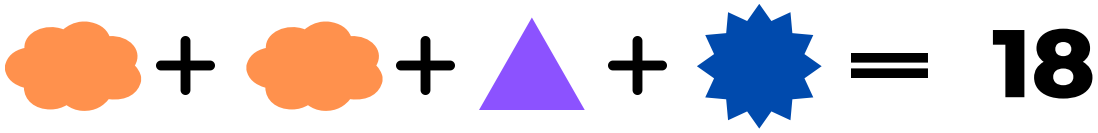
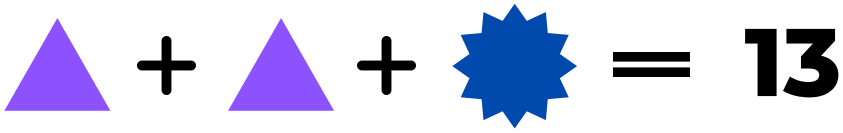
# CODE BREAKER

PROBLEM SCORING:
2 POINTS

YOUR TASK IS TO DETERMINE THE VALUE OF EACH COLORED SHAPE.







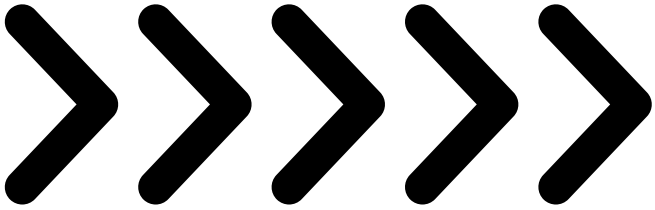
**SOLUTION:**

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO ROOM HISTORIC 1056 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

# EVERYTHING YOU DO IS RIGHT

PART ONE
PROBLEM SCORING:
1 POINT



TODAY IS “EVERYTHING YOU DO IS RIGHT” DAY. LET’S PUT THIS THOUGHT TO TEST.

FOLLOW THE DIRECTIONS AND REPORT TO THE MASTER TEACHER WITH YOUR RESULT:

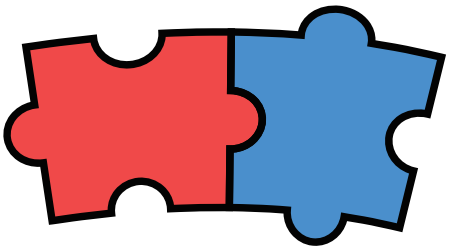
- CHOOSE A THREE-DIGIT NUMBER IN WHICH EACH DIGIT IS DIFFERENT.
- REVERSE THE ORDER OF THE DIGITS (THE HUNDREDS PLACE DIGIT IS NOW IN THE ONES PLACE, AND THE ONES PLACE DIGIT IS NOW THE HUNDREDS PLACE. THE TENS PLACE DIGIT STAYS PUT).
- SUBTRACT THE SMALLER THREE-DIGIT NUMBER FROM THE LARGER THREE-DIGIT NUMBER TO CREATE A NEW THREE-DIGIT NUMBER (DIFFERENCE).
- REVERSE THE ORDER OF THE DIGITS FOR THE DIFFERENCE (THE HUNDREDS PLACE DIGIT IS NOW IN THE ONES PLACE, AND THE ONES PLACE DIGIT IS NOW THE HUNDREDS PLACE. THE TENS PLACE DIGIT STAYS PUT).
- ADD THE DIFFERENCE AND REVERSE DIFFERENCE TOGETHER.
- WHAT IS YOUR SUM?

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1067 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER. WHEN THE MASTER TEACHER IS SATISFIED WITH YOUR RESULT, YOU WILL RECEIVE PART TWO OF THE PROBLEM.

# EVERYTHING YOU DO IS RIGHT

PART TWO
PROBLEM SCORING:
2 POINTS



THIS IS PART-TWO OF A TWO-PART PROBLEM:

- YOUR RESULT FROM PART-ONE SHOULD BE 1089.
- YOUR NEW TASK IS TO VERIFY THAT ANY THREE-DIGIT NUMBER YOU CHOOSE (WHEN EACH DIGIT IS DIFFERENT) WILL HAVE THE END RESULT OF 1089.

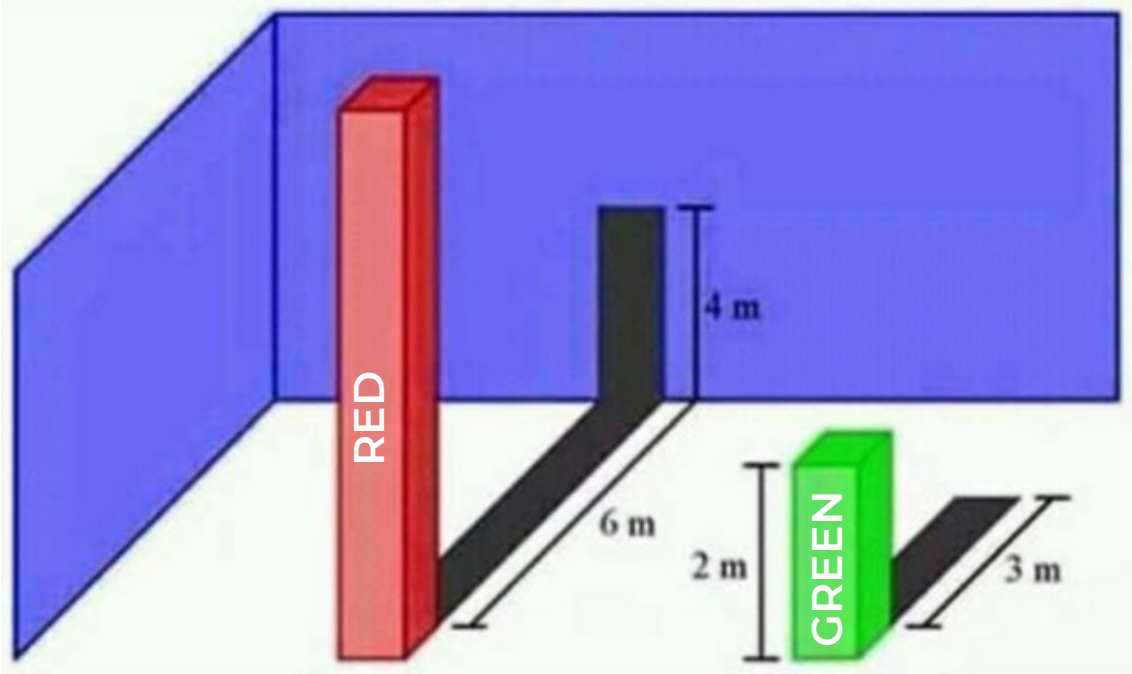
*BE PREPARED TO JUSTIFY YOUR REASONING.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1067 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# SHADOWS

PROBLEM SCORING:
3 POINTS

## FIND THE HEIGHT OF THE RED BAR.*




*(NOT DRAWN TO SCALE.)*

*THE MASTER TEACHER CAN GIVE YOU A HINT TO THIS PROBLEM FOR A ONE-POINT DEDUCTION.

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1015 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# SQUARE ROOTS

PART ONE
PROBLEM SCORING:
1 POINT

YOUR TASK:

DETERMINE THE $\sqrt{250}$ BETWEEN TWO INTEGER VALUES.

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1019 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER. WHEN THE MASTER TEACHER IS SATISFIED WITH YOUR RESULT, YOU WILL RECEIVE PART TWO OF THE PROBLEM.

# SQUARE ROOTS

PART TWO
PROBLEM SCORING:
2 POINTS

THIS IS PART TWO OF A TWO-PART PROBLEM.

YOUR TASK:

USING BASE-TEN BLOCKS, CREATE A GEOMETRIC MODEL FOR THE $\sqrt{250}$ TO AT LEAST THE HUNDREDTHS PLACE. THE MORE PRECISE, THE BETTER!

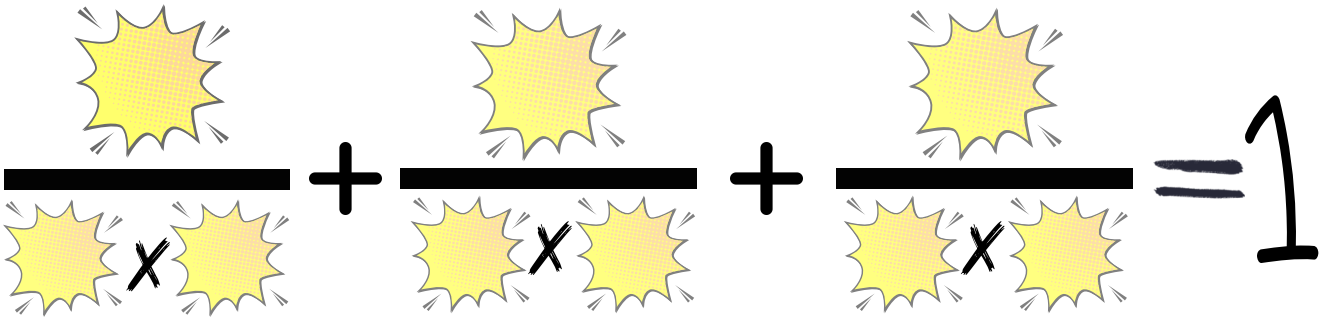
*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1019 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# ALL FOR ONE

PROBLEM SCORING:
3 POINTS

PLACE A DIGIT (1 TO 9 ONCE EACH) INTO A STAR SO THAT THE FRACTIONS SUCCESSFULLY SUM TO ONE.



| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|

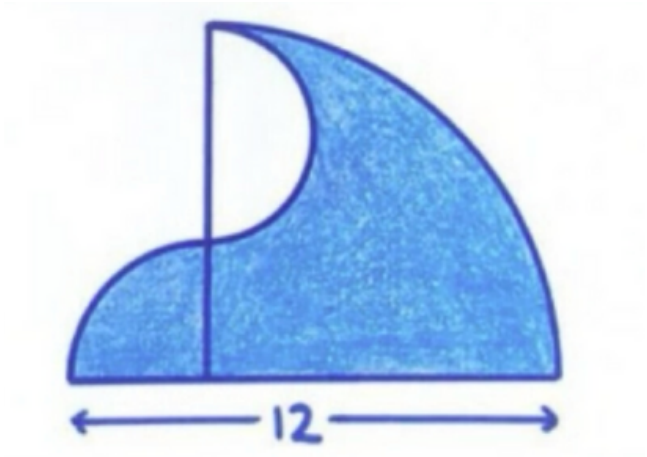
*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1064 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# SHADY CIRCLE

PROBLEM SCORING:
4 POINTS

THE FIGURE BELOW CONTAINS TWO QUARTER CIRCLES AND A SEMICIRCLE. WHAT'S THE AREA OF THE BLUE-SHADED REGION?




- THE MASTER TEACHER HAS TWO PREDETERMINED HINTS FOR THIS PROBLEM.
- EACH HINT WILL DEDUCT ONE POINT FROM THE POSSIBLE POINTS FOR THIS PROBLEM.
- REPORT TO THE MASTER TEACHER IF YOU NEED A HINT.
- IF YOU DO NOT NEED A HINT, REPORT YOUR SOLUTION.

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1060 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# SCHOOL OF PERCENTAGES

**PROBLEM SCORING:**
**2 POINTS**



- THE NUMBER OF STUDENTS AT ANDERSON STREET SCHOOL IS 240% OF THE NUMBER OF STUDENTS AT THE PHILLIPS SCHOOL.
- THE NUMBER OF STUDENTS AT ANDERSON STREET SCHOOL IS ONLY 60% OF THE NUMBER OF STUDENTS AT MIMS' SCHOOL.
- WHAT COULD THE NUMBERS AT EACH SCHOOL BE?
- WHAT IS THE FRACTION RELATIONSHIP BETWEEN THE MIMS SCHOOL AND PHILLIPS SCHOOL?

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1069 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# THE RACE

PROBLEM SCORING:
2 POINTS

*There once was a speedy hare who bragged about how fast he could run. Tired of hearing him boast, Slow and Steady, the tortoise, challenged him to a race. All the animals in the forest gathered to watch.*

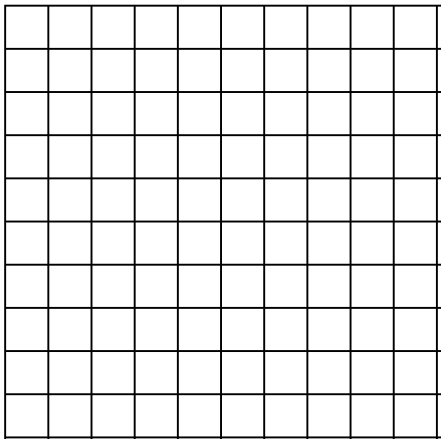
*Hare ran down the road for a while and then paused to rest. He looked back at Slow and Steady and cried out, "How do you expect to win this race when you are walking along at your slow, slow pace?"*

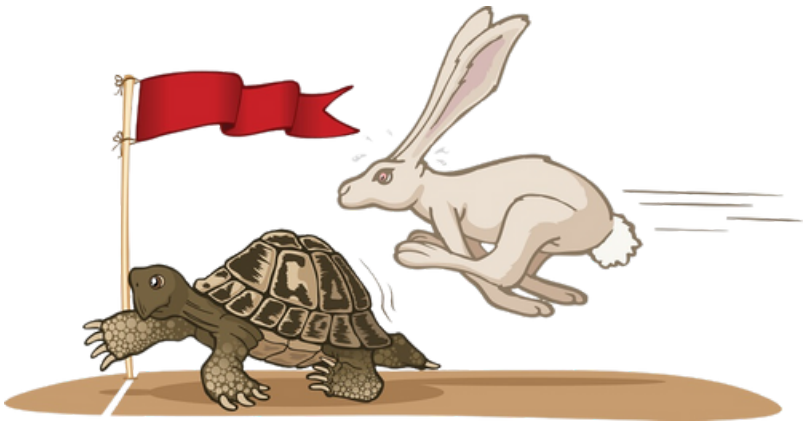
*Hare stretched himself out alongside the road and fell asleep, thinking, "There is plenty of time to relax." Slow and Steady walked and walked. He never, ever stopped until he came to the finish line.*

*The animals who were watching cheered so loudly for Tortoise, they woke up Hare. Hare stretched and yawned and began to run again, but it was too late. Tortoise was over the line. After that, Hare always reminded himself, "Don't brag about your lightning pace, for Slow and Steady wins the race!"*

Your Task:

Draw a graph that represents the race between the tortoise and the hare. Be sure to label the parts of your graph.





*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1063 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# KNOW YOUR ABC'S

PROBLEM SCORING:
2 POINTS

GIVEN: $5A = 7B = 9C$

WHAT IS THE RATIO $A : B : C$

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1059 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# THAT'S AN ODD ONE

PROBLEM SCORING:
2 POINTS

**HOW MANY FOUR-DIGIT ODD NUMBERS CAN BE FORMED USING**

**0 1 2 3 4**

**AS DIGITS?**

**(REPITITION OF DIGITS IS ALLOWED.)**

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1013 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# QUICKONOR GAME

PROBLEM SCORING:
1, 2, 3, OR 4 POINTS

- **THIS GAME INCLUDES A GRID AND A SEQUENCE OF NUMBERS ARRANGED IN ASCENDING ORDER: THE OPERANDS.**
- **MATCH THE OPERANDS 'TWO-BY-TWO' SO THAT THEIR ADDITION EQUALS A GRID NUMBER AND THEIR MULTIPLICATION EQUALS ANOTHER GRID NUMBER.**
- **ONCE THIS IS DONE, THIS PAIR OF OPERANDS AND GRID NUMBERS ARE NOT USED AGAIN.**
- **THERE ARE THREE LEVELS OF THE GAME. YOUR TEAM EARNS CREDIT FOR THE FIRST TWO LEVELS YOU SUBMIT (THAT ARE CORRECT).**
- **EACH LEVEL OF THE GAME CAN ONLY BE SUBMITTED TO THE MASTER TEACHER *ONE TIME*.**

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1066 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# QUICKONOR GAME

LEVEL SCORING:
1 POINT

LEVEL ONE

## GRID

| | | |
|---|---|---|
| 49 | 19 | 88 |
| 21 | 39 | 68 |
| 14 | 16 | |

## OPERANDS

3 4 7 7

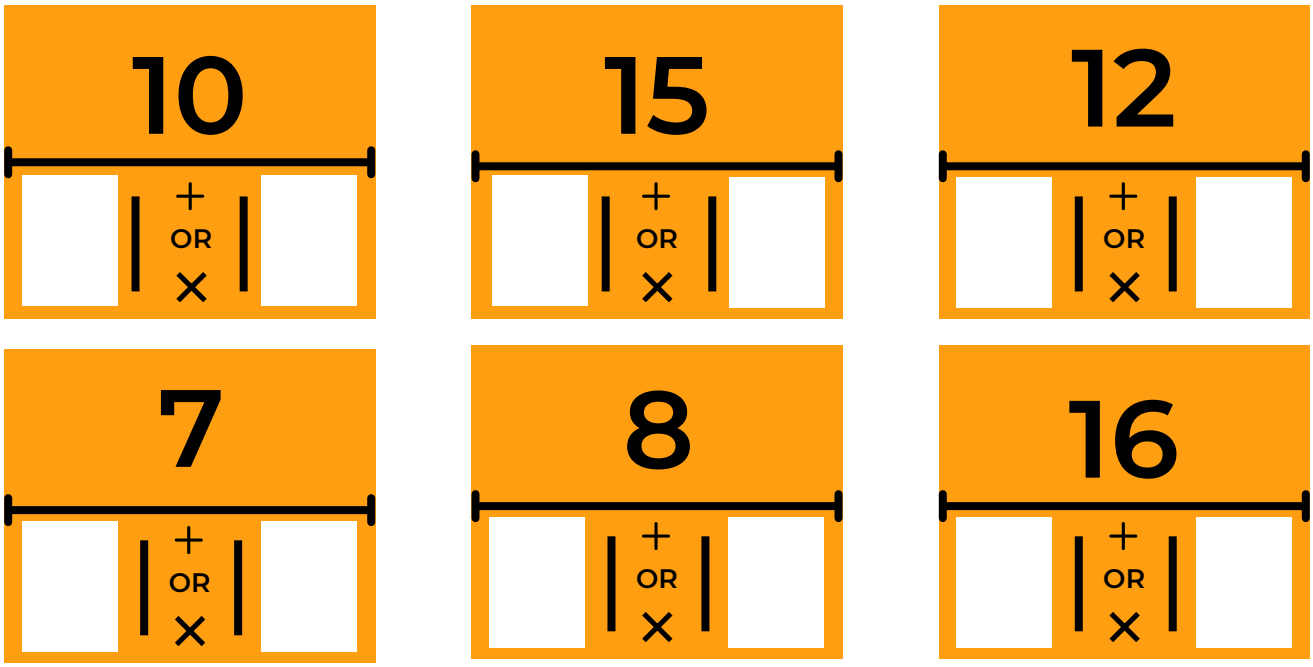
8 11 13 17

# QUICKONOR GAME

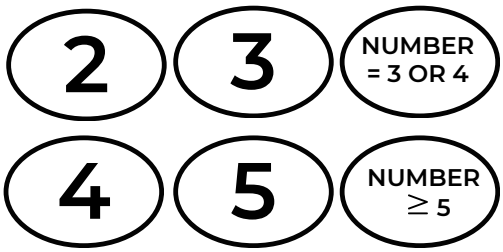
LEVEL SCORING:
2 POINTS

LEVEL TWO

## GRID




## OPERANDS:

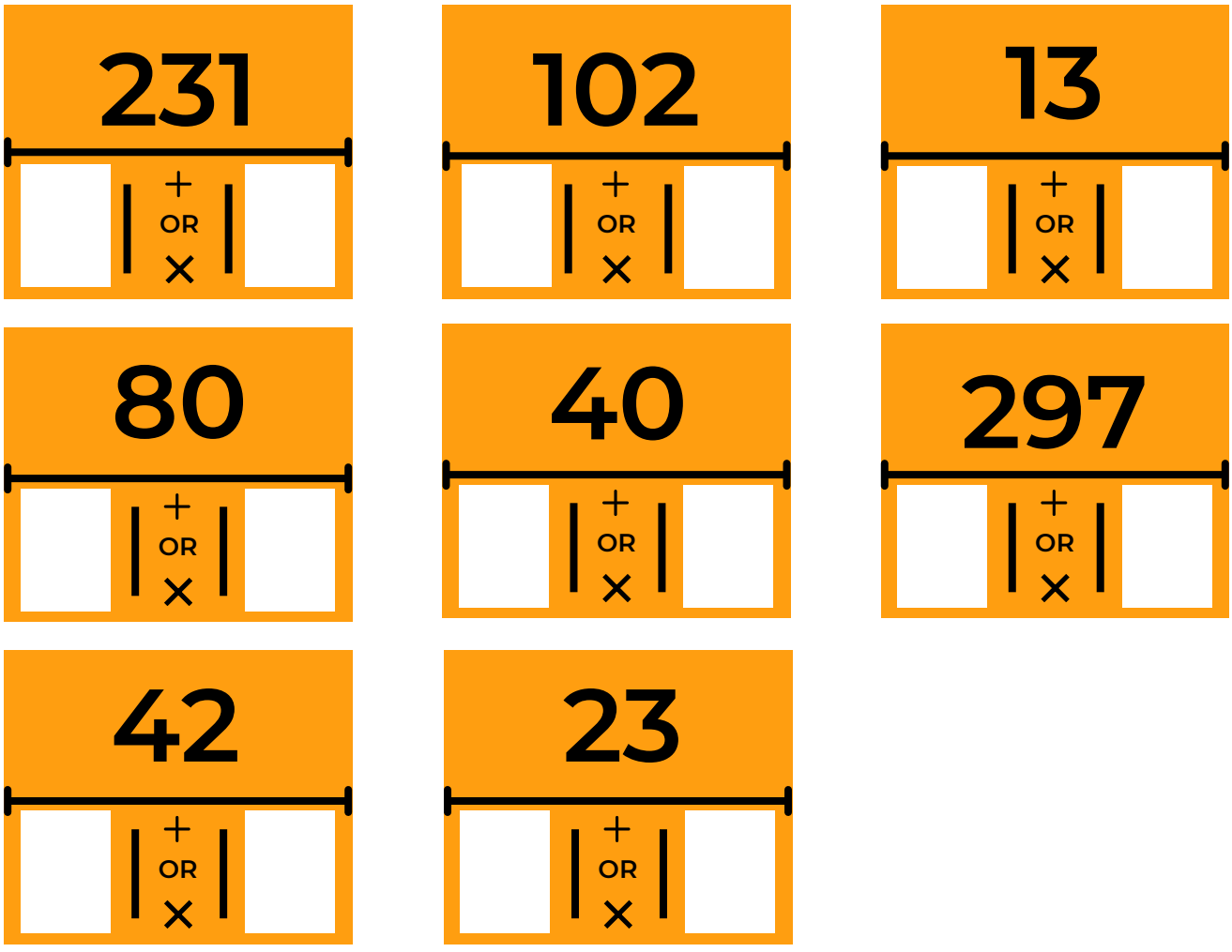


# QUICKONOR GAME

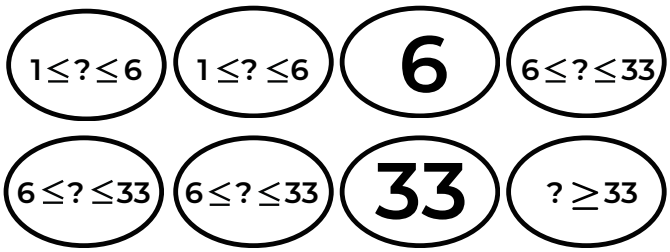
LEVEL SCORING:
2 POINTS

**LEVEL THREE**

## GRID

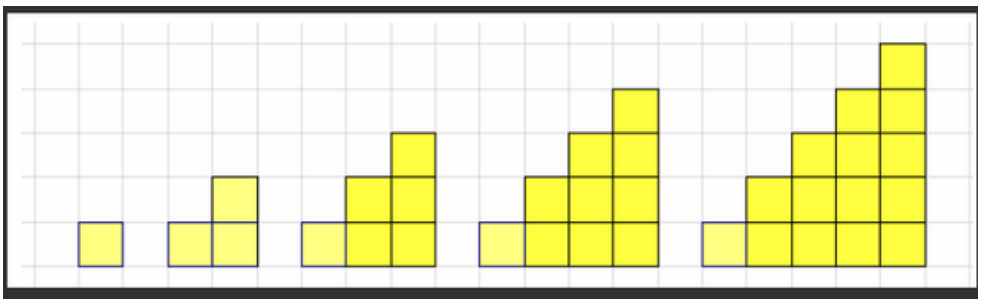



## OPERANDS:



# PATTERNS

PART ONE
PROBLEM SCORING:
2 POINTS



- THE FIGURE ABOVE REPRESENTS STAGES 1 THROUGH 5 OF A NUMBER PATTERN.
- GENERATE A FORMULA THAT WILL DETERMINE THE NUMBER OF BLOCKS NECESSARY TO BUILD THE NTH CASE FOR THE GROWING SHAPES. BE PREPARED TO JUSTIFY EACH ASPECT OF YOUR FORMULA WITH RESPECT TO THE GROWTH OF THE SHAPES OR THE STRUCTURE OF THE GEOMETRIC ASPECTS OF THE SHAPES.

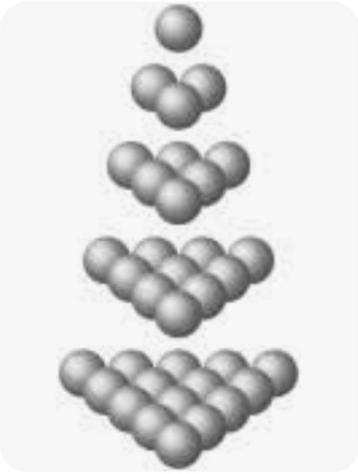
*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1016 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER. WHEN THE MASTER TEACHER IS SATISFIED WITH YOUR RESULT, YOU WILL RECEIVE PART TWO OF THE PROBLEM.

# PATTERNS

PART TWO
PROBLEM SCORING:
2 POINTS

**CONGRATULATIONS!**
**YOU COMPLETED PART ONE!**



- THE PATTERN OF NUMBERS FROM PART ONE IS THE TRIANGULAR NUMBERS.

- THE SUM OF THE TRIANGULAR NUMBERS FORMS THE TETRAHEDRAL NUMBERS.
- THE TETRAHEDRAL NUMBER MODEL IS CREATED BY STACKING THE TRIANGULAR NUMBERS.

YOUR TASK:
HOW MANY LAYERS ARE THERE TO REACH THE TETRAHEDRAL NUMBER, 2024?

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1016 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# NRICH TASK

PROBLEM SCORING:
3 POINTS

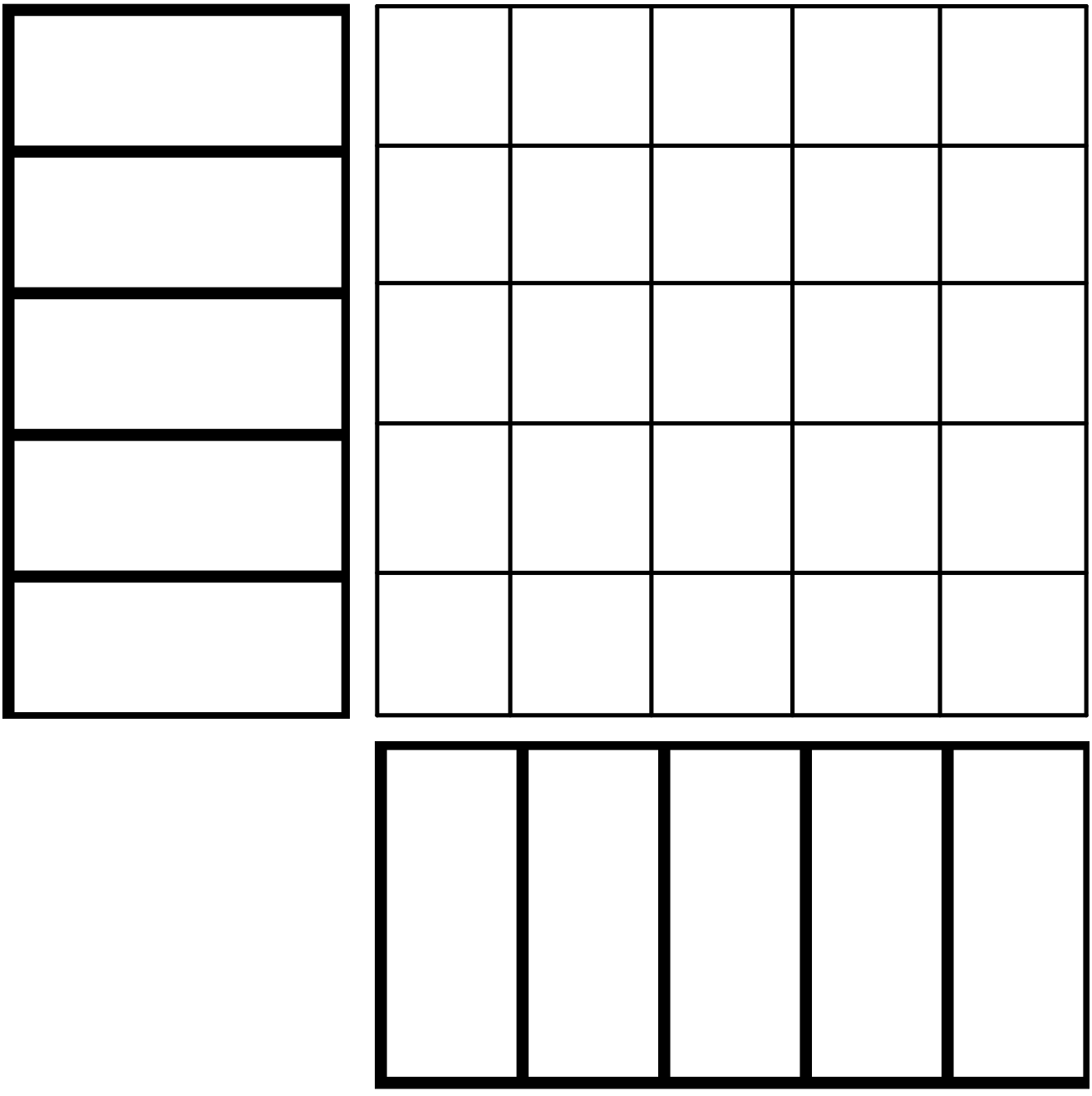
- **CUT OUT THE TEN HEADING CARDS AND PUT ONE IN EACH OF THE TEN SPACES AROUND THE PLAYING BOARD.**
- **CUT OUT THE 25 NUMBER CARDS AND PLACE EACH ONE IN A DIFFERENT SQUARE ON THE PLAYING BOARD SO THAT THE NUMBER SATISFIES THE CONDITION GIVEN BY THE HEADING CARD FOR THAT ROW AND THE CONDITION GIVEN BY THE HEADING FOR THAT COLUMN.**
- **BY REARRANGING THE HEADING CARDS AND THE NUMBER CARDS, COMPLETE THE PLAYING BOARD.**

*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1070 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# NRICH TASK

PROBLEM SCORING:
3 POINTS

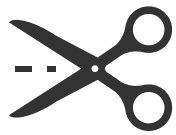


*BE PREPARED TO JUSTIFY YOUR SOLUTION.*

WHEN YOU HAVE SOLVED THIS PROBLEM, GO TO HISTORIC ROOM 1070 TO PRESENT YOUR SOLUTION TO THE MASTER TEACHER.

# NRICH TASK

THIS IS THE CUT-OUT PAGE.

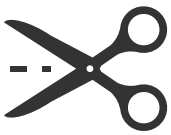


**HEADING CARDS**

| |
|---|
| PRIME NUMBERS |
| SQUARE NUMBERS |
| NUMBERS LESS THAN 20 |
| NUMBERS MORE THAN 20 |
| ODD NUMBERS |

| |
|---|
| TRIANGULAR NUMBERS |
| FACTORS OF 60 |
| MULTIPLES OF 3 |
| MULTIPLES OF 5 |
| EVEN NUMBERS |

# NRICH TASK

THIS IS THE CUT-OUT PAGE. 

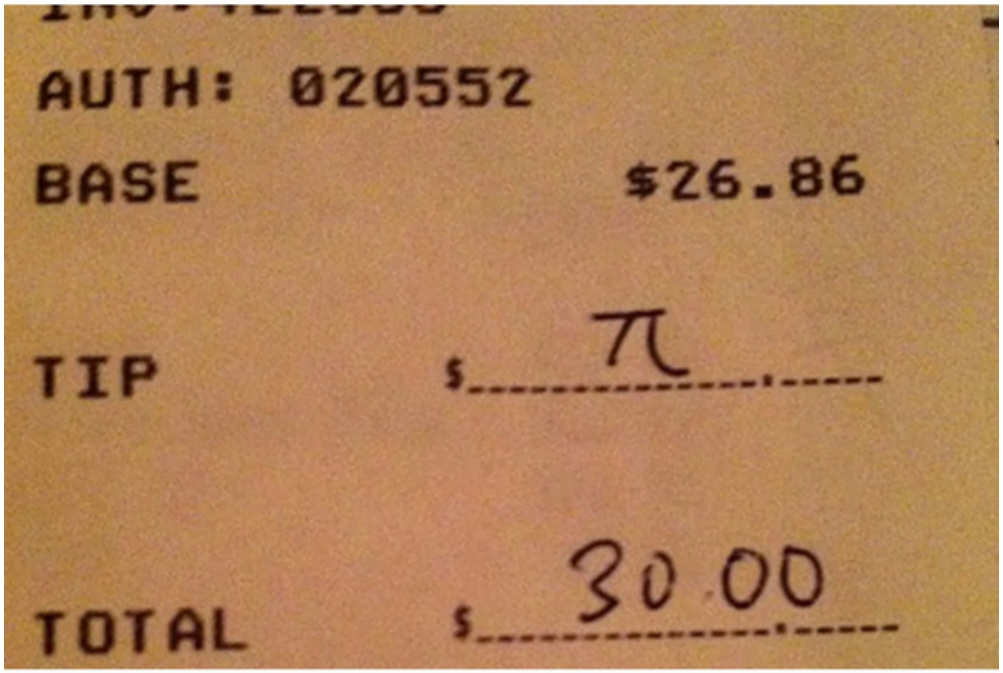
**NUMBER CARDS**

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 9 | 10 | 11 |
| 12 | 15 | 16 | 18 | 20 |
| 21 | 23 | 24 | 25 | 30 |
| 35 | 36 | 45 | 55 | 60 |

# TIE-BREAKER
# PI TIP

**THIS IS AN IMAGE OF A RECEIPT FLOATING ON THE INTERNET. A MATH GEEKS' DREAM TIP! BUT WAS THE SERVER PLEASED?**

**WHAT PERCENTAGE IS THE TIP OF THE BASE CHARGE?**




**ONCE YOUR TEAM SOLVES THE PROBLEM, YOUR SOLUTION SHOULD BE RETURNED TO THE TIEBREAKER ENVELOPE. THE COACH MONITORING YOUR TEAM WILL SEAL THE ENVELOPE AND SIGN THEIR NAME ACROSS THE SEAL. THE TEAM WILL BRING THE ENVELOPE TO THE AWARDS CEREMONY. THE RESULTS WILL BE REVEALED DURING THE CEREMONY. MOVE TO ROOM #1304 (AUDITORIUM) AT 12:15.**