

Math in Action: Interactive Math for Elementary Learners

21st Century Competencies Workshop



Presented by: Shirley Barclay and Carole Butcher
Sun West School Division



Math Warm Up: KenKen Puzzles



KENKEN
www.kenken.com

The world's most entertaining puzzle!!

Rules

1. Every box in the grid will contain a number 1~4.
2. Every row and column will contain the numbers 1~4 only once.
3. The numbers in each heavily outlined set of squares, called cages, must combine (in any order) to produce the target number in the top corner using the mathematical operation indicated.

5+		1 1	11+
3+	5+		
		5+	
7+		3+	

© Tetsuya Miyamoto / Gakken Co., Ltd.

Let's KENKEN together!!
KENKEN is a great way to have fun and exercise your brain at the same time!

Mr. Tetsuya Miyamoto, the math teacher & inventor of KENKEN

www.kenken.com

Answer

- ❑ Engage students
- ❑ Encourage perseverance
- ❑ Available in a wide variety of levels; great DI tool
- ❑ www.kenken.com

Using KenKen Puzzles
to Develop Math
Reasoning article by
NCTM



Welcome

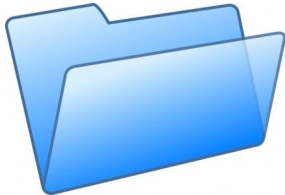
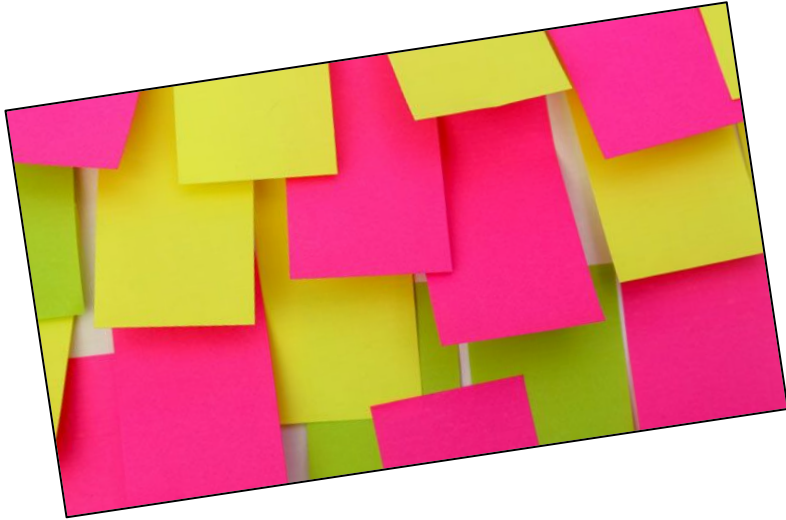
In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures.

National Council of Teachers of Mathematics, 2000

**Play with Math and
Give your Brain a Workout**



Parking Lot



File Folder Doodling

Conceptual Understandings: Learning Continuums

*“At every point in the process of a student’s construction of meaning for a mathematical idea, **the nature of what gets constructed depends on the student’s current ideas and ways of reasoning.**”*

***Thus:** To guide and support students’ construction of meaningful mathematical ideas and reasoning we must understand how they are constructing meaning for particular mathematical ideas.”*

Michael Battista, 2012



Six Volume Set

Available at Amazon:
<http://goo.gl/6p8ql4>

Conceptual Understandings: Learning Continuums

From the work of Michael Battista, 2012:

- ❑ Place Value
- ❑ Addition and Subtraction
- ❑ Multiplication and Division
- ❑ Fractions



<http://goo.gl/Ofz9jh>

Note: These are not by achievement level or by grade level, but rather a developmental scope and sequence of understanding.

Important Math Foundational Concepts

Conservation of Number: Understanding that the quantity of a given number of objects remain the same regardless of how it is spatially arranged.

One-to-one Correspondence: Understanding the counting quantity of objects corresponds with a specific number. Use 5 frames, 10 frames, 20 frames.

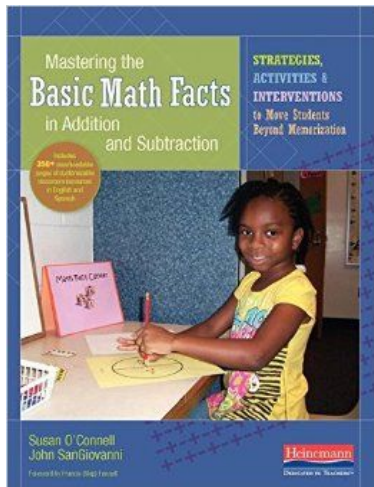
Subitizing: The immediate recognition of a collection of objects is a given number. Use Dot Cards.

Composing/Decomposing of Number: What values make up a number and how can those values be broken apart and then put back together.

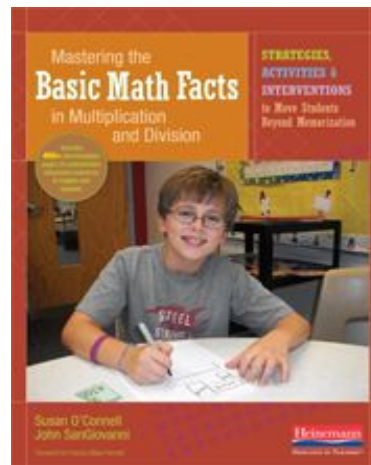
Number Lines: Use an open number line for computation, place value

Teaching of the Basic Facts

Check out suggested approach by Susan O'Connell and John SanGiovanni:



Adding and Subtracting PDF:
<https://goo.gl/f39tTt>



Multiplying and Dividing PDF:
<https://goo.gl/Zf1yNP>

Mapping the Outcome



Step 1: Map the Math

When thinking about your next unit of instruction, identify what ideas are in the curriculum.

Step 2: Determine Pre-Skills and Understandings

Think about what pre-skills and understandings are necessary for success in this math concept?

Step 3: Lessons would be available for students needing mastery in pre-skills

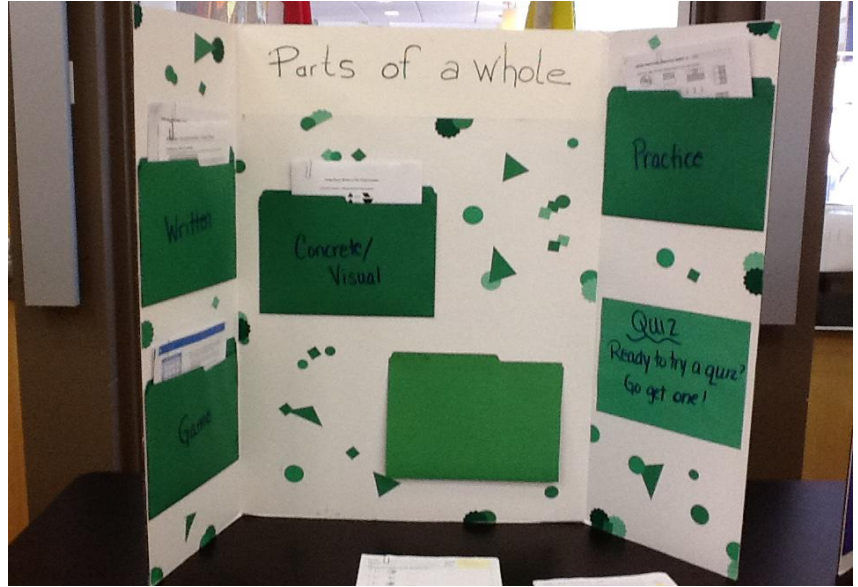
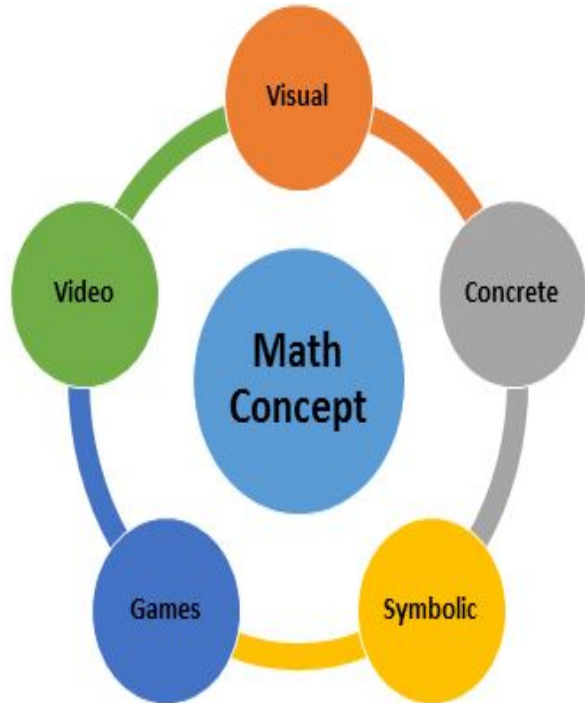
Peculiar # 6174



<http://goo.gl/dq9hb4>

- ☐ Pick 4 different numbers from 0 to 9
- ☐ Arrange them to make the largest number possible
- ☐ Now arrange them to make the smallest number possible
- ☐ Subtract the smaller number from the larger number
- ☐ Now, take that answer and arrange those numbers to make the largest number possible
- ☐ And the smallest
- ☐ Subtract
- ☐ Repeat
- ☐ How many times until you get to the **PECULIAR # 6174?**

Basic Learning Styles



I can differentiate my instruction by:

Changing the depth and breadth of the content

- Open questions
- Problem solving and inquiry

Using a variety of strategies and representations

- Work stations
- Guided math structures
- Journaling

Considering how my learning environment can better meet my students' needs

- Movement (stand, sit, partner/group work)
- Physical layout
- Classroom culture

Asking for products that allow students to demonstrate their learning

- Choice of how to show what they know

21st Century Skill: Math Reasoning

Find Out What Your Students Really Understand about Math.

- Focus on how students think and reason.
- Uncover students' strategies, understandings, and misconceptions.
- Learn how students respond to questions / Formative Assessment.

How?

Open Ended
Questions

Parallel Tasks

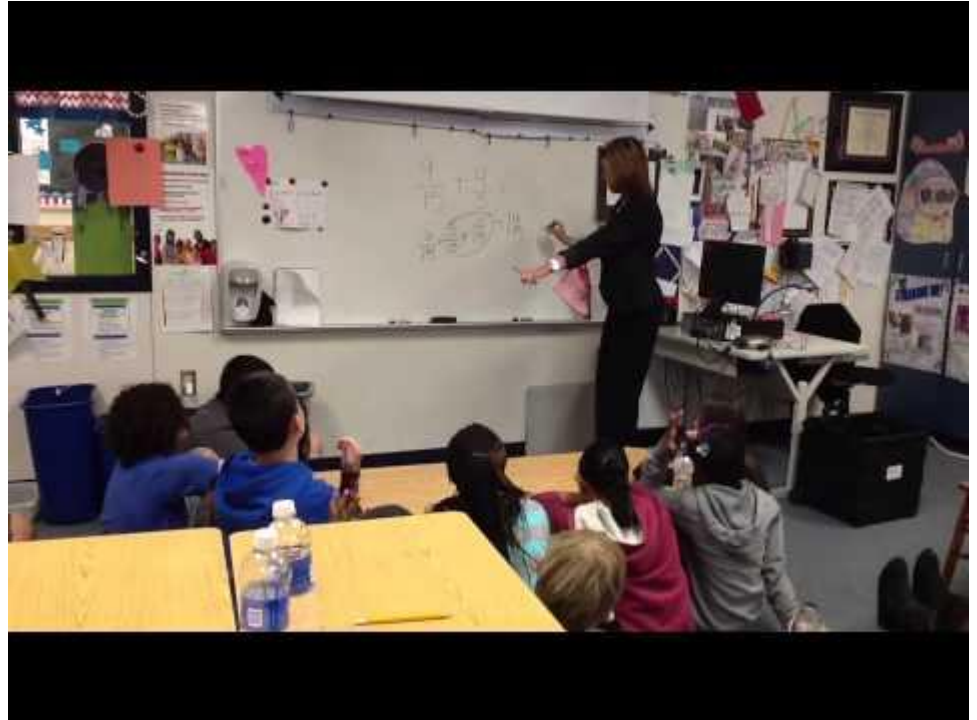
Number Talks

Number Routines

Agree ~ Disagree ~ Construct ~ Represent ~ Explain ~ Justify ~ Deeper Learning

Student Reasoning and Number Talks

<https://mathreasoninginventory.com/Home/VideoLibrary>



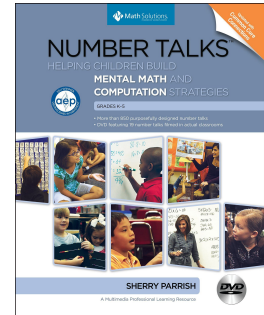
Number Talks

"Number Talks can best be described as classroom conversations around purposefully crafted computation problems to elicit specific strategies that focus on number relationships and number theory."

Parrish, Sherry. Number Talks: Helping Children Build Mental Math and Computation Strategies
(Available from Amazon: <http://goo.gl/4meDQz>)

There are 3 goals of number talks:

- ❑ Accuracy
- ❑ Flexibility
- ❑ Efficacy



Number Talks

The purpose is to **build from memorization to mathematical reasoning**.
As a community of learners, *students are actively constructing and making sense of math foundations*.

When could I use a number talk?

- ☐ Introduce concepts and properties about numbers.
- ☒ **Explore mathematical connections and relationships.**
- ☐ Review, reinforce, and practice procedures and concepts

More info on Number Talks at: http://www.mathperspectives.com/num_talks.html

Open Ended Questions

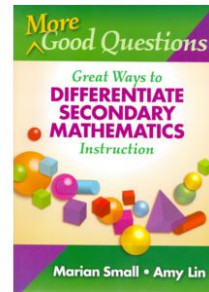
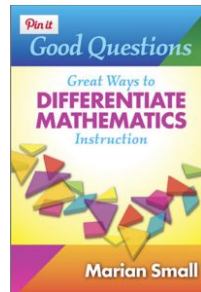
Features of open ended questions:

- ❑ There is no fixed *answer* (many possible answers)
- ❑ Solved in different *ways* and on different *levels* (accessible to mixed abilities)
- ❑ Empower students to make their own mathematical *decisions* and make room for own mathematical *thinking*
- ❑ Develop *reasoning and communication* skills



Good Question of the Week

Choose a reason why each number does not belong with the other three:
60, 120, 123, 240

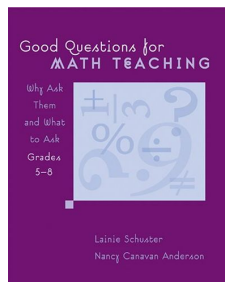
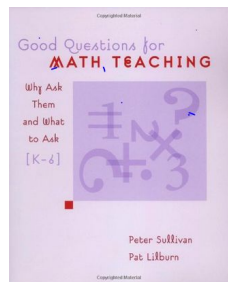


Open Ended Questions

HOW do you create open-ended tasks?

Usually, in order to create open-ended questions or problems, the teacher has to **work backwards**:

- ❑ Identify a mathematical topic or concept.
- ❑ Think of a closed question and write down the answer.
- ❑ Make up a new question that includes (or addresses) the answer.



STRATEGIES to convert closed problems/questions

- ❑ Turn the questions around.
- ❑ Asking for similarities and differences.
- ❑ Ask for explanation.
- ❑ Create a sentence.

Parallel Tasks

Parallel Tasks are sets of tasks with the *same mathematical foundation*, but allow for *different developmental* levels.

To **CREATE** a parallel task:

- ☐ Think of student readiness to engage in the concept.
- ☐ Think of similar contexts but create the task with a different developmental readiness expectation.
- ☐ The tasks are similar enough to have the same follow up conversations.

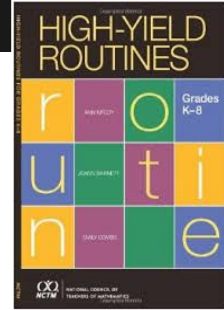
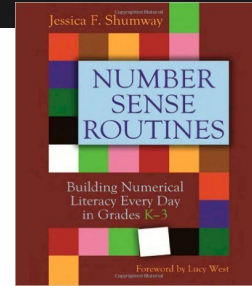
Choice 1: Create a word problem that could be solved by multiplying two one-digit numbers.

Choice 2: Create a word problem that could be solved by multiplying two numbers between 10 and 100.

Number Routines

Number Routines are used to:

- ❑ “Warm up” the brain for math reasoning
- ❑ Build the students’ number sense
- ❑ Provide for review and practice



“Students who struggle in math often lack number sense. It is difficult to compute without number sense. It is a struggle to find relationships among numbers or equations without number sense. It is more arduous to figure out measurement, geometry, and data problems without number sense. In other words, number sense is the foundational building block for all strands of mathematics.”

SMART Cards



<http://goo.gl/O17dSc>

1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

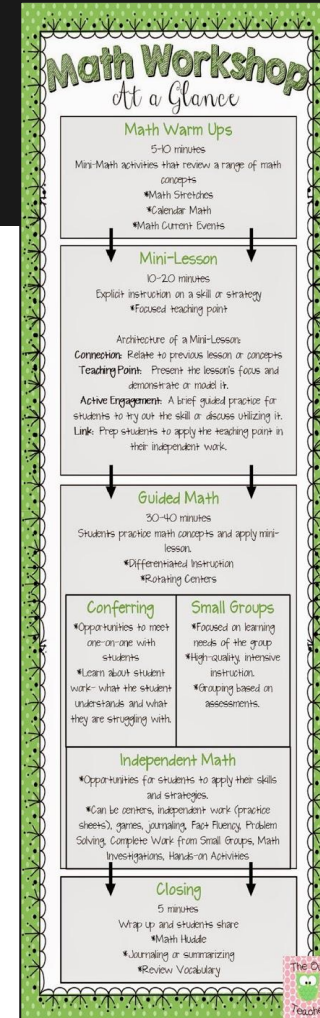
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Guided Math Structures

Math Workshop



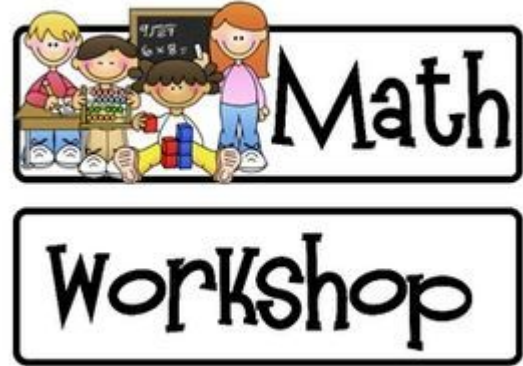
Get kids **DOING** math!!



Math Workshop

Benefits of Math Workshop:

- Redesign the classroom environment
- Schedule and Pace Lessons
- Use curriculum for effective planning
- Manage the classroom for rigor and risk-taking and encourage authentic learning opportunities

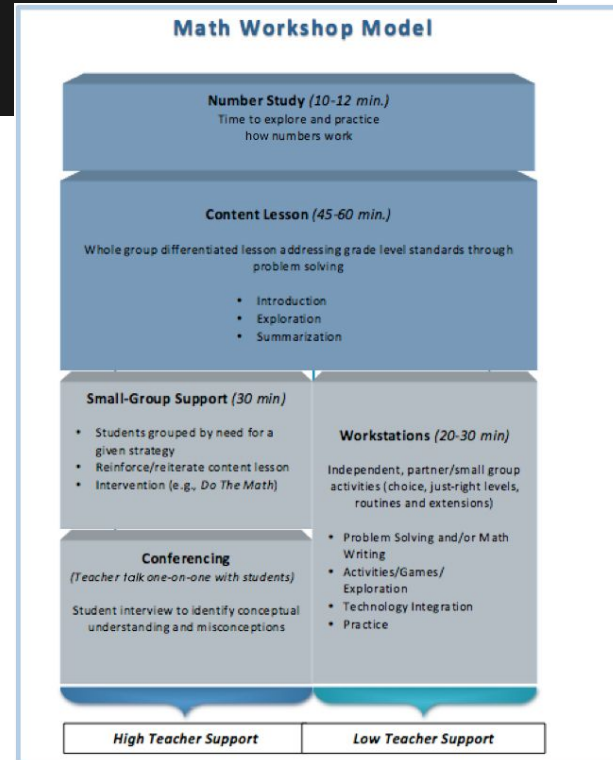


<https://goo.gl/4atxTv>

Math Workshop

Components of Math Workshop

- number talk or number study
- minilessons or other whole-group lessons
- independent work on mathematics
- time to explore and practice how numbers work
- guided small-group support or strategy lessons
- conferring
- group work: structures for collaboration, talk, and choice
- math shares (reflection)



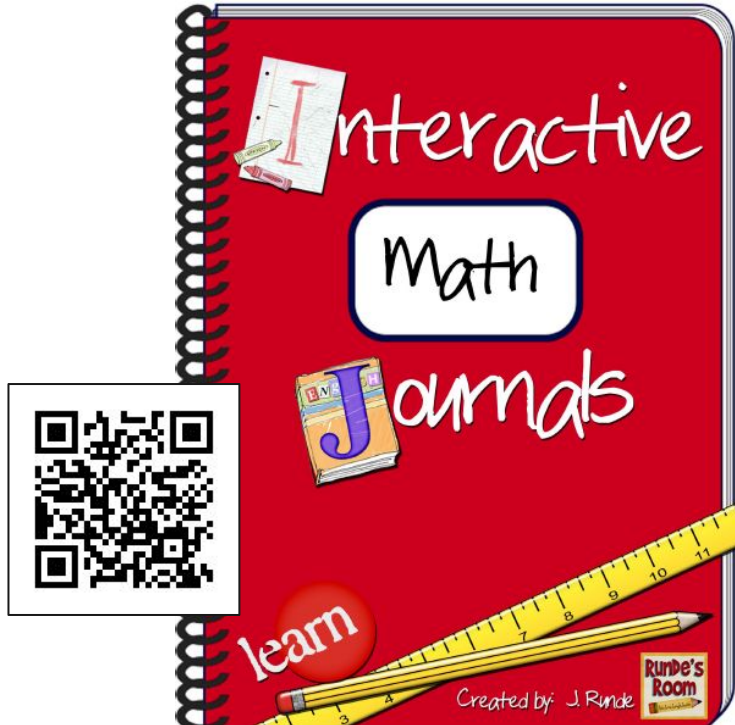
Math Workshop

Refer to the text box **“From Reading to Math”** on the last page of your handout. Use the questions as discussion starters with a partner or your table group.



<http://goo.gl/Ofz9jh>

Interactive Math Journals



- Resource available from TpT: <https://goo.gl/xVIqp5>
- \$14.99
- www.rundesroom.com



Using Foldables in Math



Resource
available from:
<https://blogs.edutech.nodak.edu/badlandsreadingcouncil/files/2012/03/math-foldables.pdf>



Why use foldables in mathematics???

- they quickly organize, display and arrange information
- they display student-generated work
- they can be used to compare and contrast concepts and student work
- they enhance math journals:
 - record ideas
 - problem-solving strategies
 - examples
 - questions that arise during class work
 - personal experiences that occur during learning

Race for 20



How to Play:

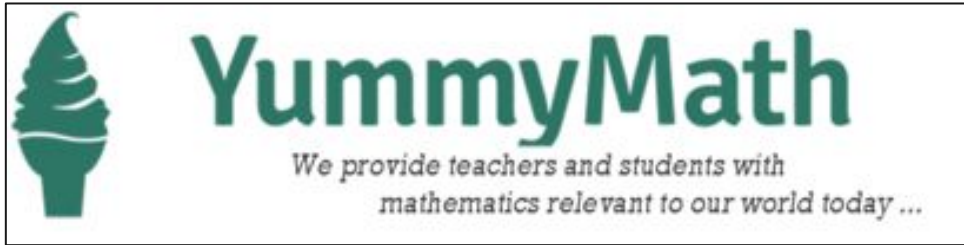
- ☐ Any number of people can play, but is best for 2
- ☐ It's a counting game
- ☐ Whoever gets 20 wins!
- ☐ Taking turns, you may count 1 or 2 numbers
- ☐ i.e. The first person says "1" or "1,2". The second person continues with 1 or 2 numbers
- ☐ Try it. If there is more than 2 people, take turns and play the winners
- ☐ Keep track of how many games you win
- ☐ What's the secret?

<http://goo.gl/O17dSc>



<http://goo.gl/asjRSw>

Math Problem Solving



<http://www.yummymath.com/>

- **real-life problems**
- **many topics**
 - **by grade level**
 - **seasonal**
 - **cross-curricular**
 - **search available**
- **printable**

Math Problem Solving



<http://www.mathalicious.com/>

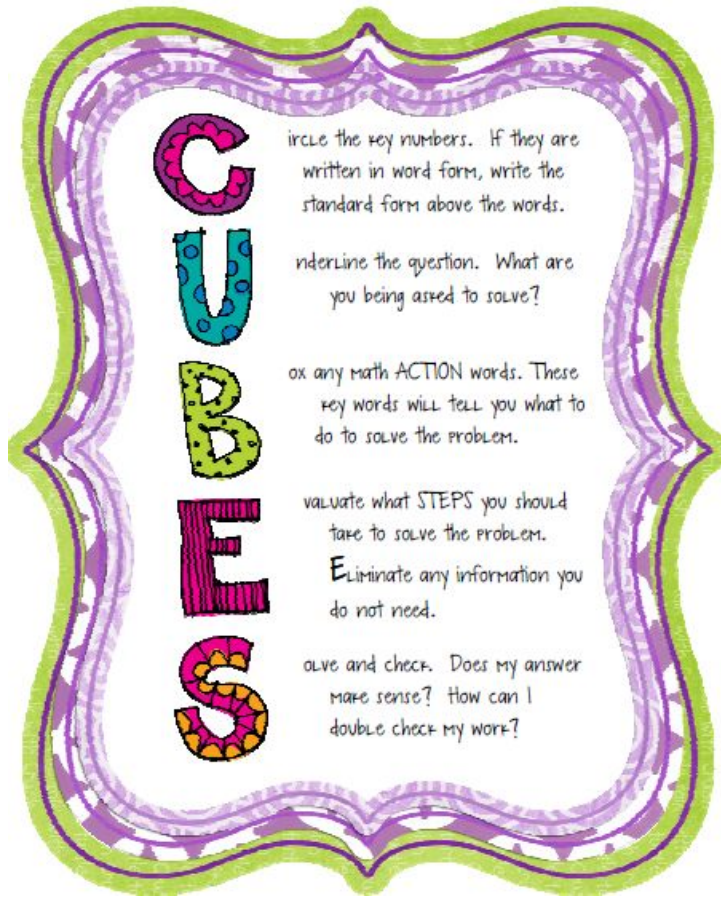
- on-line interactive site
- middle level and high school focus
- real-world issues
- cross-curricular

Math Problem Solving



<http://illuminations.nctm.org/>

- Featured:
 - Lesson Plan
 - Brain Teaser
 - Mobile Game
 - Interactive
- Search by grade level or strand
- Printable



<https://goo.gl/tgUcy2>

Math CUBES

C

Circle the key numbers.

U

Underline the question.

B

Box any math ACTION words.

E

Evaluate (What step should I take?)

S

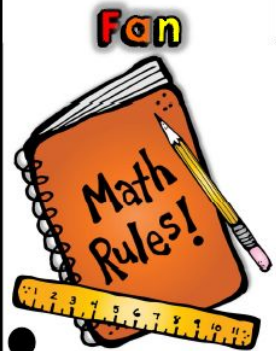
Solve! And Check!

- Does my answer make sense?
- How can I double check?

(C) Nicole Hernandez 2012 at www.nicadez.blogspot.com

<https://goo.gl/o45rvX>

Problem Solving Discussion Fan



Explain

- How did you solve?
- What strategy did you use to solve? Explain.
- Explain the steps you took to solve.
- Did you change your strategy? Explain why.
- Is there more than one way to solve? Explain.

Compare & Connect

- What does this situation remind you of?
- How is this situation like another we have explored? Different?
- What did you and your partner do that was the same? Different?
- Tell when you have used this strategy before today.
- How could you use this thinking in your life outside of school?

Justify

- Why do you think your answer is a good one?
- Prove that your solution is correct.
- Why did you choose to solve this way?
- How well did your strategy work? Explain.
- Is there a better way to solve? Explain.
- If your answer is not correct, how do you know?

Reflect

- How was your strategy helpful?
- Was your strategy efficient? Explain.
- Will you choose to use the same strategy when given a problem like this one again? Explain.
- What was difficult about coming to a solution? Explain.
- What was easy for you? Explain.
- After seeing other solutions, would you solve differently? Explain.

Summarize

- Explain what skills you used to solve.
- Explain what you have learned from this experience?
- Explain your partner's strategy.

Kudos

- Tell your partner something he/she did well.
- Tell your partner something you learned from him/her.
- Explain a great idea your partner had.
- Give your partner a compliment.

This will be available on the Sun West Math Wiki



The 10 Game



<http://goo.gl/O17dSc>

How to Play:

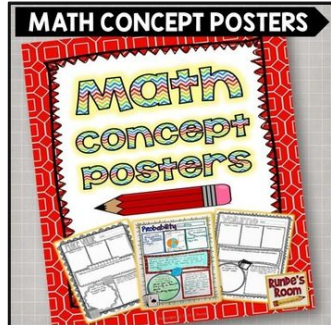
- ☐ Any number of people can play
- ☐ It's a counting game
- ☐ The winner is the person left standing at the end of the game
- ☐ Taking turns, you may count 1 or 2 numbers
- ☐ i.e. The first person says "1" or "1,2". The second person continues with 1 or 2 numbers
- ☐ The person how ends up having to say "10" has to sit down
- ☐ Play continues until one person is left.
- ☐ What's the secret?



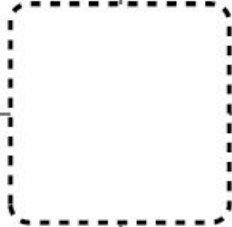
<http://goo.gl/Y569YR>

Math Vocabulary

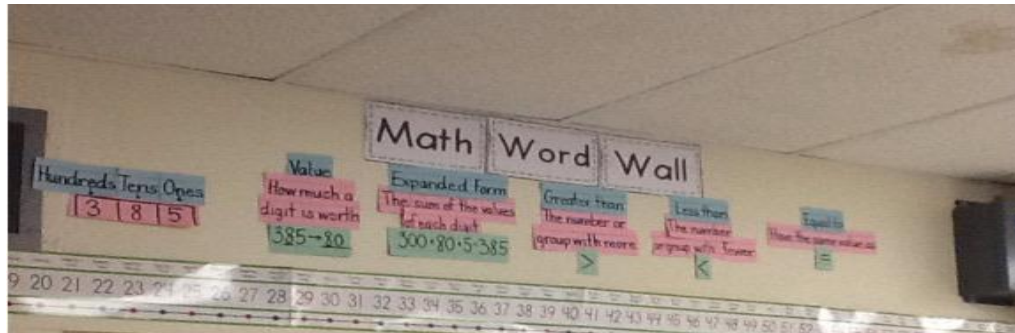
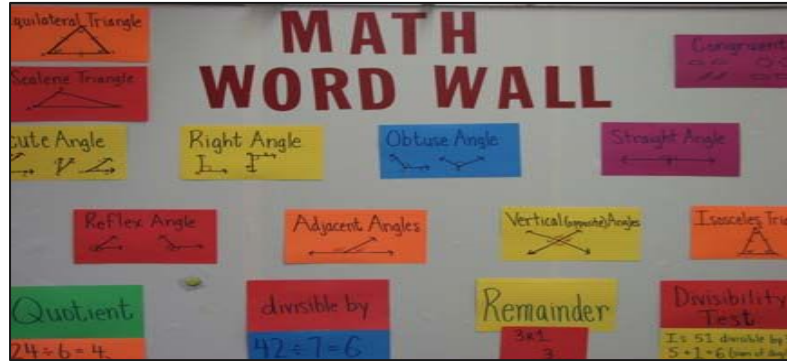
**Math Makes Sense Math
Vocabulary** - <http://supportingmath.wikispaces.com/>



Math Concept Posters -
from TpT
<https://goo.gl/21FggR>
(\$8.00)

draw a picture.	write your own definition.
	
cut and paste, or draw a real life example.	write your own sentence.

Math Vocabulary



Word form	Number of the Day	Expanded form
Odd or even?	10 more _____ 10 less _____ 100 more _____ 1,000 more _____	Round to the nearest... 10 _____ 100 _____
Represent with base-10 blocks	Sum of the Digits	Write 2 equations to make the number
Represent using coins and bills	Comes between... [] [] []	Subtract from _____
Fact family using two of the digits		

Worksheet created by Scripps Education Resource, 5042 K, <http://www.scrippseducation.com>
© 2012 Donna Boucher

Number of the Day

Modelling ~ Strategies ~ Anchor Charts

Math Talk

1. Explain: "This is my solution/strategy..."
 - explain your thinking
 - show your thinking
2. "I agree with _____ because..."
 - explain why you agree with another student
3. "I disagree because..."
 - explain why you disagree with another student, offer a different solution
4. Go Beyond: "This makes me think..."
 - extend the ideas of another student by linking them to other things
5. Ask Good Questions:
 - "Why did you...?"
 - "How did you...?"
 - "Could you have...?"
 - "How can that be?"
 - "What if...?"

How would you solve 9×16 mentally?

Lia used friendly numbers:

$$\begin{array}{r} 9 \times 16 \\ + 1 \text{ (group of 16)} \\ \hline 10 \times 16 = 160 \\ 160 - 16 = \underline{144} \end{array}$$

Ben used partial products:

$$\begin{array}{r} 9 \times 10 = 90 \\ 9 \times 6 = 54 \\ 90 + 54 = \underline{144} \end{array}$$

Michael broke a factor into smaller factors:

$$\begin{array}{r} 9 \times 16 \\ 9 \times (8 \times 2) \\ 72 \times 2 = \underline{144} \end{array}$$

Lisbeth used doubling and halving:

$$\begin{array}{r} 9 \times 16 \\ 18 \times 8 \\ 36 \times 4 \\ 72 \times 2 \\ 144 \times 1 = \underline{144} \end{array}$$

More examples can be found at: <http://goo.gl/vyj6pb>

Assessment in Math

Provincial Common Math Assessments:

- ❑ On each school's S-Drive, Colony schools have flash drive
- ❑ Within Mathletics program
- ❑ Link: <https://learning.lskysd.ca/mathematics/first-steps-in-math/>

Basic Concepts of Math

- ❑ From Greater Saskatoon Catholic
- ❑ See Shirley and Carole for copies

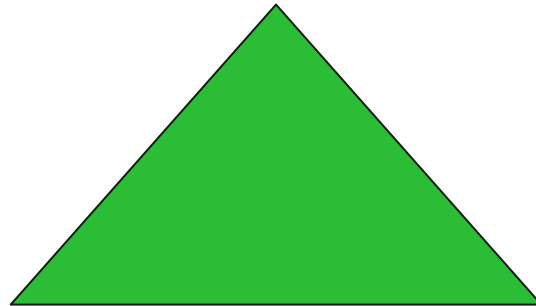


Triangulation of Evidence

Observations

Source: *Making Classroom Assessment Work*, Anne Davies, 2011.

Conversations



Performance/Product

Triangulation of Evidence is not only beneficial to gather evidence of learning from multiple sources over time, but listening to students talk (and have conversations) about their math learning and knowledge can help explain what is known and understood. These conversations and observations help increase teacher knowledge of student learning.

Assessment Principles

Seven Strategies of Assessment for Learning (Chappuis, Stiggins)

Where Am I Going? ~ Focus the Learning

Provide a clear and understandable vision of the learning target.

- Share “I Can” Statements
- Share the rubric or scoring guide
- Strive for mastery learning

Use examples and models

- Provide “Think Alouds” when working through a problem
- Give examples of the work expected

Assessment Principles

Seven Strategies of Assessment for Learning (Chappuis, Stiggins)

Where Am I Now? ~ Set Goals to Achieve

Offer regular feedback.

- Co-construct criteria - remember each school has the “Setting and Using Criteria” book used in our 2013 Sandra Herbst Inservice.

Teach students to self-assess and set goals.

- Identify strengths and areas for improvement.
- Select work samples for portfolios that meet criteria.
- Teacher helps student set goals to work on.

Assessment Principles

Seven Strategies of Assessment for Learning (Chappuis, Stiggins)

How Can I Close the Gap? ~ Design a Plan

Design lessons to focus on one aspect of quality at a time.

- Differentiated Instruction.
- Model how to ask for support, revise, look for quality.

Engage students in self-reflection, and let them keep track of and share their learning.

- By reflecting on their learning, students deepen their understanding.

The Game of Pig



<http://goo.gl/O17dSc>

How to Play:

Skills: adding to 100 **Materials:** 2 six-sided dice **Players:** two - four

- Players take turns to roll both dice.
- On your turn, roll the dice as many times as you want.
- Keep track of the sum of the numbers rolled.
- The total is your score for that round.
- If either die shows a 1 before you decide to stop rolling, your score for that round is 0.
- If you roll double 1s before you decide to stop rolling, you lose all points earned so far in the game.
- Keep a running score on the scoreboard provided.
- The first player to score 100 or more points wins.



<http://goo.gl/05eZXp>

Walk and Talk

Four A's:

- ☐ Agree
- ☐ Argue
- ☐ Aspire
- ☐ Ah-ha Moment



<https://goo.gl/AEYL6r>

Find a colleague to share the beautiful day with. As you go for a walk outside, discuss the four A's in relation to what we have talked about so far today :)

Making Math More Fun

PDF of booklet of games available at <http://goo.gl/NWLgVJ>

Sign up for free games and newsletters at <http://www.makingmathmorefun.com/>

Free Downloads of the magazine “Let’s Make Math Fun” at <http://goo.gl/yzCbrD>



Poison - A Friendly Game



<http://goo.gl/O17dSc>

❑ **Materials:** a partner, 12 things that are the same - beans, bottle caps, bingo markers, etc., one thing that is different - THE POISON!

❑ **Directions:**

- Take turns
- On your turn, you must take away 1 thing, or 2 things, until only the “poison” is left
- The player who is “stuck” taking the poison ...dies!



<http://goo.gl/mKVKE>

Reflection and Artifact Building Time



Resources - Websites

Dr. Nicki Newton on Pinterest: <https://www.pinterest.com/search/boards/?q=Dr.+Nicki+Newton>

Illuminations: <http://illuminations.nctm.org/>

Math Solutions: <http://mathsolutions.com/freeresources/>

Resources - Books

- McCoy, Ann, Barnett, Joann, and Combs, Emily (2013) High-Yield Routines Grades K - 8 National council of Teachers of Mathematics
- Parrish, Sherry (2014) Number Talks: Helping Children Build Mental Math and Computation Strategies Grades K - 5 Math Solutions
- Shumway, Jessica F. (2011) Number Sense Routines Stenhouse Publishers
- Schuster, Lainie and Anderson, Nancy Canavan (2005) Good Questions for Math Teaching Why Ask Them and What to Ask Grades 5 - 8 Math Solutions and Scholastic
- Small, Marian (2012) Good Questions Great Ways to Differentiate Mathematics Instruction NCTM. Nelson Education
- Sullivan, Peter and Lilburn, Pat (2005) Good Questions for Math Teaching Why Ask Them and What to Ask Grades K - 6 Math Solutions and Scholastic

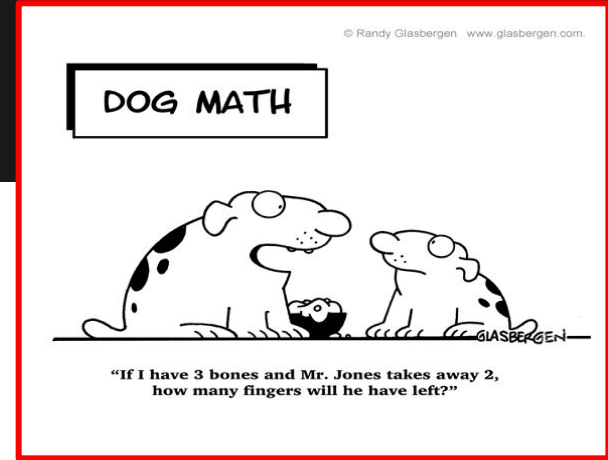
Questions / Wrap Up

Wr

The only way
to learn
mathematics
is to do
mathematics.

PAUL HALMOS

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Farewell!!

**Good Luck with the teaching of
interactive math in your
classroom!**

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Safe Trip Home!



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