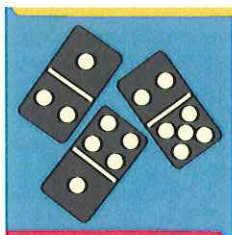# Fun, Fun, Fun with Math Games

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Handouts available at: rusmp.rice.edu

Benefits of Math Games

- Increases curiosity and motivation

- Establishes a sense of community

- Creates a student-centered learning environment

- Reduces anxiety in the mathematics classroom

- Allows for cooperative learning opportunities

- Inherently differentiates learning

- Builds strategy and reasoning skills

- Reinforces mathematical objectives

- Engages individual learners simultaneously

- Teaches life skills

Source:
http://www.nctm.org/resources/content.aspx?id=27612

Task   Students play a game in which they pick dominoes, identify them as two-digit numbers, and then find the sum of the numbers.

Setup   A pair or small group of students uses one set of double-six dominoes.

Start-up Hold up a single domino horizontally and point out that it can be read as two different two-digit numbers. The 3–4 domino, for example, can be read either as 34, with the greater number of pips in the ones place, or as 43, with the greater number of pips in the tens place.
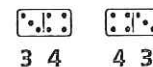
3 4   4 3

The dominoes are placed face down on the playing area. Players take turns picking a domino, deciding on its value as a two-digit number, and recording the number. Each player keeps a running sum of the numbers named for five picks, trying to reach a sum of 100 without going over it. One domino may be rejected if a player thinks either of its values is so high that it would bring the sum over 100 or so low that it would not bring the sum close enough to 100. Each player may reject only one domino. Even a rejected domino is considered to be one of the five picks. The player with the sum closest to 100 without going over it wins.

Discussion Students will notice that choices they made early in the game can affect the sum. With each pick, they decide whether to use the domino or reject it. They either calculate or estimate the impact of this decision on the next sum. Many students get as close as possible to 100 with their first four dominoes, knowing they may reject their fifth domino.

Sample round for two players:

PLAYER 1				PLAYER 2		
PICK	DOMINO		SUM	PICK	DOMINO		SUM
1st	3–4	Keep	34	1st	4–2	Keep	42
2nd	5–5	Reject	—	2nd	1–5	Keep	57
3rd	3–1	Keep	65	3rd	1–4	Keep	71
4th	2–6	Keep	91	4th	0–6	Keep	77
5th	0–4	Keep	95	5th	2–4	Reject	—

Player 1, with a sum of 95, wins.

Keep up   Have students look again at the dominoes they picked in a game and determine either the highest or the lowest score possible with those picks. Remind them that they may reject any one of their five picks in determining this score.

Wrap-up   Key questions for discussion or response in journals:

   • Each time you picked a domino, how did you decide whether to read it with the greater number of pips in the tens place or in the ones place?

   • When did you decide to reject a domino? Explain.

Follow-up Have students play another game, this time playing so that the winner is the one whose sum is closest to 100 even if it goes beyond 100. In another version of the game, instead of having players add to get a sum closest to 100, have them start with 100 and subtract to get a sum closest to 0.

Task Students play a game in which they pick dominoes, identify them as whole numbers and/or decimal numbers, and find the sum of the numbers.

Setup A small group of students uses one set of double-six dominoes.

Start-up Hold up a single domino horizontally, pointing out that in each of two positions, it can be read as two different decimal numbers. The 2–3 domino, for example, can be read either as 2.3 or 0.23 or as 3.2 or 0.32.

2.3 or 3.2 or
0.23 0.32

The dominoes are placed face down on the playing area. Players take turns picking a domino, deciding how to read it as a decimal, and recording the decimal. Each player keeps a running sum of the decimals named for five picks, trying to reach a sum of 5 without going over it. One domino may be rejected if a player thinks each of its four possible values is so high that it would bring the sum over 5 or so low that it would fail to bring the sum close enough to 5. Each player may reject only one domino. Even a rejected domino is considered as one of the five picks. The player with the sum closest to 5 without going over it wins the game.

Discussion Students will notice that the choices they made early in the game can affect the sum. With each pick, they decide whether to use the domino or reject it. They calculate or estimate the impact of this decision on the next sum. Many students get as close as possible to 5 with their first four dominoes, knowing they may reject their fifth domino.

Sample round for two players:

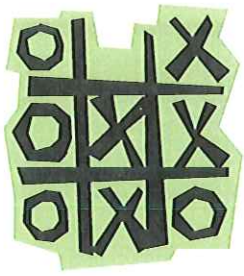|	PLAYER 1				PLAYER 2		
PICK	DOMINO		SUM	PICK	DOMINO		SUM
1st	0.34	Keep	0.34	1st	2.4	Keep	2.4
2nd	0.55	Keep	0.89	2nd	1.5	Keep	3.9
3rd	1.3	Keep	2.19	3rd	0.45	Keep	4.35
4th	2.6	Keep	4.79	4th	0.66	Reject	—
5th	0.04	Keep	**4.83**	5th	0.60	Keep	**4.95**

Player 2, with a sum of 4.95, wins.

Keep up Students look again at the dominoes they picked in a game and determine either the highest or the lowest score possible with those picks. Remind them that they may reject any one of their five picks in determining this score.

Wrap-up Key questions for discussion or response in journals:

- Each time you picked a domino, how did you decide whether to read it as a whole number and a number of tenths or as a number of hundredths?
- When did you decide to reject a domino? Explain.

Follow-up Have students play another game, this time playing so that the winner is the one whose sum is closest to 5 even if it goes beyond 5. In another version of the game, instead of adding to get a sum closest to 5, players start with 100 and subtract to get a sum closest to 0.
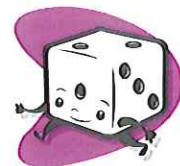

Multi-Tic-Tac-Toe

Materials:
- 2 cubes
- a different colored pencil for each player
- a game sheet

Directions:
1. Player 1 will place two cubes on any two factors around the edge of the game board. The two cubes may also be placed on the same factor. Player 1 will then color in a box with the product of these factors.

2. Player 2 will then move only one of the cubes from a factor along the edge of the game board to a different factor. Player 2 will then use a different color to shade in a box with the product of these new factors.

3. The players will continue playing in this manner. Their goal will be to get three shaded boxes in a row, column, or diagonal within each of the 8 three by three sections.

4. The first player to get a tic-tac-toe within a three by three section will win that section.

5. The player who has won the most three by three sections at the end of the game is the winner.

9	8	7			
28	63	48	132	60	77
7	88	64	20	8	32
49	96	50	27	81	55
110	25	72	1	84	14
2	56	100	42	9	21
18	36	44	70	121	30
24	40	33	54	12	63
4	10	22	5	15	108
49	144	66	20	24	12
56	16	45	8	18	48
6	99	120	3	36	35
80	81	10	28	90	11

Left edge labels (top to bottom): 10, 11, 12
Right edge labels (top to bottom): 6, 5, 4
Bottom edge labels: 1, 2, 3

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TAKING CHANCES WITH ALGEBRA

Directions: Players will take turns rolling a die and finding an equation or inequality for which that number is a solution. The player will enter the number on the die as his/her score on a row for which that number is a solution. If the number rolled does not fit into a category, the player may enter that number next to CHANCE (if available) or a score of zero will be entered into one of the remaining boxes. Players will alternate rolls for ten turns. If a player can fill all ten categories without entering a zero score, that player will earn the extra ten BONUS POINTS. The player with the highest score wins.

| Category	Player 1	Player 2
1. $n + 6 = 10$		
2. $n - 2 < 5$		
3. $2n + 1 \geq 10$		
4. $3n < 13$		
5. $4n = 12$		
6. $5n + 6 > 27$		
7. $4n - 2 \leq 6$		
8. $n \div 2 = 3$		
9. $4n < 9$		
10. *CHANCE*		
BONUS POINTS (10)		
TOTAL POINTS		

The Die Plot Game

Objective: Be the first player to get four points marked in a row – horizontally, vertically, or diagonally

Materials: 3 dice, a different colored pencil for each player, a game sheet

Rules:
1. The Die Plot Game is for two players.
2. The player throwing the highest total on the 3 dice rolled starts the game.
3. The first player rolls 3 dice and selects any 2 of the 3 dice to form an ordered pair.
4. This player may then choose to color or to mark an X or an O to indicate his/her point on the game sheet representing that ordered pair.
5. Once a point is covered, it belongs to that player and cannot be used by another player.
6. If a player cannot find an uncovered point, he/she loses their turn.

An Area Game of Categories

ROLLING RECTANGLES GAME
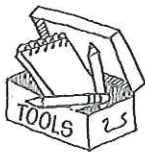
For each pair of students: grid paper (p. 62), two dice, one score chart (below), and a writing utensil.

Objective: Find rectangle areas that meet given conditions.

GAME RULES

- Roll the dice. Those numbers reflect dimensions of a rectangle.
- Sketch the rectangle on grid paper: label the dimensions, area, and perimeter.
- Enter the area of your rectangle as your "score" in one of the ten boxes below.
- If the area will not fit a category, enter it in CHANCE (if available) or enter a zero score in the box of your choice.
- Alternate rolls for ten turns. If you fit all categories, score 10 extra bonus points.
- Total your column. Highest score wins!

SCORE CHART

Category	Player 1: Score	Player 2: Score
1) Area (A) = Perimeter (P)		
2) Area = Even number		
3) P – A = 4 or A – P = 4		
4) Area = Perfect square		
5) Perimeter > Area		
6) CHANCE		
7) Area = Odd number		
8) Area = Prime number		
9) Area = Perfect Number		
10) Area > Perimeter		
Bonus Points (10):		
GRAND TOTAL		

- Which categories were hardest and easiest to roll? Why?
- How many different areas with perfect number dimensions can be rolled?

COMMUNICATE

AREA STRATEGIES

AREA OF CIRCLES
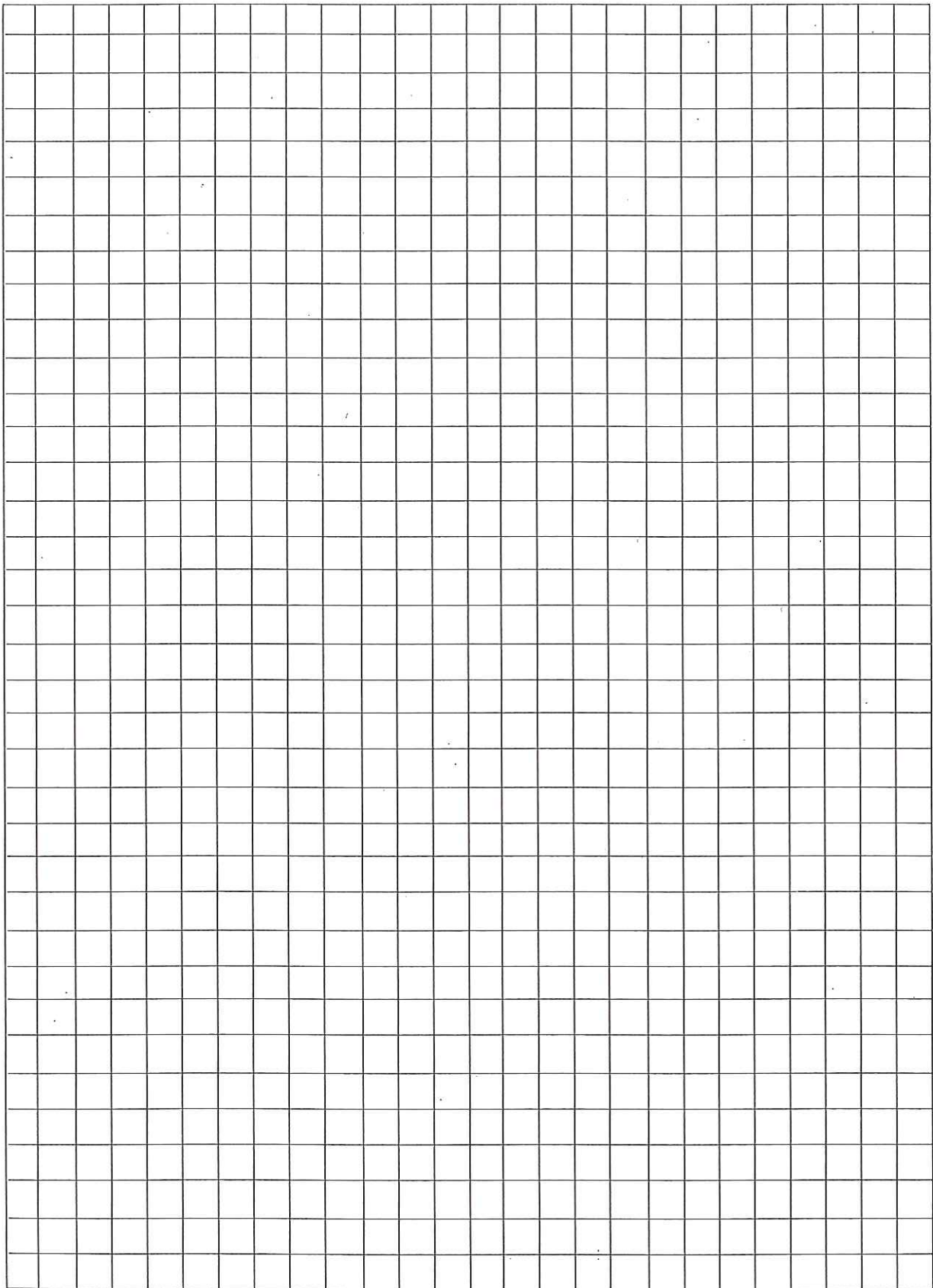
What a Deal!

Materials: 1 deck of cards, score sheet, pencils

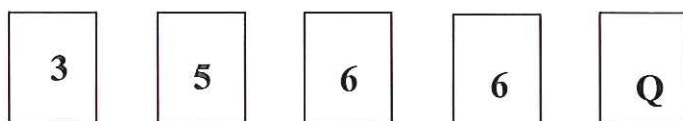**Number of players:** 2 to 4

Value of cards: A = 1 2 = 2 3 = 3 4 = 4 5 = 5 6 = 6 7 = 7
                     8 = 8 9 = 9 10 = 10 J = 11 Q = 12 K = 13

Directions:

1. The dealer shuffles the cards and deals 5 cards facedown to each player.

2. Players put down their cards and arrange them in order from the smallest value to the largest value.

3. Player will calculate the measures of central tendency (range, mean, mode, or median) for their set of cards.

4. Players explain to their group how they calculated their measures of central tendency.

5. Players record scores on the score sheet. The player with the highest value for their measure of central tendency will circle their value and get one point. In case of a tie, both players circle their values. At the end of each round, students will total their points.

6. Repeat steps 1-5 for each round.

7. The winner is the player with the highest total after all rounds.

Extensions: The dealer will add an additional card with each round. (Round 1 – 5 cards, round 2 – 6 cards, round 3 – 7 cards…)

Example:

| 3 | 5 | 6 | 6 | Q |

Range = Q – 3
   12 – 3 = 9

Median = 6
   3 5 <u>6</u> 6 12

Mode = 6

Mean =
3 + 5 + 6 + 6 + 12 = 32/5 = 6.4

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Score Sheet for <u>What a Deal!</u>

	Player 1	Player 2	Player 3	Player 4
Names of players				
Round 1	Range	Range	Range	Range
	Mode	Mode	Mode	Mode
	Median	Median	Median	Median
	Mean	Mean	Mean	Mean
Round 2	Range	Range	Range	Range
	Mode	Mode	Mode	Mode
	Median	Median	Median	Median
	Mean	Mean	Mean	Mean
Round 3	Range	Range	Range	Range
	Mode	Mode	Mode	Mode
	Median	Median	Median	Median
	Mean	Mean	Mean	Mean
Round 4	Range	Range	Range	Range
	Mode	Mode	Mode	Mode
	Median	Median	Median	Median
	Mean	Mean	Mean	Mean
Round 5	Range	Range	Range	Range
	Mode	Mode	Mode	Mode
	Median	Median	Median	Median
	Mean	Mean	Mean	Mean
TOTAL POINTS				

ROLLING WITH PROBABILITY

Directions to play: Each partner will take a turn rolling a number cube. Using the number shown on the number cube as the denominator of a fraction where the numerator is always 1, the player will find a situation on this sheet that has a probability equivalent to the fraction formed by the number cube and shade in or place a marker on that box. For example, if a 2 is rolled, the player will look for a situation that has a probability equivalent to ½. If a situation cannot be found with that probability, the player loses their turn. The winner is the first player to get three boxes in a row in any direction.

Materials: a number cube, markers or place holders of two different colors

Rolling a 2 on a number cube	Selecting a boy out of an equal number of girls and boys	Selecting a specific mouse out of the Three Blind Mice	Selecting the letter C from the letters in the word "SUCCESSFUL"
Tossing heads on a coin	Selecting summer out of the four seasons	Selecting a specific vertex of a triangle	Selecting heads or tails on a coin
Selecting Joe out of Jim, Joe, Jan, or Jill	Selecting a vowel from the word "dice"	Selecting a girl from Tom, Jill, Dan, or Joe	Choosing a specific corner of a hexagon
Selecting a specific pig out of the Three Little Pigs	Selecting the letter A in the word "A"	Selecting May from the months of January through June	Rolling a 2 or 3 on a die
Selecting blue out of red, blue, black, yellow, or green	Selecting an odd number on a die	Selecting the letter E out of the letters in the word "BEST"	Selecting an even number out of 1, 3, 5, 8, or 9
Selecting an even number out of 2, 4, 6, and 8	Selecting the letter A in the word "ACTION"	Selecting an odd number from 1, 3, 5, or 7	Selecting a red card from a deck of cards

Created by: Susan Troutman - Rice University School Mathematics Project

References

Gutman, D. C., & Thornton, C. (1998). *Measure and solve: Activities on perimeter and area: Grades 5-8*. Vernon Hills, IL: Learning Resources, Inc.

Silverman, H., & Oringel, S. (1997). *Math activities with dominoes*. Vernon Hills, IL: ETA/Cuisenaire.