count out the first number in pennies (36).

Then, he should divide them equally into the smaller number of egg carton cups

(4). He will see that 36 divides into 4 groups of 9, or  $36 \div 4 = 9$ . If the number doesn't divide equally, he will have a remainder.



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# YOUNG ENGINEERS

Engineers design or improve many of the things in your children's lives, from the warm coats they wear to the airplanes they fly in.

With these activities, you can get your youngsters thinking like engineers. In the process, they'll use math, science, problem-solving, and other skills that will help them succeed in school.

## FLY AN AIRPLANE

Making paper airplanes can teach your child about aircraft design and *aerospace* engineering.

Ask her to make a paper airplane and estimate how long it will stay in the air and how far it will go. Then, she can sail it. Have her use a timer to see how many seconds it stays aloft and then a ruler or yardstick to measure the distance it traveled.

Now it's time to build a better airplane. Encourage your youngster to revise her design by adding extra folds to the wings or tail or altering the body, for example. With each change, she can sketch or take a photo of her plane and then record the time and distance it travels. Which one flew the longest and farthest? Why does she think that design worked the best?

Aerospace engineers continually work to improve real airplanes. They experiment with new designs to help planes take off and stay in the air with the least resistance—and in the process improve fuel economy.

## EXTEND A CANTILEVER

How long can a diving board be and still support weight? Let your child use CD or DVD cases to make a *cantilever*—a structure, like a diving board, that is anchored at only one end.

To start, he can place a case on a table with one end barely hanging off the edge. Tell him to continue stacking cases so



each one juts out a little farther than the one beneath it. Have him use a ruler to measure the length of his cantilever with each case added. What's the longest one he can build before the cases tumble down? (Once the cantilever becomes too heavy at the unsupported end, it will fall.)

Suggest that your youngster repeat the experiment with lighter or heavier materials, such as playing cards or books. What changes?

The farther you get from the base, the less weight a cantilever can hold. A diving board has to be strong enough to support its own weight and the weight of a diver, which limits how far out over the water it can go.

## CONSTRUCT A DAM

Beavers are amazing engineers! They use materials like branches and mud to make dams in rivers and streams.

And people build dams to control the flow of water and to generate electricity. Here's how your child can construct her own mini-dam.

First, have her collect twigs from the ground and crisscross them in a pile on a gently sloping sidewalk or grassy hill. Next, she should pour water (from a watering can or bucket) toward her dam—the water will flow easily through the twigs.



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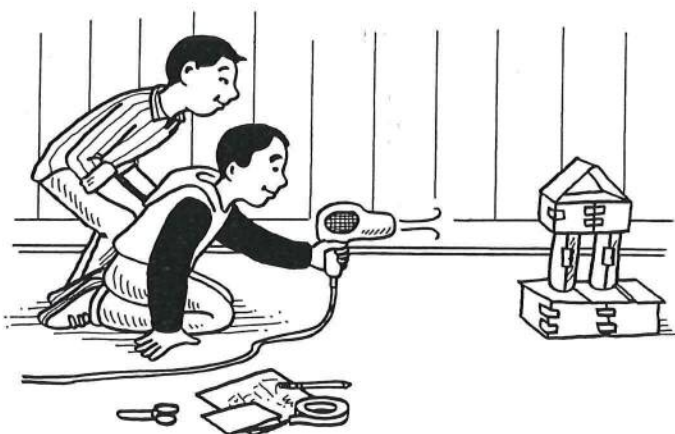
Ask what she could do to keep the water from going into the dam. For instance, she might fill in the gaps between the twigs with mud, leaves, and rocks. When she pours water again, it should pool in front of her dam. If too much water gets inside, she'll need to revise her design and try again.

*Idea:* Encourage her to look outdoors for beaver dams and other examples of animal engineering like bird nests and spiderwebs.

## WINDPROOF A BUILDING

Can your youngster use only index cards and tape to create a building that will withstand strong "winds"?

First, have him make a house of cards that has a roof and walls. (It should be at least 1-ft. tall.) He could tape together several cards in a stack for the roof and then support the stack with columns made by rolling pieces of paper into tubes.



To test his building's strength, he can stand a few feet away and blow on it with a hair dryer set on low (to mimic wind). Does his building topple over, or does it just scoot along the floor? If the "wind" blows it down, suggest that he redesign and retest it. He'll figure out that a wide base and strong vertical supports affect how well a building can withstand wind.

## INSULATE AN ICE CUBE

Engineers design insulation to protect against cold or heat. With your child, look around your home for insulators, such as a soft lunch box, a winter coat, or wall insulation in a basement or an attic. Then, challenge her to design insulation that will keep an ice cube frozen longer.

First, have her gather materials to try, such as tinfoil, plastic wrap, a cotton T-shirt, play dough, a mitten, and a towel. Then, she should test each substance by wrapping it around an ice cube. Help her time how long it takes for the cube to melt and record her findings. What does she think causes one material to work better than another?



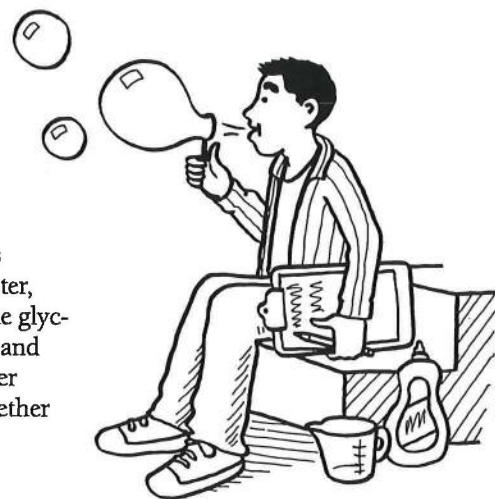
*Idea:* Have your youngster use the information to build the best possible insulator. She might combine materials or use double or triple layers.

## BLOW BETTER BUBBLES

Your child can experiment with chemical engineering by making a longer-lasting bubble.

Ask him to start by trying to create a bubble with just water. He should put 4 cups of water into a pitcher and dip a plastic bubble wand into it. What happens? (The wand won't hold the water.) Next, he can make a bubble solution by adding  $\frac{1}{4}$  cup liquid dish soap,  $\frac{1}{4}$  cup glycerin or corn syrup, and  $\frac{1}{4}$  tsp. sugar to the water. Let him blow a few bubbles, and help him time how long each one lasts before popping. Suggest that he experiment with different quantities of the ingredients and try again. He could record each recipe and the results on a chart to see which formula is the most successful.

You can explain that a bubble is air suspended in liquid. Water by itself won't hold air because it doesn't stretch. But dish soap adds elasticity to the water, and ingredients like glycerin or corn syrup and sugar help the water molecules stay together as a bubble floats.





# Exploring Fractions & Decimals



What does eating a snack, taking a car trip, or reading the newspaper have to do with fractions and decimals? With these activities, your youngster will see the connections to his everyday life—and get practice in using numbers that represent parts of a whole.

## Play with pizzas

"I'd like a pizza with  $\frac{1}{4}$  sausage,  $\frac{1}{8}$  mushroom, and  $\frac{3}{4}$  pepperoni!" Your child can use pretend pizzas to create and add equivalent fractions.

Get eight paper plates, and have him draw a different pizza topping (pepperoni, green pepper, pineapple) on each one. Let him use a ruler to draw lines dividing each pizza into a different number of equal pieces—halves, thirds, fourths, fifths, sixths, eighths, and twelfths. He can cut on the lines to make slices and label the backs with the correct fractions. So for the pizza with 6 slices, he would label each piece " $\frac{1}{6}$ ."

Then, ask your youngster to mix and match the different fractions to make whole pizzas. For instance, he could put together one pizza with two  $\frac{1}{6}$  pieces and two  $\frac{1}{3}$  pieces ( $\frac{2}{6} = \frac{1}{3}$ , and  $\frac{2}{3} + \frac{1}{3} = 1$ ). How many combinations can he come up with? Suggest that he keep track by writing addition sentences with the fractions that equal 1 (example:  $\frac{1}{2}$  cheese +  $\frac{1}{4}$  sausage +  $\frac{1}{4}$  spinach = 1 pizza).

**Idea:** Follow up with a pizza party for dinner, and let your child hand out fractional pieces to everyone!

them by ingredient. Then, take turns coming up with word problems using fractions. Say there are 7 pretzels, 6 crackers, 4 peanuts, and 3 chocolate chips. You could ask, "If you ate all of the crackers and peanuts, what fraction of the total pieces did you eat?" (Answer:  $\frac{1}{2}$ , because 6 crackers + 4 peanuts = 10 pieces, and 10 is  $\frac{1}{2}$  of the total 20 pieces.) Or she might say, "If I eat 2 chocolate chips, what fraction of my chocolate chips will be left?" (Answer:  $\frac{1}{3}$ . She ate 2 of the 3 chocolate chips, which is  $\frac{2}{3}$ , and  $\frac{2}{3} - \frac{2}{3} = \frac{1}{3}$ .)

As you share the snack, continue creating new fraction problems. Or spill out more trail mix to change the numbers, and start again.



## How much farther?

Get your child thinking about fractional parts of a road trip with this twist on the question, "Are we there yet?"

Before a car trip, tell your youngster the number of miles to your destination, and set the trip odometer to zero. Along the way, read the odometer aloud, and ask him what fraction of the trip's length you've gone so far. For example, if your trip is 50 miles and you've traveled 20 miles, you've gone  $\frac{2}{5}$  of the



## Sort and snack

Here's a tasty way for your youngster to make up and solve fraction addition and subtraction problems.

Have her put 20 pieces of trail mix on a plate and sort

way. What portion is left? He should say  $\frac{2}{3}$ . Then, challenge him to turn those fractions into decimals ( $\frac{2}{3} = \frac{4}{6} = 0.4$ , and  $\frac{3}{3} = \frac{6}{6} = 0.6$ ).



### Read all about it!

Newspapers are full of decimals. Encourage your youngster to look through the paper for numbers that include decimals. Her goal? To find ones that add up to exactly 100—without going over. She'll practice adding decimals, and she'll see how decimal numbers are used for many purposes.

She might find a baseball player's batting average (.275), the price of a gallon of gas (\$3.79), and the magnitude of an earthquake (5.8). After she writes each number, she can add it to her total. As she gets close to 100, she'll need to find smaller numbers to avoid going over. How many days of newspapers will it take for her to add up to exactly 100?

**Tip:** Suggest that your child record all the ways decimals are used. How many can she find?



### Estimate the bill

Your youngster uses decimals every time he reads a price tag or counts money. With this activity, he can use prices to practice rounding decimals.

Let him carry a small notebook and a

pencil around the grocery store and round items in your cart to the nearest dollar. Tell him he will need to look at the numbers after the decimal—if it's \$0.50 or higher, he would round up to the next dollar, and if it's \$0.49 or below, he would round down. For example, if you put a \$3.45 box of cereal in the cart, he should write \$3. And if you get a \$1.57 bag of raisins, he would write \$2.

Before you check out, encourage him to add the numbers in his head—he'll practice "mental math" as he estimates your total bill. How close did he come?

**Variation:** In a restaurant, your child could use a menu to round and add up the prices of items you order. When you get your bill, he can compare his amount to the total before taxes.

### Build a decimal

Who can make a decimal that's closest to 1? To 0? This game gives your youngster a chance to find out.

You'll need a deck of playing cards (face cards and jokers removed). Also, each player gets a button (to represent a decimal point) and a card with a zero on it (to put before the decimal).

The dealer announces a "rule" for the round and deals three cards to each player. Her rule tells players how to arrange their cards to create a decimal. For instance, the rule might be to make the decimal closest to 1 or the decimal closest to 0.



Then, each person arranges her cards faceup, using the button as a decimal point. If the rule is to create the decimal closest to 1 and your cards are 5, 1, and 7, you should make 0.751. Read your numbers aloud, and the dealer declares the winner (751 thousandths beats 643 thousandths, for example). That person keeps all the cards and becomes the next dealer. Play until the cards are used up. The person with the most cards wins.

**Tip:** Have the dealer make a number line from 0 to 1 and write the decimals on the line. That's an easy way to see which number is closest to 0 or 1.



# Excellent Experiments

Exploring the world, from a small penny to the vast night sky, can teach your child about science. With these experiments, your youngster will learn about chemical reactions, simple machines, moon phases, mold growth, and more.

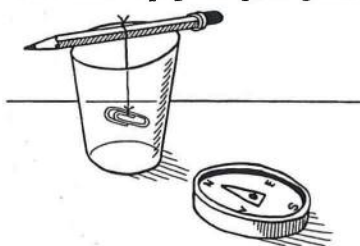
All you need are household materials and a little time. Then, help your child conduct these experiments—and watch him learn to think like a scientist.



## Make a compass

Does your child know that the earth's north and south poles are magnetic? This experiment will show him the proof.

**You'll need:** paper clip, magnet, string, pencil, clear cup



**Here's how:** First, your youngster will need to make one end of the paper clip magnetic by rubbing it along the magnet about two dozen times (rub in the same direction each time). To

test it, he can hold the clip to the refrigerator to see if it sticks. Next, help him tie one end of a string tightly around the center of the paper clip so the clip hangs horizontally. He should tie the other end around the middle of a pencil and lay the pencil across the cup so the paper clip hangs freely.

**What happens?** When the paper clip stops moving, the magnetic end will point north.

**Why?** The earth has a magnetic field, which is strongest at the North Pole. But if your child holds the magnet close to the paper clip, the clip will turn toward the magnet. That's because the magnetic field of the magnet is closer than that of the North Pole.

## Create a scent

Making perfume is a fun way for your youngster to learn about *diffusion*, or the way that matter spreads through a liquid.

**You'll need:** water, measuring cup, 2 bowls, scented natural objects (lemon or orange peels, flowers, pine needles), coffee filters, funnel, small clean jar with a lid, food coloring

**Here's how:** Have your child measure 1 cup of water into a bowl. Ask her what the water smells like (it will have no odor). Then, she can add any scented item, or combination of items, to the water. Let the mixture sit overnight. The next day, she should strain the liquid through the coffee filter into the other bowl and smell it again. She can use a funnel to pour her perfume into the jar so she can keep it.

**What happens?** The water will smell like the objects she added.

**Why?** Molecules from the items spread, or *diffuse*, into the water. They start out close together and gradually get farther apart until they're spread evenly throughout the liquid. *Idea:* Your youngster can watch diffusion happen if she adds a drop of food coloring to the water.

## Raise a flag

A simple machine has no moving parts, yet it makes objects easier to move. This activity will show your child how one simple machine, a *pulley*, can help raise and lower a flag.

**You'll need:** 4-foot piece of string, paper, crayons, tape, spool, pencil (pencil must fit through the spool and turn easily)



**Here's how:** Help your youngster tie the string together into a loop. Then, let him draw and color a flag and tape its left edge to the string. Have him slide the spool to the center of the pencil and hang the string over the spool (the flag should be at the bottom of the loop). To work his pulley, he can pull down on the loop of string opposite from the flag.

*continued*

**What happens!** The flag can be raised and lowered.

**Why!** In science, “work” means using force to move an object. Simple machines do some of the work for us so that we need less force to make something move. In this experiment, the spool and string make a pulley, which directs the force your child puts on the string to move the flag up and down.

**Tip:** Ask your youngster to think about the flagpole at his school. Without a pulley, the flag raisers wouldn’t be able to get the flag to the top of the pole.



the moon, she would draw nothing. After 28 days, she can look over the calendar to find a pattern. Then, ask her to use the calendar to predict what the moon will look like on any particular day next month.

**What happens!** The moon moves in a regular pattern—it appears to get bigger and then smaller.

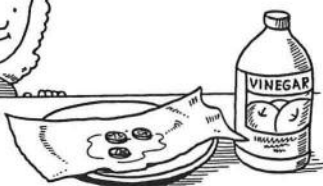
## Cause a reaction

Why is the Statue of Liberty green? Your child will find out with this chemistry experiment.



**You’ll need:** several pennies, paper towel, shallow dish, vinegar

**Here’s how:** Have your youngster lay the pennies on



a paper towel in a shallow dish. Next, have her pour a little vinegar onto the paper towel, leaving the tops of the pennies exposed to the air. She should check on them in an hour or two to observe any changes in their color.

**What happens!** The tops of the pennies will begin to turn greenish.

**Why!** Pennies, like the Statue of Liberty, are coated with copper. When copper is exposed to the oxygen in the air, it causes a chemical reaction that creates a green substance called copper oxide. Acids in liquids (such as vinegar) speed up the reaction. In the statue’s case, the combination of exposure to air and the acid in rain has caused it to turn green.

## Find a full moon

The moon makes a full circle around the earth every 28 days. Encourage your youngster to follow and then predict the patterns of the moon’s cycle.

**You’ll need:** calendar, pencil

**Here’s how:** On a clear night, take your child outside with a calendar and a pencil. Have her draw the moon in that day’s calendar square and write words describing it (“completely dark,” “a tiny sliver,” “a perfect circle”). *Note:* If she can’t see

**Why!** “Moonlight” is actually sunlight reflected off the moon. As the moon travels around the earth (once every 28 days), the planet blocks some or all of the sunlight. When the moon is between the sun and the earth, all the light is blocked—we see the side of the moon that’s completely dark, so it seems to be invisible. When the entire bright side of the moon faces the earth, we call it a “full moon.”

## Discover mold

Where does mold come from? Your child can find out with this experiment.

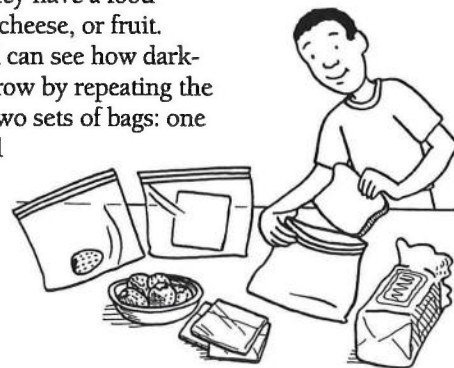
**You’ll need:** 1 slice of bread, 1 slice of cheese, small piece of fruit (grape, strawberry), 3 zipper bags, teaspoon, water, notebook, pencil, crayons

**Here’s how:** Have your youngster put each food in a separate zipper bag. He should add 1 tsp. of water to each bag and seal it tightly. Have him observe the changes daily and record what he sees (in words and pictures) in his notebook.

**What happens!** Mold appears on the food.

**Why!** Mold is everywhere. It is a *fungus*, a living thing that gets its nutrients from the food it grows on. Because mold starts out as microscopic *spores*, we don’t see it until it begins to grow. Mold spores grow quickly in dark, wet places—especially when they have a food source like bread, cheese, or fruit.

**Idea:** Your child can see how darkness helps mold grow by repeating the experiment with two sets of bags: one set in the light and another in a dark cabinet. In which place does mold grow faster?





# What's My Strategy?

Math problems may have one correct answer, but there's more than one way to find that solution. Let your youngster explore these strategies to see which ones work best in different situations.

## Strategy #1: Use objects

Matching up objects with numbers is a great way for your child to see what's happening in a math problem. Have him gather 50–100 small items like cereal pieces or paper clips.

Then, he can use those objects to show his homework problems. For instance, if he has to solve  $48 \div 6$ , he could divide 48 cereal pieces evenly into 6 piles. The answer (quotient) would be the number of pieces in each pile (8). Or he might make groups of 6 pieces each. He'll keep making piles of 6 until all 48 pieces are used—the quotient would be the number of groups (8). *Idea:* Ask your youngster which multiplication problems he just demonstrated ( $6 \times 8 = 48$  and  $8 \times 6 = 48$ ). Or what if the pieces don't divide evenly? Say his problem is  $49 \div 6$ . He'll find he has one cereal piece left over—or a remainder of 1.

## Strategy #2: Act it out



Suggest that your child act out story problems to help her understand the math. Here's an example:

"Julie works at a hardware store. One Saturday, Kim came in to buy a lawn mower that cost \$278. She gave the cashier \$300. What change should she get back?"

Your youngster can set up a store and act out the problem with play money. She might practice swapping a \$100 bill for 10 \$10 bills and a \$10 bill for 10 \$1 bills. This is a great way to visualize math using place value.



## Strategy #3: Draw a picture

The difference between 0.1 and 0.01 may not seem like much to your child, but when he draws it, the difference will be obvious.

Start by having him draw two large boxes that are the same size and dividing each box into 10 equal rows. In one box he should shade one row. This represents 0.1 ( $\frac{1}{10}$ ). For the second box, ask him to divide it further into 10 equal columns. That will make 100 small squares. What happens if he shades one square in that box? He will illustrate 0.01 ( $\frac{1}{100}$ ). Now, at a glance, he'll see that 0.1 is way more than 0.01.

You can encourage your youngster to apply the "draw a picture" strategy to all sorts of math problems. For instance, he could sketch the elements of a word problem to help him understand what is being asked and to illustrate the steps.





## Strategy #4: Estimate to justify

With four dice and paper and pencil, your child is ready to practice estimating. Have her roll two dice to form a number (3 and 4 could be 34 or 43), while you roll the other two dice to make another number.

Announce your numbers, and ask her to estimate the sum. If the numbers are 43 and 62, she might think, “40 + 60 = 100” and estimate the answer at 100. Meanwhile, you figure out the actual sum ( $43 + 62 = 105$ ). If her estimate is close to your sum, she can assume your answer is probably right since estimates help predict solutions. Suggest you both roll again, except let her figure the sum while you estimate. With just a few tries, your youngster will realize the value of estimating to check if her answer makes sense.

## Strategy #5: Put it on the line

Number lines are a handy tool for understanding number relationships. To make a number line, your child should draw a line and add tick marks for each number—say 1–20—and label 0, 5, 10, 15, and 20.

Then, take turns demonstrating a number pattern for the other person to guess. For instance, you might start at 0 and draw an arc to 2, another arc from 2 to 4, then another arc from 4 to 6, and so on. He would guess your pattern is + 2. Now, see if you can guess a pattern he creates. Some suggestions are:

- $\times 2$  (1, 2, 4, 8, 16)
- $+ 4$  (0, 4, 8, 12, 16)
- a two-step pattern like  $+ 5, - 1$  (0, 5, 4, 9, 8)

## Strategy #6: Number sentences

Your youngster and her friends will have a “blast” with this approach. Give each child a blown-up balloon and a permanent marker. Call out a math problem, such as  $12 \times 5$ , and set a timer for 3 minutes. Using the marker, each person should write all the number sentences she can think of that would solve the problem.

Examples:

- $12 \times 5 = 60$
- $12 + 12 + 12 + 12 + 12 = 60$
- $(10 \times 5) + (2 \times 5) = 60$
- $12 \times 10 = 120$  and  $120 \div 2 = 60$

When 3 minutes are up, let them swap balloons to check each other's answers. Then they get to pop the balloons!

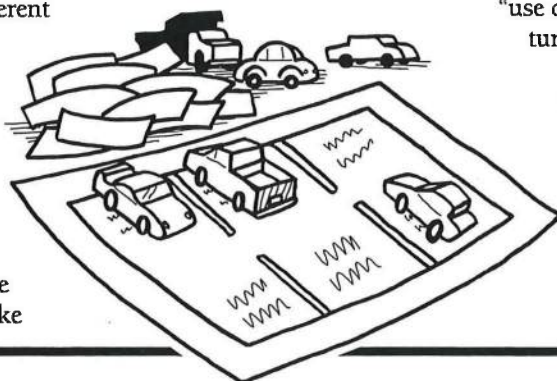


## Putting it all together: Where should I park?

Make a game out of using all the different math strategies your child is learning.

First, have him write 20 addition, subtraction, multiplication, or division problems on separate slips of paper. Examples:  $399 + 73 = \underline{\quad}$ ,  $4 \times 72 = \underline{\quad}$ .

Then, each player gets 6 toy cars and draws a 6-space parking lot on a sheet of paper. In every parking spot, the player writes a different math strategy like



“use objects,” “act it out,” “draw pictures,” or any of the other strategies.

Turn the math-problem slips facedown. Now take turns picking one and using one of your strategies to figure out the problem. Solve it correctly, and you get to park a car on that strategy. The winner is the first person to fill up his parking lot.