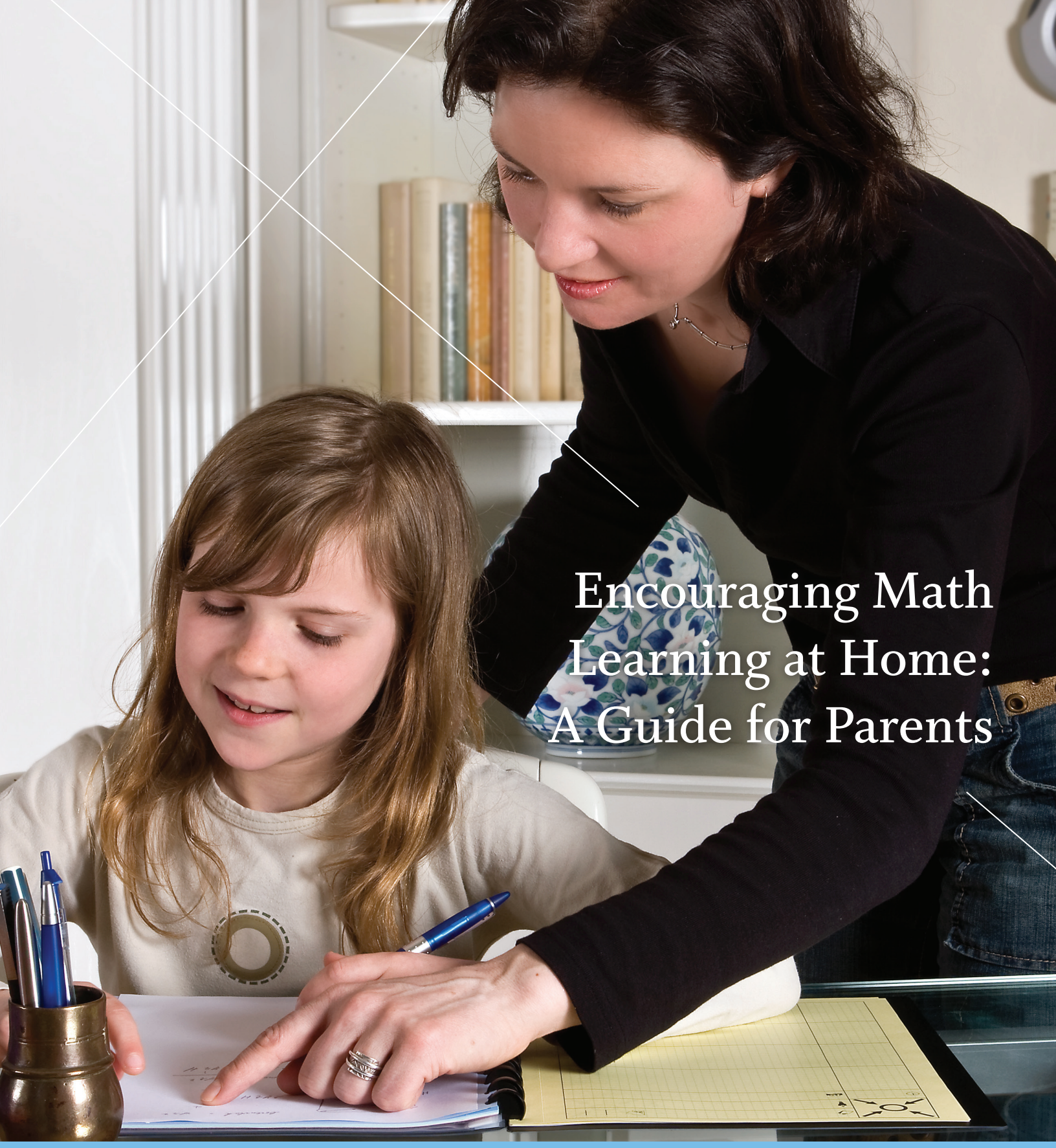

Encouraging Math Learning at Home: A Guide for Parents

A Professional Development
Steering Committee Project

ONTARIO ENGLISH
Catholic
Teachers
ASSOCIATION

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INTRODUCTION

Parents are important partners in ensuring a child's mathematical success. A warm, inviting numeracy-rich learning environment at home is the first step to fostering a love of mathematics in children. Research consistently shows that children who live in homes where parents nurture a positive attitude and support their child's efforts are most likely to be confident and competent learners. Parents' most significant influence arises from their ability to create a positive mindset about mathematics. They do this by believing in their child's ability to learn and succeed and by teaching them to embrace mathematical activities as opportunities for growth. Simple activities, such as incorporating math language and reasoning in routine communication with children, builds important problem-solving and critical thinking skills. Even everyday activities such as cooking and baking can provide abundant opportunities for applying and deepening an understanding of concepts such as numbering, measurement, patterning and algebra, fractions and decimals. For instance, doubling and halving measurements for baking a cake involves a high level of reasoning about numbers.

This resource will suggest opportunities for parents to contribute meaningfully to their child's learning. It will help you find ways to encourage and sustain math learning in the home, while recognizing that you need to be engaged with your child's learning on your own terms and in ways that fit your role as a parent as well as with your family's real-life, daily opportunities for learning. There is great benefit in a parent being a supporter of their child's learning through encouragement and mentorship – not as a replacement for the teacher but as a valuable partner in a child's learning journey.

The learning opportunity suggestions in this guide will help parents and children build mathematically rich environments in their home and through their everyday activities. The activities are consistent with the expectations in the Ontario mathematics curriculum and are distributed among the five strands of mathematics: Number Sense and Numeration; Measurement; Geometry and Spatial Sense; Patterning and Algebra; and Data Management and Probability.

The Ontario mathematics curriculum also contains seven process skills that are considered important for learning and applying mathematics. The skills are problem solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating. The activities in this parent's guide will incorporate these processes into the learning opportunities as appropriate.

For more information about the math curriculum in Grades 1-8, please go to:

https://www.edu.gov.on.ca/eng/curriculum/elementary/math18curr.pdf

For more information about the math curriculum in Kindergarten, go to The Full-Day Early Learning Kindergarten Program:

https://www.edu.gov.on.ca/eng/curriculum/elementary/kindergarten_english_june3.pdf

PARENTS AS MODELS OF MATH LEARNING

Fostering a joy of learning at home is the most important gift a parent can give to their child. A child's natural curiosity encouraged and supported by caring parents sets a lifelong foundation for learning. This is especially so in the area of mathematics. Engaging your child in interesting mathematical activities can help stimulate a lifelong enjoyment of mathematics. You can build your child's self-confidence and optimism, and help them to see math learning as valuable as well as fun. You can also set a positive mindset for the mathematics learning that takes place at school. Parents cannot replace the school experience but they are a significant influence on their children's developing attitudes towards, and enjoyment of, mathematics. Significant studies have shown that a child's attitude to mathematics has a positive or negative effect on how well they perform in mathematics. Fostering a positive math mindset is as simple as encouraging a belief in one's ability to learn and succeed in mathematics; to see challenges as opportunities for growth rather than as barriers to it.

Just as reading to and with children at home has long been attributed to literacy success at school, its mathematical corollary arises out of the everyday types of mathematical experiences children have at home. Including math in outdoor and indoor games, reading stories, singing songs and chants, art activities, and in everyday routines and activities, will ensure that your child is surrounded by a mathematically rich environment. Math is everywhere, throughout the day and in many of your child's ongoing interests and activities. The trick is to recognize the math and capitalize on the mathematical opportunities. You can be the architect of a rich at-home mathematical environment with only a few changes and additions to the regular interactions you have with your child. These small contributions to your child's math learning can have a considerable effect. Studies have proven that a child's math skills in the early years are a better predictor of future school success than reading levels (Duncan, 2007).

An inviting numeracy-rich home environment is the first step to creating a love of mathematics. Research demonstrates that children in homes with caring, supportive parents are most likely to become confident math learners.

MATHEMATICS AND TALK

"*The more math and numbers there are around a child, the more likely they're going to like math and enjoy math and develop as mathematicians*" (Geist, 2009).

Talk is fundamental to children's learning. Children who come from homes where reading and talking about reading is a common occurrence have much higher success rates in literacy throughout their life (regardless of income, parent's education, rural or urban experiences). This same phenomenon occurs in homes where parents talk about and do math with their children.

LOOK FOR OPPORTUNITIES TO USE MATH TALK

Math talk grows with your child. Math talk is simply talking to your child about the math that they experience. Parents can mathematize everyday experiences. If we add two more children to your birthday party list, how many children will there be? How many goody bags should we make up? Let the child think about it and work it out. The key is to participate in a friendly discussion over interesting mathematical ideas and concepts. For instance, wrong answers that were arrived at with good reasoning need to be rewarded. A child who notes correctly that a recipe needs to be doubled to make twice as many cookies but incorrectly computes some of those measurements is using good reasoning, even if the answer is off. Let your child talk through the math and show their reasoning. Often talking it through reveals the error to a child without further parental intervention. Resist the temptation to overdo assistance. Being quiet and listening respectfully is sometimes more helpful.

Ask older children to help with math that is encountered in everyday situations. A mother balancing a cheque book might ask, "Dylan, can you help me balance these numbers?" When shopping, parents can discuss how much things cost, how to decide which items are the best bargains, and what items can be bought with a certain budget. Listed below are some additional ways to use math talk with your child (Geist, 2011).

1. Look for opportunities to count, add, subtract, multiply or divide

Count the number of green tiles on the floor of the grocery store or the number of cracks you walk over on the sidewalk. Once children are able to count, look for opportunities to allow them to extend that knowledge. On a drive or a walk you might say, "I see two geese on this side of the lake and three geese on the other side. How many geese does that make?" With older children, provide more challenging opportunities; "These ski boots are 10% off at Eaton's but $10 off at Sears. Which ones will make a better deal?"

2. Look for opportunities to problem–solve

Grocery shopping and other routine situations provide many opportunities for mathematics. For example, asking your children to draw up a list of groceries needed for a camping trip can involve calculating days, meals, cost per meal, total cost, etc. Calculating the amount of paint needed to paint a child's bedroom or the weight and/or monetary value of candies collected on Halloween provide other examples of problem-solving activities in the home.

3. Use open–ended questions to sustain math talk as long as possible

Math talk means talking about mathematical ideas and open-ended means being ready with questions that allow for multiple routes to solutions. Wonder out loud how much money you would have if you had saved a dollar every day since your child was born. Estimate how many acorns have fallen on your lawn in the fall. Sustaining the talk as long as possible is the key.

MATHEMATICS AND YOUR CHILD'S EXPERIENCES AROUND THE HOME

In countries where there is a natural, longstanding culture of using math-type games and mathematically focused everyday activities in the home, students tend towards higher scores on international testing. Similarly, in Canada many parents focus on reading with their children, hence the very high scores we tend to achieve in international reading indicators. In order to encourage more home-based mathematical activity, try some of the following:

1. Count everything

Count the number of steps to the car, the number of toys in a box, the number of candies in a jar. Later, introduce estimating the same quantities. Double-check your child's counting when appropriate. Reasonable estimates are one of the most useful strategies for successful mathematical thinking.

2. Count in a variety of ways

As age-appropriate, move from counting by 1's to counting by 2's, 10's, 5's and later to counting by 6's, 7's, 8's and 9's. Count forward and backwards. Count beginning at different numbers, such as starting the count at 4 or 5. Play the game "Blast-Off!." The child counts backwards from any designated number (say ten) and when they get to 0, they yell "Blast-Off!" and everyone jumps up. The next child may say they want "Blast-Off!" to be counting forwards to ten or some other number. When they get to the designated number, everyone yells, "Blast-Off!" and jumps in the air. Although this is a simple game, it is usually met with a significant buy-in from young children.

3. Daily routines

a. Open up daily routines and experiences for math-based activity. Use specific mathematical terms, for example: "Is it five minutes until the bus comes?" or "The temperature in here seems low, can you please read the thermostat for me?"

b. Point out math in your environment. There are numbers everywhere: on houses, on thermostats, on hockey jerseys, on busses, on speed limit signs, in phone numbers. Discuss what these numbers mean.

4. Bake together

Let your child become familiar with the purpose of measuring, the various measurements (milligram, gram, litre) and an understanding of quantity. At later stages, let them work out amounts naturally, such as doubling or halving a recipe.

5. Use imaginative play

Act out real-life situations such as setting up a store, a coffee shop or a restaurant. Use play money or real money for the transactions. Start simple and work up to monetary amounts that are appropriate for your child's grade or maturity level.

6. Plan an event

Have your child help you to plan a birthday party or other appropriate event. Your child will be practicing one-to-one correspondence as they calculate the number of cupcakes or party favours for each person.

7. Encourage measurement in the home

Let your child make meaningful and helpful measurements, for example: "How high should the dog house for our new dog be?" Use both standard measurement (e.g., centimetre, metre, etc.) and non-standard (e.g., child's footsteps, blocks or cubes).

8. Encourage measurement in daily activities

Go for a walk. Point out when you have walked approximately a kilometre. Show what a metre looks like (roughly one large adult step). Predict and measure how long it takes to run 20 metres.

9. Play with perimeter and area

Point out and measure perimeter and area when building or setting up a garden, for example. It's fun and easy to illustrate using real spaces: perimeter equals the distance around the outside of something; area equals the number of consistently sized shapes that cover something. Measurements can be made either with standard tools such as a measuring tape, or using non-standard measures such as counting footsteps around a perimeter.

10. Point out fractions

Cut food into equal pieces. Point out $^1/_2$, $^1/_3$, $^1/_4$, etc. Help establish the concept that $^1/_4$ of a piece of a chocolate bar is smaller than $^1/_2$ of a piece.

11. Set a math reading time

Set aside time every week to read a math story rather than a traditional story. Make sure they are interesting stories that both engage the reader and provoke mathematical thinking. Ask questions about counting, comparing, finding totals and differences, looking at patterns or shapes, etc.

12. Create a family math night

Designate a night as Family Night. Play board games and other games that use number cubes (dice), card games, dominoes, puzzles, tangrams (Chinese puzzle), pentominoes, Googleplex, Magneblox, etc.

13. Ordering food night

If your family sometimes orders take-out food, keep the take-out menus handy and have your child calculate the amounts required and the total cost. If the amounts are beyond your child's mathematical understanding, help them use a simple calculator.

14. Do a shape hunt

Look for shapes in your home, neighbourhood, playground, etc. (e.g., our house has a rectangular door; our windows are square). Use terms that will be introduced at school (e.g., our house is shaped like a rectangular prism – square or rectangular sides; our roof is shaped like a triangular prism – triangle shapes at the ends but squares or rectangles on the sides).

15. Plan a garden or other space

Use estimation to consider how many plants might fit into the space. Work out accurate measurements and then compare.

16. Household chores

Estimate the time it will take to clean a bedroom or toy box. Then do an accurate timing and compare.

17. Outdoor activities

Look for things to count, then compare and tally. For example, ask, "How many doors do you think there are on this street?" Take the time to use math in physical activity. Can your child run faster or jump farther than they did the last time? Use rulers, stopwatches and tape measures to track distance and time.

18. On the road

Play number games in the car. Try a mathematical scavenger hunt. Take turns choosing and searching for something specific, such as a truck with eight wheels, a speed limit over 60 km/h, a house number, or shapes in the environment.

MATHEMATICS AND PLAYING GAMES

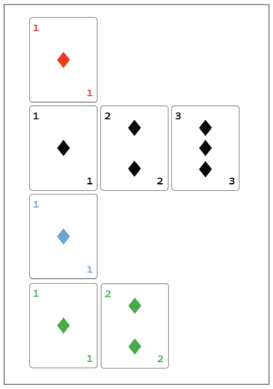
Math games are a useful way to learn or practice mathematical concepts in a natural and enjoyable manner. A good math game is one that is challenging enough for the child but not so challenging that it will fail to hold their interest. Below are a few simple games. In most cases, they can be modified to make them easier or harder by adjusting the numbers that are used.

Card Dominoes

No. of players: 3 or 4

Materials: Use playing cards Ace-10 or make up cards with numerals and pictures

1. Deal all the cards to the players.
2. The players who have ones put them down in a column in the middle of the table.



3. Decide who will go first, second and third.
4. Players take turns putting down one card at a time to continue each line as above with the next number in the sequence.
5. Anyone who does not have a card, can pass.
6. The first player to lose all his/her cards wins.

Modification: Start the game at 10 and work backwards (10, 9, 8…)

Tens Concentration

No. of players: 2-4
Materials: Deck of cards with 6 of each number from Ace through 9
How to play:

1. Place 16 cards in the middle of the table, face down in a 4X4 arrangement.
2. Players take turns turning over 2 cards trying to turn over a pair that totals 10.
3. If a pair can be made, the player keeps those cards and continues to try and turn over another pair. If the player is not successful, they return the cards they turned over to their original position, face down and they replace any cards that they took to make a pair with new ones from the deck.
4. The person who collects the greatest number of pairs is the winner.

Variations:
For younger children, use only small numbers that add up to 5 (e.g., all the cards from Ace to 4).
For older children, the pairs could be multiplied and points given as follows: if the answer is under 20, they get one point; if the answer is 20-40 they get two points; if it is over 40 they get three points.

Making Fifteen

No. of players: 2-4
Materials: Deck of cards, counters
How to play:

1. The object of the game is to get as close to a total of 15 as possible without going over.
2. One player deals two cards face down to each player.
3. The player to the left of the dealer goes first. If their cards add up to less than 15, they can ask the dealer for another card, trying to get their cards to total a number as close to 15 as possible with out going over.
4. If the player goes over 15, they are out for that round.
5. Each player takes a turn asking for more cards.
6. After each player has had a turn, everyone turns over their cards and compares totals. The player with the total closest to 15 wins that round and takes a counter from the pile in the centre of the table.
7. If there is a tie, no one gets a counter.
8. The game ends when one player has collected 10 counters.

Variations: Instead of 15, use other totals such as 21, 30, 50, and deal out three cards to begin.

Go Fish Five

No. of players: 2-4
Materials: Deck of cards
How to play:

1. Deal out 5 cards to each player. The rest of the cards are put in a pile face down in the centre.
2. If a player can make a pair that adds to 5, they place their cards down in front of them face up.
3. Every player should check each other's pairs.
4. The dealer then starts by asking any other player for a card that would help them to make a pair that adds to 5.
5. If they get a card that gives them a pair they put the pair down face up.
6. If the other player does not have the card asked for, they say "GO FISH" and that player must pick up a card from the centre. It is then the next player's turn.

7. The game ends when one player has no cards left.
8. The players then count up their pairs and the player with the largest number of pairs wins.

Variations: Go Fish Ten, Go Fish Fifteen. Use a higher target number with the same rules.

War

No. of players: 2-4
Materials: Deck of cards
How to play:

1. All the cards are dealt so that each player has one stack placed face down.
2. Without looking, each player turns up the top card in their pile.
3. The player whose total is the highest takes all cards played.
4. If the sums are equal, players keep their own cards.
5. The player who has the most cards in the end is the winner.

Double War to Ten

No. of players: 2-4
Materials: Deck of cards
How to play:

6. All the cards are dealt so that each player has two stacks placed face down.
7. Without looking, each player turns up the top two cards in their pile.
8. The player whose total is the highest takes all cards played.
9. If the sums are equal, players keep their own cards.
10. All players must agree on the totals before anyone takes the cards for that round.
11. The player who has the most cards in the end is the winner.

Salute!

No. of players: 3
Materials: Deck of cards
How to play:

1. The cards are dealt to two of the three players.
2. The two players dealt cards sit facing each other and place their stacks of cards face down in front of them.
3. At the same time, these two players take their top card and say "Salute!" as they hold the card on their forehead (you are not allowed to look at your own card, only the other player's card).
4. The third player (with no cards) announces the total of the two cards showing.
5. Each of the players guess the number on their card by subtracting the other player's card from the total that was announced.
6. The third player is the referee and decides which player announced their card's value first. That player takes both cards.
7. The player with the most cards wins.

MATHEMATICS AND MUSIC

Most children enjoy music. It is one of the first ways that a child experiences math. Babies clap along with their parents. Children react to the beat, rhythm and melody of music, all of which are based on mathematical principles. Math songs help children to remember mathematical concepts and in some cases, to better understand those concepts. Emphasize beats by stomping and clapping and counting forward or backward. Use the beat to count by 2's, 5's and 10's. Make patterns with claps and have your child repeat or extend the pattern. Find songs that include number concepts. For example:

There was a farmer has
a cow and **Even** was her
name-o!
0, 2, 4, 6, 8! 0, 2, 4, 6, 8!
0, 2, 4, 6, 8!
And **Even** was her
name-o!

Counting songs help children to count, but they also help children to develop other concepts, such as one-to-one correspondence (counting one thing for each number word). Youtube and teachertube provide many examples of songs for teaching math. One website that provides a wide variety of math songs with words and music is: **http://www.songsforteaching.com/mathsongs.htm.**

An example of a favourite math poem is:

Five Green and Speckled Frogs
sat on a speckled log
Eating some most delicious bugs.
Yuuuuuuuuummmmmmmmm...yuuummm!
One jumped into the pool
where it was nice and cool.
Then there were four green speckled frogs,
Glub, glub.
Four green and speckled frogs…
Three green and speckled frogs…
Two green and speckled frogs…
One green and speckled frog…
…Then there were no green speckled frogs!
Glub, glub, glub, glub.

http://www.songsforteaching.com/folk/fivegreenandspeckledfrogs.php

MATHEMATICS AND READING

Reading stories can enhance your child's interest in and understanding of mathematics. Stories provide natural contexts for exploring ideas about number, space and shape. When children read and discuss math stories, they hone their mathematical reasoning and communication skills.

Children's first experience with mathematics is often through numbers introduced in stories, rhymes and games. Consider the natural learning of numbers that comes from the many nursery rhymes and stories that focus on the concept of three (e.g., Three Little Pigs, Goldlilocks and the Three Bears, Three Blind Mice, Three Little Kittens) and then later on the concept of five (e.g., Five Little Monkeys Jumping on the Bed, Five Little Ducks). Through repetition, these books introduce children to the concept that numbers have a consistent sequence; that they follow a pattern; that the quantity increases by one each time and that the final number in the count is the entire amount that is contained in the set that was counted. As children get older, introduce them to books that contain more complex mathematical ideas such as: *How Much Is a Million?* Schwartz, D. (1993); *How Tall, How Short, How Faraway.* Adler, D. (1999); or *How the Second Grade Got $8,205.50 to visit the Statue of Liberty*. Zimelman, N. (1992).

When you read a mathematics story with your child, keep in mind the same strategies you use to read any story. Find a story that is interesting. Read with expression. Provide background information, as necessary. Talk about numbers, patterns, shapes and sizes. The best books have a mathematical or reasoning problem that needs to be addressed. Brainstorm and make predictions. Even books that are not specifically mathematical in context can be used to generate more mathematical ideas. Make comparisons, look for differences and changes. Involve children in making estimations: "It says that this dinosaur is 12 metres long and 3 metres high. Do you think it would fit in our doorway?"

For a plethora of excellent examples of math books for reading, visit the following two sites. They provide information about the best mathematics books for different ages of children.

http://www.dearteacher.com/math-books and
http://www.whatdowedoallday.com/2015/02/math-picture-books.html

A small sampling of some popular math books are listed here:

Akers, S. (1990). *What comes in 2's, 3's and 4's?* New York: Simon & Shuster.
Bogart, J.E. (1989). *10 for Dinner.* Richmond Hill, ON: Scholastic Tab.
Christelow, Eileen. (1998). *Five Little Monkeys Jumping on the Bed.* New York: Clarion Books.
Crews, D., (1992). *Ten Black Dots.* Toronto, ON: Scholastic.
Merriam, E. (1996). *12 ways to get to 11.* New York: Aladdin.
Sheppard, J. (1992). *The Right Number of Elephants.* New York: Harper Trophy.

MATHEMATICS AND ONLINE SITES

Many mathematics activities are available online. They are usually designed to appeal to a child's natural interest in animals, sports, toys, etc. As a parent, though, it is important to realize that the computer can become an isolating and static learning environment. Join your child on these sites. Make it an interactive experience. A parent's guidance and mutual interest will go a long way to making the activity on the computer a rich and rewarding learning experience. Some effective sites are listed below.

- ABCya: Children's educational computer activities created or approved by certified school teachers. (Site requires Flash Player) http://www.abcya.com/
- Bedtime Math www.bedtimemath.org Engaging, age-appropriate math topics for kids at bedtime (alternative or addition to bedtime stories).
- Canada Science and Technology Museum (CSTM) – Kids' Zone: Activities, articles and interactive features like the Inventions Gallery, where kids can submit their own inventions to be showcased online.
- Canadian Children's Museum: Interactive online features complement the museum's collection.
- Canadian Museum of Nature: Online movies, games, facts and features about the natural world we live in.
- Civilization.ca: Centralized website for the Canadian Museum of Civilization, the Canadian Children's Museum, the Canadian Museum, the Canadian War Museum and the Virtual Museum of New France. Feature-rich site also offers special areas for Student and Educator Resources.
- Constance Kamii: Math games https://sites.google.com/site/constancekamii/materials-for-the-classroom
- Ecokids: Canada's interactive environmental web site for students of all ages.
- e-Learning Ontario: e-Learning Ontario is developing an e-learning strategy to provide all students in the province with access to high-quality courses and resources through emerging information and communication technologies.
- Eworkshop Learning Modules and videos: http://eworkshop.on.ca/edu/core.cfm?p=modView.cfm&L=1&modID=9&c=0&navID=mod
- Tangram-A Game of Shapes: http://cstmuseum.techno-science.ca/en/education/try-this-out-math-game-fun-tangram-a-game-of-shapes.php
- The Canadian Atlas Online-State-of-the-art interactive atlas from The Royal Canadian Geographical Society. http://canadiangeographic.ca/atlas/
- IXL – Canada: http://ca.ixl.com Comprehensive coverage of math curriculum from junior Kindergarten to Grade 12; iPad and Android tablet apps for mobile practice.
- Martin Gardner: a well-known math writer who also designs math games: https://en.wikipedia.org/wiki/List_of_Martin_Gardner_Mathematical_Games_columns
- Math City: http://www.tvokids.com/shows/mathcity
- Math Master: http://www.tvokids.com/apps/mathmaster
- Math Picture books, blog with ideas for math books for kids: http://www.whatdowedoallday.com/2015/02/math-picture-books.html
- Math Songs: http://mathstory.com/mathsongs/mathsongs.htm#earlylearners
- Mathmagic CSTM: http://cstmuseum.techno-science.ca/en/education/try-this-out-incredible-science-tricks-mathmagic.php (Did you know that many tricks performed by magicians and illusionists are based on mathematical principles?)

- Mobius Strip Racetrack CSTM: http://cstmuseum.techno-science.ca/en/education/try-this-out-math-game-fun-mobius-strip-racetrack.php
- More Math Picture books: http://www.dearteacher.com/math-books
- Nature Challenge for Kids— Information and resources for David Suzuki's "Nature Challenge" program as tailored for youngsters: Teachers/Parents pages http://www.davidsuzuki.org/what-you-can-do/
- NCTM Illuminations Project— an interactive tool for learning mathematics: http://illuminations.nctm.org/
- Prodigy (Game and education content): https://www.prodigygame.com/Canada/
- Roman Numeral Memory Game: http://cstmuseum.techno-science.ca/en/education/try-this-out-math-game-fun-roman-numeral-memory-game.php
- Sandy Math Numbers: http://www.tvokids.com/shows/sandymathnumbers
- Science Tricks Shopping List, CSTM: http://cstmuseum.techno-science.ca/en/education/try-this-out-incredible-science-tricks-shopping-list.php
- Songs for Math: http://www.songsforteaching.com/jennyfixmanedutunes/s/add1more.mp3
- TVOKids provides a range of educational projects (activities are grouped by topic and age level): https://www.teachontario.ca/community/explore/parents-as-partners/

LAST WORDS

Enjoy your math time with your child. Build an environment where mathematical ideas are embraced and enjoyed. Engage with your child in a relaxed but supportive manner. Encourage exploration and thinking outside the box. Find math riddles, stories, songs and art ideas that extend the math learning into other areas of children's interests. Explore the geometry, measurement and data management involved in sports and other activities. Make your home a haven for math experimentation and creativity. Cultivating mathematics learning can be a rewarding experience, opening opportunities for future academic and employment success. Plant those learning seeds gently and early, and nourish them well.

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