

# Warm-up: Go Play!

Download the Pick-a-Path app from iTunes or Google Play.



Were you engaged? Did you learn something?  
How could you use this to teach? Will you?



NATIONAL COUNCIL OF  
TEACHERS OF MATHEMATICS

# Welcome

<b>49</b>	<b>54</b>	<b>35</b>	<b>45</b>
<b>51</b>	<b>56</b>	<b>37</b>	<b>47</b>
<b>31</b>	<b>36</b>	<b>17</b>	<b>27</b>
<b>34</b>	<b>39</b>	<b>20</b>	<b>30</b>



NATIONAL COUNCIL OF  
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# Welcome

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31	<del>36</del>	<del>17</del>	<del>27</del>
<del>34</del>	<del>39</del>	20	<del>30</del>



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# What'd You Get?

152



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# Session 152

# Whoa!

How did that work?

Join NCTM's New Teacher  
Facebook group to find out.

Ready. Set. GO!



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# Get Up! Get Movin! Get Started!

- Who are you? Where are you from?



# Session #152



## New Teacher Workshop

October 18, 2013

Sarah DeLeeuw

[sdeleeuw@nctm.org](mailto:sdeleeuw@nctm.org)



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# illuminations.nctm.org



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# Welcome!

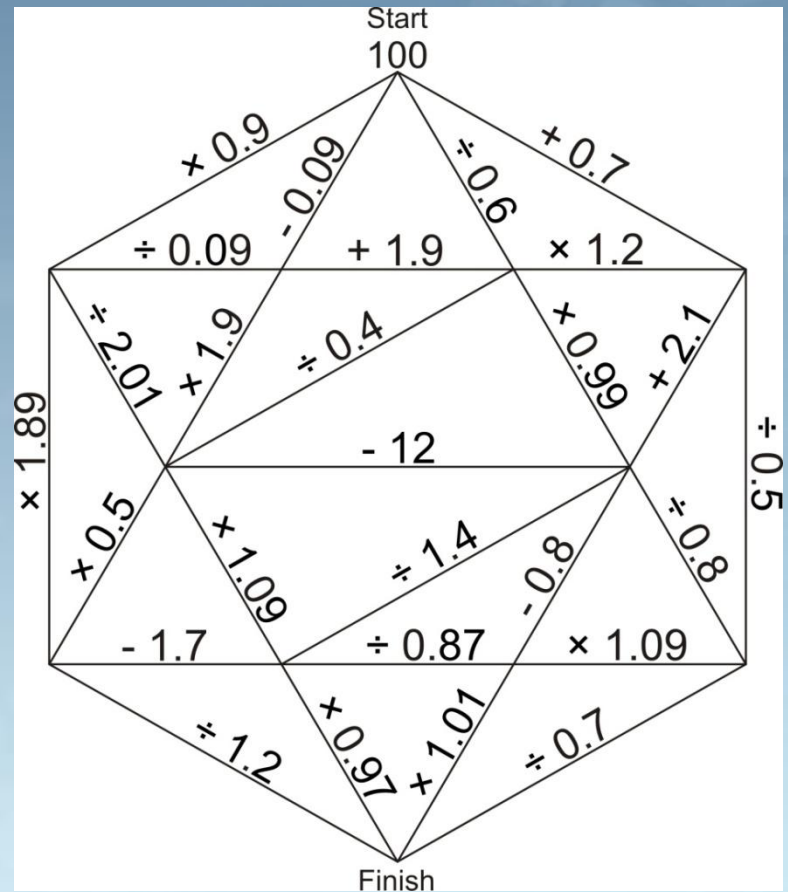
- Info cards - Fill out Front & Back
- NCTM is interested in knowing what new teachers and those in training want.
- Prizes will be drawn using info cards!



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# Decimal Maze

- Begin with a value of 100.
- Move down or sideways from **Start** to **Finish**.
- As you cross a segment, perform the indicated operation.
- You may not go up. You may not cross a segment more than once.
- *What is the largest possible value when you reach **Finish**?*



# Standards for Mathematical Practice

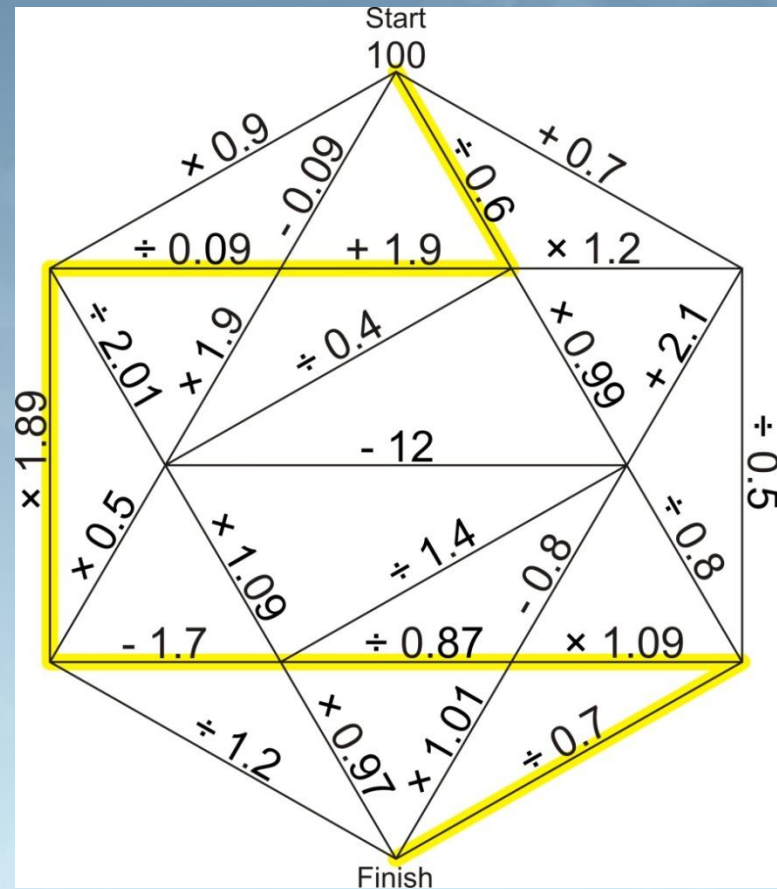
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# Reasoning and Sense Making

- It is very important for teachers to lead scholars into the habit of **attending to the process going on in their own minds** while solving questions, and of **explaining how they solve them**. [...] It is next to impossible for a person to direct another's thoughts unless he knows the channel in which they are already flowing.
  - Warren Colburn, *Teaching Arithmetic in the Method of Pestalozzi*, 1830

# Decimal Maze

- Maximum value: **6332**
- Minimum value?
- Finish value closest to 100?
- How many paths from Start to Finish?
- How else might you modify this activity?



# Decimal Maze

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## Too Big or Too Small?

In this lesson, students develop number sense through a series of three hands-on activities. Students explore the following concepts: the magnitude of a million, fractions between 0 and 1, and the effect of decimal operations.

**Learning Objectives**


**Materials**

**Instructional Plan**

Included here is a selection of problems and activities, appropriate for the middle grades classroom, for which the use of number sense is required. These activities can be used in varied ways to generate discussion and to extend student number-related concepts. The discussion that arises as students describe their thinking will certainly give insight into what will help in evaluating students' development of number sense.

**Activity 1: Exploring the Size of a Million Dollars**

This activity explores whether one million dollars will fit into a standard suitcase. If so, how large would the suitcase have to be? You may have students work in small groups (2 or 3 students per group) to explore these questions.



Begin the investigation by telling the following story:

Just as you decide to go to bed one night, the phone rings and a friend offers you a chance to be a millionaire. He won \$2 million in a contest. The money was sent to him in two suitcases, each containing \$1 million in one-dollar bills. Will you give your mom or dad to drive him to the airport to pick it up. Could your friend be telling you the truth? Can he make you a millionaire?

Involve students in formulating and exploring questions to investigate the truth of this claim. For example:

- Can \$1,000,000 in one-dollar bills fit in a standard-sized suitcase? If not, what is the smallest denomination of bill that would fit?
- Could you lift the suitcase if it contained \$1,000,000 in one-dollar bills? Estimate its weight.

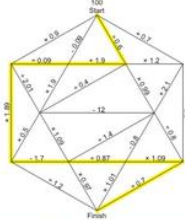
Calculators should be available to facilitate and expedite the computation for analysis.

Note: The dimensions of a one-dollar bill are approximately 6 inches by 2.5 inches. Twenty one-dollar bills weigh approximately 0.2 ounces.

[Maze Playing Board Activity Sheet](#)

Students are to choose a path through the maze. To begin, have the students enter 100 on their calculator. For each segment chosen on the maze, the students should key in the assigned operation and number. The goal is to choose a path that results in the largest value at the finish of the maze. Students may not retrace a path or move upward in the maze.

In pairs or in groups of three, students should discuss their strategies (after playing the game) and what worked best for them. Students should be able to achieve a score in the thousands. The path highlighted below gives a result of roughly 6332.



Possible follow-up activities include finding the path that leads to the smallest finish number or finding a path that leads to a finish number as near the start number (100) as possible.

**NCTM Standards and Expectations**

**References**

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supported by the Verizon Foundation

verizon

More and Better Mathematics for All Students

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# Pick-a-Path

The image displays three screenshots of the 'Pick-a-Path' game interface, set against an underwater background with a purple octopus character.

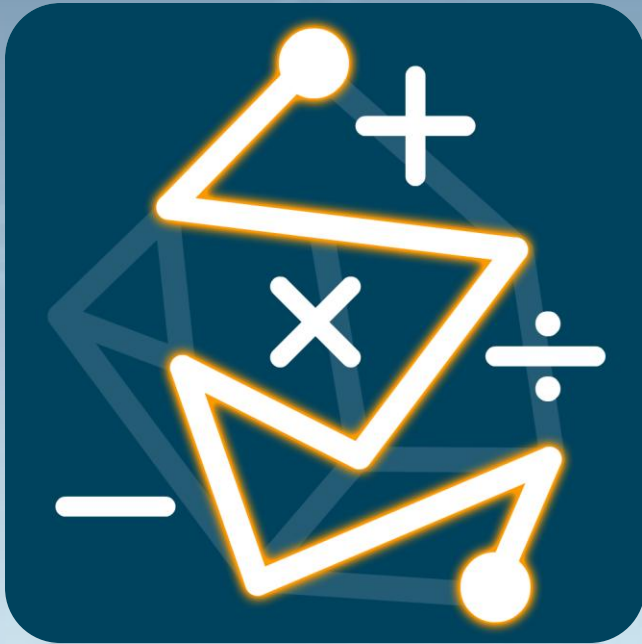
**Left Screenshot:** Shows a maze with a score of 24 and a target maximum. A 'move' instruction box says: "Octo through the maze to boost your score!".

**Middle Screenshot:** Shows the 'Pick-a-Path challenge' screen. It says "Choose a 1" and "Level 1". Below are seven numbered buttons (1-7) with star ratings. A 'challenge' box says: "seven levels, each with seven puzzles!".

**Right Screenshot:** Shows the maze with a score of  $\frac{3}{2}$  and a target. An 'explore' instruction box says: "powers of 10, fractions, decimals, exponents, more!".

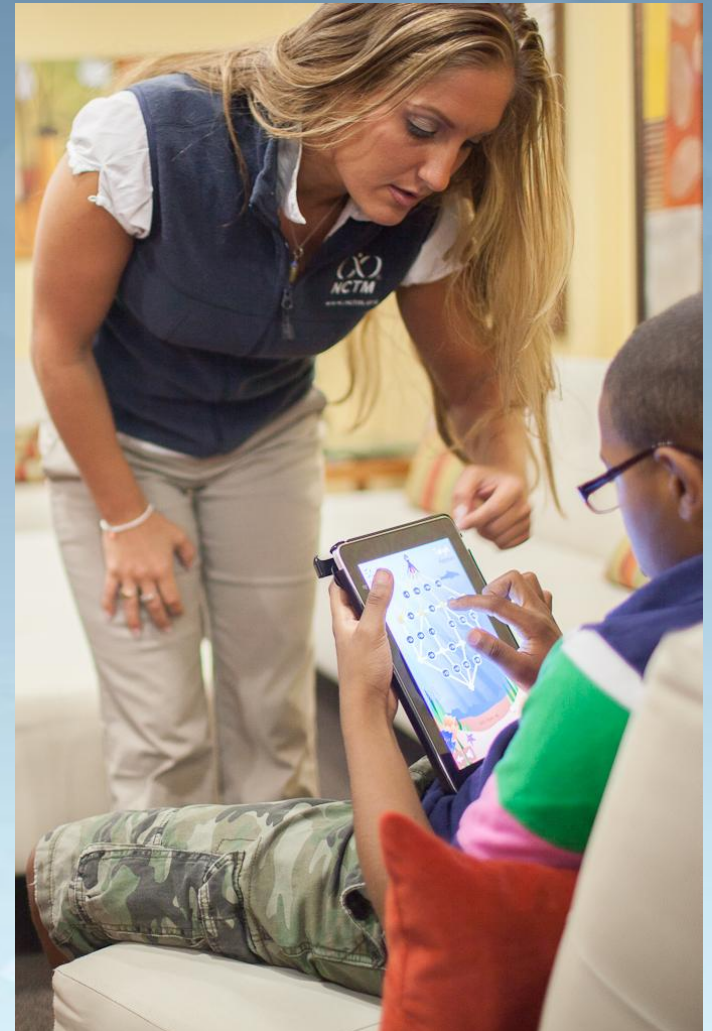
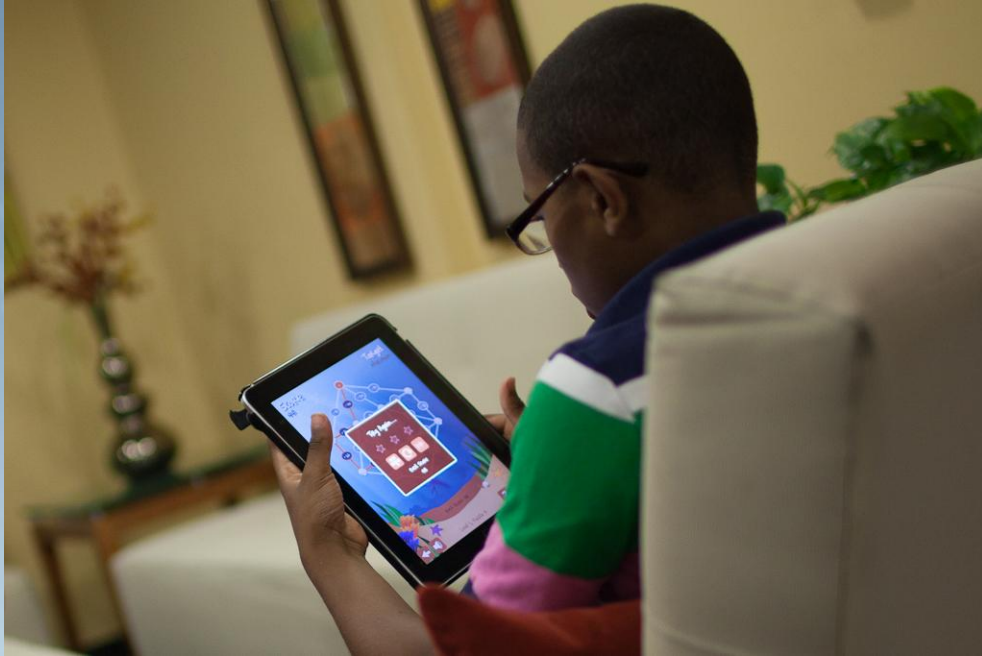
# Pick-a-Path

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





# Play Anywhere. Learn Everywhere.



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# Power Hour: A Familiar Concept?!

- It's 5 o'clock somewhere!
- Meet & Greet.
- Share & Learn.
- Ready, Set, Go!



# Share and Learn

- Share: Offer an idea that has worked well for you with a colleague. Share your contact information too!
- Learn: Get an idea from a new friend. Fill in your blue sheets.



# Want Free Money?

- No, seriously.
- Learn more at [www.nctm.org/met](http://www.nctm.org/met)



# Resources

## Tips from NCTM's *Empowering the Beginning Teacher of Mathematics Series*



***Success from the START:  
The Essential Guide to  
Navigating Your First Years  
of Teaching Secondary  
Mathematics***



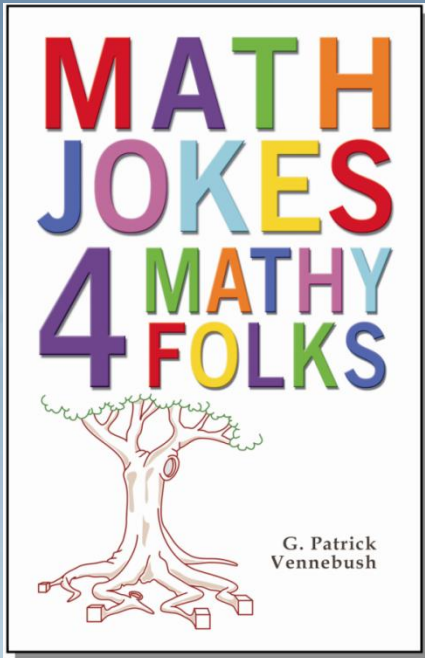
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# Like what?!

- What do I do when students don't "get" the lesson?
- How can I help students who struggle with math that they supposedly learned in elementary school?
- How do I arrange for students who are absent to make up the work?
- Do I assign seating or let students choose their seats?
- Should I have students work in groups?
- How much homework should I assign—and how much should I grade?



# Simple and Oh So Fun



- Write a positive integer on a piece of paper.
- Show it to your neighbor.
- The winner is...

*Whoever wrote the smallest integer NOT written by anyone else.*



# What a constraint!



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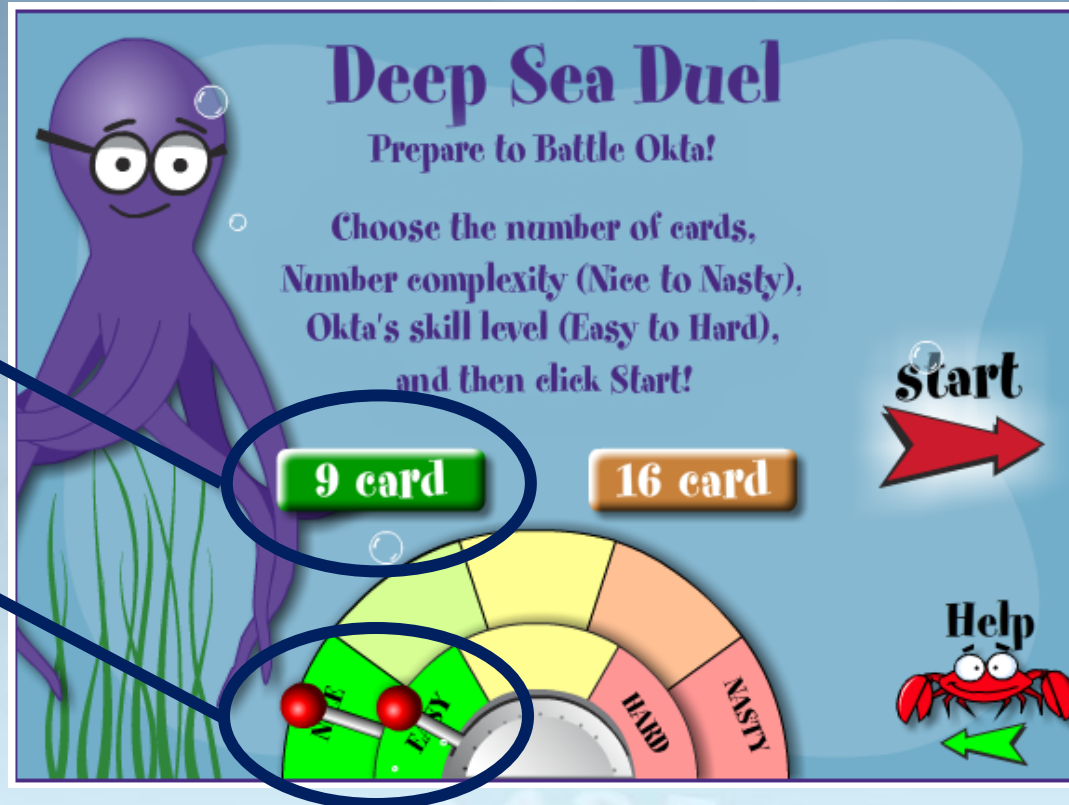


# Another App from Under the Sea

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

9 Card

Nice / Easy



# Challenge Okta to Deep Sea Duel!



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# Options & Modifications in App

**Deep Sea Duel**  
Prepare to Battle Okta!

Choose the number of cards (9, 16, 25) and Okta's skill level (Nice, Easy, Hard) and then click Start

9 card

16

NICE EASY HARD

restart

Okta 0  
Ties 0  
You 0

LEVEL 4  
74.8  
MEDIUM

2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6
19.8	22.0	24.2	26.4	28.6	30.8	33.0	35.2

Drag card to beach

Help

# Learning is fun. Get addicted!

**Deep Sea Duel**  
is FREE online at  
Illuminations and  
Google Play and  
the App Store for  
phones and  
tablets.



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# 11Q – Q

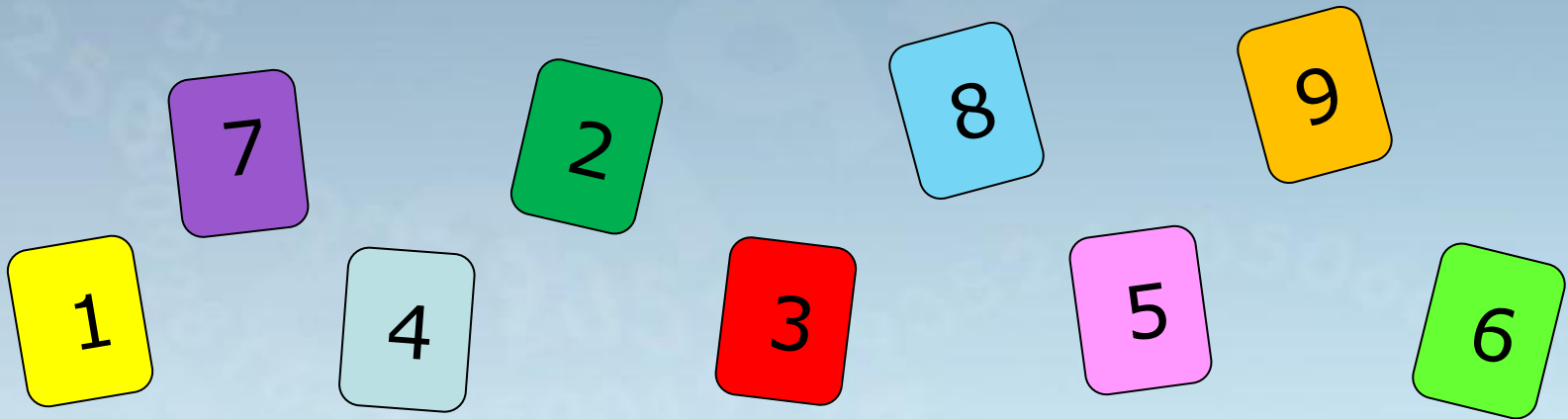
[sdeleeuw@nctm.org](mailto:sdeleeuw@nctm.org)



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# Game of Nine Cards

- **Materials:** Nine cards numbered 1–9
- **Object:** To have any three cards in your hand that add up to 15



# Game of Nine Cards

- Sample Game:



Player 1



Player 2

**Player 1 Wins:  $2 + 9 + 4 = 15$**

# Game of Nine Cards

---

Now what?

# You Play!



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# The Basics...



- Who is more likely to win — the first player or the second player? Why?
- Will someone always win? Lose?
- What can you do to ensure that you don't lose?

- Is there a “best” card to choose?
- Why do we use a sum of 15?

# A Winning Strategy?

- You play first, **pick 8**.
- Your opponent then **chooses 3**.
- What are the **three numbers** that you can choose to ensure a win?



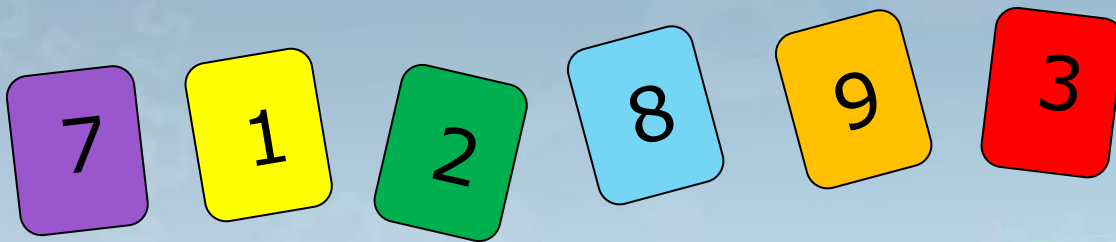
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Yours

His or Hers

# A Winning Strategy?

- Your opponent plays first, **picks 6**.
- You **choose 5**.
- Your opponent **picks 4**.
- Which **two numbers** should you *not* pick?



Yours



His or Hers



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# A Winning Strategy?

- Your opponent plays first, **picks 7**.
- Then you **choose 2**.
- Your opponent **picks 9**.
- Which **three numbers** should you *not* pick?



Yours



His or Hers

# More Sophisticated Yet?

- If your opponent plays first and picks an **even** number, what number should you choose to **avoid a loss**?



# Another App from Under the Sea

## Deep Sea Duel

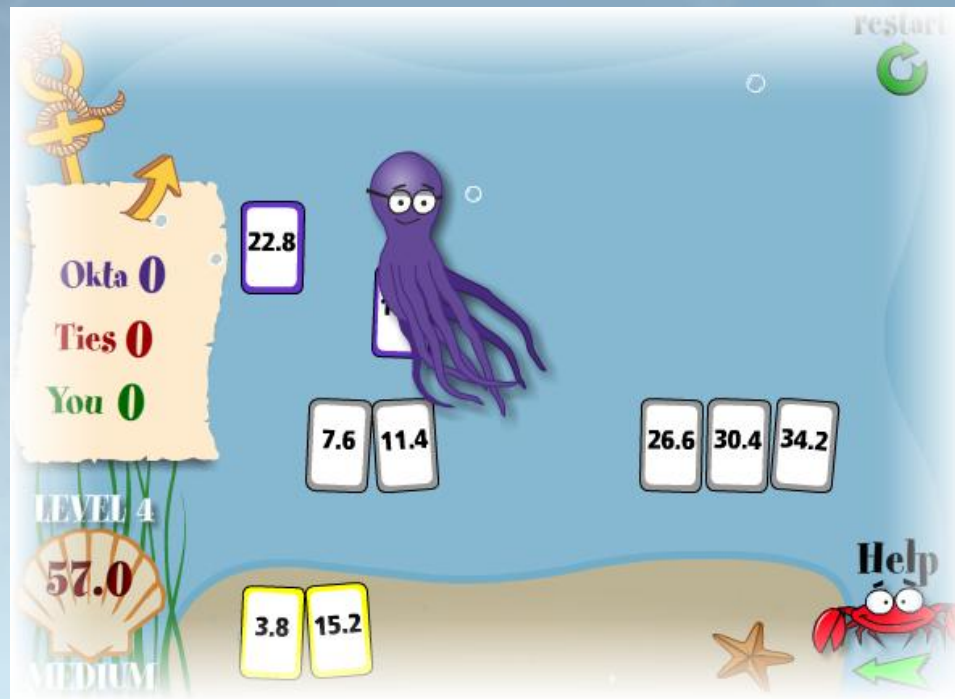
9 Card

Nice / Easy

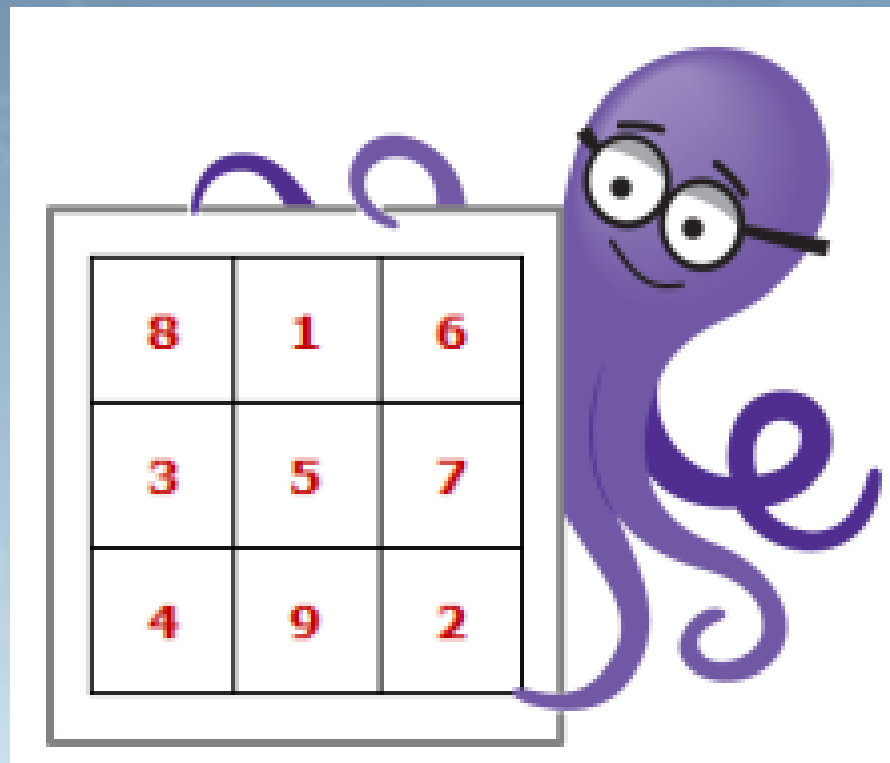


# Game of Nine Cards

- **Deep Sea Duel** is online!
  - <http://illuminations.nctm.org/deepseaduel>



# A Hint from Under the Sea





# Modifying the Game of Nine Cards

- Label the nine cards as follows:

**5, 12, 19, 26, 33, 40, 47, 54, 61**

The winner must get three cards that total 99.



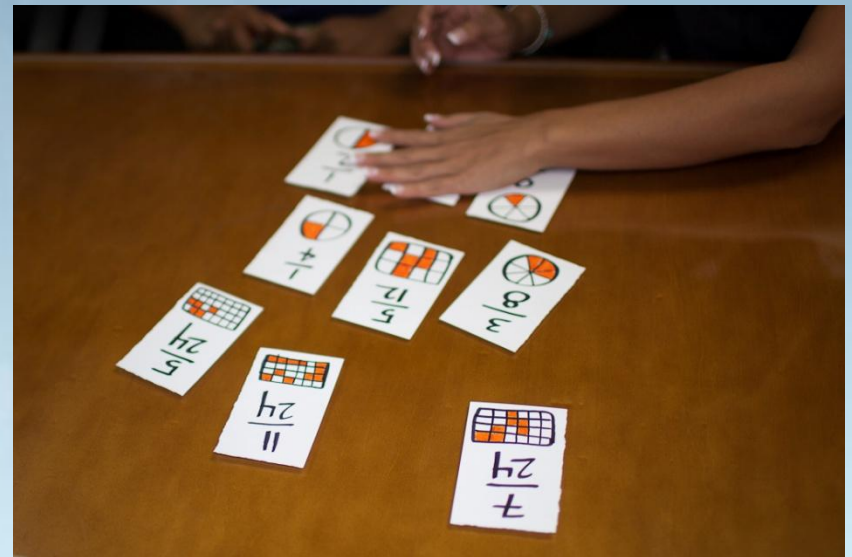
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# Modifying the Game of Nine Cards

- Label your nine cards with fractions:

$1/6$ ,  $5/24$ ,  $1/4$ ,  $7/24$ ,  $1/3$ ,  $3/8$ ,  
 $5/12$ ,  $11/12$ ,  $1/2$

The winner must get three cards that total 1.



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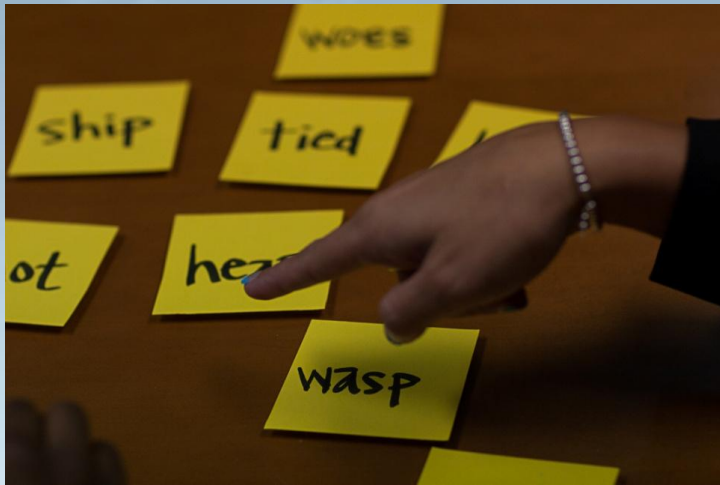
Mahoney, John. What Is the Name of This Game?  
*Mathematics Teaching in the Middle School*, October 2005.

# Modifying the Game of Nine Cards

- Use words! Label the cards as follows:

*TIED, HOT, HEAR, TANK, WASP,  
WOES, SHIP, HORN, BRIM*

The winner must get three cards that bear the same letter.



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Mahoney, John. What Is the Name of This Game?  
*Mathematics Teaching in the Middle School*, October 2005.

# Modifying the Game of Nine Cards

- Use exponents!
- Label the nine cards as follows:

$$x, x^2, x^3, \dots, x^9$$

The winner must the *product* get  $x^{15}$ .



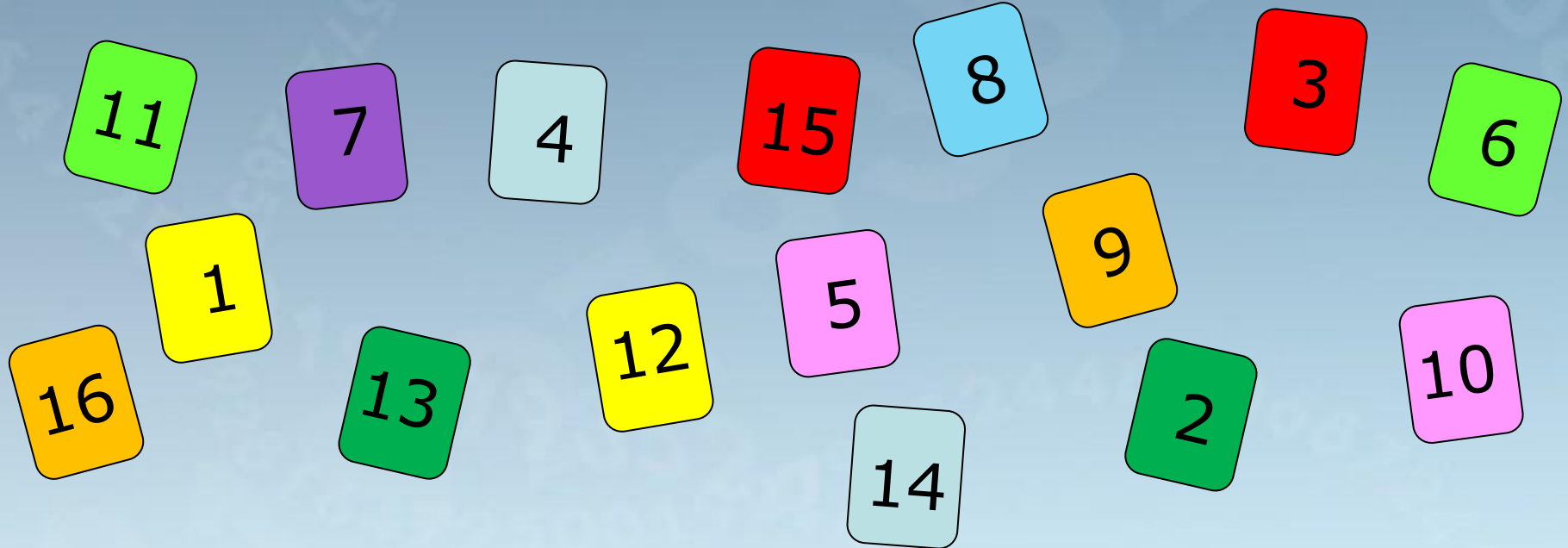
# You tell me!

What sum should the winner need to win?



# From NINE to SIXTEEN

The winner would use the sum of *four* cards to win.



# Another Extension

- The winner is the first player to obtain the sum of exactly 15 from any **TWO OR MORE** cards.
- Does your strategy change? How so?



# Reminder: What is the Goal?

- How does your strategy from the first version of the game of 9 cards compare to the strategy for these modifications?
- REFLECT: *How* did I come up with these other versions for the game of 9 cards?



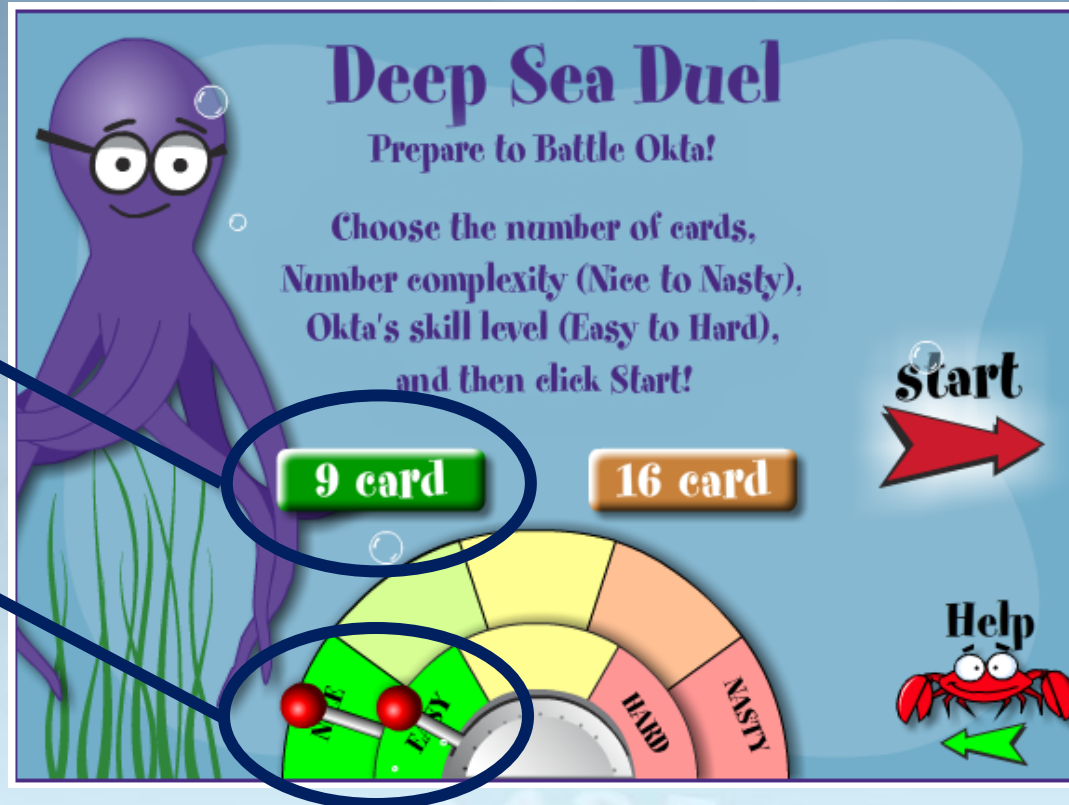


# Another App from Under the Sea

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

9 Card

Nice / Easy



# Challenge Okta to Deep Sea Duel on the web.



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# Options & Modifications in App

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Choose the number of cards (9, 16, 25) and Okta's skill level (Easy, Medium, Hard) and then click Start

9 card

NICE EASY HARD

restart

Okta 0  
Ties 0  
You 0

LEVEL 4  
74.8  
MEDIUM

2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6
19.8	22.0	24.2	26.4	28.6	30.8	33.0	35.2

Drag card to beach

Help

# Learning is fun. Get addicted!

**Deep Sea Duel**  
is FREE online at  
Illuminations and  
Google Play and  
the App Store for  
phones and  
tablets.



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# KenKen®

The screenshot shows the KenKen page on the Illuminations website. At the top, the Illuminations logo and navigation menu are visible. The KenKen section includes a description of the game, a link to instructions, and a featured puzzle grid. The grid is titled 'Today's puzzles' and contains four puzzles: three 4x4 grids and one 6x6 grid. Below the grid, there is a section for 'Yesterday's solutions' with four puzzles: three 4x4 grids and one 6x6 grid. A link to 'www.kenken.com' is provided for more puzzles. A sidebar on the right contains a 'Comment About This Page' button and a link to 'NCTM Resources'.

**ILLUMINATIONS**  
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### KenKen®

KenKen is a puzzle game that helps students improve their calculation skills, logical thinking and persistence. The goal is to fill a grid with numbers so that no number appears more than once in any row or column. In addition, the numbers must combine to form a target number using a specific operation. This page is updated with **four new KenKen puzzles daily** and is provided in partnership with Nextoy, LLC.

[Instructions](#)

## KENKEN

Puzzles That Make You Smarter™

Today's puzzles

4x4 4x4 4x4 6x6

Yesterday's solutions

4x4 4x4 4x4 6x6

For More KENKEN® Puzzles Visit [www.kenken.com](http://www.kenken.com)

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[NCTM Resources](#)  
[Principles and Standards for School Mathematics](#)

[Comment About This Page](#)

[illuminations.nctm.org/kenken](http://illuminations.nctm.org/kenken)



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# An Example

**KENKEN**  
Puzzles That Make You Smarter™

Today's puzzles

4x4 4x4 4x4 6x6

Yesterday's solutions

4x4 4x4 4x4 6x6

For More KENKEN® Puzzles Visit [www.kenken.com](http://www.kenken.com)

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2	12X		
1-		3-	2÷
7+			
3-		6X	

[www.kenken.com](http://www.kenken.com) print this puzzle 00:00:19



**11Q – Q**



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# 11Q – Q

- Thank you for attending the session and for all you'll do as a teacher.
- This is the best job on earth!
- Stand up straight!  
Hold your head high!  
Look people in the eye and announce proudly,  
**“I am a teacher!”**





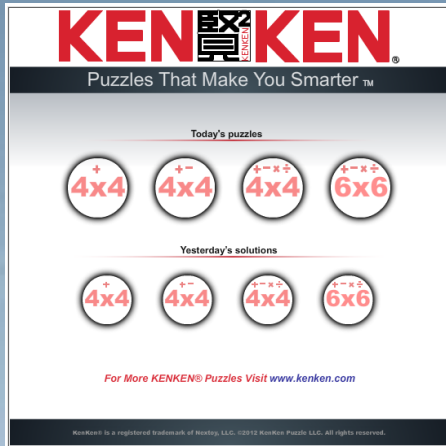
# KenKen®

[illuminations.nctm.org/kenken](http://illuminations.nctm.org/kenken)



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# An Example



**KENKEN**  
Puzzles That Make You Smarter™

Today's puzzles

4x4 4x4 4x4 6x6

Yesterday's solutions

4x4 4x4 4x4 6x6

For More KENKEN® Puzzles Visit [www.kenken.com](http://www.kenken.com)

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2	12×		
1-		3-	2÷
7+			
3-		6×	

[www.kenken.com](http://www.kenken.com) print this puzzle 00:00:19



# Discussion Topics

- Planning
- Instruction
- Assessment
- Classroom Organization
- Classroom Management
- Homework
- Questioning Techniques
- Using Technology
- Online Resources
- Motivating Students
- Problem Solving
- Group Work
- Parents and Family
- Keeping Your Sanity

# Planning

- Questions to ask:
  - What do I want? – Be Specific!
  - Do you have a hook?
  - How do you engage?
  - Is there another way?

# Planning

- Write it Down!
  - Jot down ideas/notes in your book
  - Recalling a good teaching suggestion from a previous year may be difficult
- Ask, Listen, Decide!



# Instruction

- Door Problems!
  - Quick problem when they hit the door
  - Always have an assignment
- Know your content
- Know your audience
- Strategies for learning

# Instruction

- If a lesson is going badly

–STOP

- Regroup with a new approach, or Do something else
- Examine what went wrong
- Make plans for the next day



# Assessment

- Help students learn to explain their reasoning
- Ask “Why?” and questions such as:
  - What did you do first?
  - How could I show that?
  - Then what did you do? Why?
  - I don’t understand how you did that. Can you tell me more?



# Assessment - Scoring

- Valuing the Process and the Answer
  - Avoid all-or-nothing grading schemes
  - Insist on detailed explanations
  - Reward reasonable efforts and different approaches
  - Use “+2 out of 4” instead of “-2 out of 4”



# Classroom Organization

- Help students (and parents) to track their own progress
  - Create assignment sheet for students' notebooks
  - Make class folders where absent students find missed assignments/handouts.



# Classroom Management

- Have a seating chart – Day 1!
- Establish and enforce your classroom rules **consistently**
- Create engaging mathematics activities
- Create extensions of your activities to challenge your students



# Homework

- How much homework to assign?
  - What do you expect from the assignment?
  - What information will it provide you?
  - How many problems to assign? Will 5 work?
  - How long did it take you?
- Homework quizzes



# Questioning Techniques

- Use class-centered prompts  
“Think about how you would ...?”
- No yes/no or single number questions.
- Students justify answers - “Explain to us how you found your solution”
- Ask “Why?” a lot!



# Using Technology

- Technology is not **the** answer
- Use technology as a tool to make the learning of mathematics richer and better
- Scaffold an investigation with a handout of specific questions versus “Explore”
- Resist having students work individually

# Which Gray Matter?

- Hexagonal Prism?
- Hard?
- Soft?

# Which Gray Matter? Quiz

- $(14.26 * 2.7 * 4.5 * 0) + 27 = ?$
- $1/3 + 3/8 + 2/10 = ?$
- Square Root of  $27 = ?$





# Online Resources

- The NCTM Web site—[www.nctm.org](http://www.nctm.org)
  - Organized by elementary, middle, and high school
- NCTM Member's Only—[www.nctm.org/members](http://www.nctm.org/members)
  - Access to current and archived journals, On-Math, Student Math Notes, and more
- NCTM Standards—[standards.nctm.org](http://standards.nctm.org)
  - Full text of *Principles and Standards for School Mathematics*, electronic examples for each grade band

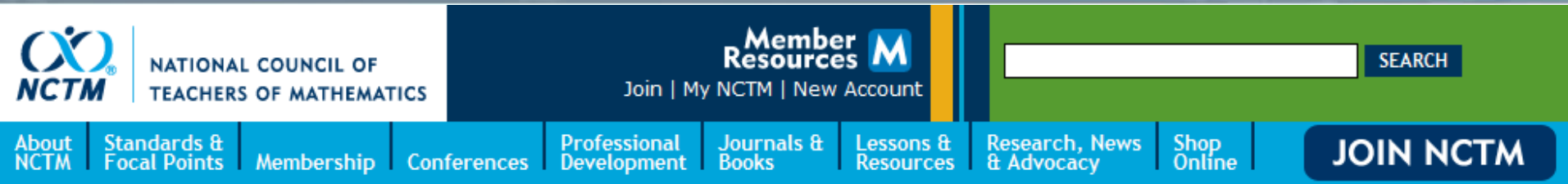


# Online Resources

- Illuminations Web site—[illuminations.nctm.org](http://illuminations.nctm.org)
  - Lesson plans for teachers, interactive applets for students, reviewed Web resources
- Reflections Web site—[www.nctm.org/reflections](http://www.nctm.org/reflections)
  - Reflect on instructional practices through video clips, lesson plans, and student work
- Figure This! Web site—[www.figurethis.org](http://www.figurethis.org)
  - Math challenges for middle school students, information to help families get involved



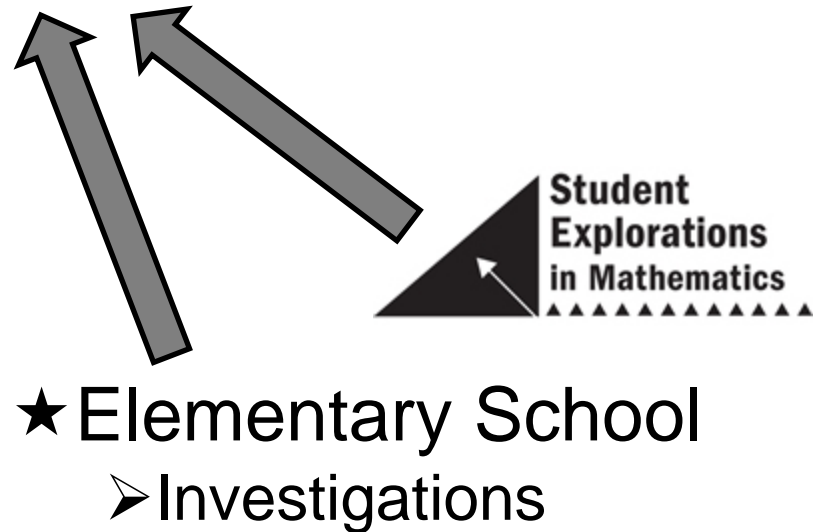
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★ e-Examples

TEACHING CHILDREN  
**Mathematics**

- ★ Article Downloads
- ★ Problem Database



# Middle School @ nctm.org



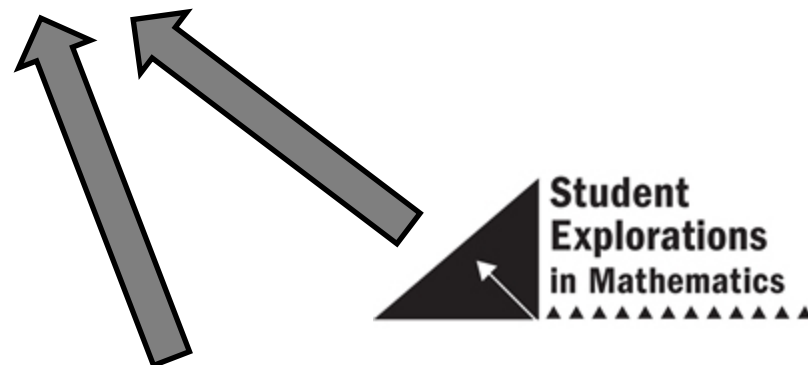
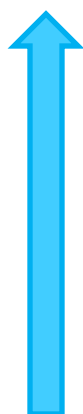
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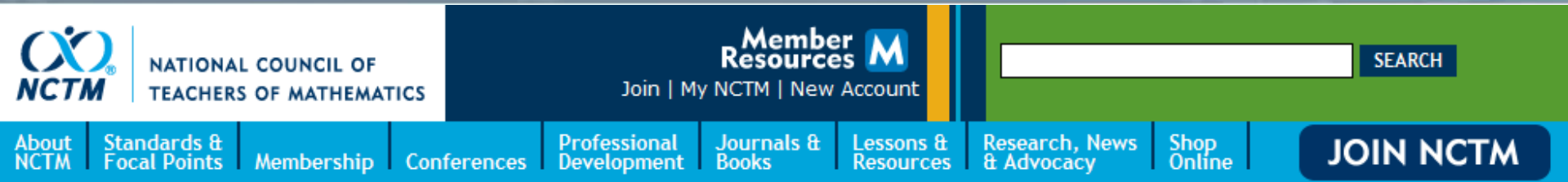
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★ e-Examples

mathematics  
teaching in the **MIDDLE SCHOOL**  
★ Article Downloads  
★ Problem Database



- ★ Figure This
- ★ Math Here & Now
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# High School @ nctm.org



★ e-Examples

**MATHEMATICS**  
teacher

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- ★ Calendar Problems



- ★ Math Here & Now
- ★ High School
  - Activities for Students



# Motivating Students

- If you want magic in your students... look for it and find it in them!
  - Include them
  - Ask them what they think
  - Ask them what they see
  - Ask them to share their ideas, opinions, and reactions



# Problem Solving

- Don't make Problem Solving the first thing to go
- Give time to struggle
- Give specific hints
- Celebrate elegant and unique solutions
- Engage Parents! – Parent – Teacher Night – Weekly problems to work on



# Problem Solving

## Non-problem solving mode

1.  $14 + 29$
2.  $8 + 35$
3.  $15 + 29$

## Problem-solving mode

1. Find two consecutive numbers whose sum is 43.
2. Find two counting numbers whose sum is 43 and whose ones digit differs by 3.
3. Find two numbers whose sum is 44 and one of whose addends is 14 more than the other.





# Group Work

- Find the right task – Complex enough to need working together
- Identify and teach roles to students
- Hold all students accountable for the work of the group
- Watch, listen and then interact with groups as they work



# Parents and Families

- Build Parents as Allies
  - Brag to parents within the first 4 weeks.
  - Ask them to work with you
  - Keep in touch



# Parents and Families

- Parents can learn!  
Don't just tell parents, show them!
  - Help students to engage their parents
  - Family math night where parents and students work on math together
  - Give parents ways to help their children



# Keeping Your Sanity

- Do not work alone – communicate with colleagues, interact with others online, attend meetings
- Find a mentor
- Learn to say “No”
- Make a mistake?
  - Apologize if you need to. Move on.
  - Don’t beat yourself up.

# Keeping Your Sanity

Laugh  
&  
Enjoy

