Developing Fluency through
Activities, Games, Magic Tricks, Puzzles, & Problems

by
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&
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Foster delight, develop children's basic math skills and engage them in higher-level thinking with hands-on activities, games, magic tricks, puzzles, and problems. The aim of this paper is to discuss ways for teachers and parents to get primary school children to play, experiment, and explore — and in the process do many computations and calculations. We present some of our favorite problems and offer some insights into why we selected them.

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How to Work with Students

To inspire enthusiasm, we aspire to the following empirical guidelines:

1. Strive to ask more questions than you answer and do more listening than talking — this is hard! Start by finding out what a child has done and knows already. Ask questions such as: "What have you tried so far?"; "Why must that be so?"; "Can you show me an example?"; "Help me understand what you've found that has worked so far"; or "What might you do next?" Often it helps to model question-posing or make invitations to switch gears: "I wonder if drawing a picture would be helpful — or maybe you have another idea"; "Maybe there's a way to think of this in simpler numbers — or maybe you've done a problem like this before?"; "Would manipulatives (e.g., tiles, blocks, rods, dice) help solve your problem?" For a child near a solution, you may point her to what is requested: "Tell me again — what you are supposed to find out?" Or maybe a child will solve the problem by himself and you can guide him towards a different way of looking at the problem or solution: "Will that always work?" "What if the constraint was...?" For some, you'll be helping them read and understand the instructions.

2. Let the children experiment, compute values, make their own mathematical discoveries. Avoid trying to teach students new concepts or shortcuts; allow their natural processes to guide them once they understand the goals of the problem, game, puzzle, or activity. Give specific feedback on progress and struggle (i.e., instead of "You are so smart! Nice job!" try "You figured out how to multiply those numbers! Nice job!"). Discovering one or more methods to solve a problem is more important than just getting an answer.

3. Generally limit yourself to 2 or 3 minutes' talking to any one child or a group of children, then move on. Meet each child at his or her level. Feel free to return to a child or group if you sense a need or desire for more interaction.

4. Encourage the children to WRITE DOWN what they're doing so you can make more effective use of your time when you work with them. Writing is a great skill for young kids to learn. You may need to model this for some kids, offering to play scribe as they describe what they did in their heads.

5. Keep the focus on the math. Keep abreast of what each child is doing and figure out where the child wants to go next. If you see a kid's attention wandering, point her back to the problems; try to figure out what may be of more interest to her and direct her accordingly. Some kids may get more interested when they see fellow classmates working on the problem. Other kids may need some support in working on harder problems: they may not have experience in what to do when it takes more than a few minutes to figure something out. You might suggest an easier, related problem to help get them started, and reassure them that they are doing well. Encourage them to challenge themselves!

6. Give kids positive feedback for discovering something that excites them, for writing things down clearly, and especially for battling a challenging problem. Praise effort rather than ability.

7. Enthusiasm is contagious. Before you arrive at your class, take time to become familiar with the planned activity, game, puzzle, or problem. Imagine several possible ways kids might respond, and how you might respond to them. If you don't understand the material or think it isn't interesting, find something else that you do enjoy.

8. Set the stage for a positive, supportive, challenging environment: establish ground rules for respecting the participants and their work.

Here's a summary of tips for facilitating:

- Listen. Ask questions such as "What have you tried so far? What have you found that has worked? Where did you get stuck? What might you do next? Can you use a manipulative to solve the problem?"
- Observe. Watch what each student is doing.
- Meet each student at his or her level.
- Refrain from teaching. Avoid trying to teach students new concepts or shortcuts; allow their natural processes to guide them.
- Encourage students to document what they do.
- Give specific feedback on progress and struggle (i.e., instead of "You are so smart! Nice job!" try "You figured out how to multiply those numbers! Nice job!").
- Be prepared. It is important that you understand what you are introducing to your class. Familiarize yourself with the activity, problem, or material before you arrive to class.
- Show your enthusiasm. Enthusiasm is contagious. If you don't like your assigned activity, find one that you enjoy, preferably before class begins.

Favorite Problems

> *Good education systematically gives opportunity to the student to discover things by himself.* — George Pólya

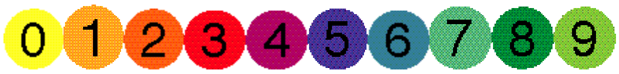
We select problems that entice students to play, talk, and write about numbers, calculations, equations, and concepts. When students make discoveries themselves, they are more enthusiastic and likely to understand and remember what they learned.

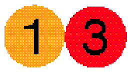
Arithmetic Fluency

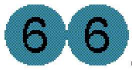
What follow are some of our favorite activities, puzzles, games, and problems that promote arithmetic fluency. We like these problems because they offer some depth, e.g., some involve discovering a strategy or pattern. If our description is terse, check the reference (webpage or book) for a more detailed description.

Number Bracelets
From www.geom.uiuc.edu/~addingto/number_bracelets/number_bracelets.html
Unlike worksheets, this problem gets kids to practice addition and discover patterns.

Imagine that you have lots of beads with numbers 0 to 9.



Start with any two beads, e.g., 1 & 3 or 6 & 6 

or 

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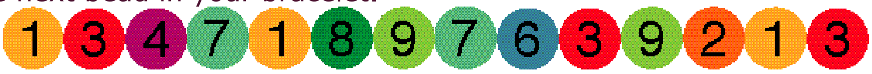
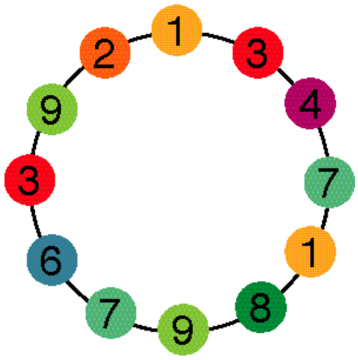
To determine the next bead, add the value of two beads and record only the unit digit of their sum. For example, after 1 & 3 is 4, after 8 & 9 is 7 (since their sum is 17 and 7 is in units place of the sum). Repeat this procedure, using the value of the last two beads to create the next bead in your bracelet.



A sequence becomes a bracelet when the ending two beads are the same as the starting two beads and in the same order.



Record some sequences on graph paper (with large squares), preferably with 10 or 15 columns of squares. Investigate and write up your findings.

We've been delighted how engaging children found this problem. They discovered:

- many long bracelets are the same length.
- there is a pattern of where the zeros appear.
- two odd numbers are followed by an even number.

If children get stuck, give them time to think; if they are still having difficulty making progress, consider asking some of the following questions:

1. How many different possible pairs of numbers can you use to start?
2. What's the shortest bracelet you have found?
3. What's the longest bracelet you have found?
4. What odd- and even-number patterns are there in all your bracelets?
5. If you start with two beads with different numbers, but put the beads in the opposite order, e.g., 2 4 and 4 2, do you get the same bracelets, i.e., with the same sequence of beads?
6. How many different bracelets are there?

Find comments and variations of the Number Bracelet problem on "The Math Less Traveled" blog (mathlesstraveled.com/?p=513), e.g., "It is easy to generalize number bracelets to moduli other than 10—at each step, add the two previous numbers and take the remainder of dividing by something other than 10."

For another version of this problem, visit www.galileo.org/math/puzzles/IrritatingThings.htm.

Nine-Digit Puzzle
From *Historical Connections in Mathematics, Volume II*, page 85

Many children we have taught enjoy making lists, and kids who are not strong at their number facts show enthusiasm for solving this problem.

Find all the equations of the form __ + __ = __ using only the numbers 1 - 9 in each blank, and using each number only once in each equation, e.g., 1 + 2 = 3.

1 2 3
4 5 6
7 8 9

Once you think you have found all the equations, how can you check that you haven't forgotten any?

Palindromes
From *Family Math* by Jean Kerr Stenmark, Virginia H. Thompson, Ruth Cossey and math.youngzones.org/palindrome.html and library.thinkquest.org/TQ0312134/palindromes.html

A palindrome is a number that reads the same forwards and backwards, such as 4, 22, 575, 4884, and 52125.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

34 is not a palindrome, but you can create a palindrome in 1 step by adding 34 to its reverse, i.e., 43. 34 + 43 = 77. We'll call 34 a 1-step palindrome. Check that 46 is a 2-step palindrome.

Explore the numbers from 1-100. Take a hundreds chart, like the one shown to the right, and outline in the same color the squares with numbers that are palindromes; outline in a different color the squares with numbers that are 1-step palindromes; outline in another different color the squares containing numbers that are 2-step palindromes, etc. Describe the patterns that you find.

Other questions to consider: How many palindromes are there between 1 and 300? How many palindrome numbers are there? Prove it.

The webpage letsplaymath.wordpress.com/2008/09/22/things-to-do-hundred-chart/ describes other things to do with a hundreds chart.

The Game of Pig or Pass the Pigs
From *About Teaching Mathematics: A K-8 Resource, 3rd Ed.* by Marilyn Burns, page 99

Materials: A pair of dice (or a pair of pigs from *Pass the Pigs* Winning Moves game)

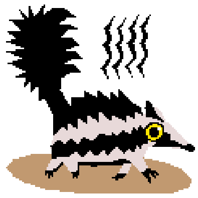
This is a game for two or more players. The goal of the game is to be the first to reach 100. On your turn, roll the dice as many times as you like, mentally keeping a running total of the sum. When you decide to stop rolling, record the total for that turn and add it to the total from previous turns.

The catch: If you roll a 1, your turn automatically ends and you score 0 for that round. If you roll two 1's, not only does your turn end, but your accumulated total returns to 0.

After becoming familiar with the game, write a strategy for winning.

Below is a review of *Pass the Pigs*, which appears on Amazon.com:

> I am a teacher and I use this game with my kids at school all the time. They LOVE it from grade school to high school, depending on how you use it. I don't really follow the rules that came with it, only the values of how the pigs land. I have used it often in an after-school tutoring program where we practice math facts and addition. I took the instruction sheet from the game, found the place where they have the pigs drawn and what the rolls are worth, enlarged it on the copier so all the kids (usually less than 6) can see it at the same time (and of course, colored the pig drawings pink!) Then each student rolls, finds what his roll is worth, and adds his score. The first to pass 100 points wins. We sometimes start with 100 and subtract our score — the first to zero (or less) wins. We have played where I announce at the beginning of the round that "This roll will be multiplied by 7" and the kids all cheer "Come on double razorback!" I was amazed how fast they learned what each roll was worth.

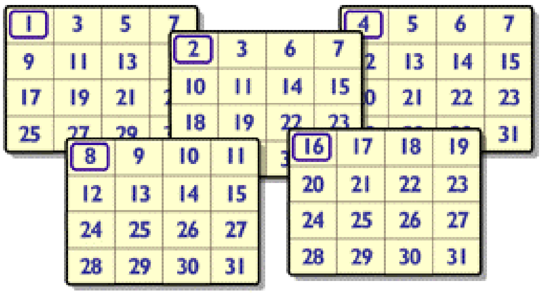


Pass the Pigs involves discovering and implementing a strategy in addition to doing arithmetic.

If your children enjoy playing the *Pass the Pigs*, check out the Game of Skunk. Below are links to descriptions of the game and scoring sheets:

- NTCM Illuminations: illuminations.nctm.org/LessonDetail.aspx?id=L248
- Digital Lesson: digitallesson.com/MathGames/GameSkunk.pdf

The skunk on the right is from MathWire.com (mathwire.com/data/dicetoss2.html), where you can find these two-dice games and others.



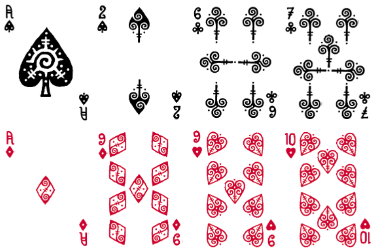
Magic Card Trick
Graphic from www.edb.utexas.edu/resources/mathclub/magictrick/

Start by performing this trick until at least some of the kids think they know the trick or are dying to know how it works. This may seem an obvious ploy but it isn't. There are teachers who will start by explaining the trick and children will lose enthusiasm for it. We've found that children lose their enthusiasm for the trick when they are creating the cards but then gain an appreciation and understanding when they perform the trick on others.

Perform magic by creating magic cards based on the binary representation of numbers.

- www.edb.utexas.edu/resources/mathclub/magictrick/ (base 2 - pdf for creating cards)
- mathdelights.org/delights/activities/magic_cards_base10instructions.pdf (instructions for base 10 cards)
- mathdelights.org/delights/activities/magic_cards_base10.pdf (base 10 - for young children)
- gwydir.demon.co.uk/jo/numbers/binary/cards.htm (online version)

Your Number Magic Trick
Taught to Nancy by Rita Levinson
The image of cards is from www.emilyarkin.com/art/cards.html.



Ask a volunteer to pick a card from a shuffled standard deck of 52 cards without showing it to you. After doing magic, you will tell the number of the volunteer's card (but not its suit). The trick is much easier to perform than it is to describe. This trick gets children to become familiar with pairs of numbers that sum up to 10; if the children make a mistake, the magic trick doesn't work.

Here's the trick:

1. Make a stack out of the 51 cards that the volunteer didn't select.
2. Take 16 cards from the top of the stack; place the cards on a table face up in four rows and four columns.
3. Find two cards (or, as you continue, piles of cards) whose face numbers add up to 10, e.g., 4 and 6; take two cards from the stack and place those two cards face up on top of the two cards that add up to 10 so only the faces of the new cards are showing.
4. If any 10's are face up, cover the 10 card with a card from the stack.
5. If there are a Jack, Queen, and King facing up, take three cards from the stack and place the cards face up on top of the Jack, the Queen, and the King.
6. Continue steps 3, 4, and 5, until there are three or fewer cards in the stack.
7. Remove from the table: two piles of cards for which the two cards on top of the piles sum up to 10 or three piles of cards in which there are a Jack, Queen, and King on top of the piles.
8. If there are any cards in the stack that contained 51 cards in the beginning, place them face up in the locations where you removed piles of cards.
9. Continue removing piles of cards, as described in Step 7, until either only one pile remains with a numbered card on top, two piles remain with picture cards on top, or there are no cards on the table.
10. The number of the card that the volunteer selected is either the difference of 10 and the number card that is face up or the picture card that isn't face up. For example, if there is one pile of cards with a 7 on top, the volunteer picked a 3 because 10 - 7 = 3. If a Jack and a King are facing up, the volunteer picked a Queen. If there are no cards on the table, then the volunteer selected a 10.

Variation: Find cards that add up to 14. Assign a Jack the value 11, Queen 12, and King 13.

Adding Plus
From nrich.maths.org/2007 and www.cut-the-knot.org/do_you_know/digits.shtml

If you write plus signs between each successive pair of the digits 1 to 9, this is what you get:

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 45$$

However, if you alter the placement of the plus signs, you could also get:

$$12 + 3 + 45 + 6 + 7 + 8 + 9 = 90$$

Can you place plus signs below so that the following is true?

$$1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9 = 99$$

How many ways can you do it?

Can you place plus or minus signs below so that the following is true?

$$1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9 = 100$$

See if you can get more than one solution.

The Ten-Digit Sum Puzzle

From Diane Resek, Professor Emerita of Math, SF State
This problem was adapted from a problem in *A Think Twice Quiz for a Cold Night* by Harold Taylor, California Math Council, Northern Section, 1969.

Take the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 and arrange them in any order to make two numbers in two rows. Now add the two numbers to get a third row.

Find one or more arrangements in which each of the ten digits is used once and only once in one of the three rows.

If your students get stuck, try adding more constraints (problem from nrich.maths.org/804):

> This addition sum uses all ten digits 0, 1, 2 ... 9 exactly once. Find the sum and show that the one you give is the only possibility.

```
  * * 4
+ 2 8 *
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* * * *
```

There are several other interesting puzzles with a similar name involving ten-digit numbers, e.g., Write a ten-digit number where the first digit indicates the number of zeros in the ten-digit number; the second digit the total number of ones; the third digit the total number of twos; and so on until the last digit, which indicates the total number of nines. For example, 8000000010 is not true because there is one 1 but the second digit is 0, not 1. (mathforum.org/library/drmath/view/65585.html).

Cryptarithms and Deductive Reasoning

From Diane Resek, Professor Emerita of Math, SF State
These problems came from *Some Problems Stolen from Various Places*, by Don Colman.

In the following addition problem, the letters A, B, and C stand for three different digits. Figure out which digit each letter stands for and explain why your answer is the only possible one.

```
   A A
+  B B
------
 C B C
```

Now, just as in true life, the following calculation is not only hard, but it is in fact impossible. Explain why this subtraction problem cannot be performed with each letter standing for a different digit.

```
  S P E N D
 –  L E S S
-----------
  M O N E Y
```

This puzzle is a variation Henry Ernest Dudeney's equation, which was published in the July 1924 issue of Strand Magazine:

```
    S E N D
 +  M O R E
-----------
  M O N E Y
```

According to the website www.mathematik.uni-bielefeld.de/~sillke/PUZZLES/ALPHAMETIC/:

> *Cryptarithms* are puzzles in which letters or symbols are substituted for the digits in an arithmetical calculation. Algebraic expressions might be regarded as cryptarithms of a sort, but algebra is not generally considered to be

mathematically recreational. Cryptarithms have existed for centuries, and it is doubtful if it will ever be known when such puzzles were first devised. If a cryptarithm utilizes letters in place of the digits, and these letters form sensible words or phrases, the puzzle is termed an *alphametic*. J. A. H. Hunter coined the term in 1955.

You can find more cryptarithms on the website www.mathematik.uni-bielefeld.de/~sillke/PUZZLES/ALPHAMETIC/ and in the book *Getting Smarter Every Day* (Books D, E, and F) by Dale Seymour.

What's the Difference

What's the difference between a two-digit number and its reverse?

1. Choose a two-digit number, e.g., 20. Make a new number by reversing the digits, e.g., 02.
2. Subtract the smaller number from the larger number, e.g., 20 - 02 = 18.
3. Check your subtraction by adding your result, e.g., 18 + 02 = 20.
4. Do you notice a pattern? If not, choose another two-digit number and go back to step 1.

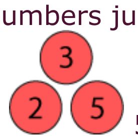
On the basis of your findings, see if you can predict the difference between a two-digit number and its reverse.

For more of a challenge, investigate three-digit numbers.

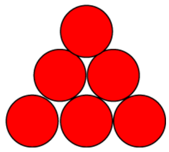
Find the Difference

From nrich.maths.org/6227

Place the numbers 1 to 6 in the circles so that each number is the difference between the two numbers just below it.

Example: 

5 – 2 = 3



Not only does the NRICH website have intriguing problems and puzzles, but the site also offers teachers' notes, hints, pdf worksheets, and solutions, e.g.,

- Teachers' Notes: (from nrich.maths.org/6227&part=note)

Why do this problem?

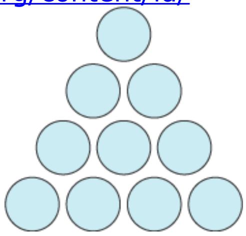
This problem is a challenging way of practicing subtraction at the same time as being logical about arranging the numbers. The idea of "difference" can be hard for children to grasp and this problem is an ideal way of coming to terms with it. You could also use this problem to focus on how children record their workings.

Possible approach

You could start by putting the numbers in any places in the pyramid and asking children to describe what they see. They may notice some accidental number patterns, but also which numbers are used. Then put two numbers into the pyramid, for example 4 and 5 in the bottom row, next to each other. Introduce the idea of the problem and invite pupils to suggest what number should go above the 4 and 5.

- Hint: "Where can the largest number go?" (from nrich.maths.org/content/id/6227/FindDifa.pdf)

- Worksheet: A sheet of blank pyramids. (nrich.maths.org/content/id/6227/FindDifa.pdf)



For children who want more of a challenge, add another row (nrich.maths.org/927).

Multiplication
From Steve Willoughby

1. Pick any three-digit number and multiply it by any two-digit number. You want the largest possible product.

2. Hopefully that wasn't too hard. Now select a number with five different digits (no repeats). How do you know that your answer is the largest possible product without calculating all the products?

3. Now let's play a game: Roll a die (10-sided if you have one) to generate digits and place them in your three-digit times two-digit problem. What is the best place to put your first digit if it is a 7? What is the best strategy for playing this game?

Four 4's

Martin Gardner, a well-respected mathematics and science writer who passed away in 2010, posed this simple but challenging puzzle in his "Mathematical Games" column.

Express as many integers as possible, by using the digit 4 exactly four times and using
- Common mathematical functions: + − × ÷
- Concatenation and decimal points are permitted, e.g., 44, 4.4, & .4

For example,
 1 = 44/44 or (4 + 4)/(4 + 4)
 2 = 4/4 + 4/4

In his book *Brain-Flexing Balance Problems and Other Puzzles* (page 62), Ivan Moscovich writes:

> It is possible to construct every digit from 1 to 10 this way. If square roots are also allowed, you can make the numbers from 11 through 20, with one exception.
>
> Can you find the equations for the numbers from 3 to 20, and find the number that can't be expressed in this way? (There is a way to express it, but it involves a different function—can you figure it out?)

Note: Judy Ann Brown started a contest at the Math Forum (mathforum.org/yeargame/2010) with a similar challenge.

> Use the digits in the current year, e.g., 2,0,1,0 (for this year) and the operations +, -, x, ÷, ^ (raised to a power), sqrt (square root), and ! (factorial), along with grouping symbols, to write expressions for the counting numbers 1 through 100. This year the contest will also allow the use of decimal points and double-digit numbers. This year we'd also like to challenge you to try to use the digits in the order 2, 0, 1, 0 in your expressions. We'll accept digits in any order, but we're more likely to publish an expression like 2 + 0 - 1 + 0 than 2 * 0 + 0 + 1. Teachers may print out worksheets for students to record their findings, or may print sheets of manipulatives for students to use.

Simplified Krypto

Nancy loved playing Krypto when she was in junior high school. The Krypto deck consists of 56 cards: three each of numbers 1-6, 4 each of the numbers 7-10, two each of 11-17, one each of 18-25. You can play Krypto with a standard deck of cards. If you use a standard set, consider taking out the picture cards or having Jacks be 11, Queens be 12 and Kings be 13.

1. Deal each player 5 cards.
2. Then select an additional card, which is the "target."
3. Your task is to find a way to combine 2 or more cards (each card used at most once) using arithmetic operations (+, −, ×, ÷) to yield the target value. The more ways to compute the target value, the better.

Make the game easier by using only cards numbered 1 through 5 or 10 and just + and -. Make the game harder by making each player use all 5 cards.

There are online versions of Krypto at mphgames.com/krypto/krypto.htm and jon.limedaley.com/code/stuff/krypto.php.

Finding Delightful Mathematical Material

There is a wealth of websites with inspirational activities, games, problems, and puzzles, many of which offer material free of charge. If you know or run across other sites, please let me know by emailing (*nancyZ@Zmathdelights.org* — remove both Z's from the address) or faxing me (1-650-348-8997).

NRICH - nrich.maths.org

On the wonderful NRICH website you will find thousands of free mathematics enrichment materials (problems, puzzles, games, and articles) for teachers and geared for learners from ages 5 to 19 years. All the resources are designed to develop subject knowledge, problem-solving and mathematical thinking skills. You can search the NRICH website for material of a specified level or type. For many of the materials, NRICH also offers pdf worksheets, hints, and solutions. For more guidance on how to find resources that suit your needs, go to the Help section of the site.

Following each problem on NRich is a a *tag cloud* to assist you in finding materials related to a given topic.

Factors and multiples. Working systematically. Interactivities.
Investigations. Multiplication & division. Trial and improvement. Place value.
Addition & subtraction. Combinations. Visualising.

The tags in the cloud are hyperlinks that lead to materials that are associated with the tag. For example, clicking on an Addition & subtraction. hyperlink will lead you to a page with links to addition and subtraction problems and activities.

Galileo Educational Network - www.galileo.org/math/puzzles.html

Galileo Educational Network website includes puzzles and problems from their math fairs, which are non-competitive, student-oriented festivals in which children of different abilities do math. For more advanced explorations in mathematical beauty, visit www.mathlesstraveled.com.

AIMS Puzzle Corner - www.aimsedu.org/Puzzle/

The AIMS Puzzle Corner provides over 100 interesting math puzzles that can help students learn to enjoy puzzles and the mathematics behind them. The puzzles are categorized by type, and within each category are listed in order of increasing difficulty. The puzzles have not been assigned grade levels of appropriateness because AIMS Educational Foundation has discovered that the ability to solve a puzzle varies by individual, not grade level.

SNAP Math Fairs — www.mathfair.com/puzzles.html

SNAP Math Fair offers challenging, age-appropriate and engaging puzzle problems. SNAP math fairs are designed to be:

- **S**tudent-centered,
- **N**on-competitive,
- **A**ll-inclusive, and
- **P**roblem-based.

Computer Science Unplugged - csunplugged.org

Computer Science Unplugged teaches principles of computer science, such as the binary representation of numbers, algorithms and data compression, through games and puzzles that use cards, string, crayons and lots of running around. In addition to free downloadable material, the website includes videos showing how their materials have been used for children.

Noyce Foundation Problem of the Month

The Noyce Foundation provides wonderful problems to their public-school partners. We would appreciate their making their problems of the month, www.noycefdn.org/pom.php, freely available to anyone, not just their partners. If you like the Noyce Foundation materials, please let them know.

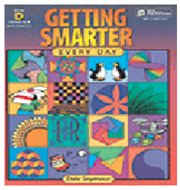
The Noyce Foundation was created by the Noyce family in 1990 to honor the memory and legacy of Dr. Robert N. Noyce, co-founder of Intel and inventor of the integrated circuit, which fueled the personal computer revolution and gave Silicon Valley its name. Much of the focus of the Foundation is on "improving instruction in math, science, and early literacy in public schools."

Family Math Games

The website www.mrsgoldsclass.com/MathGames.htm describes games for which you only need a deck of cards or a pair of dice.

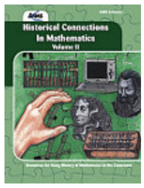
Books

Below are some of Nancy's favorite books that have intriguing problems, activities, games, and puzzles for primary school children.



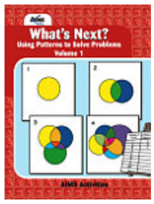
Getting Smarter Every Day
By Dale Seymour

Getting Smarter Every Day is a selection of activities, puzzles, ideas, information, and graphics to excite, enrich, challenge, instruct, amaze, and entertain students. This program aims to broaden student perspectives on what mathematics really is and its application in the real world.



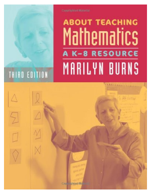
Historical Connections in Mathematics, Volumes I, II, & III

Published by AIMS. In addition to intriguing ready-to-use classroom activities, these books include biographical information on famous mathematicians. These books claim to be for 6-9th graders, but Nancy has successfully used material from them in her 2nd-5th grade math classes and camps.



What's Next: Using Patterns to Solve Problems, Volumes 1, 2, & 3

We agree with the description on the book's back cover: "A rich collection of life-related problems that demonstrate the power of pattern recognition in problem solving."



About Teaching Mathematics: A K-8 Resource
By Marilyn Burns

"This comprehensive text helps teachers teach math to guide students' understanding and skills; understand the math they are responsible for teaching; and understand how children best learn math." (From the back cover) We've found interesting problems and activities in this book that we use in our classes.

Conclusion

Our goal in providing you with delightful math resources is to stimulate the interest and curiosity of primary school children, their parents, and their teachers. Like the Elementary School Math Club at the University of Texas at Austin, we hope "exploring and playing with math will result in a positive attitude toward the subject that will serve [children] well throughout their formal education and beyond." For this article and more delightful mathematical materials, visit MathDelights.org. Please let us know of other engaging math materials, resources, and web pages.

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