NCTM 2017 San Antonio, Texas

High-Impact Games and Meaningful Mathematical Dialog
Grades 3-5

Elizabeth Cape
Jennifer Leimberer
Sandra Niemiera
mathtrailblazers@uic.edu

Teaching Integrated Math and Science Project
mathtrailblazers.uic.edu

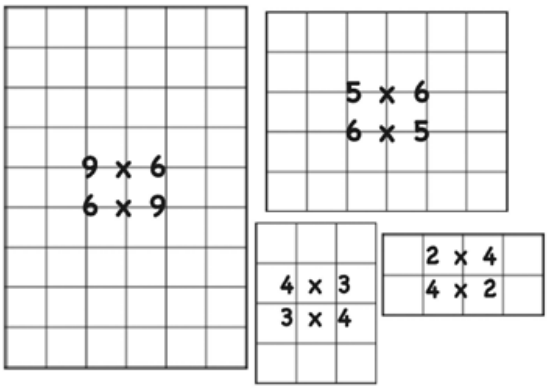
Learning Sciences Research Institute
Metro Chicago Mathematics Initiative
http://mcmi.uic.edu/

University of Illinois at Chicago

Cover it

From Three Steps to Mastering Multiplication Facts by Gina Kling and Jennifer M. Bay-Williams www.nctm.org Vol. 21, No. 9 | teaching children mathematics • May 2015 555

In this two-player matching game, students spread selected array cards so that all are visible (adapted from Russell and Economopoulos 2008). Player 1 pulls an array from the middle and gives it to player 2, who must find two arrays that exactly cover the array he or she received. If player 2 does this successfully, he or she keeps the three array cards. If player 2 cannot find a pair, player 1 gets a chance and can also win the cards. Players switch roles and continue. Students say or write the combinations that they have found to cover the original array.



To make a set of array cards, use centimeter grid paper. Label each one with the facts written both ways (e.g., 9 x 6 and 6 x 9). Depending on the activity, you may also write the product on the back of each card.

Name _____ Date _____

Floor Tiler

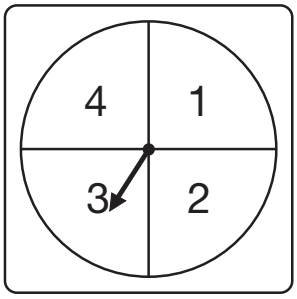
The object of the game is to be the first player to fill his or her grid paper with rectangles. This game can be played by two to four players.

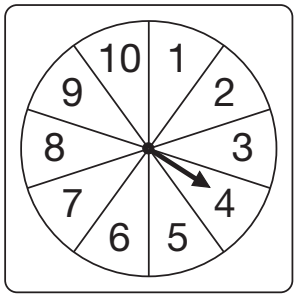
Materials

- Spinners 1–4 and 1–10
- A clear plastic spinner or a paper clip and pencil
- $\frac{1}{2}$ sheet of Floor Tiler Grid Paper
- Crayon or marker
- Scissors

Directions

1. The first player makes two spins so that he or she has two numbers. The player may either spin one spinner twice or spin each spinner once.





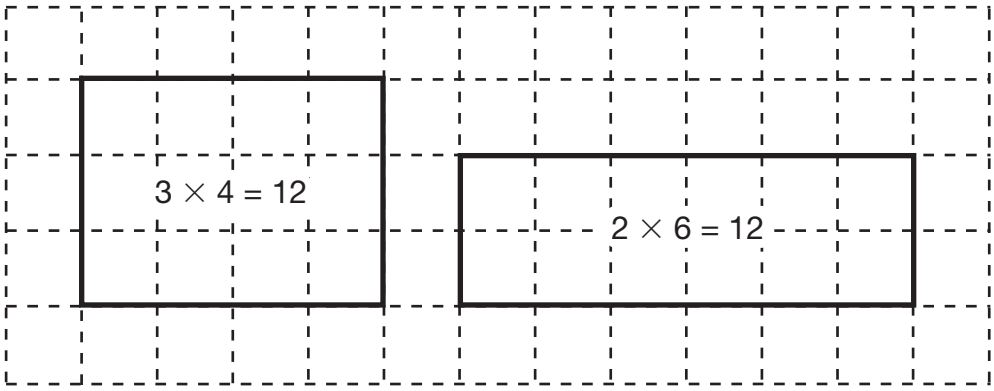
2. The player must then find the **product** of the two numbers he or she spun. The product is the answer to a multiplication problem. For example, $3 \times 4 = 12$. 12 is the product.

Name _____ Date _____

3. After finding the product, the player colors in a rectangle with that number of grid squares on the grid paper. He or she can use any two factors of the product to make a rectangle, not just the facts on the spinner.

   For example, the player might use the factors on the spinner and color in 3 rows of 4 squares for a total of 12 squares. But the player can also think of other factors of 12, such as 2 rows of 6 squares or 1 row of 12 squares. (Remember, the squares colored in must connect so that they form a rectangle.)

4. Once the player has made his or her rectangle, the player draws an outline around it and writes its number sentence inside. For example, a player who colored in 3 rows of 4 squares would write "3 × 4 = 12." A player who used the factors 2 and 6 would write "2 × 6 = 12."



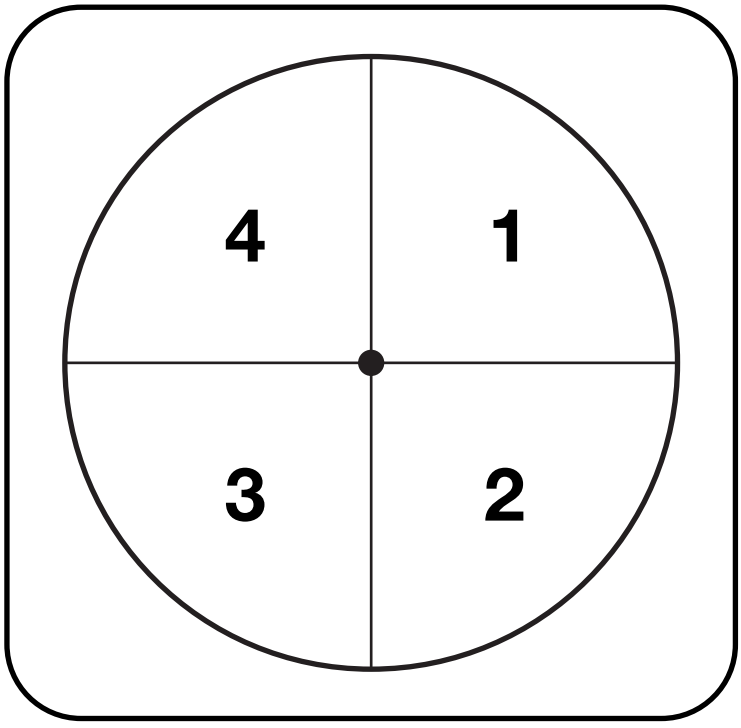
5. Players take turns spinning and filling in their grids.

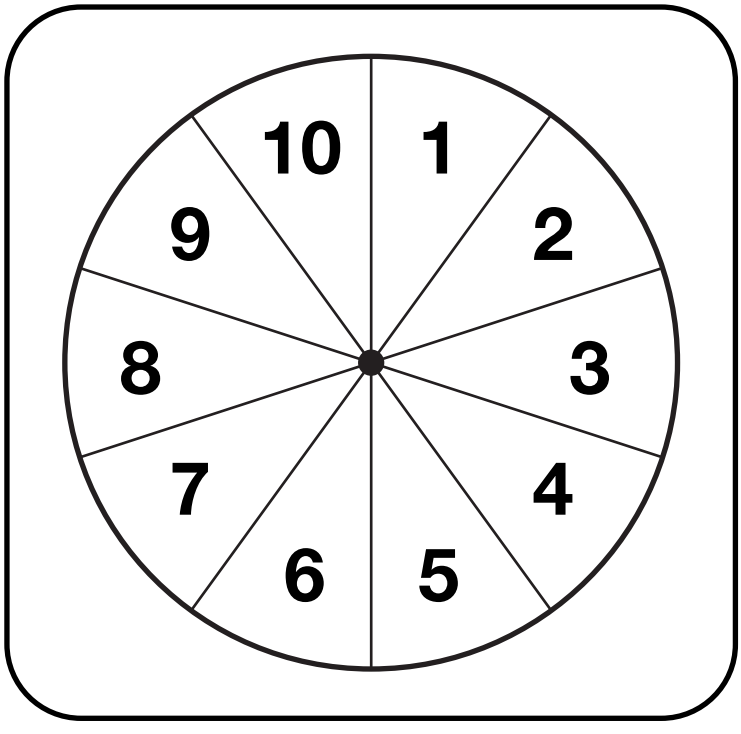
6. If a player is unable to fill in a rectangle for his or her spin, that player loses the turn, and the next player takes a turn.

7. The first player to completely fill in his or her grid paper wins the game.

Name _____ Date _____

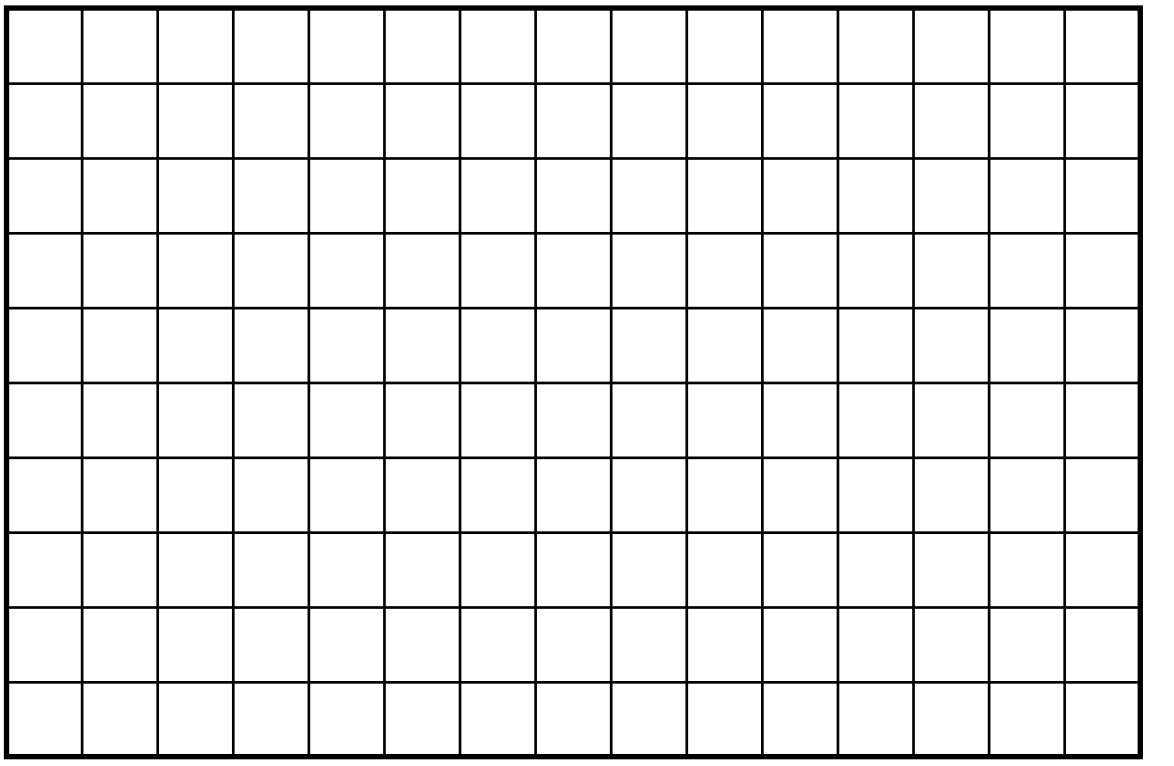
Spinners 1-4 and 1-10

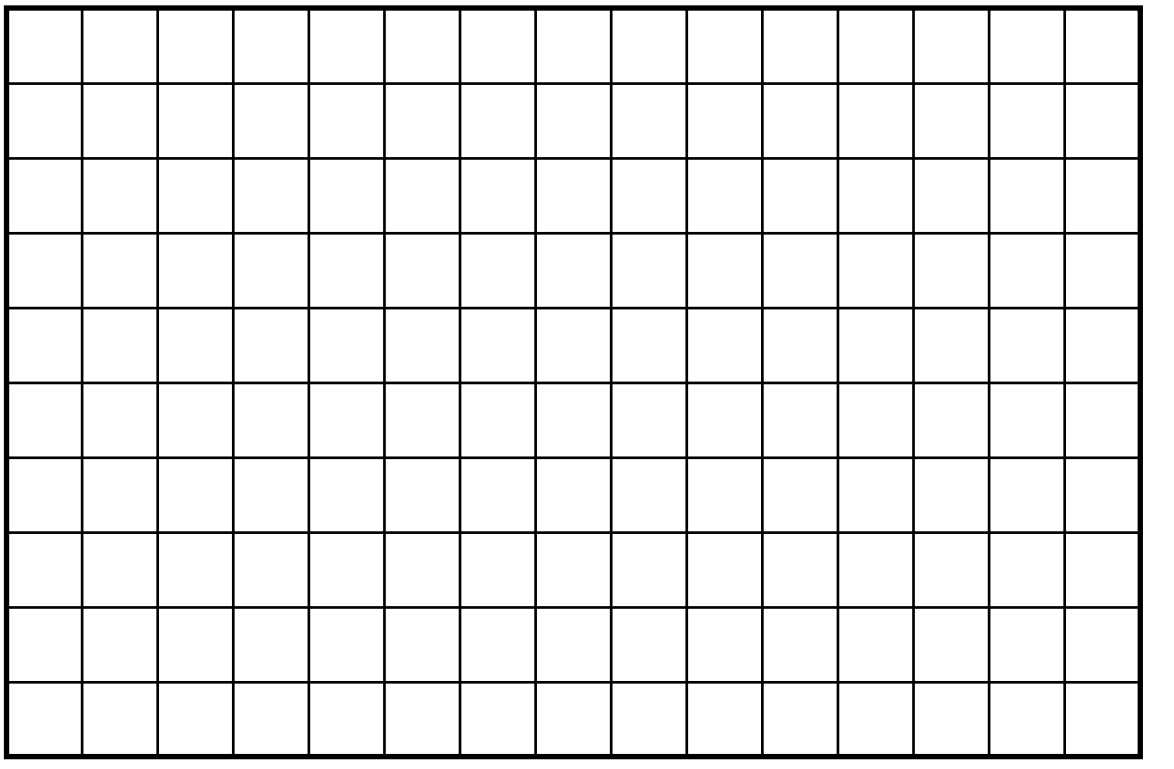




Name _____ Date _____

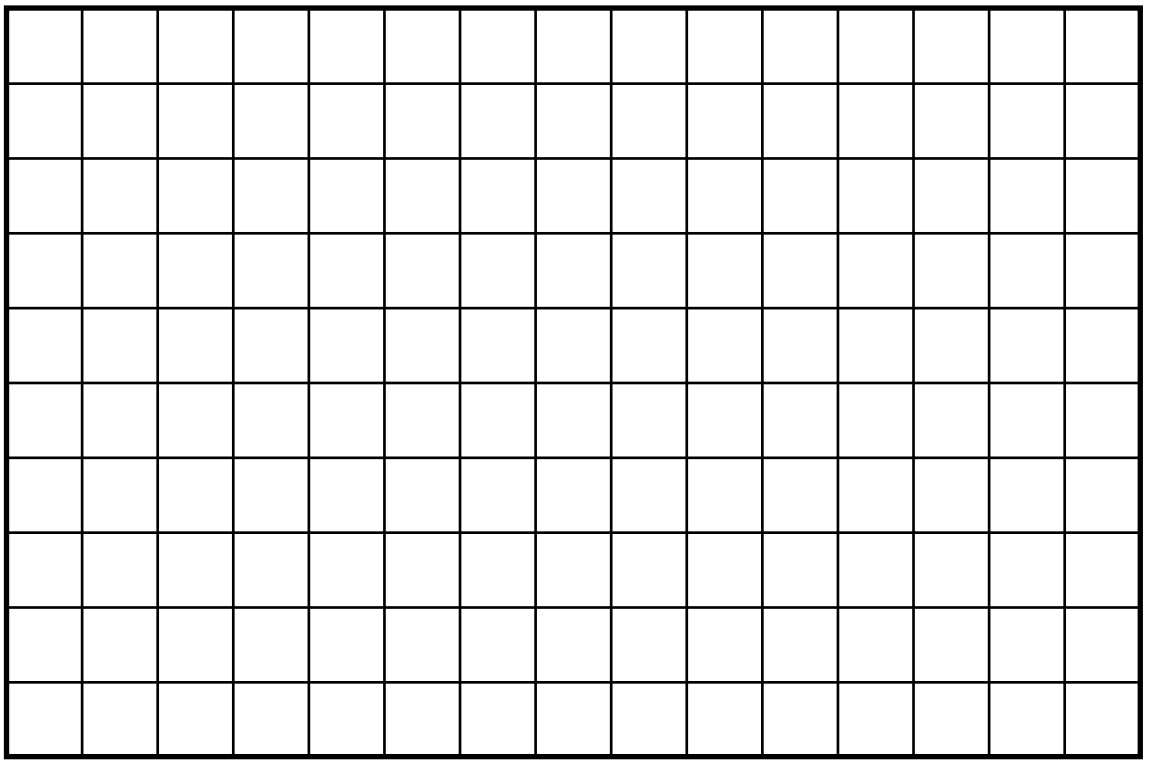
Floor Tiler Grid Paper

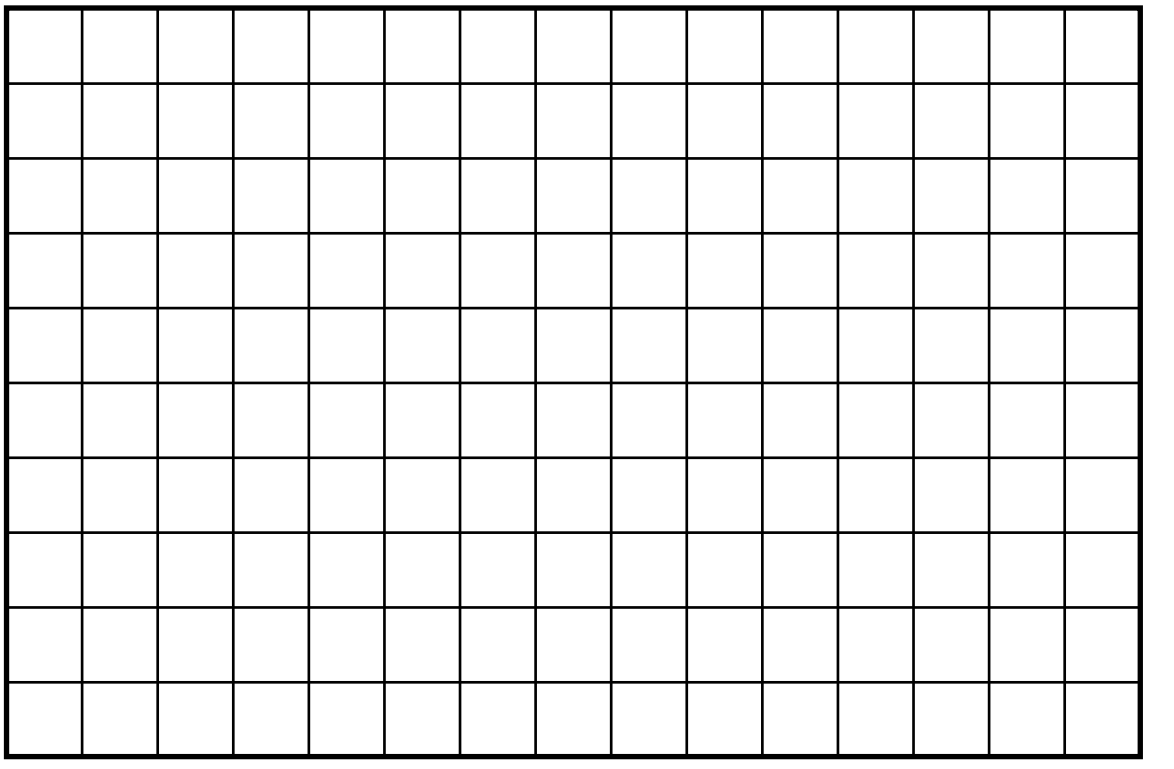




Name _____ Date _____

Floor Tiler Grid Paper





youcubed at Stanford University

Topic(s): Multiplication

Concept(s): Number Sense

Mathematical Practice(s): MP5, MP6

Grade(s): 3rd 4th 5th 6th 7th 8th

Math Cards

Many parents use 'flash cards' as a way of encouraging the learning of math facts. These usually include 2 unhelpful practices – memorization without understanding and time pressure. In our Math Cards activity we have used the structure of cards, which children like, but we have moved the emphasis to number sense and the understanding of multiplication without any time constraints.

Number of Players: 1 or more

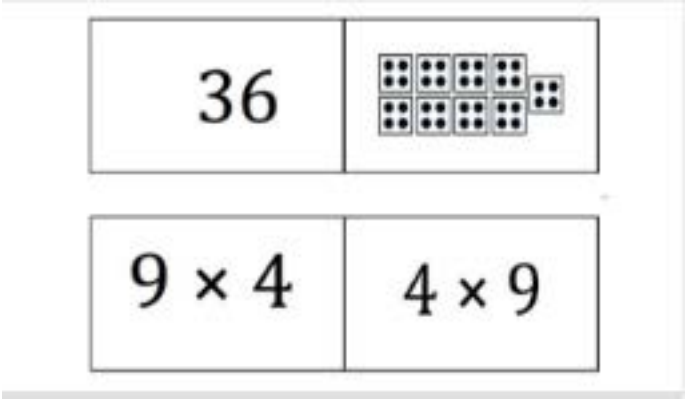
Material: one deck of math cards (see handout)

Task Instruction

1. The aim of the activity is to match cards with the same numerical answer, shown through different representations.
2. Lay all the cards down on a table and ask children to take turns picking them; pick as many as they find with the same answer (shown through any representation).

For example 9 and 4 can be shown with an area model, sets of objects such as dominoes, and the number sentence. When students match the cards they should explain how they know that the different cards are equivalent. This activity encourages an understanding of multiplication as well as rehearsal of math facts.

A full set of cards can be found at www.youcubed.org/task/math-cards/



Product Bingo

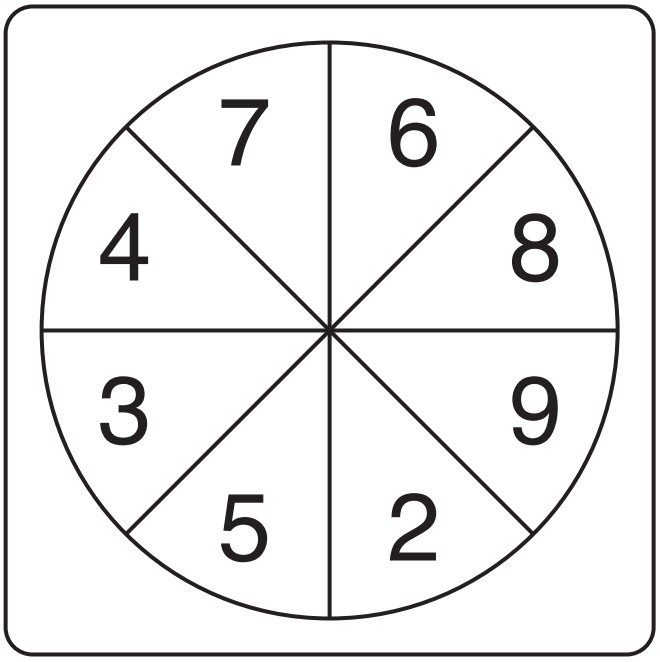
This is a game for five players. The object of the game is to be the first player to place four markers in a row or a marker in each corner.

Materials

- *Product Bingo Game Boards* in the *Student Activity Book* for each player
- Clear plastic spinner or a pencil and a paper clip
- Small objects such as beans to use as markers

Directions

1. Choose one player to be the Caller. The remaining players each choose a game board from the *Product Bingo Game Boards* page.
2. The Caller spins the spinner twice, keeping track of all digits spun by writing multiplication sentences on a piece of paper.
3. If the product of the spun digits is on a player's game board, he or she puts a marker on that number.
4. The first player with four markers in a row (horizontally, vertically, or diagonally) or a marker in each corner is the winner. (The **P** space, for **Product,** is a free space.)
5. The Caller records the winner and the winning game board for each game played.
6. Switch the Caller and the game boards after each game.



Name _____ Date _____

Product Bingo Game Boards

Board 1

40	72	10	35
42	28	20	27
15	45	P	6
30	48	14	56

Board 2

9	P	22	81
64	13	25	32
15	14	56	29
7	10	4	49

Board 3

8	24	27	54
20	12	21	32
36	P	14	45
63	18	72	16

Board 4

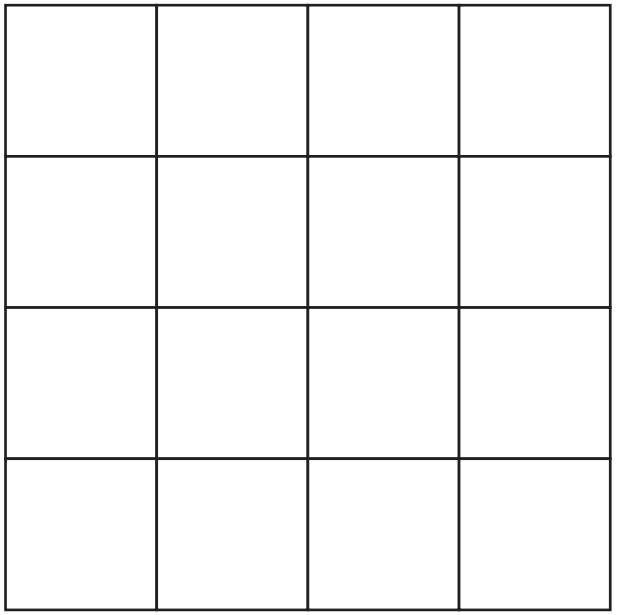
4	45	25	81
49	56	6	32
9	64	P	10
15	8	42	48

Name _____ Date _____

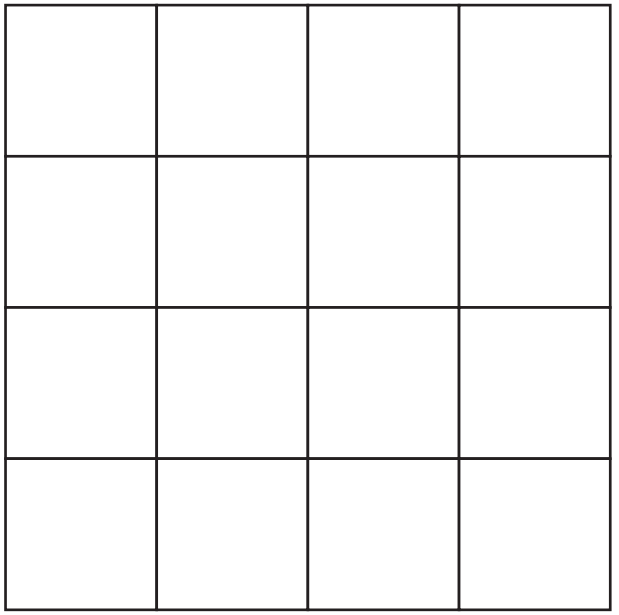
Design Your Own Boards

1. Design your own Product Bingo game boards. The spinner is labeled with the numbers 2 through 9. Design a "Best" game board that is highly likely to win and a "Worst" game board that is unlikely to win.

Best



Worst



Game Analysis Tool

Name of Game
Math Involved in the Game
This game supports students' development of (circle all that apply): models informal strategies counting strategies reasoning strategies flexibility connections recall

1. What strategies do you anticipate your students will use when playing the game?

2. Where do you anticipate your students will be successful?

3. Where do you anticipate they will be challenged?

4. What questions would you ask as the game progresses to promote conceptual development?

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youcubed at Stanford University

Topic(s): Multiplication

Concept(s): Number Sense

Mathematical Practice(s): MP5, MP6

Grade(s): 3rd 4th 5th 6th 7th 8th 9th

Circles & Stars

Number of Players: 2

Material:

- one die
- paper and pencil for each player

Task Instruction

- Player A rolls the die, then draws that number of fairly large circles.
- Player B rolls the die and does the same.
- Player A rolls the die and draws that number of stars in each of his circles.
- Player B rolls the die and does the same.
- Each player writes the number sentence that tells how many stars he or she has (for example, four circles with three stars in each circle would be 4x3 = 12 stars).
- Play six rounds, then determine the total number of stars that each player has.

Variation For each round, after Player A draws stars in his circle, determine the probability that Player B will end up with more stars than Player A.

Reference

From Helping with Math at Home: More Ideas for Parents. 2006. Portsmouth, NH: Heinemann.

Name _____ Date _____

Four in a Row

The object of the game is to cover four squares in a row vertically, horizontally, or diagonally. This is a game for two players.

Materials

- *Four in a Row Game Board 1*
- 2 paper clips
- 2 different color game markers, 1 color for each player

Directions

1. Player 1 chooses a number from the Factor List by placing a paper clip on the number.
2. Player 2 also chooses a number from the Factor List by placing the second paper clip on the number. Two paper clips can be placed on one factor, for example 5 x 5.
3. Player 2 finds the product of the two numbers marked by the paper clips and places one of his or her makers on that number on the Product List.
4. Player 1 then moves either paper clip to another factor, and covers the new product with one of his or her markers.
5. Players take turns moving one paper clip and covering a product with their marker. If a product is already marked, the player does not get to mark a product in that turn. If the product the player tries to mark is not correct, the the correct product must be marked.
6. The winner is the first player to mark four products in a row with his or her markers.

Variations

- Vary the game board by varying the list of factors and creating a board with all the related products. See the Four in Row Game Board 2.
- Change the number of products players have to get in a row to win (for example, five in a row).

Name _____ Date _____

Four in a Row Game Board 1

Product List

0	1	2	3
4	5	6	9
10	15	18	20
25	27	30	45
50	81	90	100

Factor List

0	1	2	3	5	9	10

Name _____ Date _____

Four in a Row Game Board 2

Product List

1	2	3	4	5	6
7	8	9	10	12	14
15	16	18	20	21	24
25	27	28	30	32	35
36	40	42	45	48	49
50	54	56	60	63	64
70	72	80	81	90	100

Factor List

1	2	3	4	5	6	7	8	9	10

Multiples Cover-Up

The goal is to be the first to place markers on all the spaces on the board. This is a game for three or more players.

Materials

- clear plastic spinner or pencil and paper clip
- beans or other small markers
- *Multiples Cover-Up Spinner* and *Multiples Cover-Up Game Boards*

Directions

1 One player is the Caller. The remaining players make a game board on one of the game boards on the *Multiples Cover-Up Game Board* pages.

2 The Caller spins and reads the description.

3 If there are any numbers on a player's game board that fit the description, he or she puts a marker on one of those numbers.

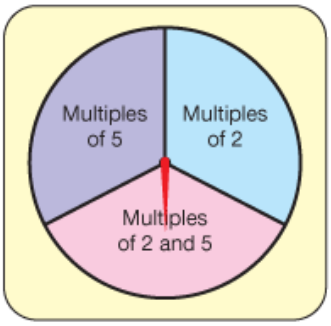
4 The first player to cover all the numbers on his or her game board wins the game.

5 Switch the Caller and game boards after each game.

Sample Play

The Caller spins "Multiples of 2 and 5." A player can cover either 10, 20, 30, 40, 60, or 80 on the sample game board shown below since these numbers are multiples of both 2 and 5.

Sample first spin:

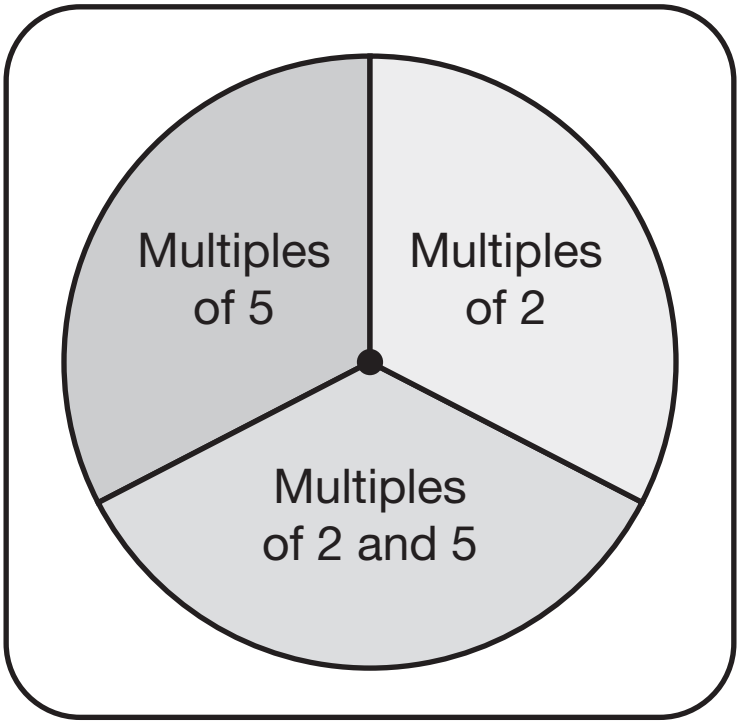


Possible marker positions on sample game board.
Player places marker on only one of the circled numbers.

5	35	8	**10**
20	32	25	**80**
2	**30**	65	55
40	35	12	**60**

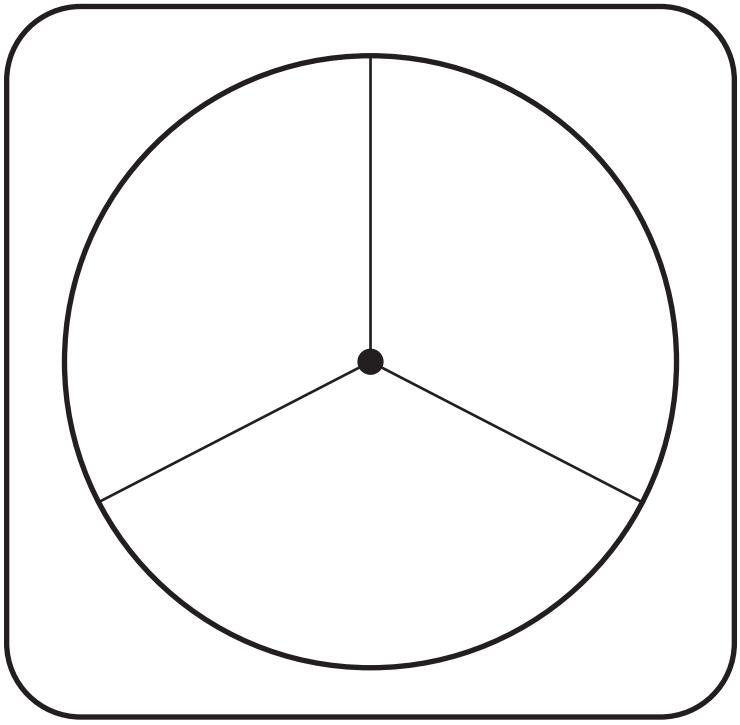
Name _____ Date _____

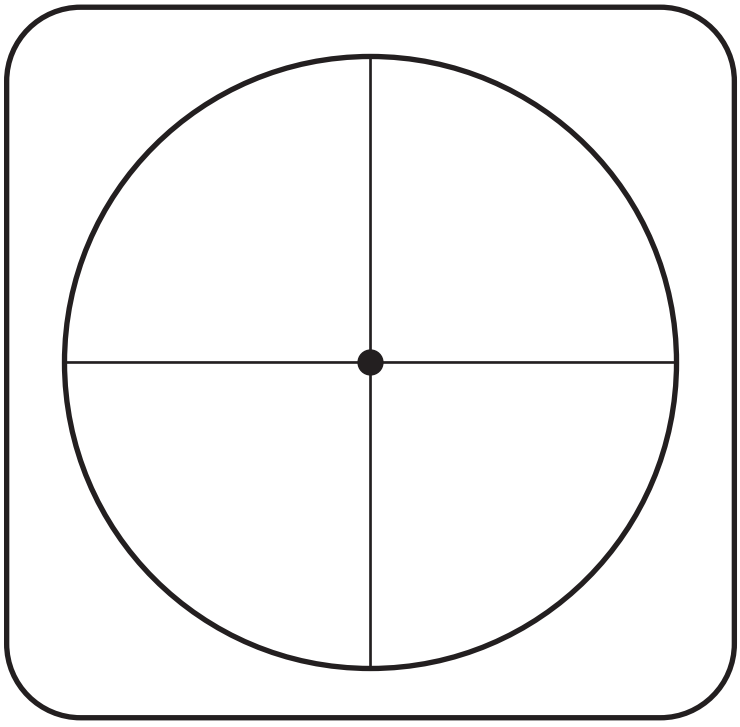
Multiples Cover-Up Spinner



Name _____ Date _____

Make Your Own Spinner

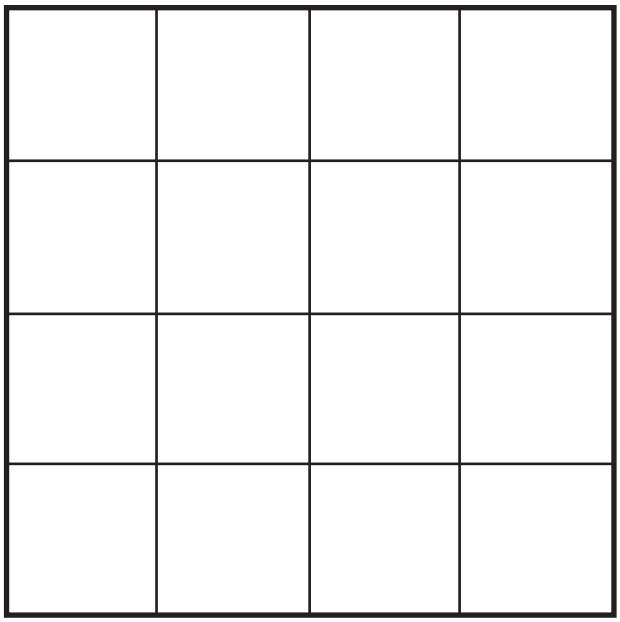




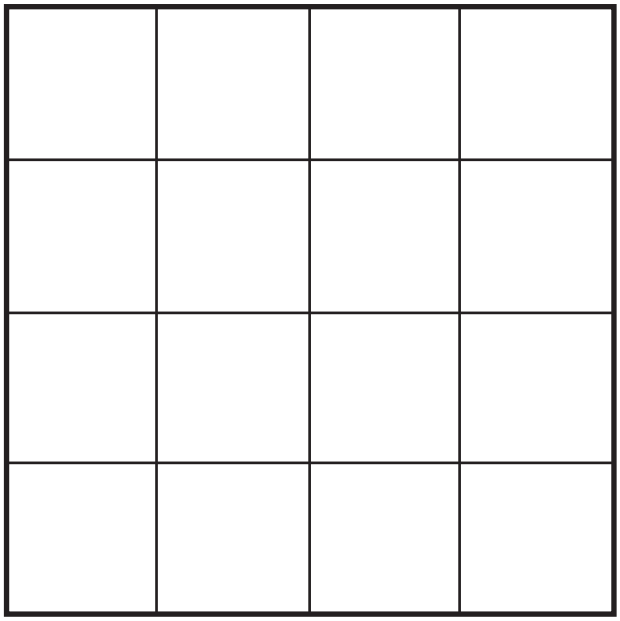
Name _____ Date _____

Multiples Cover-Up Game Boards

Look at the spinner. Make a game board. Use each number only once.



Look at the spinner. Make a game board. Use each number only once.



Multiplication Digits

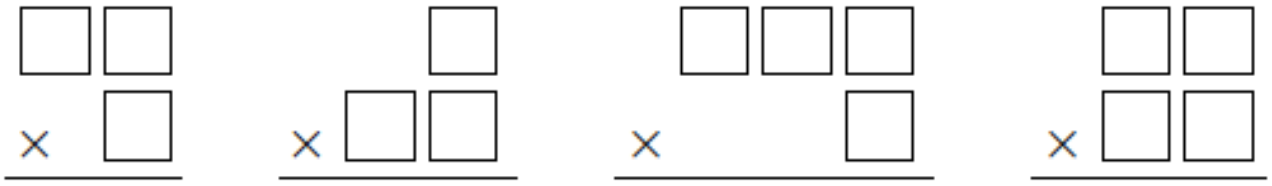
The object of the game is to get the largest (or smallest) correct answer to a multiplication problem. Any number of people can play.

Materials

- one set of *Digit Cards 0–9*
- paper and pencils

Directions

1. One person is the leader and the others are players. The leader chooses whether the largest or smallest answer will win and draws one game board so that all of the players can see it.



2. Each player draws the game board on his or her paper.

3. The leader shuffles the cards, places them face down, picks the top card, and reads the digit to all the players.

4. Each player writes that digit in one of the boxes on his or her game board. Each player must decide where to place the digit in order to get the largest (or smallest) answer. Once a player has written down a digit, it may not be moved. No digit will be repeated.

5. The leader places the first card in a discard pile then reads the next card. Players place this digit in another empty box. Play continues until all the boxes are filled.

6. When all the boxes are filled, players multiply to find their answers. Since the player with the largest (or smallest) correct answer wins the game, players should check their answers using a second strategy or estimate to see if their answers are reasonable.

Factor Games

Factor 20 and Factor 40 are games about factors. The **factors** of a number are the whole numbers that can be multiplied together to get the number. For example, 3 and 4 are factors of 12 since $3 \times 4 = 12$. All the factors of 12 are 1, 2, 3, 4, 6, and 12.

Factor 20 or Factor 40

The goal is to mark the most factors and earn the most points. This is a game for two players.

Materials

- one *Factor 20* Game Board and Score Box or *Factor 40* Game Board and Score Box from the *Student Activity Book*
- one pencil per player
- calculator, optional

Directions

Before Play Begins

- Players will alternate who uses an X and who uses an O for each round. Player X always takes the first turn.

First Turn

- Player X chooses any number except 1 on the game board and draws an "X" on it. Player X writes that number in Column X of the score box. Player X earns that number of points for this turn.
- Player O circles all the factors of Player X's number that are not marked. Player O writes all of those factors in Column O of the score box. Player O earns points equal to the sum of the factors for this turn.

Second Turn

- Player O chooses any unmarked number on the board. (An unmarked number is one that has not yet been circled or marked with an X.) The number must have at least one factor that is unmarked. Player O circles the number and records it in Column O.
- Player X draws an X on all the unmarked factors of that number and records them in Column X.

Play Continues

- Players take turns choosing numbers, marking factors, and recording scores in the score box for each turn.
- Players may choose only numbers that still have unmarked factors.
- The game ends when there are no numbers left with unmarked factors.
- Players total their points at the end of the game. The player with more points wins.

Name _____ Date _____

Factor 20

Game Board

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Score Box

Running Total		×	○	Running Total
_____	Number			Factors _____
_____	Factors			Number _____
_____	Number			Factors _____
_____	Factors			Number _____
_____	Number			Factors _____
_____	Factors			Number _____
_____	Number			Factors _____
_____	Factors			Number _____
_____	Number			Factors _____
_____	Factors			Number _____
	TOTAL			TOTAL

Name _____ Date _____

Factor 40

Game Board

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35
36	37	38	39	40

Score Box

	X	O	
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
Number			Factors
Factors			Number
TOTAL			TOTAL

Number Bingo

The goal is to place four markers in a row. This is a game for five players.

Materials

- two clear plastic spinners, or pencils and paper clips
- beans or other small markers
- *Number Bingo Spinners* and *Number Bingo Game Boards* pages in the *Student Activity Book*

Directions

1 One player is the Caller. The remaining players each choose a game board from the *Number Bingo Game Boards* page and mark the FREE space.

2 The Caller spins Spinner 1 and then Spinner 2, keeping a list of each spin on a piece of paper.

3 If there are any numbers on a player's game board that fit the descriptions on both spinners, he or she puts a marker on one of those numbers.

4 The first player with four markers in a row (horizontally, vertically, or diagonally) or a marker in each corner wins.

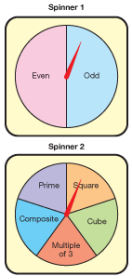
5 The Caller records the winner and the winning game board after each game.

6 Switch the Caller and game boards after each game.

Sample Play

The Caller spins “Odd” on Spinner 1 and “Square” on Spinner 2. A player can mark either 1, 25, or 49 on the game board shown below, since these numbers are both odd and square. No other numbers on the board match both.

Sample first spin:



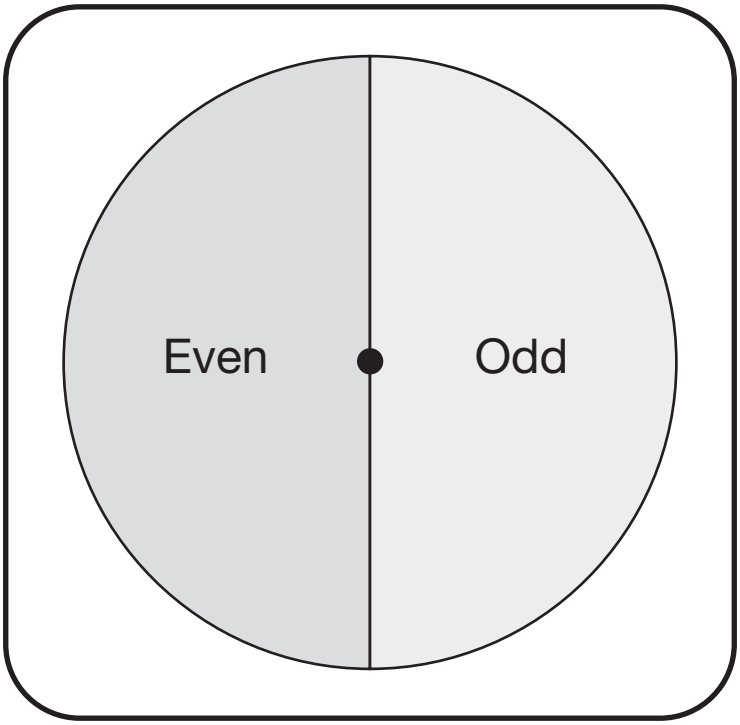
Possible marker positions on sample game board. Player may place marker on only one of the circled numbers.

5	35	8	25
1	FREE	10	87
34	24	65	49
84	4	23	22

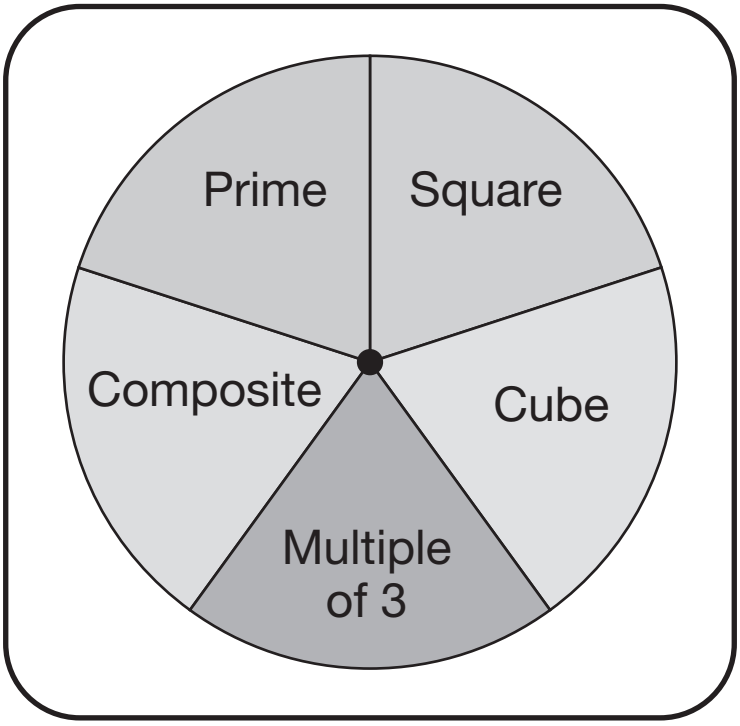
Name _____ Date _____

Number Bingo Spinners

Spinner 1



Spinner 2



Name _____ Date _____

Number Bingo Game Boards

Board 1

95	14	3	55
11	70	54	25
5	FREE	61	31
32	29	40	7

Board 2

26	18	3	16
30	2	FREE	29
17	78	20	9
81	8	85	36

Board 3

100	39	64	48
18	2	35	3
72	27	FREE	4
8	11	9	1

Board 4

5	35	8	25
1	FREE	10	87
34	24	65	49
84	4	23	22

Multiplication and Division

Bojagi http://bojagi-gotmath.rhcloud.com/list
Players solve this puzzle by building arrays around a given product. Students can also be challenged to create their own puzzles. *(Modeling, Flexibility)*

Product Game http://illuminations.nctm.org/Activity.aspx?id=4213
The player can play against the computer or against another player. This is a fluency and flexibility game. *(Flexibility, Fluency)*

Factor Game http://illuminations.nctm.org/Activity.aspx?id=4134
The player can play against the computer or against another player. This is a fluency and flexibility game. *(Flexibility, Fluency)*

Factorize http://illuminations.nctm.org/Activity.aspx?id=3511
This is an interactive that focuses in finding the factors of a number by building arrays. This activity is for one player. *(Modeling, Flexibility)*

Multiplication Blocks
https://www.brainpop.com/games/multiplicationblocks/
This is single player game where students are asked to find factors for a given product. This game progresses in difficulty. *(Fluency, Flexibility)*

Sortify Multiplication
https://www.brainpop.com/games/sortifymultiplication/
This is a single player game that involves multiplication, division, factors, and multiples. Players classify and group products. *(Modeling, Reasoning, Flexibility)*

Primary Krypto http://illuminations.nctm.org/Activity.aspx?id=3569
This puzzle game involves arithmetic and order of operations. *(Flexibility, Reasoning)*

Visual Multiplication Table
https://itunes.apple.com/us/app/visual-multiplication-table/id457381162?mt=8
This is an iPad app designed to help students visualize multiplication. This would classify as a tool rather than a game.

Bunny Times
https://illuminations.nctm.org/Activity.aspx?id=6801#AC
This is an interactive game about a bunny planting and harvesting arrays of vegetables.