

This sine has
threee errors.

Order of Ops Bingo

- Write the word FREE in one space on the board.
- Choose numbers for the other 24 boxes. Choose numbers within the given range for each column.
- You are not allowed to repeat any numbers.

Order of Ops Bingo

B (1-10)	I (11-20)	N (21-30)	G (31-40)	O (41-50)

Order of Ops Bingo

- $6 \cdot 5 - 4 \cdot 3$
- $2 \times 3 \times (3 + 4)$
- $(5 \cdot 4 \cdot 4 - 4) \div 2$
- $2 \times 2 \times (3 + 4)$
- $2 \times 3 \times 4 - 6 - 7$
- $54 - 3 \times 2$
- $8 + 7 \times 6$
- $(3 + 3) \times 2 \times 3$
- $1 + 2 + 1 \times 2 + 1 + 2$
- $1 \times 2 + 3 \times 4$
- $3 \times 3 \times 3 + 4$
- $3 \times 3 \times 3 \div 3$
- $5 \times 4 \times 3 \div 5$
- $5 \times 6 + 7$
- $4 \times (3 \times 4 - 1)$
- $4 \times (3 \times 4) - 1$
- $9 \cdot 8 - 7 \cdot 6$
- $3 \cdot 2 - 1$
- $1 + (2 + 3) \times 4$
- $(5 \times 5) \div (5 \times 5)$
- $7 + 6 \cdot 5 - 4$
- $7 \times 6 - 5 \times 4$
- $8 + 8 + 8 \div 8$
- $7 \div 7 + 7 \div 7$
- $(1 + 4) \times (4 + 1)$
- $4 \times 4 + 4 \times 4$
- $(3 + 4 \cdot 5) + 6$

Where Are You?

1. Multiply your age by 12.
2. Add your friend's age.
3. Divide by 7.
4. Divide by 11.
5. Divide by 13.
6. Add the first six digits after the decimal point.
e.g., $0.123456 \rightarrow 1 + 2 + 3 + 4 + 5 + 6 = 21$
7. Finally, multiply by 7, then subtract 1...

What'd You Get?

188

Session **188**

Whoa!

How does that work?



**Engaging and Free
Online Resources for
Teaching Operations and Fractions**

October 12, 2012

G. Patrick Vennebush

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Today's Agenda

- Good Problems
- Classroom Activities from Illuminations
- Demonstrate Good Teaching Practices for Using Illuminations Resources
- Wrap-Up and Q + A



Problems

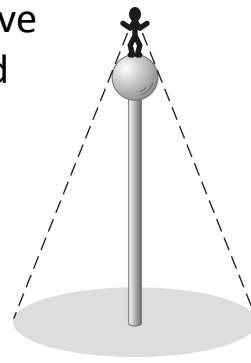
The solution of problems is one of the lowest forms of mathematical research. . . yet its educational value cannot be overestimated. It is the ladder by which the mind ascends into higher fields of original research and investigation. **Many dormant minds have been aroused into activity through the mastery of a single problem.**

– Benjamin Franklin Finkel
American Mathematical Monthly, Number 1

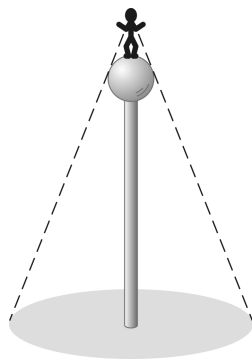


Problems

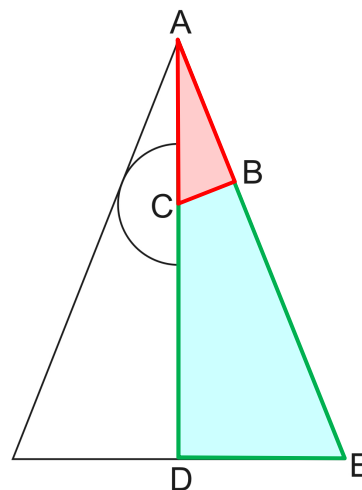
- There is a sphere 12 feet in diameter on top of a pole 60 feet high. On the sphere stands a man whose eye is six feet above the sphere. How much ground beneath the ball is invisible to him?



Problems

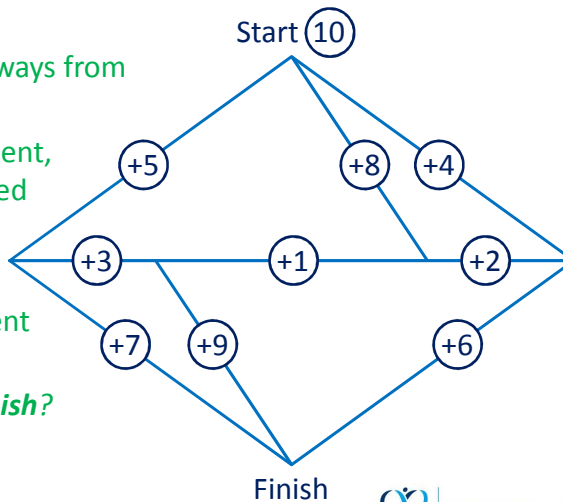


(Solution Strategy)



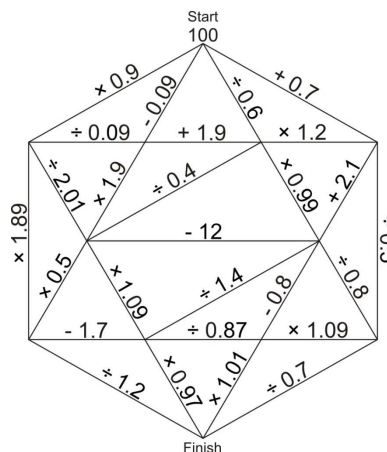
Number Maze

- Begin with 10.
- Move down or sideways from **Start to Finish**.
- As you cross a segment, perform the indicated operation.
- Don't go up.
- Don't cross a segment more than once.
- *Largest value by **Finish**?*



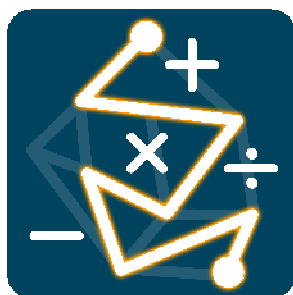
Decimal Maze

- 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**?*



Pick-a-Path

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



Decimal Maze

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 central. These activities can be used in varied ways to generate discussion and to extend the number-sense concepts. The discussion that arises as students describe their thinking and certainty give insight into all the interesting mathematical investigations 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? How many students could fit in a suitcase? (2 or 3 students per group) To explore these questions, students will:

- Compare the size of a million dollars to a standard suitcase.
- Compare the size of a million dollars to a standard suitcase.
- Compare the size of a million dollars to a standard suitcase.

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 will give you \$1 million. The only way you can do this is to take on the challenge, each carrying \$1 million in cash. You will be the richest person in your class. You will also have to be the person to pick a path that will lead you to the money. Can you make you a millionaire?

Invite students to formulate and explore questions to investigate the truth of this claim. For example:

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

Conditions should be available to facilitate and explore the comparison for groups.

Note: The dimension of a one-dollar bill are approximately 6 inches by 2.5 inches. Twenty-one dollar bills weigh one pound.

Math Standards and Expectations

References

Math Practice Based Activity Sheet

Students are to choose a path through the maze. To begin, have the students enter 00 on their calculator. For each integer chosen on the path, the students should hit on the correct operation and number. The goal is to choose a path that results in the largest value at the finish of the maze. Students may be required to path or even square of the maze.


In pairs or 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 8322.



Fraction Circle


Cut

1
0

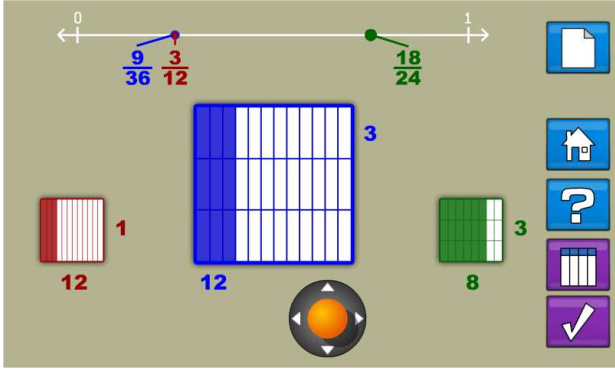
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Equivalent Fractions


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



Video
Tutorial





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Krypto

Combine the five numbers below...



...using the four operations (+, −, ×, ÷) to create the following **target number**:

7

*You **must** use all five numbers,
but you don't have to use all four operations.*

Krypto

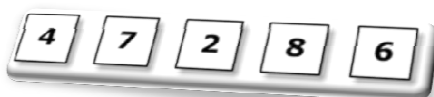
The rules of **Krypto** are really simple.

- You are dealt five cards.
- A sixth card—the “target card”—is pulled from the deck.
- You must **use all five of your cards** and the four arithmetic operations (+, −, ×, ÷) to get the value on the target card.

Krypto

Now that you know the rules, try another...

Your five cards:



target: **1**

Solutions:

$$(8 - 7) \times ((4 + 2) \div 6)$$

$$8 \div 4 \div 2 \times 7 - 6$$

$$6 + 7 - (8 \times 2) + 4$$

Krypto

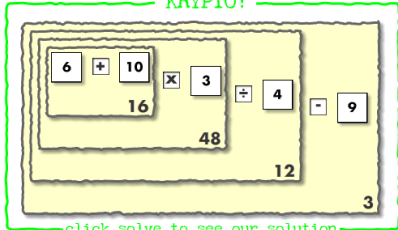
<http://illuminations.nctm.org/ActivityDetail.aspx?ID=173>

PRIMARY KRYPTO

deal
hint
solve

target: **3**

KRYPTO!



click solve to see our solution

Krypto

What are some useful strategies for this game?

- Can you get 1?
- Can you get 0?
- Can you use only addition and subtraction?
- Solve a simpler problem—e.g., if one of the numbers is 2, can you get half or double the target number?

Krypto

Back to the example...

Your five cards:

4 7 2 8 6

target: **1**

Sum of five cards is **odd**.

Target is **odd**.

- There is *likely* to be a solution using only addition and subtraction.

illuminations.nctm.org



Illuminations

The web site currently contains...

- 607 Lessons
- 108 Interactive Tools

On average, 325,000 visitors per month

- August 2004 – 93,371
- March 2012 – 632,910



Illuminations

New in 2012...

- 1 new game for Calculation Nation[®]
- 10 new lessons, based on Calc Nation games
- 1 web app
- 3 mobile apps



Illuminations

Click on two cards that you think will match

Games
Face Down

Cards
Numbers 1-8

Players
One

New Game
Reset

Sorry, but that's not a pair. Keep looking!!



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DISCUSSION
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KEYWORDS STATE STANDARDS

See what standards aligned resources are available by filling out the Keywords or State Standards tab.

Keywords:
Keywords...
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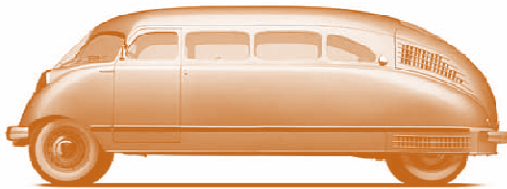
Thinkfinity

- Provides standards-based content and professional development for K–12 teachers
- Supported by the **Verizon Foundation**
 - NCTM received a three-year, \$1.4M grant for Illuminations
- Consortium of content partners across all disciplines
 - science, arts, humanities, geography, economics, language arts, math, and history

Julia Problem

When Julia's family travels, her father always drives, and her mother always sits in the front passenger seat. Julia and her siblings sit in the middle and back rows of the vehicle.

Julia told her brothers and sisters, "Of all the ways that two of us can sit in the middle row, I'm involved in one-third of those pairs."



How many siblings does Julia have?

Julia Problem

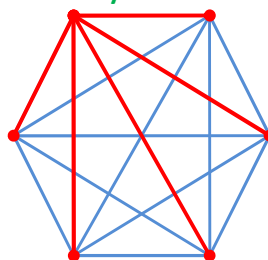
Siblings	Fraction of Pairs that Include Julia
1	$1/1$
2	$2/3$
3	$3/6$
4	$4/10$
5	$5/15$
6	$6/21$
7	$7/28$

Julia Problem

- **List:**

J1	12	23	34	45
J2	13	24	35	
J3	14	25		
J4	15			
J5				

Geometry:




- **Algebra:** $\frac{n}{\frac{1}{2}n(n+1)} = \frac{1}{3}$

Probability

- Write a really big number on your paper.
(Use lots of digits. And it should be sufficiently ugly... that is, not some nice round number like 25 or 7,000,000,000.)
- How many people do you think wrote a number that has a 3 in it?
- What's the probability that a randomly chosen number has 3 as one of its digit?


Probability

Numbers	Fraction that Contain a 3
0 – 9	1/10
0 – 99	19/100
0 – 999	271/1,000
0 – 9,999	3,439/10,000
0 – 99,999	40,951/100,000
0 – 999,999	468,559/1,000,000
0 – 9,999,999	5,217,031/10,000,000


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http://calculationnation.nctm.org

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Resources for Teaching Math

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Dig It

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Guest: 21913
0 1 1 3 10

Calculation Nation: 19748
2 1 2 2 8

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Dirt: 5.57 tons 5,570 points
Gems: 24 12,965 points
Diamond: 1
Emerald: 1
Sapphire: 3
Ruby: 6
Topaz: 13

0 1 2 3 4 5 6 7 8 9

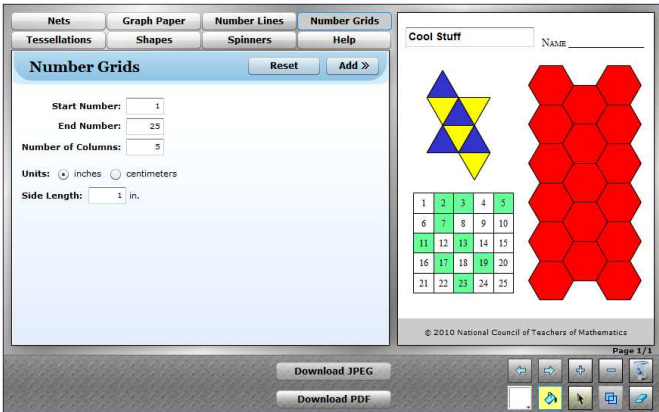
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Dig It

- What are the best numbers to try to get?
- What number(s) are easiest to get?
- Which points on the number line can be created in the least number of ways?
- How many fractions can be created with a value less than 1?
- Which digit is the best to get?

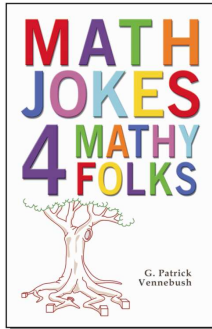
Dynamic Paper

- To make nets — and other things!



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My Favorite Game...



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

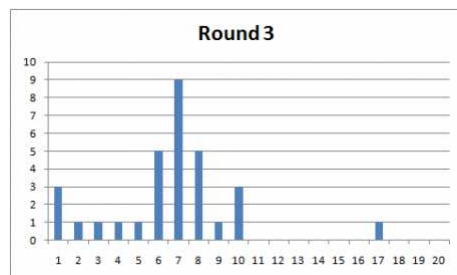
Whoever wrote the smallest integer NOT written by anyone else.

My Favorite Game



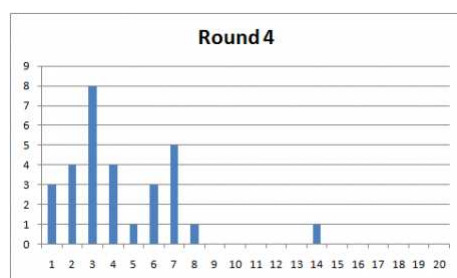
- Min: 1
- Max: 18
- Mode: 1
- Average: 8.5

My Favorite Game



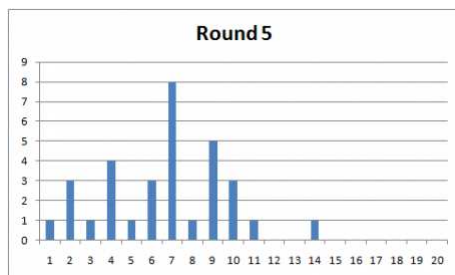
- Min: 1
- Max: 17
- Mode: 7
- Average: 7.5

My Favorite Game



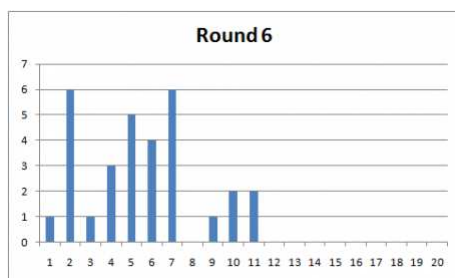
- Min: 1
- Max: 14
- Mode: 3
- Average: 5.3

My Favorite Game



- Min: 1
- Max: 14
- Mode: 7
- Average: 7.7

My Favorite Game



- Min: 1
- Max: 11
- Mode(s): 2, 7
- Average: 6.4

11Q – Q

Wrap-Up

- Questions?
- Comments?
- Compliments?

Wrap-Up

- What is $11q - q$?

Thank You!



Engaging and Free Online Resources for Teaching Operations and Fractions

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