

NCTM Regional Conference: Indianapolis (October 29-31, 2014)

Gallery Workshop: Math Learning Games

3:15 – 4:30 pm in Capitol 1 (Westin)

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Source for Everyday Mathematics games: *Everyday Mathematics: Teacher's Guide to Games* published by SRA a division of McGraw-Hill, 2003. ISBN 0-07-572760-9. Check their booth in the exhibit hall. I asked them to have this book available for purchase.

Although the games are K-6, most can be adapted to any grade. There are many good game formats in this book.

Game	Source	Skills practiced
MATH MAGIC	Many sources Speaker created the ones in this packet	Arithmetic review Whole numbers, decimals, or integers.
TOP IT	Everyday Math	Arithmetic review – whole numbers and integers
BUMP IT	Speaker	Beginning algebra skills simplifying commonly confused variable expressions like $x + x + x$ and $x \cdot x \cdot x$
SPIRAL	Speaker	Beginning algebra skills evaluating variable expressions using integers and ordering of integer values
STAT STRATS	Modified from Everyday Math “Landmark Shark”	Strategy game involving mean, median, mode, and range of a 5 point data set.
ALGEBRA ELECTION	Everyday Math	5 th -6 th grade review questions tied to concept of electoral votes in a presidential election

MATH MAGIC

MATH MAGIC “games” are created using algebra to create a series of operations that, regardless of what number the student starts with, the result will either be the same number or a specific number that is the same for everyone no matter what number they started with.

Students are often intrigued by this process and become quite concerned when their answers do not come out as predicted.

Using a “record sheet” is helpful because it allows either the teacher or the go back and find any errors. A record sheet is included with this package as well as an instruction sheet with four examples of MATH MAGIC: 1 for each of whole numbers, decimals, fractions, and integers.

On the instruction sheet it also shows the algebraic results of each step and you can follow along and see why the series of operations will always result in the given answer.

You can create your own MATH MAGIC instructions by filling out a record sheet using a variable instead of a specific number. See the attached instruction sheet.

Grade level: 5-8, working on whole number, decimal, fraction, or integer arithmetic.

Number of players: played with whole class or part of class

Materials: Each student needs a record sheet (attached)

Instructions: The teacher shows students where they will write their chosen number and how they will record the operations and results. When you read the instructions, be sure to give enough time for students to do the necessary arithmetic.

The teacher reads the instructions off the instruction page. For instance, in game 1 the teacher would say, “I want each of you to choose a number that is less than 100 and write it in the box next to the “Start with” shaded area.

Now take your number and add 70.

Record the operation and your result on your record sheet.

Multiply that answer by 3.

Subtract 201.

Multiply by 201

Add 54.

Divide by 9.

Subtract 9. Your answer should be the number you started with. Is it?

Instructions and How MATH MAGIC Works:

1. **Whole Numbers:** choose a whole number less than 100.

Start with:	x
+ 70	$x + 70$
$\times 3$	$3x + 210$
- 201	$3x + 9$
$\times 3$	$9x + 27$
+ 54	$9x + 81$
$\div 9$	$x + 9$
- 9	x

Your answer should be the number you started with.

2. **Decimals:** Choose number between 10 and 20.

Start with:	x
Add 0.5	$x + 3.8$
Double	$2x + 7.6$
+ 10.4	$2x + 18$
$\times 0.2$	$0.4x + 3.6$
-3.6	$0.4x$
$\times 10$	$4x$
$\div x$	4

Your answer should be 4.

3. **Fractions:** Choose a proper fraction with denominator 2, 4, 6, or 8

Start with:	x
$\times \frac{1}{4}$	$\frac{1}{4}x$
$+ \frac{1}{2}$	$\frac{1}{4}x + \frac{1}{2}$
$\times 8$	$2x + 4$
+ 10	$2x + 14$
$\times \frac{1}{2}$	$x + 7$
+ 1	$x + 8$
-x	8

Your answer should be 8.

4. **Integers:** Choose a negative number between -1 and -10

Start with:	x
$\times 9$	$9x$
- 9	$9x - 9$
$\div 9$	$x - 1$
$\times (-5)$	$-5x + 5$
$+ (-5)$	$-5x$
-x	$-6x$
$\div (-6)$	x

Your answer should be the number you started with.

INTEGER TOP IT Games

TOP IT games come from Everyday Mathematics curriculum and are one of the more popular games, so if your students have come through Everyday Mathematics they may have played at least the whole number version of TOP IT already.

TOP IT games are played with regular decks of cards, either removing the face cards or counting Jack as 11, Queen as 12, and King as 13. It is similar to the game traditional card game of “WAR”.

For INTEGER TOP IT, red cards are negative values and black cards are positive values.

Number of players: 2-4 works best

Materials: 2 decks of regular playing cards (remove face cards for easier version of game). Works best if the decks have different backings so can separate out the decks again.

Instructions: The cards are dealt so that each student receives the same number of cards. Cards remain face down.

2 players	Each player gets 40 non-face cards	The face-cards are put aside.
3 players	Each player gets 26 non-face cards	The face-cards and 2 other cards are put aside.
4 players	Each player gets 20 non-face cards.	The face-cards are put aside.

Addition Version:

Player 1 turns over his top 2 cards and says the sum of the two values. The rest of the players check the sum. If it is correct, the next player follows in turn. If not, the sum is corrected, and the player is disqualified from winning the round, even if the correct sum turns out to be the highest one showing.

The rest of the players follow in turn.

When all the players have had a turn, the player with the largest sum (that has not been disqualified) wins all the cards that have been played in that round.

If there is a tie for highest value, each of the players involved in the tie turn over 1 more card, and the player with the highest card wins.

The game is over when all the cards have been taken. The player with more cards at the end wins.

Subtraction Version: (Teacher should review greater-than and less-than with integers on the number line before this game is played.)

Player 1 turns over 2 cards, one-at-a-time, and then gives the difference for the first card value minus the second card value. A wrong answer disqualifies the player from winning the round, even if the difference turns out to be the largest one showing.

Play continues as in addition, except that subtraction is being used.

Multiplication Version:

Works the same way except that the two values turned up are multiplied.

BUMP IT – Levels 1 and 2

Grade level: 6-8, working on pre-algebra skills simplifying expressions using like terms, exponents, Identity Property (+ or \times), Zero Property (+ or \times), Commutative Property (+ or \times) Associative Property (+ or \times).

Number of players: 3-4 per group.

Materials: Each group of students need:

- 1 deck of BUMP IT playing cards (Level 1 or 2 Gray or Beige)
- 1 playing mat (Matching Level Gray or Beige)
- 10 marker squares for each student (different colors for different students)

NOTE: The playing mat is arranged somewhat like a BINGO card, with each column being associated with a letter in the word BUMPT. All the expressions in the column use that letter as the variable.

Instructions:

1. Shuffle the BUMP IT playing cards and place them face down in the middle.
2. Players take turns turning over the top card in the drawing pile and trying to match the expression on the card with its simplified form on the playing mat. If the player finds a match, he marks the region on the mat with one of his playing pieces and puts the card he drew in the discard pile. If the player does not identify a match, then the playing card is placed in the discard pile and it is the next player's turn.
3. Zero's can be played in any column. For instance, the simplification of $0(3x)$ is zero and if a zero is open in the "B" column, the player may place the marker there, even though the variable in the expression was x . (All zeros are created equal.)
4. The previous player must declare whether the new play is correct or not. If not, he must explain why and then may replace the other player's marker with his own. (Even though the correct answer does not match the square.) If the play is declared "Correct", then play continues to the next player.
5. If any player draws a "FREE" card, the player may claim any unclaimed region on the playing mat.
6. If any player draws a "BUMP" card, the player may "bump" any marker off the board and take its place with his own marker. BUMP cards can only replace markers that are already on the board.
7. The game continues either until a player gets 5 markers in a row (vertical, horizontal or diagonal) or all the playing cards have been used. (If the deck is complete, the card SHOULD be completely covered.)
8. Scoring: 5 in a row gives a player 10 points. Otherwise, each player receives the number of points corresponding to the number of markers they have placed on the mat. When 5 rounds have been completed or time is called, the game is over and points are totaled. The player with the most points wins the game..

Materials are available online at www.nctm.org/planner

Spiral Chase

Grade level: 6-8 working on evaluating expressions, integer arithmetic, and ordering integers.

Instructional Goal: Practice of integer arithmetic, evaluating algebraic expressions, and ordering integers from least to greatest. The emphasis is on handling negative signs and exponents in algebraic expressions. Some basic probability concepts come into play as players have to decide whether to “stop” the Spiral or keep chasing around it.

Number of players: 4-6 per group

Materials: Each group needs:

- 1 deck of Spiral Chase Cards
- 1 SPIRAL Spinner

Instructions: The Spiral Chase Cards are then shuffled and five cards are dealt to each player. The rest of the Spiral Chase cards are placed in the center, face down. Players look at their own cards, but do not show them to the other players.

The first player spins the spinner. Where the spinner lands is the replacement value for the entire round.

The first player selects a SPIRAL Card from his hand to play and places it face up in the middle of the playing area, saying “I have _____”, filling in the amount that results from substituting in the replacement value into the expression just laid down. Before going on to the next player, player 1 draws a replacement card from the SPIRAL Deck. Each player should have 5 playing cards in their hand at all times.

The next player to the left must then play a card from his hand that, when evaluated with the (same) replacement value is equal or greater than the value the last player produced, saying “I have _____”. He then draws a replacement card from the SPIRAL Deck.

Play continues going around to the left and each player must play a card that when evaluated with the replacement value yields a value greater than or equal to the previous value.

The SPIRAL round ends one of three ways:

1. **A player is unable to play** a card that yields a value equal to or greater than the last value played. Result: The previous player wins all the SPIRAL cards that have been played in the round.
2. **A player mis-calculates the value** when evaluating the expression. Result: previous player wins all the SPIRAL cards that have been played in the round.
3. A player plays a “STOP” card. Result: That player wins all the SPIRAL cards that have been played in the round.

Each player keeps the cards they have won in a stack. At the end of the game, the player who has won the most captured playing cards wins the game.

The winner of the round begins the new round by spinning the spinner playing the first expression card. Play continues as before.

The game ends when a player cannot replace a spent card because there are no replacement cards left.

The winner is the player who has captured the most SPIRAL cards.

SAMPLE SCORE SHEET

Players → Rounds ↓						
Round 1						
Round 2						
Round 3						
Round 4						
Round 5						
TOTAL						

Materials are available online at www.nctm.org/planner

STAT STRAT

This is a modification of the Everyday Mathematics game “LANDMARK SHARK”. The game as presented in Everyday Mathematics has two flaws which have been corrected in this modified version. (The flaws were that the range was very rarely a good choice in the original game, and using the highest value instead of the lowest made it very hard to catch up once someone has a good hand.)

Grade level: 6-8 working on range, median, mode, and mean of a data set.

Instructional Goal: Students practice computing range, median, mode, and mean and strategize about which will yield the SMALLEST value for a 5 number data set.

Number of players: 4

Materials: Each group needs:

- 1 deck of regular playing cards (remove the face-cards for easier version of game. Otherwise face-cards are valued as Jack = 11, Queen = 12, and King = 13)
- 1 score sheet

Instructions:

1. The dealer shuffles the cards and deals 5 cards facedown to each player.
2. Each player picks up and puts his or her cards in order from smallest to largest.
3. Players consider their cards and decide if the range, median, or mode will result in the **smallest value**. Examples:

Range: The player's score is the *range* of the hand.

EXAMPLE Player 1's hand:

1	4	6	8	12
1	4	9	8	12

Range = $12 - 1 = 11$
Total points = 11

Median: The player's score is the *median* of the hand.


EXAMPLE Player 2's hand:

4	9	13	14	15
4	6	13	14	15

Median = 13
Total points = 13

Mode: The player must have at least 2 cards with the same number. The player's score is found by multiplying the mode of the hand by the number of modal cards. If there is more than 1 mode, the player uses the mode that will produce the **Lowest score**

EXAMPLE Player 3's hand:



Mode = 8; $2 \times 8 = 16$
Total points = 16

4. Players declare which measure they will use by placing the corresponding marker out in front of them. (Markers read “range”, “median”, and “mode”.
5. Players may exchange up to 3 of their cards for new cards from the deck. However, their declared stat measure stays the same.
6. Players lay down their hands and record their scores on the score sheet. Each player then must calculate the mean for their hand and record it on the score sheet as well. The two values are added to produce the player’s score for the round.

STAT STRAT Score Sheet for 3 rounds

Round 1:

	Player 1	Player 2	Player 3
Points to Hand			
Mean			
Round 1 score			

Round 2:

	Player 1	Player 2	Player 3
Points to Hand			
Mean			
Round 1 score			

Round 3:

	Player 1	Player 2	Player 3
Points to Hand			
Mean			
Round 1 score			