box cars and one-eyed jacks®

Presents

RADICAL MATH

Middle Years Math Games
www.boxcarsandoneeyedjacks.com

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Notes:

Games as a Teaching Strategy

- Make math fun & motivating; meaningful context for repetitive practice and exploration of concepts
- Multi-sensory, manipulative experience - use all learning channels
- Complement any existing mathematics program; reaches all levels in a class
- Beyond rote memory - connections through patterns, strategy, talk
- Rich in problem solving opportunities
- Language and Communication; Writing in math journals
- Opportunities to invent and create

Make The Games Come To Life

- Every Student Participates - Not used as reward
- Games as Warm Ups
  - Short play period
  - Frequent 5-10 mins / day
- Games to Teach a Concept - Longer play period
  - Practice a concept
  - Review a concept
- Center Play
- Cross Graded Play
- Assignments
  - Students are the experts
  - Learn game & teach it
- Invent a Game
- Home Connections

Notes:

PARENTS CAN HELP KIDS SUCCEED IN MATH

AS A PARENT, YOU ARE YOUR CHILD'S MOST IMPORTANT TEACHER!

YOU CAN:

PRESENT A POSITIVE ATTITUDE *about math - even if you didn't care for it in school. Kids need to feel good about math. If you say, "I hated math," or "I can't do math," your child may start to feel the same (You probably know more about math than you think!).*

SHOW INTEREST *in your child's homework - and be on hand to help.*

ENCOURAGE ACTIVITIES *that make math interesting and fun!*

GAMES ARE A PERFECT WAY TO MAKE HOMEWORK... "HOME PLAY"

A "REFRESHER" IN THE LANGUAGE OF MATH

Addition:	addend + addend = sum
Subtraction:	minuend - subtrahend = difference
Multiplication:	factor x factor = product
Division:	dividend ÷ divisor = quotient (and sometimes a remainder)
Fractions:	$\frac{\text{numerator}}{\text{denominator}}$

Let The Games Begin

All the Box Cars games are written using the same format. As a sample, we've chosen one of our basic games to familiarize you with our style.

LEVEL: Grade 1 - 3
SKILLS: addition facts 1 - 10, 1 - 18 combinations
PLAYERS: 2
EQUIPMENT: Cards (Ace = 1) - 5, or (Ace = 1) - 9
GETTING STARTED: Players divide cards evenly between themselves. Each player turns over two cards and adds them together. The highest sum gets all the cards. In the event of a tie; (ie: each player has the same sum), WAR is declared. Each player deals out three more cards face down and then turns over two more cards. These two cards are added together. The highest sum wins all of the cars. Play continues until one player has collected all of the cards.

Cards 1 - 5 Grade 1 - 2 Sums to 10
Cards 1 - 9 Grade 2 - 3 Sums to 18

Player 1	Player 2	
2 + 3	4 + 1	
War is declared		
2 + 3	4 + 1	
____	____	
____	____	3 cards are turned upside down.
____	____	
4 + 3	6 + 2	

Player 2 collects all of the cards

Try These Variations

Place Value War
Subtraction War
3 Addend War
Multiplication War
Integer War
Fraction War

Remember: War is a traditional game. However, due to the negative connotation you may want to change the term "war" to one of your own choice. We often call these our Buzz Games (ie. Three Card Buzz).

Notes:_____

The following game boards are teacher and student favorites. Yours to copy and use.

	Hundred Million	Ten Million	One Million	Hundred Thousand	Ten Thousand	One Thousand	Hundred	Ten	One	My Number
1										
2										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

ROLL ON... DECIMALS

Roll Number	Ones	Tenths 10ths	Hundredths 100ths	Thousandths 1000ths	Running Total
1					
2					+ =
3					+ =
4					+ =
5					+ =

difference from whole number (+/-)

Fractions, Decimals, Percents

										1 Whole Number 1/1 1.0 100%
										One half ½ .5 50%
									One Third 1/3 .333 33.3%	2/3
								One Fourth ¼ .25 25%	2/4	3/4
							One Fifth 1/5 .2 20%	2/5	3/5	4/5
						One Sixth 1/6 .166 16.6%	2/6	3/6	4/6	5/6
					One Seventh 1/7 .142 14.2%	2/7	3/7	4/7	5/7	6/7
				One Eighth 1/8 .125 12.5%	2/8	3/8	4/8	5/8	6/8	7/8
			One Ninth 1/9 .111 11.1%	2/9	3/9	4/9	5/9	6/9	7/9	8/9
		One Tenth 1/10 .1 10%	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10
	One Eleventh 1/11 .0909 9%	2/11	3/11	4/11	5/11	6/11	7/11	8/11	9/11	10/11
One Twelfth 1/12 .083 8.3%	2/12	3/12	4/12	5/12	6/12	7/12	8/12	9/12	10/12	11/12

Name_____

Order In The Court

Date_____

Reject Rolls

Reject Rolls

Reject Rolls

Reject Rolls

Reject Rolls

Reject Rolls

Use Double Sided Dice; 6-Sided Dice; or 1-12 Dice

Goal: To get as many fractions in a row as possible

- Roll one die at a time (Variation: You may roll all the dice at once and race your partner to line them up)
- Write the fraction into the chain or put into the reject boxes
- Points are awarded at the end of 7 rolls. 1 point for each fraction in the chain.
- Use Fraction Circles or Fraction Bars to check accuracy

DOUBLES + PATTERNS

DOUBLE (EVEN)	DOUBLE + 1 (ODD)	NICKNAME
1 + 1 = 2	1 + 2 = 3	Goal Post
2 + 2 = 4	2 + 3 = 5	Rabbit, Kangaroo, Caribou
3 + 3 = 6	3 + 4 = 7	Dental
4 + 4 = 8	4 + 5 = 9	Spider, Octopus
5 + 5 = 10	5 + 6 = 11	Ten Tickly Fingers
6 + 6 = 12	6 + 7 = 13	"Box Cars", Egg Carton, Farmers
7 + 7 = 14	7 + 8 = 15	Valentines Day
8 + 8 = 16	8 + 9 = 17	Sweetheart
9 + 9 = 18	9 + 10 = 19	Adult Double

- Learn doubles – cards 1-6 or 1-9, regular dice, 10 sided 0-9 dice
- +1 Trick counting on
- Doubles + 1 ⟶ Then transfer to symbolic work

PATTERNS FOR DICE PLAY

1	2	6
2	4	7
3	6	8
+4	+8	+9
10	20	30

SIMPLE SIXES
SUCCESSFUL SEVENS
EASY EIGHTS
NIFTY NINES
TERRIFIC TENS
ENORMOUS ELEVENS
TREMENDOUS TWELVES

COMMIT AND CAPTURE

1. $\square \times (\square - \square) - \square =$

2. $\square + \square \times \square \div \square =$

3. $\square^2 - \square \times \square - \square =$

4. $\square + \square \div \square \times \square =$

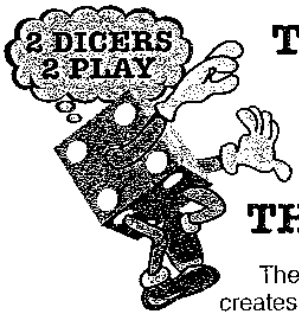
5. $\square \times (\square + \square) - \square =$

6. $\square [\square^3 \times (\square - \square)] =$

7. $\square \div \square + \square \times \square =$

8. $\square \div \square \times \square - \square =$

ROLL'N ON PLACE VALUE

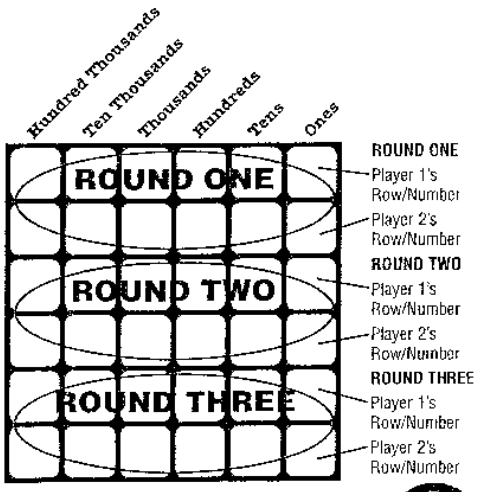


TO BEGIN

Dicers select their own colour of dice. The dice will be rolled alternately one at a time by the players throughout the game. A total of three rounds will be played (see example 7).

THE GOAL

The goal of the game is to be the player who creates the largest six-digit number in each round.



Example 7

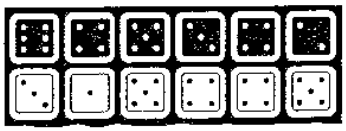
TO WIN

A Dicer must be the first one to win two out of three rounds. To start the first round player number one rolls a die and selects the best place value position in their row. For example, if player one rolls a two, the "tens" position might be selected. Player two now might roll a five and place it in the "ten thousands" position of their row. Once a die is placed in any place value position it cannot be moved. Remember, this is a game of chance. It depends on chance whether you throw the number you want on the die. Be a risk-taker and make a calculated guess. The more you play, the better you'll play. Players alternate taking their remaining five rolls, each building their own hundred thousands number - keeping in mind the goal of the game is to create the largest number possible.

ROLL'N ON PLACE VALUE (CONTINUED)

Player 1 rolls a 5
Player 2 rolls a 4
Player 1 rolls a 3
Player 2 rolls a 4
Player 1 rolls a 6
Player 2 rolls a 5
Player 1 rolls a 4
Player 2 rolls a 5
Player 1 rolls a 2
Player 2 rolls a 1
Player 1 rolls a 4
Player 2 rolls a 3

Player one's number is 645,342 which beats player two's number 315,445.



Example 8

Once all dice have been placed, players say their numbers out loud and compare them to determine which player has made the greatest hundred thousands number. This Dicer wins that round. In example 8, player one wins round one. Play continues into round two and if necessary a third round is played to determine the overall winner.

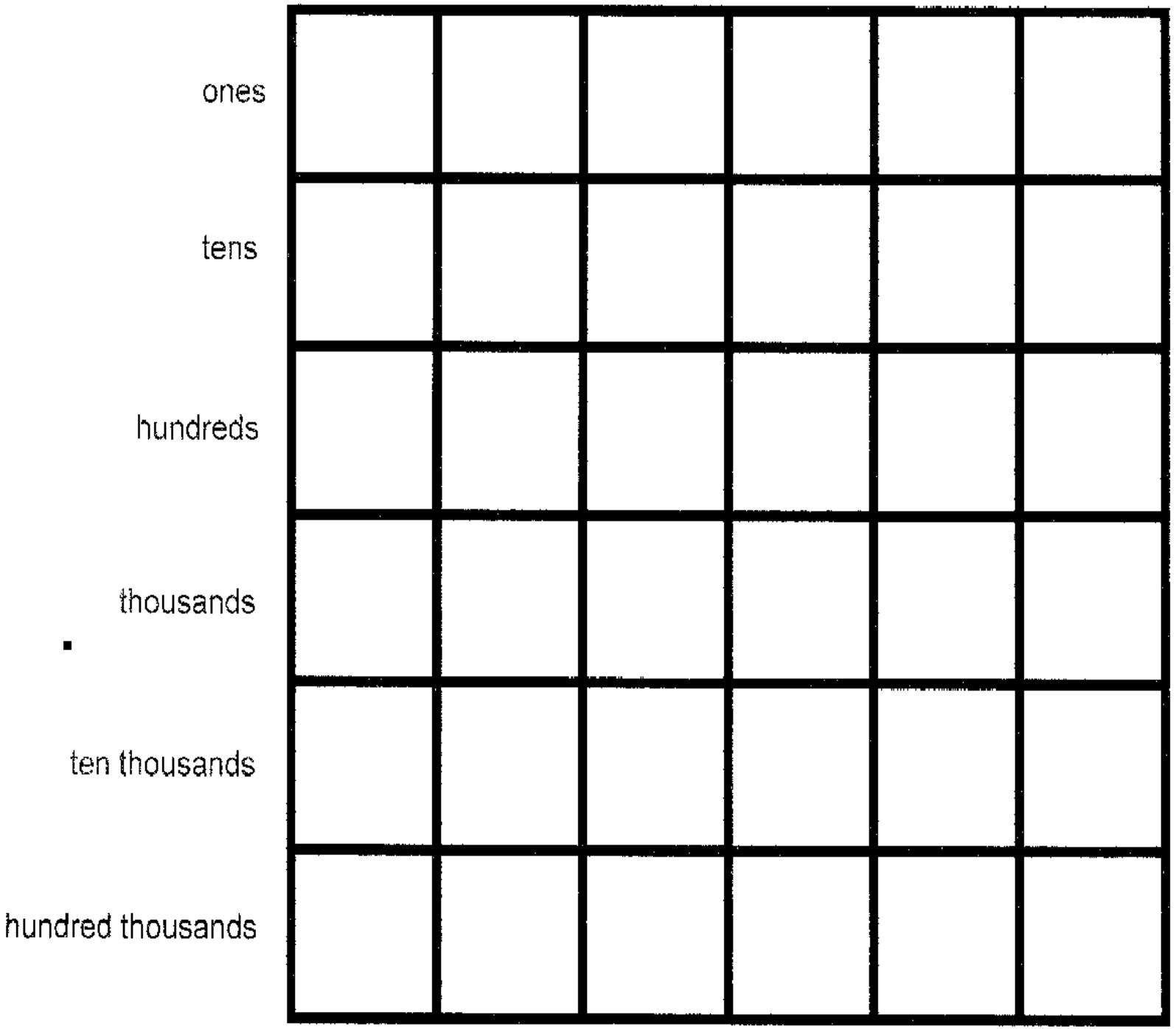
VARIATION I

To decrease the level of difficulty players may roll less dice ie., only four dice per player to build a thousands number or three dice each to build a hundreds number.

VARIATION II

Dicers can agree to change the goal of the game and now attempt to build the smallest six-digit number in each round. A roll of 1 or 2 is now considered a "nice dice" roll! The lowest number you could possibly roll would be 111,111. What would the probability of that be?

Stratedice


ones
tens
hundreds
thousands
ten thousands
hundred thousands

HORSE RACE

This is a game for two Dicers to play at one time. Players use one tray divided so that each player uses only their half.

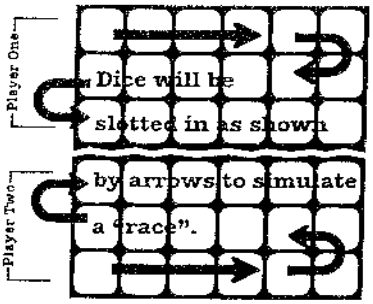
TO BEGIN

Each Dicer chooses eighteen dice of their own colour and these are removed from the tray.

THE GOAL

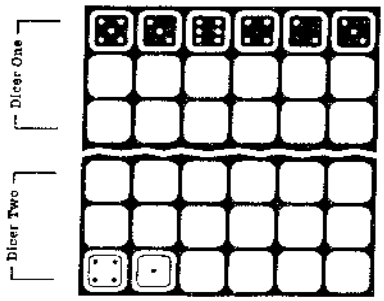
The goal of the game is to have the most dice in your side of the "horse race track" after all dice have been rolled out for the round. Dicers roll two dice at one time.

Dicers add their two dice and compare their sums. The Dicer with the greatest sum places them into their side of the "horse race track". Their opponent places their two dice into the lid (losing side). Dicers pick up two new dice, roll, add and compare their sums. The Dicer with the greatest sum places them into their side of the "horse race track" and their opponent places them into the lid. In the event of a tie sum, both Dicers place their dice into their own side of the "horse race track". Dicers roll out all remaining dice. The Dicer with the most dice on their side of the "horse race track" after nine tosses, is the winner.



The tray is divided between the two players as shown.

EXAMPLE



Play After 3 of 9 Rounds.

Toss 1

Dicer One + = 8 → WINS and places dice in tray

Dicer Two + = 5 → Tosses dice into lid

Toss 2

Dicer One + = 10 → WINS and places dice in tray

Dicer Two + = 3 → Tosses dice into lid

Toss 3

Dicer One + = 6 → TIE both players place dice in tray

Dicer Two + = 5

LEVEL 1

Play is outlined above, Dicers roll two dice and add.

LEVEL 2

Play as described in above rules, but now Dicers roll three dice and add for the greatest sum. The Dicer with the greatest sum (answer) places them into their side of the "horse race track".

+ + = 9

LEVEL 3

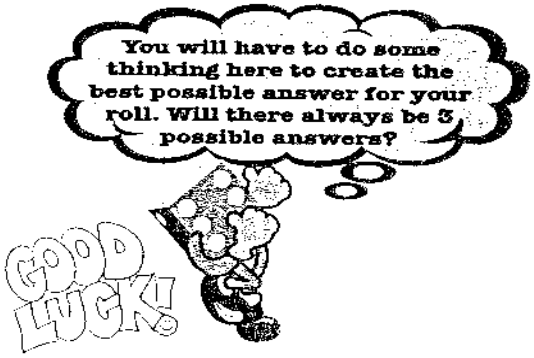
Play as described in above rules, but now Dicers roll two dice and multiply x = 20 for the greatest product. The Dicer with the greatest product (answer) places them into their side of the "horse race track".

LEVEL 4

Play as described in above rules, but now Dicers roll three dice, add two, and multiply by the third for the greatest product. **See example.**

The Dicer with the greatest product places them into their side of the "horse race track".

(5 + 3) x 6 = 48 ☆ Best Choice
(6 + 3) x 5 = 45
(6 + 5) x 3 = 33



Player One

	Touchdown	Field Goal	Total
1st Quarter			
2nd Quarter			
3rd Quarter			
4th Quarter			

Total Football Score

Player Two

	Touchdown	Field Goal	Total
1st Quarter			
2nd Quarter			
3rd Quarter			
4th Quarter			

Total Football Score

FOOTBALL FACTOR

Player One

	Touchdown	Field Goal	Total
1st Quarter			
2nd Quarter			
3rd Quarter			
4th Quarter			

Total Football Score

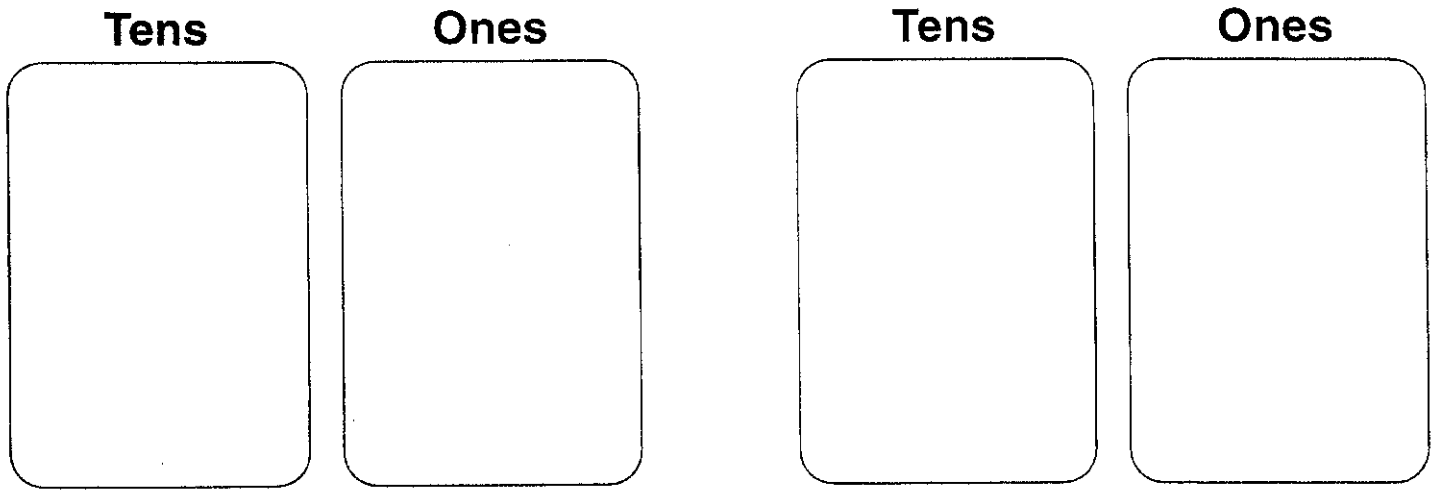
Player Two

	Touchdown	Field Goal	Total
1st Quarter			
2nd Quarter			
3rd Quarter			
4th Quarter			

Total Football Score

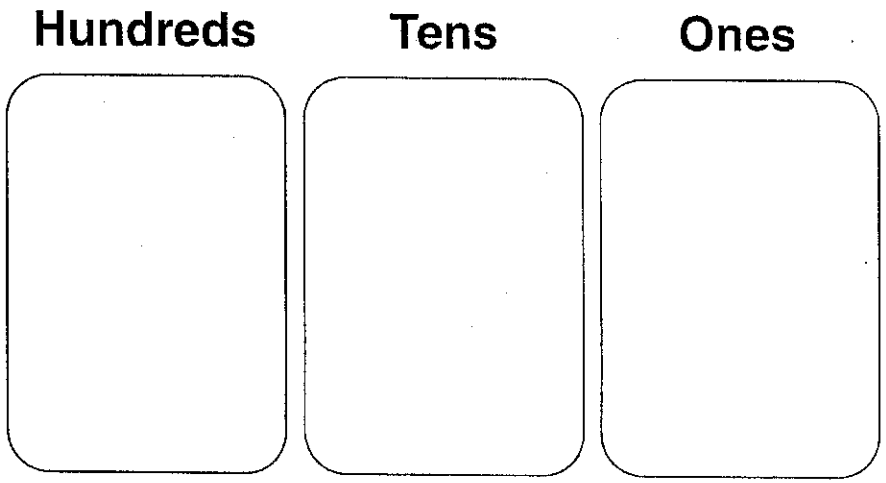
Flippin' Out

00	10	20	30	40	50	60	70	80	90	100

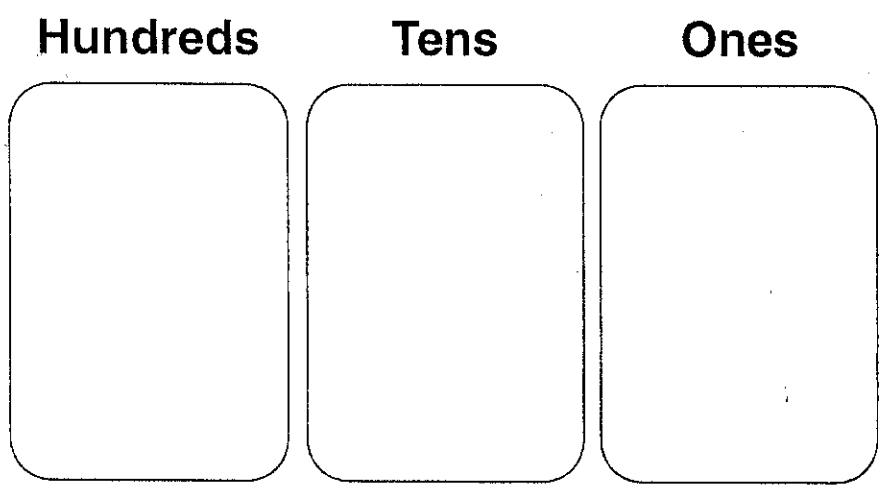


Player One **Player Two**

000	100	200	300	400	500	600	700	800	900	>



Player One



Player Two

BIG SUMS

SKILLS: Problem solving, gathering data, recording data, interpreting data

PLAYERS: Students work in groups of 2, 3 or 4

EQUIPMENT: 36 regular dice per group, paper and pencil, chart

ACTIVITY I: The goal of the activity is to find the sum of 36 dice after they have been rolled.

TEACHING TIP: Allow students several rounds to develop their own method of adding the dice. Use **Chart I** to record the methods. Teach the patterns below and show the students how to group the dice.

1	2	6
2	4	7
3	6	8
+4	+8	+9
10	20	30

THOUGHT PROVOKERS:

1. What is the most efficient pattern to start with? Why?
2. In which order should we use the patterns to be most efficient? Why?
3. What is the largest sum we could have? What is the smallest?

ACTIVITY II: The goal is the same but we are trying to determine the range of possible sums. Use **Chart II** to record the sums that are used.

THOUGHT PROVOKERS:

1. What is the estimate for the mean value of the sums?
2. Can anyone give an explanation for the mean?
3. (Challenger) What is the mean sum of 48 dice?

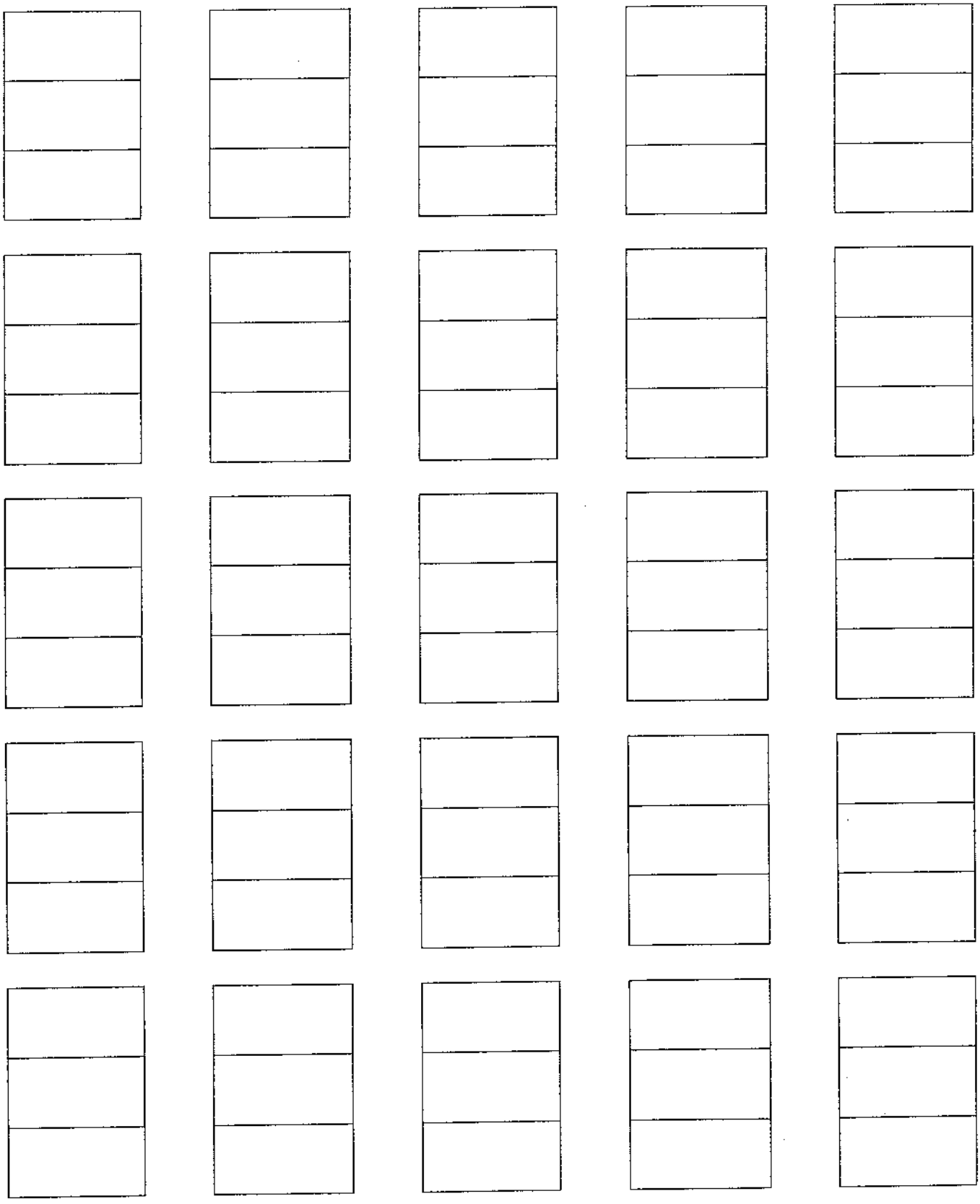
CHART I:

	Prediction	Method Used	Actual Sum	+ / - Difference
1.				
2.				
3.				
4.				
5.				

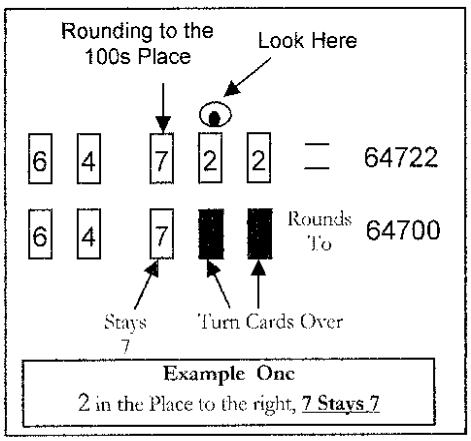
CHART II:

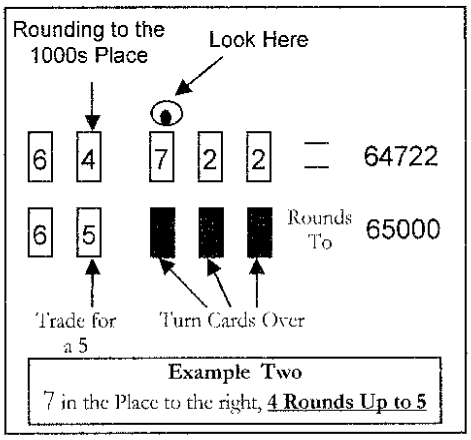
150+	141-150	131-140	121-130	111-120	101-110	90-100

BETWEENERS



Teaching Tips For Rounding





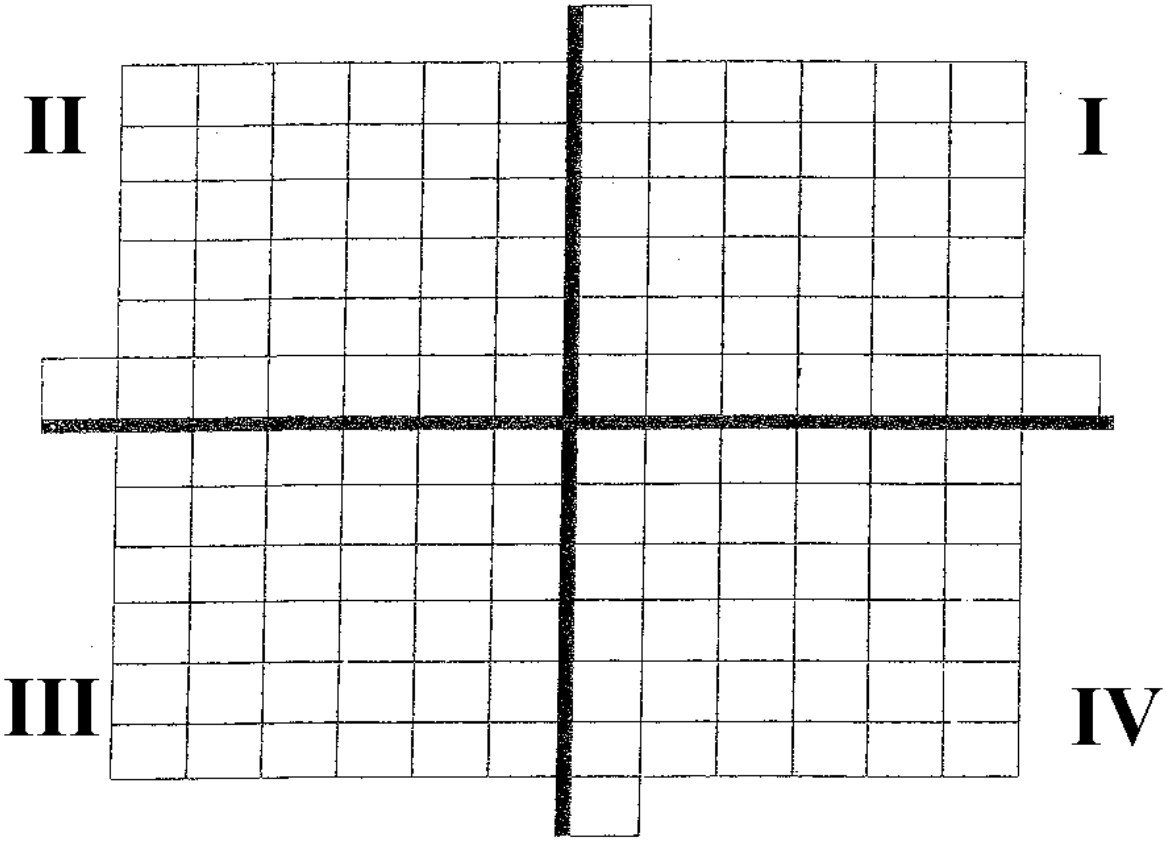
Hit Target

Goal: To get 3 in a row in each quadrant

Directions: Two players on each grid. Players take turns plotting points.

When it's your turn:

- Roll the double die.
- Choose the number or numbers to be negative or positive
- Record the Ordered Pair in the Column for the correct quadrant before you plot the point.



Player 1:				Player 2			
Quadrant I	Quadrant II	Quadrant III	Quadrant IV	Quadrant I	Quadrant II	Quadrant III	Quadrant IV

HUNDRED BOARD TIC TAC TOE

LEVEL: Grade 1 and up

SKILLS: Identification of place value 1 - 100

PLAYERS: 2

EQUIPMENT: Hundred Board, two 10-sided dice or cards (Ace=1)-9, bingo chips (1 colour per player)

GETTING STARTED: Players select a colour of marker. The goal of the game is for players to get three bingo chips of their own colour in a row, either horizontally, vertically or diagonally. Player one rolls the dice and makes a two-digit number (ie., roll 4 and 7 and verbalizes "4 tens, 7 ones, : forty-seven", OR "7 tens, 4 ones, : seventy-four"). Player then covers the two corresponding spaces on the Hundred Board. Player two then takes their turn, rolling the dice and covering both of their numbers, remembering to verbalize the tens and ones place value to their opponent. Players continue to alternate turns trying to get TIC TAC TOE - THREE IN A ROW. When this happens the player removes their markers and counts 2 points for each marker (6 points for three in a row).

CAPTURING AN OPPONENT'S SPACE: If a player rolls a two-digit number that is occupied by their opponent then that player removes their opponent's marker and replaces it with one of their own. Each captured marker is worth 5 points.

ROLLING YOUR OWN SPACE: If a player rolls a one or two-digit number that they already occupy, they may roll again to get a new number.

Players continue to alternate turns for a set period of time. At the end of play, the player with the most points is the winner.

Grade 4-9 Variation: 100 Board Wipe Out

Roll 5 dice, then using + - x ÷ (and exponents if you wish) make a math sentence that = one of the numbers on the 100 board. Using the same roll, make a new math sentence to = another number on the 100 board. Keep going until you can no longer make any more math sentences to = any other number on the 100 board. Roll the 5 dice again and continue. How many rolls will it take for you to clear the board?

100 Board Wipe Out

Roll 1
Roll 2
Roll 3

Roll 4
Roll 5
Roll 6

	=	1
	=	2
	=	3
	=	4
	=	5
	=	6
	=	7
	=	8
	=	9
	=	10
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=	99
=	100

Roll 3 to 5 dice, record numbers, create math sentence, mark on 100 Brd at answer or on answer sheet, keep making math sentences with same roll until no longer possible, then re-roll, RECORD IN WRITING ALL MATH SENTENCES

COMBO FIVE

LEVEL: Grade 3 and up

SKILLS: Mixed operations (+, -, x, ÷), problem solving

PLAYERS: Teams of 2 vs. 2

EQUIPMENT: One 20-sided die, cards Ace - King (Ace = 1, Jack = 11, Queen = 12, King = 0)

GETTING STARTED: Both teams take five cards and place them face up. The goal of the game is to equal the rolled target number each round. To begin, one team rolls the target number for the round. This number will be used by both teams. Teams now begin finding combinations that equal the target number rolled - all operations may be used. A single card cannot be taken off. Teams may take off two, three, four or five card combinations. Teams may also take off a two card and a separate three card combination or two, two card combinations leaving one card behind for the next round. Each card may only be used once in any combination (ie., in the following example 4 can only be used once and not again in a second combination).

EXAMPLE: Cards drawn are as follows:

Team One	4	9	7	2	11
Team Two	2	3	8	10	5

Target rolled = 11

Team One made the following combinations and removed the cards as follows:

9 + 2 = 11 and 4 + 7 = 11

leaving behind the 11 card as it was not used in any combination.

Team Two made the following combinations and removed the cards as follows:

(2 x 3) + 5 = 11

leaving behind the 8 and 10 cards.

SWEET 16

"A REAL FAVOURITE"

LEVEL: Grade 4 and up

SKILLS: mixed operations, problem solving

PLAYERS: 1 (solitaire) or whole class in cooperative teams

EQUIPMENT: 1 thirty-sided die, cards (Ace = 1) - K, Jack = 11, Queen = 12, King = 0

GETTING STARTED: All teams build a four x four grid with sixteen random cards, face up.

The goal of the game is for each team to remove all the cards from their grid. All cards remaining at the end of a round equal their face value score AGAINST the team, (ie. 4 and 3 left - score against = 7). The lowest and best possible score per round is zero.

To begin play the teacher rolls a target number for the first round with the die. This number will be used by all cooperative teams. Teams now begin finding combinations that equal the target number rolled - all operations may be used. Players may take off two, three, four or five card combinations.

EXAMPLE: Grid was randomly drawn as follows:

King	4	10	2
Jack	3	9	7
6	Ace (1)	8	6
5	4	10	2

Game # _____

_____

Skills: _____

Players: _____

Equipment: _____

Rules: