Fun 'Mathy' Adventures at Home (or School)

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Most people would agree that "math is all around us". When pressed for examples, though, many often remember computation used at the store and maybe a little geometry (anyone rearranging or painting a room during the COVID-19 quarantine?). But mathematics – multidimensional, beautiful, intriguing, useful, puzzling, fascinating – really **is** all around us all the time if we just know where to look. Even as you are reading this, letters are nothing more than geometric figures, positioned so as to convey agreed-upon meanings. Perhaps you have some children handy at home or school to join you in these adventures and look at the world through math-colored lenses. While playing with the mathematics is fun, participating and talking about ideas together makes the best memories and leads to lasting learning.

Explore the relationship between length (or capacity) and the pitch (high- or low-ness) of sound.

- Cut various lengths of string and pull them taut. Or find various lengths and thicknesses of rubber bands and carefully pull them taut. "Twang" or pluck the string and listen to the sound (pitch) it produces. Is there a pattern as you listen to sounds from shorter to longer strings (and vice versa)? What might you notice about string length and higher/lower pitches? What songs might you make by changing the string length or tautness?
- With a parent or other adult, collect a few drinking glasses that are of the same size. Fill a glass nearly full of water and gently tap on its rim with a teaspoon (or other piece of silverware). Now empty some water so the glass is half full. Tap the rim again. What happens to the pitch? Empty the glass completely. How does the pitch compare now? If you have several glasses, put different levels of water into each one. What do you notice? What might you wonder? Can you make a song by strategically tapping the different glasses?
- If you have one or more musical instruments at home, you can wonder about length and pitch, too. What happens when playing open strings vs. strings held by a finger in different places on the fretboard? When playing a horn like a flute or clarinet with all the holes closed vs. some or all open?
- If you have an acoustic piano, an adult can supervise opening it and exploring the strings inside the piano. Some strings are longer, some are shorter. Which strings produce

lower sounds? Where are they on the keyboard? Which strings produce higher sounds? Where are they? What do you notice and wonder about string length and pitch?

- So, what is your theory about predicting the highness or lowness of pitch?

Math connections: Direct variation (change in one quantity produces change in another in the same direction - both more or both less) and inverse variation (change in one quantity produces change in the opposite direction for another quantity; as one increases, the other decreases). Parents and young children don't need to be so concerned about the words; instead engage in the experience and learn to predict outcomes for given starting situations.

Explore Measurement and Fractions: Pots, Pans, and Measuring Cups

- Arrange a set of measuring cups (1 cup and less) from smallest to largest (or vice versa). What might you notice about the labels on the cups as they get smaller and smaller? Why might the smallest cups have a measure like 1/8 or 1/4, but the larger cups show 1/2 or 1?
- More fun with measuring cups: If you could only choose 3 measuring cups to have, which 3 would you choose? Why? What if you were only allowed 2...or even 1? Which might you choose and why?
- How much do pots and pans really hold? Predict how many cups of water the family cookware holds, then fill cup by cup with water. Any surprises? Do estimates get better the more different pots and pans that you try? Are you a better estimator for round pots than rectangular pans? Is there a pair that hold close to the same volume of water, but they aren't shaped alike? Why might that be? Extend your adventures by venturing into quarts and gallons territory, or by pulling out the measuring spoons as well. Why might nearly every other country have adopted the metric system instead of continuing with teaspoons, tablespoons, cups, pints, quarts, gallons, and so on?

Math connection: Unit fractions (1 over a number, like ½, 1/3, ¼), relative sizes of fractions, building with unit fractions (e.g., make 3/4 cup using the 1/4 cup 3 times); relative sizes of units; conversions between capacity measurements.

Since you've got the cookware out - follow a recipe and enjoy eating the results.

- A recipe is an ***algorithm*** - a step-by-step plan to get a desired, predictable, result.

- Write out each step of a favorite recipe on its own slip of paper or index card. Shuffle them. Read them in their new order. What might happen if we just follow the instructions in whatever order we want?
- Parents/caregivers - Talk with children about which parts of treasured recipes you always follow carefully, and other steps where there's wiggle room? Why are you very careful about some parts and more lenient about others?
- Now try doubling or tripling (or 'octupling') a favorite recipe - just on paper. Talk through your thinking about increasing various measurements...do I really need to measure out 12 individual teaspoons of sugar, or can I just use 4 tablespoons (or 1/4 cup)? For experienced cooks, for which ingredients would you follow the math exactly (and why)? Are there other ingredients you might add a little more or little less, even though your conversions give you definite quantities? Why might you do that?
- For those really adventurous souls, try halving or quartering a recipe, taking one that serves 8 or 12 down to 2 to 4 servings. What practicalities might you run into, and how might you solve them (1/4 of an egg, anyone)?
- Make your own algorithm and have someone follow it. Did they get the results you intended? A famous example is "making a peanut butter and jelly sandwich". This is fun for any age! Have your child write out, or record on video, the steps to make their favorite sandwich (just tell, don't do/show). Adult - follow the steps to the letter and see what you get. Don't fill in any gaps or make assumptions. It's the rare pair that ends with a neat, edible sandwich as intended.

Math Connections: number sense with fractions; arithmetic with fractional quantities and units of measurement; estimating measures; measurement conversions; following an algorithm, creating an algorithm.

Laundry time! Yes, there is math in the laundry, too.

- Have your child (of any age) join you to do laundry. Think out loud as you sort the clothes, decide on which cycle and options to use (hot? cold? longer time? less time?), how much detergent and softener to use, whether to add bleach or other additives. What do the cycle names and option names mean? How do they change times, temperatures, and speeds? How do you choose among all the options? What *variables* are you considering?
- Have your child (of any age) help fold towels. How many ways can they be folded? How do you know where "halfway" is? If you fold in thirds, how do you know where "one third" is? Why might you fold the way you do? Do you fold some things in half, and others in thirds or quarters? Why? Help your child to attend to detail and work toward folding "exact" halves, thirds, quarters. How will they know they are "exact"?
- Matching socks! This is great practice for the concept of "like terms", whether in algebra or arithmetic. If your family wears multiple colors, sizes, and/or brands of socks,

work with your child (of any age) on matching them into pairs. Talk about how you know what goes together. Men's black sock with other men's black sock (same size, style, brand); child's striped sock with other striped sock (same size/pattern/colors), etc. You can also venture into geometry by talking about congruent objects (same size and shape) vs. similar objects (same shape, but different sizes...maybe mom and daughter both wear socks that look very much alike, but mom's is in adult sizes and daughter's is in kids' sizes).

Math Connections: Direct and inverse variation (more dirt, more detergent needed; the more delicate the item, the less time in the washer, and less speed of wash/spin); symmetry and fold lines (folding towels, tablecloths, sheets, pillowcases, shirts); like terms (matching socks); congruent and similar figures.

Play Card Games and Board Games - Keep Score Manually!

- Check thrift stores, community sales, and garage/yard sales to pick up games and puzzles at little cost. Just make sure you have all the pieces or can improvise missing pieces easily.
- Many games can teach strategy as players observe patterns and either strive to repeat those actions or avoid them. What moves help you win? What moves help avoid losing?
- Most games have elements of probability (otherwise we would know who will win from the beginning). Games with spinners, dice, and drawing cards from a defined deck are excellent for developing notions of probability: certain, highly likely, likely, even chances (50:50), unlikely, highly unlikely, rare, impossible. In Monopoly, which dice totals show up least often (2 and 12); most often (7)?
- Some games help with learning to follow directions (algorithms) and in learning to count: Chutes and Ladders, Candy Land, High Ho Cherry-O, Sorry. Dot-to-dot pictures are excellent for counting (by 1s, by 2s, by 5s, by 10s).
- Even young children can get a feel for probability by playing card games like Go Fish, Crazy 8s, Slap Jack, and War. They also help promote focus and attention.
- "Memory" or "Concentration" is a great card game for any ages. Players learn to create mental images and other mental hooks to remember where a desired card lies, and to use geometric shapes or layouts as memory triggers.
- Dice games like Yahtzee (score cards are online) and Shut the Box (can play with your own cards numbered 1 to 9) hone both probability senses and arithmetic skills.
- Have fun developing logical reasoning skills by playing word games (hangman, word searches, crosswords), doing jigsaw puzzles, solving mazes, and playing games like Mastermind (can play with pencil/paper). Logic puzzles ("which child lives in which house with which pet") including Sudoku gradually grow logical reasoning ability and develop perseverance.

- "Battleship" merges strategy and logical reasoning with working on a coordinate grid (or plane). Generations of children have been introduced to coordinates by playing Battleship. It can be played on grid paper or on a coordinate plane.
- Play games that require keeping score and adding/subtracting (and sometimes, multiplying). Talk together about strategies for making 10s and 100s, and other number sense and mental math strategies. Millebournes (card game) is great for 2nd grade and up. Learning to play popular card games like multiple-player solitaire ("Blitz", "Nutsy"), Canasta, Hearts, and the like prompt strategy as well as becoming more fluent with mental mathematics and number sense. Some domino games lead to naturally making visual combinations of 10 or 20 (or other friendly numbers) for scoring.
- Checkers, chess, and backgammon are always fun. They can be improvised with homemade boards and pieces. Once you have the moves down, talk together about strategy. What moves get you closer to winning? Why? What moves contribute to losing? Why?
- Jigsaw puzzles – Begin at the earliest ages with 2-4-piece puzzles. Working puzzles develops visual skills (looking for similarities and differences); perseverance and focus; discerning sizes, shapes, colors, and patterns; developing prediction skills (the piece that would go here should look like this). Puzzles can be worked individually or with others. They can be stopped and started over time until completion. Young children love doing the same puzzles over and over and over.

Math Connections: strategic problem solving, logical reasoning, probability, number sense, mental arithmetic, pencil/paper arithmetic, algorithms, number and visual patterns, perseverance, attention to detail.

Many card sets, game layouts, player tokens, and dice can be found free on the internet for download, printing, and cutting out (or taping together). Google Images and Pinterest have a wealth of images that can be downloaded for free or nominal cost.