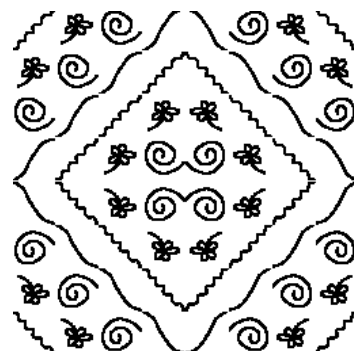
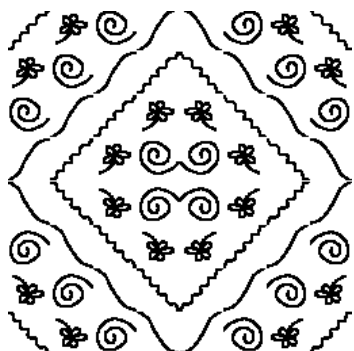
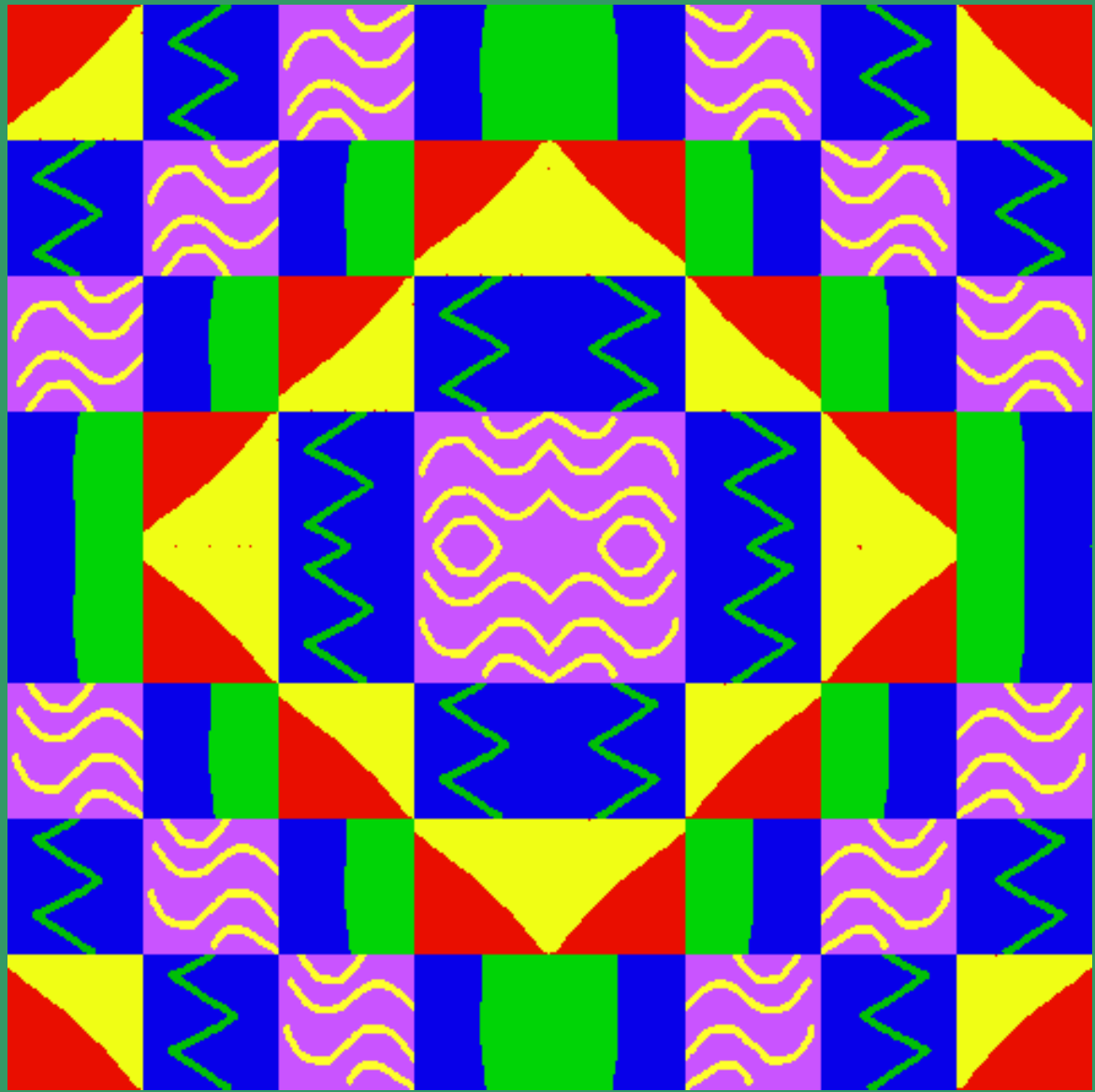
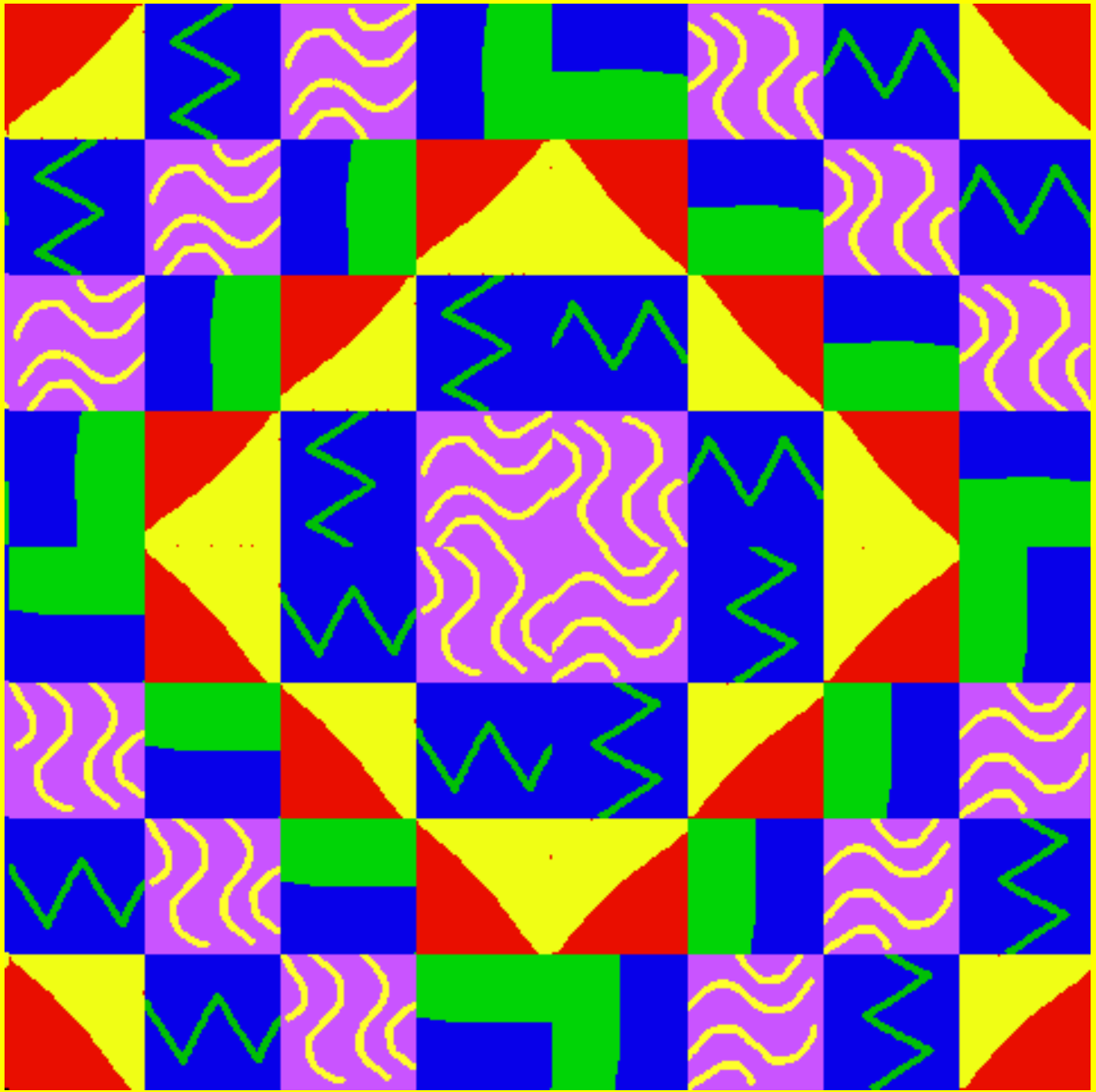


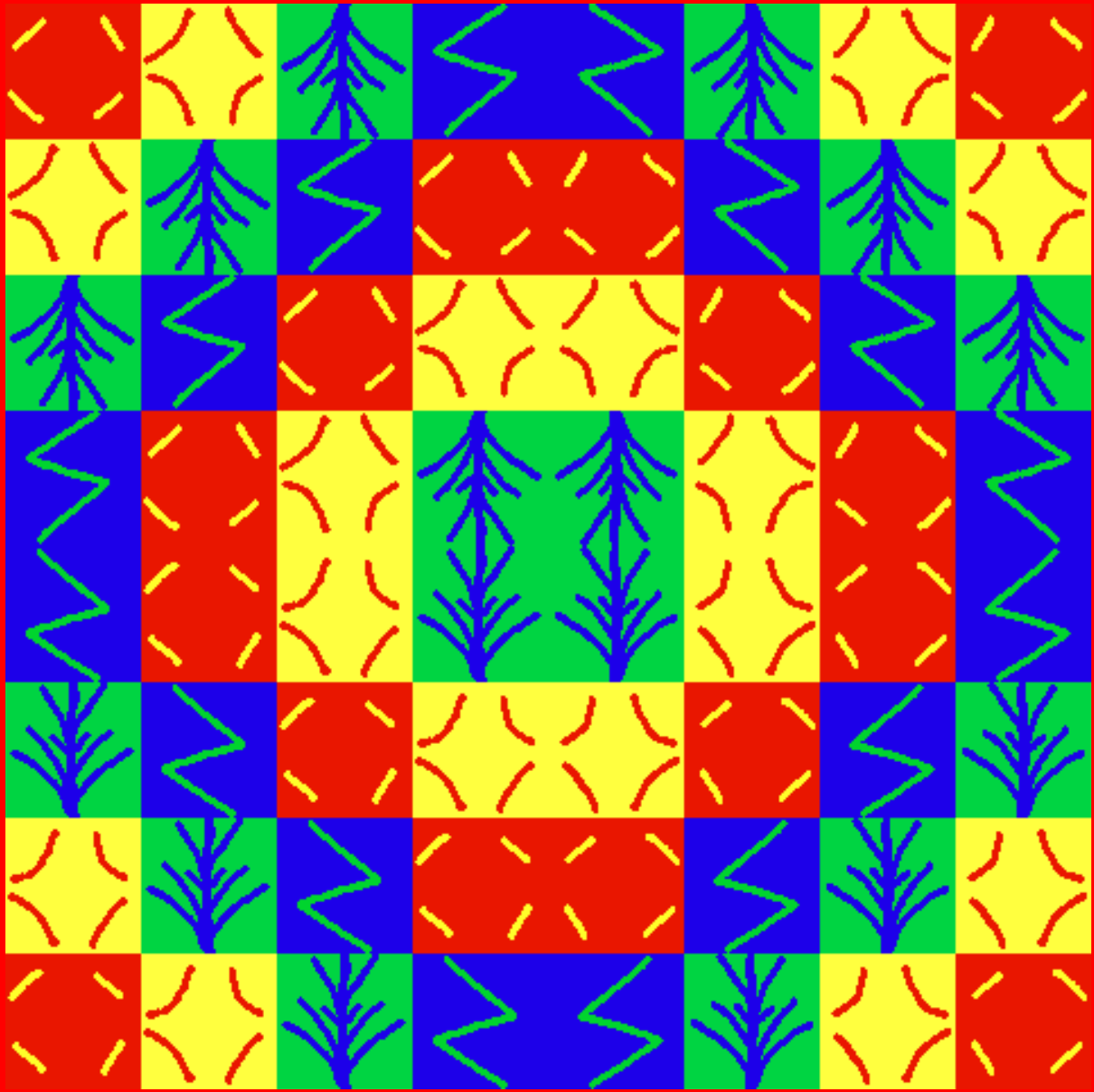
# THE POSTER ART OF CLOCK ARITHMETIC

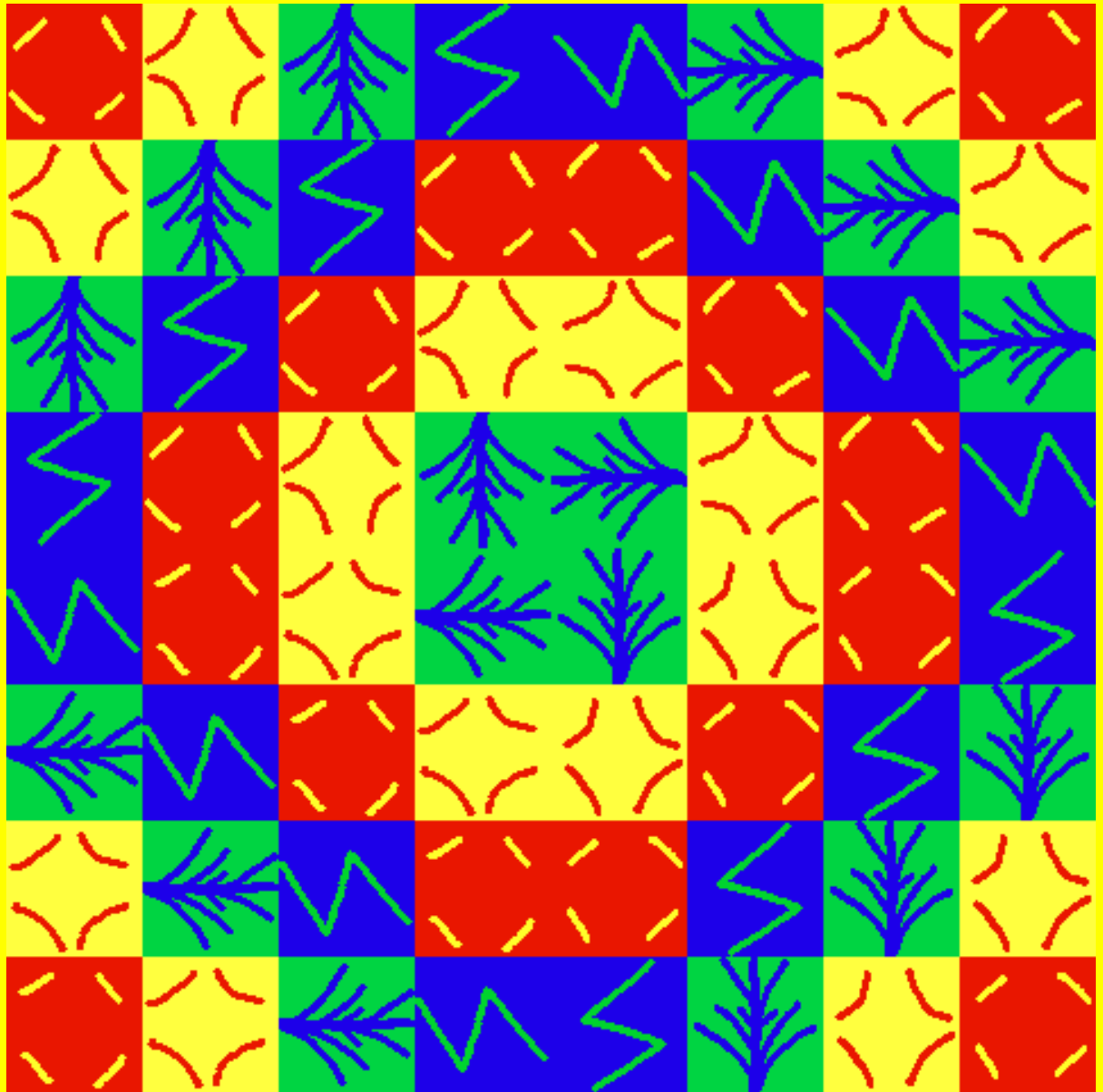
Dr. Laurie Burton  
Mathematics Department  
**WESTERN OREGON**  
**UNIVERSITY**







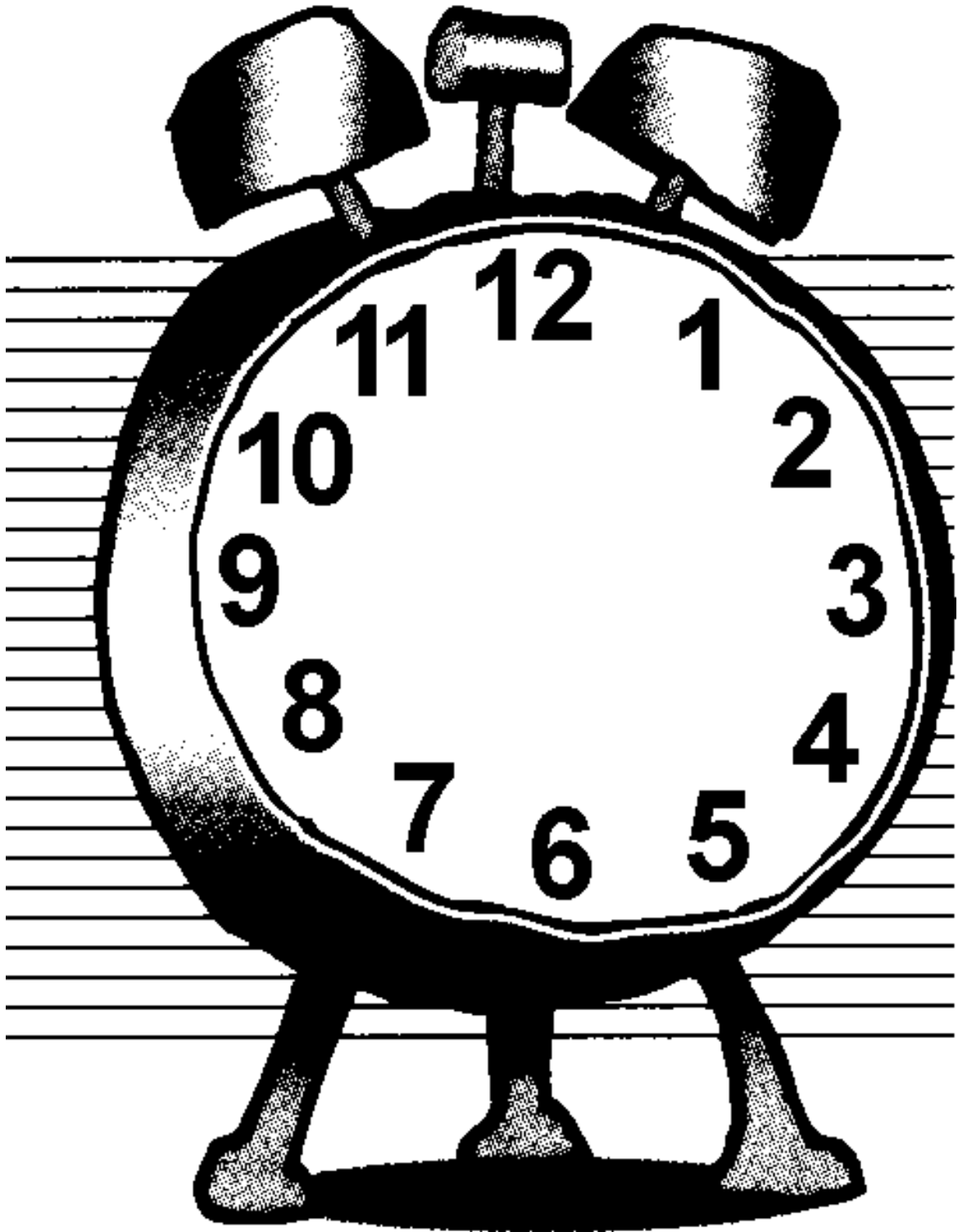




# HOW DO YOU MAKE MATH-ART POSTERS?

1. Understand the basics of clock arithmetic
2. Create numerical codes on grids using clock arithmetic
3. Replace numbers with patterns.  
Using these patterns:  
Color/draw on grids (directly or reflecting)
4. Cut and paste onto colored backgrounds to make Math Art Posters!

# THE 12 O'CLOCK CLOCK



Joe Spooner

YOU CAN USE  
CLOCK ARITHMETIC  
TO HAVE STUDENTS EXPLORE

- ❖ FACTORS
- ❖ RELATIVELY PRIME NUMBERS

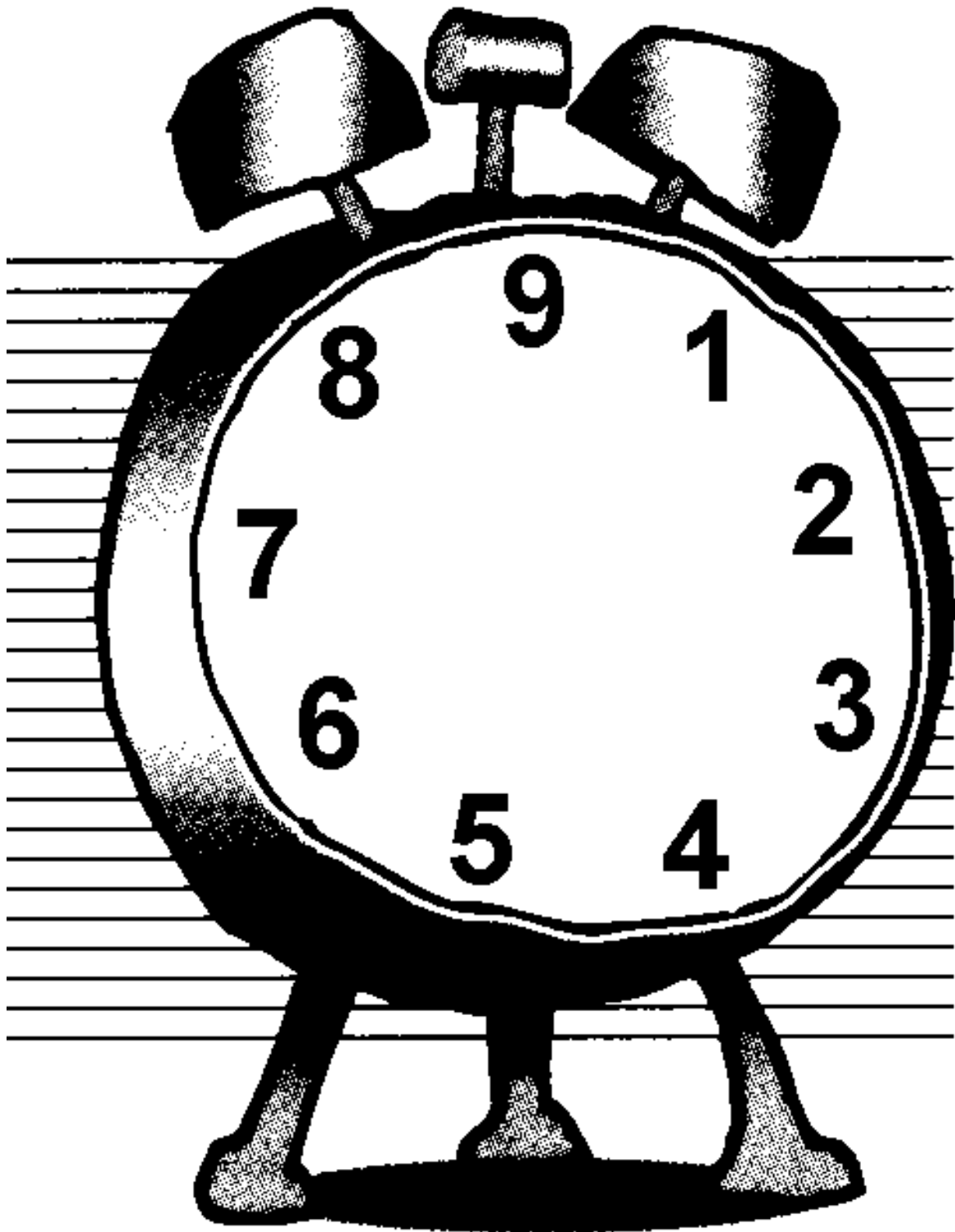
BASIC OPERATIONS

- ❖ COMMUTATIVITY
- ❖ ASSOCIATIVITY
- ❖ IDENTITY ELEMENTS

## CAYLEY TABLE, ADDITION ON THE 12 O'CLOCK CLOCK

+	1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12	1
2	3	4	5	6	7	8	9	10	11	12	1	2
3	4	5	6	7	8	9	10	11	12	1	2	3
4	5	6	7	8	9	10	11	12	1	2	3	4
5	6	7	8	9	10	11	12	1	2	3	4	5
6	7	8	9	10	11	12	1	2	3	4	5	6
7	8	9	10	11	12	1	2	3	4	5	6	7
8	9	10	11	12	1	2	3	4	5	6	7	8
9	10	11	12	1	2	3	4	5	6	7	8	9
10	11	12	1	2	3	4	5	6	7	8	9	10
11	12	1	2	3	4	5	6	7	8	9	10	11
12	1	2	3	4	5	6	7	8	9	10	11	12

9 O'CLOCK CLOCK

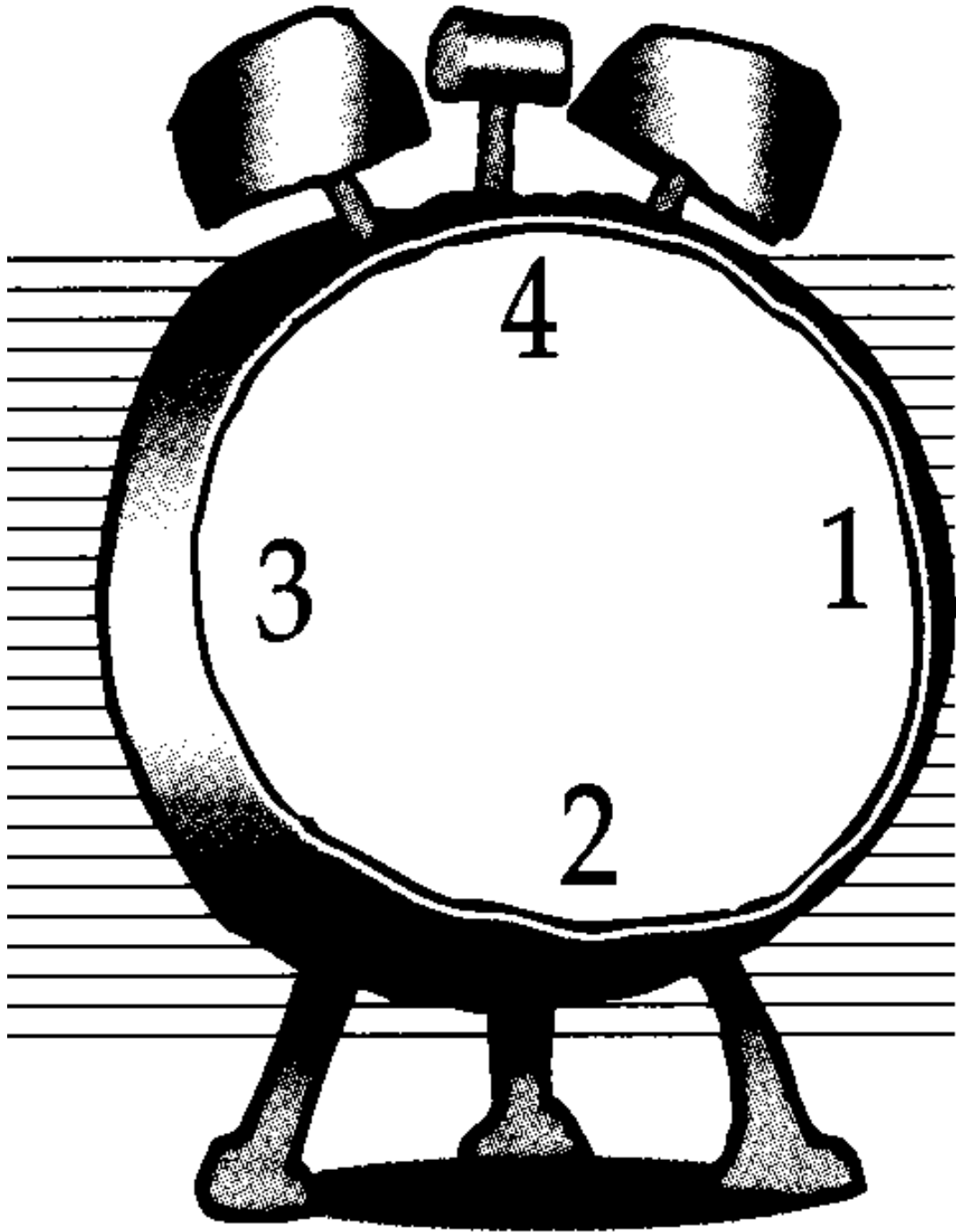


Joe Spooner

# CAYLEY TABLE, ADDITION ON THE 9 O'CLOCK CLOCK

<b>+</b>	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	1
2	3	4	5	6	7	8	9	1	2
3	4	5	6	7	8	9	1	2	3
4	5	6	7	8	9	1	2	3	4
5	6	7	8	9	1	2	3	4	5
6	7	8	9	1	2	3	4	5	6
7	8	9	1	2	3	4	5	6	7
8	9	1	2	3	4	5	6	7	8
9	1	2	3	4	5	6	7	8	9

# 4 O'CLOCK CLOCK



Joe Spooner

CAYLEY TABLE, ADDITION ON THE  
4 O'CLOCK CLOCK

+	1	2	3	4
1	2	3	4	1
2	3	4	1	2
3	4	1	2	3
4	1	2	3	4

YOU CAN SEE THIS TABLE  
WORKS LIKE THE 12 HOUR CLOCK

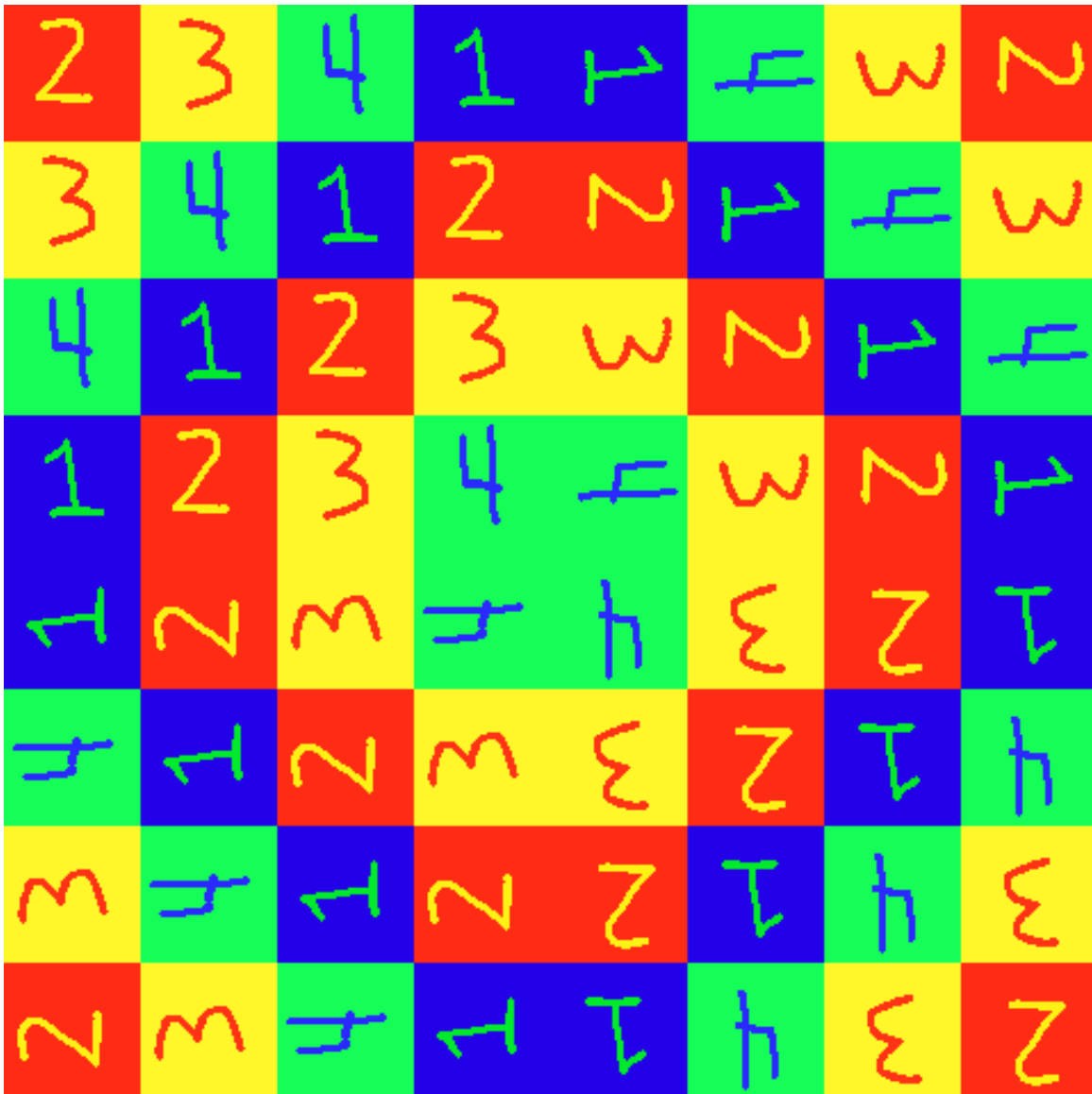
HERE YOU START OVER AT  
4 O'CLOCK

TO MAKE AN ADDITION MATH ART POSTER  
REPLACE THE NUMBERS WITH PATTERNS  
THESE "COLORED NUMBERS"  
ARE A DEMONSTRATION PATTERN

2	3	4	1
3	4	1	2
4	1	2	3
1	2	3	4

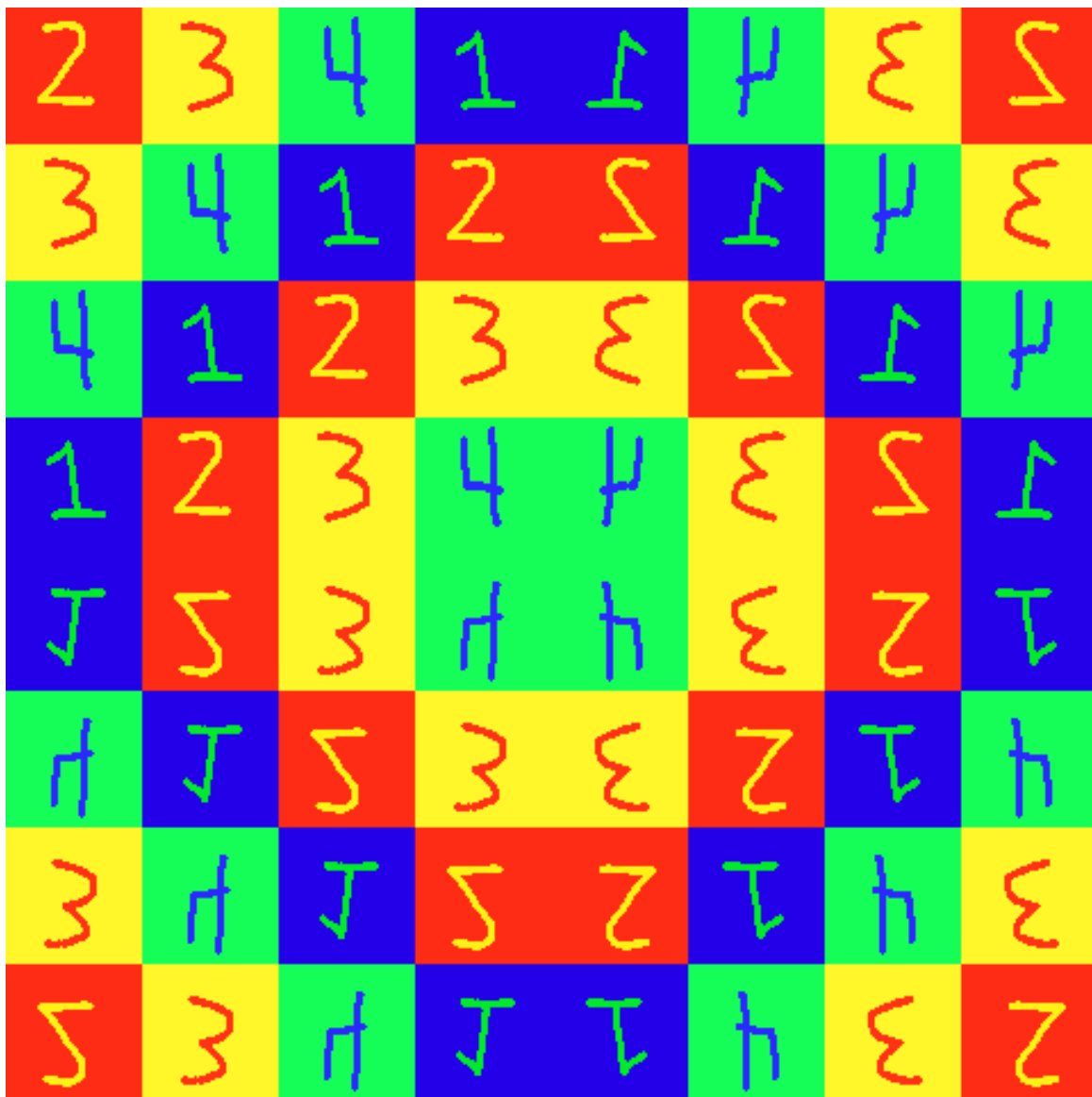
TO MAKE A ROTATION POSTER  
MAKE DUPLICATE COPIES  
AND ROTATE

THIS ROTATION IS  
 $0^\circ$   $90^\circ$   $180^\circ$   $270^\circ$   
CLOCKWISE



FOR A REFLECTION POSTER  
YOU DRAW FOUR REFLECTED COPIES

BOTH PATTERN AND POSITION  
ARE REFLECTED



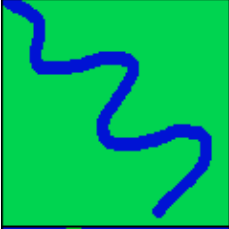

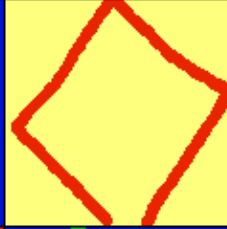

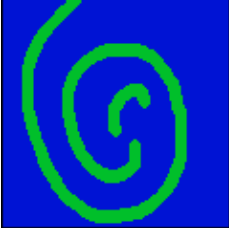

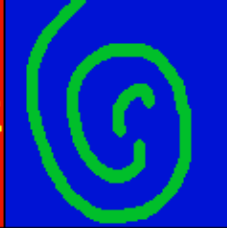

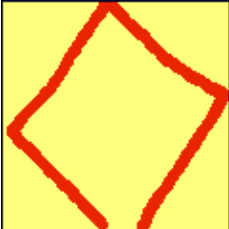

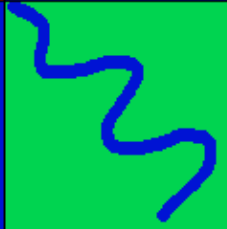





YOU CAN ALSO CREATE A  
MULTIPLICATION TABLE  
FOR CLOCKS

CAYLEY TABLE, MULTIPLICATION ON THE  
4 O'CLOCK CLOCK

X	1	2	3	4
1	1	2	3	4
2	2	4	2	4
3	3	2	1	4
4	4	4	4	4

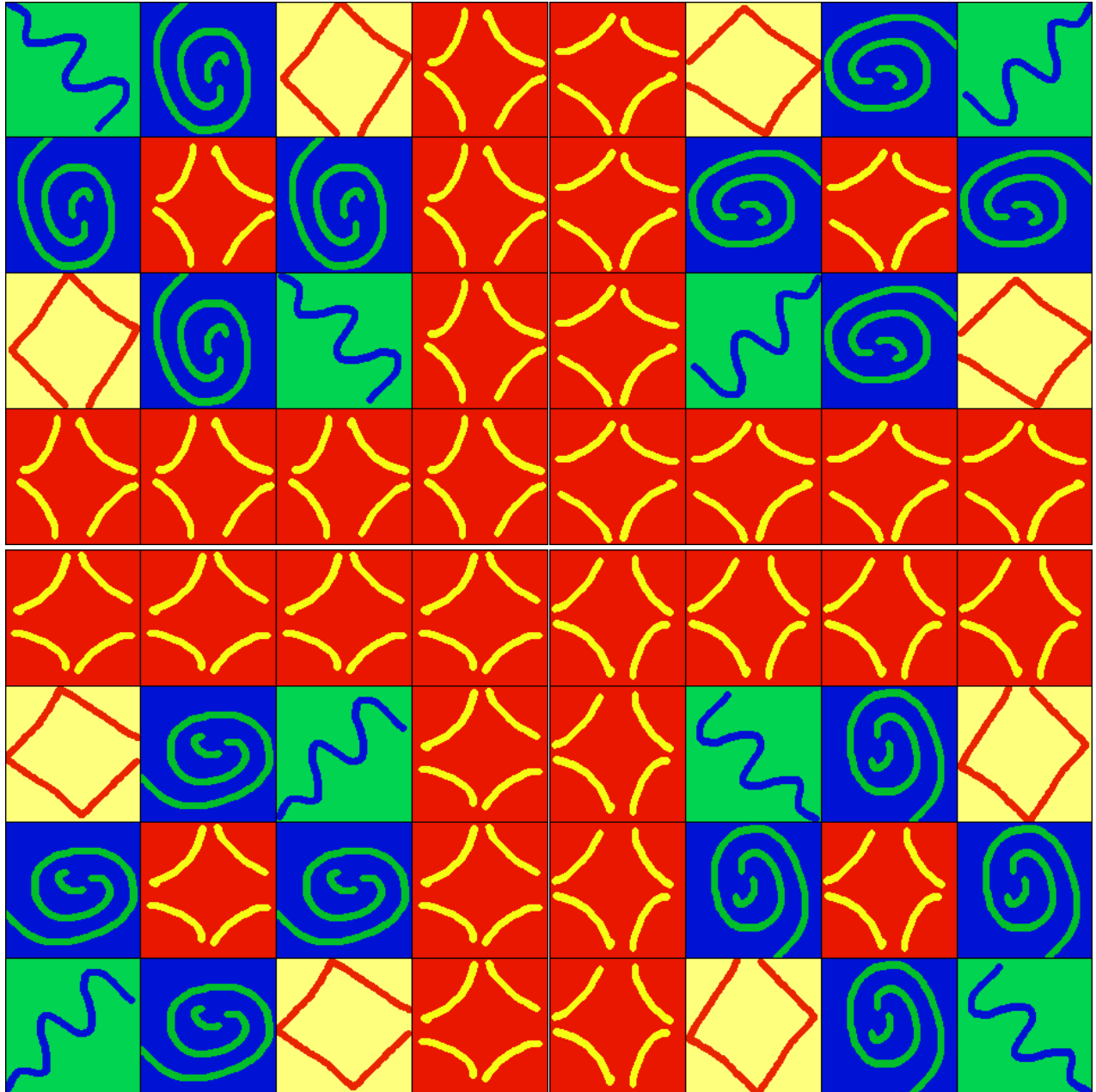
THE PATTERNS ARE DIFFERENT  
HERE BUT THEY MAKE  
NICE POSTERS TOO!

CAYLEY TABLE SAMPLE  
4 O'CLOCK CLOCK  
MULTIPLICATION TABLE  
WITH PATTERNS

# ROTATION TABLE SAMPLE

## 4 O'CLOCK CLOCK MULTIPLICATION



REFLECTION POSTER SAMPLE  
4 O'CLOCK CLOCK TABLE  
Addition or Multiplication?



ROTATION POSTER SAMPLE  
4 O'CLOCK CLOCK TABLE



# REFLECTION POSTER SAMPLE

## 8 O'CLOCK CLOCK TABLE



# ROTATION POSTER SAMPLE

## 8 O'CLOCK CLOCK TABLE

