The Sieve of Eratosthenes

You need:

1–100 chart

9 different colors of colored pencils*

highlighter

Directions

1. Cross out 1 with a red X because it is neither prime nor composite.
2. Circle 2 with a red colored pencil. Then count by 2s, placing a red X in the bottom-left corner of each box that is a multiple of 2. You will be placing Xs in the boxes of all of the multiples of 2. Color in the ☐ corresponding to the multiples of 2 at the bottom on the Sieve in red.
3. Circle 3 with a new color. Skip count by 3s, placing an X in the bottoms of the boxes of all the multiples of 3. You will notice that some numbers, such as 6 and 12, now have two Xs in their respective boxes because they are both multiples of 2 and 3 (and therefore divisible by 6, as well). Color in the ☐ corresponding to the multiples of 2 at the bottom on the Sieve in the chosen color.
4. Choose a new color for the multiples of 4. You will not circle 4 because it is already Xed, as it is a multiple of 2. Place an X in the chosen color at the bottom of 4. Then proceed to skip count by 4s, placing an X in the bottoms of all the boxes that are multiples of 4. Color in the ☐ corresponding to the multiples of 4 at the bottom on the Sieve in the chosen color.
5. Circle 5 with a new color. Continue the process of Xing the corners of all numbers that are multiples of 5. Color in the ☐ corresponding to the multiples of 5 at the bottom on the Sieve in the chosen color.
6. Continue the process through the 9s. Note that 7 will be the last number circled. Circle or highlight the remaining numbers with no Xs. The highlighted numbers are the prime numbers from 1 to 100.

* *Note:* It is advisable that all students have access to all the same colors.

The Sieve of Eratosthenes Template

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
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Key:

☐ = multiples of 2

☐ = multiples of 3

☐ = multiples of 4

☐ = multiples of 5

☐ = multiples of 6

☐ = multiples of 7

☐ = multiples of 8

☐ = multiples of 9

True or False Number Sentences

a. $3 \times 7 = 7 + 7 + 7$	**b.** $6 \times 4 = 4 + 4 + 4 + 4$
c. $7 \times 8 = (2 \times 8) + (5 \times 8)$	**d.** $8 \times 6 = 8 \times 5 + 6$
e. $9 \times 7 = 10 \times 7 - 7$	**f.** $9 + 6 = 10 + 5$
g. $37 + 56 = 39 + 54$	**h.** $33 - 27 = 34 - 26$
i. $93 = 9 + 30$	**j.** $94 + 80 + 14$

Remainder Riddles

You need:

1 piece of composition paper per riddle
1 mystery number from 1 to 25 for your first riddle
1 mystery number from 1 to 50 for remaining riddles
clues for divisors from 1 to 7

The solution to your riddle will be written on the back of your paper. You will need to offer mathematical proof of the solution of your riddle on the back of your paper in the form of number models like the ones at the bottom of this page.

Riddle Template

When you divide my number by 1, the remainder is ___.

When you divide my number by 2, the remainder is ___.

When you divide my number by 3, the remainder is ___.

When you divide my number by 4, the remainder is ___.

When you divide my number by 5, the remainder is ___.

When you divide my number by 6, the remainder is ___.

When you divide my number by 7, the remainder is ___.

An example of a *mathematical proof* that 10 was the solution to our first riddle completed in class is the following:

10 ÷ 1 = 10 r 0	true
10 ÷ 2 = 5 r 0	true
10 ÷ 3 = 3 r 1	true
10 ÷ 4 = 2 r 2	true
10 ÷ 5 = 2 r 0	true
10 ÷ 6 = 1 r 4	true
10 ÷ 7 = 1 r 3	true

Remainder Riddle 1

When you divide my number by 1, the remainder is 0.

When you divide my number by 2, the remainder is 0.

When you divide my number by 3, the remainder is 1.

When you divide my number by 4, the remainder is 2.

When you divide my number by 5, the remainder is 0.

When you divide my number by 6, the remainder is 4.

When you divide my number by 7, the remainder is 3.

Remainder Riddle 2

When you divide my number by 1, the remainder is 0.

When you divide my number by 2, the remainder is 0.

When you divide my number by 3, the remainder is 1.

When you divide my number by 4, the remainder is 0.

When you divide my number by 5, the remainder is 1.

When you divide my number by 6, the remainder is 4.

When you divide my number by 7, the remainder is 2.

Remainder Riddle 3

When you divide my number by 1, the remainder is 0.

When you divide my number by 2, the remainder is 0.

When you divide my number by 3, the remainder is 2.

When you divide my number by 4, the remainder is 0.

When you divide my number by 5, the remainder is 3.

When you divide my number by 6, the remainder is 2.

When you divide my number by 7, the remainder is 1.

The Factor Game

You need:

a partner

The Factor Game game board

colored pencils in two different colors

Directions

1. Player A chooses a number on the game board and circles it. This will be Partner A's score for that round.
2. Using a different color, Partner B circles all the proper factors of Player A's number. The proper factors of a number are all the factors of that number except the number itself. Partner B lists the factors. The sum of those factors is Partner B's score for that round.
3. Player B then circles a new number. Player A circles all the remaining factors of that number. The play continues in this manner.
4. The players take turns choosing numbers and circling factors.
5. If a player circles a number that has no factors left which have not been circled, then that player does not get points for the number circles and loses his or her turn.
6. The game ends when there are no more numbers left with uncircled factors.
7. The player with the larger sum of factors and products is the winner.

Extension: Play a game on a 49 game board!

Please see the following publications for more about *The Factor Game:*

About Teaching Mathematics: A K-8 Resource, Third Edition by Marilyn Burns (Math Solutions 2007)

Prime Time: Factors and Multiples (Connected Mathematics 2) (by Glenda Lappan, James Fey, William Fitzgerald, Susan Friel, and Elizabeth D. Phillips (Dale Seymour Publications 2006)

A similar game called *Factor Captor* appears in: *Everyday Mathematics: The University of Chicago School Mathematics Project, Grade 5* (Everyday Learning Corporation 2002).

The Factor Game
Game Board for 30

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

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

The Factor Game
Game Board for 49

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	41	42
43	44	45	46	47	48	49

Fair Game 2

You need:

a partner

1 pair of dice

Directions

1. Take turns rolling the two dice. Player A scores a point if the sum of the dice is even. Player B scores a point if the sum is odd. Is the game fair? Why or why not? How do you know? If the game is not fair, how could you make it fair? Explain your reasoning.
2. Play the game again, this time calculating the product of the two rolled dice. Player A scores a point if the product is even. Player B scores a point if the product is odd. Is the game fair? Why or why not? How do you know? If the game is not fair, how could you make it fair? Explain your reasoning.

Source: About Teaching Mathematics: A K–8 Resource, Third Edition by Marilyn Burns (Math Solutions 2007).

Multiplication Tic-Tac-Toe

You Need:

Tic-Tac-Toe game board, 1 per pair of players

2 paper clips

colored counters, 1 color per child

Directions

1. The first player places two paper clips at the bottom of the game board, indicating two factors. The player multiplies the selected factors and places a counter on the resulting product.
2. The next player can move only one paper clip to a new factor. The player then multiplies the two factors and places a counter on that product. It is permissible to have two paper clips on the same factor.
3. Play continues with players alternating turns, moving only one paper clip each time, multiplying the factors, and placing counters on the game board.
4. The winner is the first to have four counters in a row horizontally, diagonally, or vertically.

Source: Nimble with Numbers, Grades 4–5 by Leigh Childs and Laura Choate (Dale Seymour Publications 1998).

Multiplication Tic-Tac-Toe Game Board

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
54	56	63	64	72	81

1 2 3 4 5 6 7 8 9

Target 300

You need:

1 die

2 players

Directions

The object of the game is to be the player whose total is closest to 300 after six rolls of the die. The total can be exactly 300, less than 300, or greater than 300. Each player must use all six turns.

1. **Each player draws a two-column chart as a score sheet as shown, one column for each player.**
2. **Player 1 rolls the die and decides whether to multiply the number rolled by 10, 20, 30, 40, or 50, keeping in mind that each player will have six turns to reach the targeted amount of 300.**
3. **Both players write the multiplication sentence representing the first player's choice and product. For example, Player 1 rolls a 2 and chooses to multiply it by 20. Both players write the multiplication number model: $2 \times 20 = 40$.**
4. **Player 1 hands the die to Player 2. Player 2 follows the same steps as Player 1.**
5. **At the end of each turn, the player adds her new amount to the previous score to keep a running total.**
6. **At the end of six turns, players compare scores to see whose score is closest to 300. Each player records the following prompts under his or her chart:**

   _____ won.

   _____ was _____ points away from 300.

   _____ was _____ points away from 300.

Player 1	*Player 2*

Player 1	*Player 2*
$2 \times 20 = 40$	

From *Teaching Arithmetic: Lessons for Extending Multiplication, Grades 4–5* by Maryann Wickett and Marilyn Burns (Math Solutions Publications, 2001)

Rio

Please note: *Game boards for the targeted tables will need to be made prior to playing the game. Each table game board will contain the 2 through 12 multiplication facts for that targeted table. Each board will contain one free space. Boards can be laminated for future and frequent use.*

You need:

Rio game board, 1 per pair of players

10 two-colored counters (5 red and 5 yellow) or 10 transparent chips (5 of two different colors)

2 six-sided dice

2 players

Directions

1. Player A rolls the dice and calculates the sum. The sum is then multiplied by the table number listed at the top of the game board. The player places his or her colored chip on the product.
2. Player B follows the same procedure as Player A. If the product is covered by Player A's chip, Player B can remove Player A's chip and replace it with one of his or her own.
3. Chips can be bumped off the board and replaced at each turn when duplicate products are calculated.
4. The player who plays all of his or her chips first is the winner.

Rio Game Board Template

RIO

Game board for the _____ tables