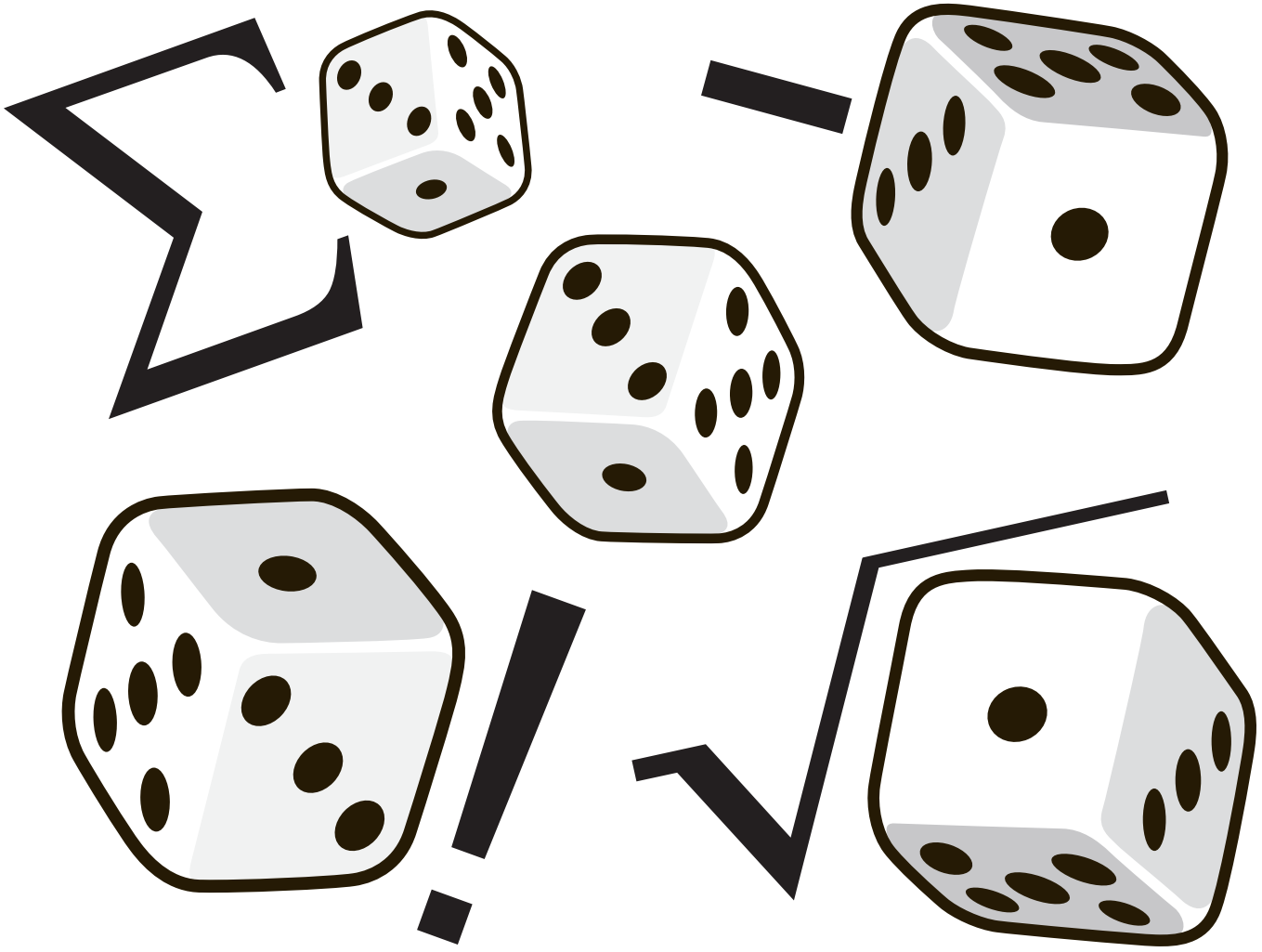
# Dice Activities for Mathematical Thinking

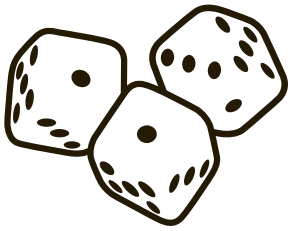
## Fluency • Understanding • Engagement



Mary Saltus and Chet Delani

# Square Number Chart – 1 to 144

| 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 |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |
| 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 |
| 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 |
| 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 |



# Prime Number Chart – 1 to 100

| 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 |

# Directions for Four in a Row Activities

**Objectives**

- Develop a working knowledge of the mathematical concepts of:
  - Square numbers
  - Square roots
  - Prime numbers
  - Factorials
  - Summations
  - Positive and negative integers
- Develop an awareness of an opponent's possible moves.
- Analyze an opponent's possible moves in order to develop a blocking strategy.
- Identify the role of luck versus skill in an activity using dice.
- Develop communication and cooperation skills by working in teams of two students.

Introduce the **Four in a Row** activities by demonstrating on an overhead and playing against the class. Two teams with two students on a team are suggested. Teams give students an opportunity to discuss moves and strategies and provide a check on correct computation.

### How to Play

- Teams toss die or dice, depending on the activity, and perform the required computation—operations differ for each activity. For example:

  *In the square root activities, if the sum of the two dice tossed is 7, then players look for the number for which 7 is the square root.*

  *In the factorial activities, if the sum of the two dice tossed is 5, then players look for 5!, or 120 (5! = 5 x 4 x 3 x 2 x 1 = 120).*
- Teams attempt to line up four tokens vertically, horizontally, or diagonally before the opposing team does.
- The first team to align four tokens in a row wins.

### Suggestions

- Before placing a token on the chart, team members explain how they arrived at a solution.
- If students are struggling with determining the closest square number or prime number, suggest that they refer to the Square Number Chart and Prime Number Chart on pages viii–ix.

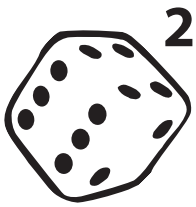
### Discussion

- This activity is similar to the games *Othello* and *Pente*, where defense is important. How does the toss of the dice influence strategy? Is this activity more a game of defense or offense?
- Does this activity involve more luck or skill?
- Keep a recording of each dice toss. Which combinations were tossed the most? The least?

# Four in a Row

## Square the Die Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.




**How to Play**

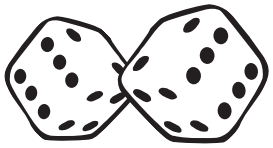
1. *Toss a die. Square the number (multiply the number by itself—for example, 7 × 7).*
2. *Place a token on the square number.*
3. *The first team to get 4 tokens in a row, vertically, horizontally, or diagonally, wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 36 | 1 | 16 | 25 | 9 | 4 | 16 |
| 25 | 9 | 36 | 1 | 4 | 16 | 1 |
| 1 | 16 | 4 | 9 | 25 | 26 | 4 |
| 4 | 25 | 9 | 16 | 36 | 1 | 25 |
| 9 | 36 | 1 | 4 | 16 | 25 | 9 |
| 16 | 4 | 25 | 36 | 1 | 9 | 36 |
| 25 | 9 | 16 | 1 | 36 | 4 | 25 |

# Four in a Row

## Square Two Dice Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.



**How to Play**

1. *Toss 2 dice. Find the sum. Square the sum (multiply the sum by itself—for example, 7 × 7).*
2. *Place a token on the square number.*
3. *The first team to get 4 tokens in a row, vertically, horizontally, or diagonally, wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 36 | 121 | 9 | 25 | 81 | 16 | 4 |
| 49 | 64 | 144 | 100 | 36 | 25 | 81 |
| 25 | 49 | 36 | 64 | 4 | 81 | 64 |
| 64 | 36 | 81 | 49 | 121 | 16 | 49 |
| 100 | 25 | 4 | 16 | 36 | 49 | 144 |
| 16 | 81 | 121 | 49 | 100 | 9 | 64 |
| 9 | 36 | 64 | 144 | 49 | 25 | 100 |

# Four in a Row

## One-Die Square Root Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

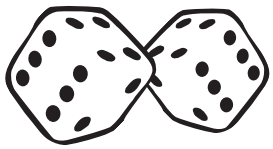
1. *Toss a die. The number tossed is the solution to which square root expression on the chart?*
2. *Place a token on that expression.*
3. *The first team to get 4 tokens in a row, vertically, horizontally, or diagonally, wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| $\sqrt{36}$ | $\sqrt{1}$ | $\sqrt{16}$ | $\sqrt{25}$ | $\sqrt{9}$ | $\sqrt{4}$ | $\sqrt{16}$ |
| $\sqrt{25}$ | $\sqrt{9}$ | $\sqrt{36}$ | $\sqrt{1}$ | $\sqrt{4}$ | $\sqrt{16}$ | $\sqrt{1}$ |
| $\sqrt{1}$ | $\sqrt{16}$ | $\sqrt{4}$ | $\sqrt{9}$ | $\sqrt{25}$ | $\sqrt{26}$ | $\sqrt{4}$ |
| $\sqrt{4}$ | $\sqrt{25}$ | $\sqrt{9}$ | $\sqrt{16}$ | $\sqrt{36}$ | $\sqrt{1}$ | $\sqrt{25}$ |
| $\sqrt{9}$ | $\sqrt{36}$ | $\sqrt{1}$ | $\sqrt{4}$ | $\sqrt{16}$ | $\sqrt{25}$ | $\sqrt{9}$ |
| $\sqrt{16}$ | $\sqrt{4}$ | $\sqrt{25}$ | $\sqrt{36}$ | $\sqrt{1}$ | $\sqrt{9}$ | $\sqrt{36}$ |
| $\sqrt{25}$ | $\sqrt{9}$ | $\sqrt{16}$ | $\sqrt{1}$ | $\sqrt{36}$ | $\sqrt{4}$ | $\sqrt{25}$ |

# Four in a Row

## Two-Dice Square Root Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.



**How to Play**

1. *Toss 2 dice. Find the sum. The sum is the solution to which square root expression on the chart?*
2. *Place a token on that expression.*
3. *The first team to get 4 tokens in a row, vertically, horizontally, or diagonally, wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| $\sqrt{36}$ | $\sqrt{121}$ | $\sqrt{9}$ | $\sqrt{25}$ | $\sqrt{81}$ | $\sqrt{16}$ | $\sqrt{4}$ |
| $\sqrt{49}$ | $\sqrt{64}$ | $\sqrt{144}$ | $\sqrt{100}$ | $\sqrt{36}$ | $\sqrt{25}$ | $\sqrt{81}$ |
| $\sqrt{25}$ | $\sqrt{49}$ | $\sqrt{36}$ | $\sqrt{64}$ | $\sqrt{4}$ | $\sqrt{81}$ | $\sqrt{64}$ |
| $\sqrt{64}$ | $\sqrt{36}$ | $\sqrt{81}$ | $\sqrt{49}$ | $\sqrt{121}$ | $\sqrt{16}$ | $\sqrt{49}$ |
| $\sqrt{100}$ | $\sqrt{25}$ | $\sqrt{4}$ | $\sqrt{16}$ | $\sqrt{36}$ | $\sqrt{49}$ | $\sqrt{144}$ |
| $\sqrt{16}$ | $\sqrt{81}$ | $\sqrt{121}$ | $\sqrt{49}$ | $\sqrt{100}$ | $\sqrt{9}$ | $\sqrt{64}$ |
| $\sqrt{9}$ | $\sqrt{36}$ | $\sqrt{64}$ | $\sqrt{144}$ | $\sqrt{49}$ | $\sqrt{25}$ | $\sqrt{100}$ |

# Four in a Row

## Positive and Negative Numbers Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

***Green die = positive number***
***Red die = negative number***

**How to Play**

*1. Toss a green die and a red die. Compute the sum or difference.*
*Example: green die = 3, red die = 5. Compute: (+3) + (–5) = –2.*
*2. Place a token on the positive or negative integer.*
*3. The first team to get 4 tokens in a row, vertically, horizontally, or diagonally, wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| +3 | –4 | +1 | +4 | –1 | –3 | +2 |
| –3 | –1 | –2 | 0 | +1 | +5 | –4 |
| –5 | 0 | +2 | –1 | +2 | –2 | +3 |
| +4 | +1 | 0 | –2 | –3 | –1 | 0 |
| –1 | +4 | –2 | +3 | –4 | 0 | +5 |
| 0 | +2 | +1 | –3 | 0 | +3 | –1 |
| +1 | –5 | –2 | 0 | +2 | –4 | +1 |

# Directions for Square Off Activities

**Objectives**

- Develop a working knowledge of the mathematical concepts of:
  - Square numbers
  - Square roots
  - Prime numbers
  - Factorials
  - Summations
  - Positive and negative integers
- Develop an awareness of an opponent's possible moves.
- Analyze an opponent's possible moves in order to develop a blocking strategy.
- Identify the role of luck versus skill in an activity using dice.
- Develop communication and cooperation skills by working in teams of two students.

Introduce the **Square Off** activities by demonstrating on an overhead and playing against the class. Two teams with two students on a team are suggested. Teams give students an opportunity to discuss moves and strategies and provide a check on correct computation.

### How to Play

- Each team tosses a die. The higher number goes first.
- Teams toss die or dice and perform the required computation—operations differ for each activity.
- Teams attempt to arrange four tokens to form any size square, 2-by-2, 3-by-3, 4-by-4, and so on. Orientation of the square can be on the diagonal.
- The first team to form three squares wins.

### Suggestions

- Before placing a token on the chart, team members explain how they arrived at a solution:

  Examples:

  Seven squared equals $7 \times 7 = 49$

  $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$
- If students are struggling with determining the closest square number or prime number, suggest that they refer to the Square Number Chart and Prime Number Chart on page viii–ix.

### Discussion

- Is this more a game of luck or skill?
- Is there more opportunity in **Square Off** than in **Four in a Row** or **Cross Over** to play defensively—that is, to prevent the opposing team from forming a square?
- Which of the three activities—**Square Off**, **Four in a Row**, or **Cross Over**—offers more opportunities to block the other team? Why is that?
- What math or strategies have you and your team partner learned from each other?
- Would you prefer to play these games with a partner or without? Why?

# Square Off One-Die Factorial (!) Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

$1! = 1$ $\quad 2! = 2 \times 1$

$3! = 3 \times 2 \times 1$ $\quad 4! = 4 \times 3 \times 2 \times 1$

$5! = 5 \times 4 \times 3 \times 2 \times 1$ $\quad 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$

**How to Play**

1. *Toss a die.*
2. *Place a token on the factorial of the number tossed.*
3. *Teams attempt to place tokens to form a square. Squares can be 2-by-2, 3-by-3, 4-by-4, and so on. Orientation of the square can be on the diagonal.*
4. *The first team to place tokens forming 3 squares wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 720 | 1 | 24 | 120 | 6 | 2 | 24 |
| 120 | 6 | 720 | 1 | 2 | 24 | 1 |
| 1 | 24 | 2 | 6 | 120 | 720 | 2 |
| 2 | 120 | 6 | 24 | 720 | 1 | 120 |
| 6 | 720 | 1 | 2 | 24 | 120 | 6 |
| 24 | 2 | 120 | 720 | 1 | 6 | 720 |
| 120 | 6 | 24 | 1 | 720 | 2 | 120 |

# Square Off

## One-Die Summation (∑) Chart

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

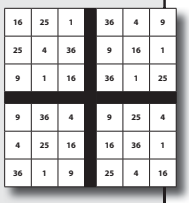
**How to Play**

1. *Toss a die. Place a token on the* ***summation (∑)*** *of the number tossed.*
   $\sum 1 = 1$ $\sum 2 = 2 + 1$ $\sum 3 = 3 + 2 + 1$
   $\sum 4 = 4 + 3 + 2 + 1$ $\sum 5 = 5 + 4 + 3 + 2 + 1$ $\sum 6 = 6 + 5 + 4 + 3 + 2 + 1$
2. *Teams attempt to place tokens to form a square. Squares can be 2-by-2, 3-by-3, 4-by-4, and so on. Orientation of the square can be on the diagonal.*
3. *The first team to place tokens forming three squares wins.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 21 | 1 | 10 | 15 | 6 | 3 | 10 |
| 15 | 6 | 21 | 1 | 3 | 10 | 1 |
| 1 | 10 | 3 | 6 | 15 | 21 | 3 |
| 3 | 15 | 6 | 10 | 21 | 1 | 15 |
| 6 | 21 | 1 | 3 | 10 | 15 | 6 |
| 10 | 3 | 15 | 21 | 1 | 6 | 21 |
| 15 | 6 | 10 | 1 | 21 | 3 | 15 |

# Directions for Tic-Tac-Toe/ Four-Grid Tic-Tac-Toe Activities

## Objectives



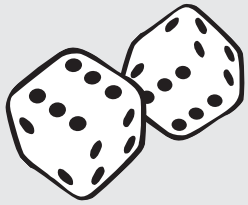

- Develop a working knowledge of the mathematical concepts of:
  - Square numbers
  - Square roots
  - Prime numbers
  - Factorials
  - Summations
  - Positive and negative integers
- Analyze an opponent's possible moves in order to develop a blocking strategy.
- Identify the role of luck versus skill in an activity using dice.
- Develop communication and cooperation skills by working in teams of two students.
- Provide an opportunity for reflection and self-correction through teamwork.

**Tic-Tac-Toe** is a familiar game form. These Tic-Tac-Toe activities provide a challenging and playful variation to use in mastering powerful and important math concepts.

**The Tic-Tac-Toe** activity is paired with a **Four-Grid Tic-Tac-Toe** activity providing a way to diversify while reinforcing specific mathematical concepts. This presents opportunities for students to practice playing **Tic-Tac-Toe** with each of the mathematical concepts before moving on to the more complicated **Four-Grid Tic-Tac-Toe**.

### How to Play: Tic-Tac-Toe Activity

- Introduce the **Tic-Tac-Toe** activity by demonstrating on an overhead and playing against the class.
- Two teams with 2 students on a team are suggested. Teams give students an opportunity to discuss moves and strategies and provide a check on correct computation.
- Decide which team will use the X and which will use the O.
- Each team chooses a token and tosses a die. The higher number goes first.
- Teams toss a die or dice and perform the required computation. Operations differ for each activity.
- With each toss of the die or dice, the teams attempt to place their tokens in continuous alignment vertically, horizontally, or diagonally to win the game.
- If the solution is not shown on the grid or already has a token on it, the team loses a turn.
- The first team to form a Tic-Tac-Toe vertically, horizontally, or diagonally wins.
- The team winning 2 out of 3 games is the winner.



### Suggestions

- Before placing a token on the chart, team members explain how they arrived at a solution. For example:

  "Seven squared is 7 × 7, which equals 49."

  "Five factorial (5!) is 1 × 2 × 3 × 4 × 5, or 120."
- If students are struggling with determining the closest square or prime number, suggest that they refer to the Square Number and Prime Number Charts on pages viii–ix.

### Variations

- Teams place a token on every box where the solution appears.
- A team replaces the opposing team's token with their own.

### Discussion

- Does the person who goes first have an advantage?
- Is this a game of luck or skill? Does the dice toss influence your strategy?
- Does the dice toss influence the outcome of the game?
- Is there a fair chance of each solution being tossed?

### How to Play: Four-Grid Tic-Tac-Toe Activity

- Introduce the Four-Grid Tic-Tac-Toe activity by demonstrating on an overhead and playing against the class.
- Each team chooses a token and tosses a die. The higher number goes first.
- Teams toss a die or dice and perform the required computation. Operations differ for each activity.
- Teams locate the solution on any of the four Tic-Tac-Toe grids and place a token on only one of the solutions.
- With each toss of the die or dice, teams attempt to place their tokens in continuous alignment vertically, horizontally, or diagonally, forming as many Tic-Tac-Toe wins as possible.
- If the solution is not shown on any of the grids or already has a token on it, the team loses a turn.
- When no more plays are possible, the teams count their Tic-Tac-Toe wins. The team with the most Tic-Tac-Toes wins.

### Variation

- Teams place a token on every box where the solution appears on all four Tic-Tac-Toe grids.
- Opposing teams agree to use the same strategy to see what happens.
- Opposing teams agree to each use a different strategy to see what happens.

### Discussion

- What was your strategy in trying to win? Were you playing offensively or defensively? Did you play on one grid at a time, or did you try to play on all four grids simultaneously?
- Which strategy works best: trying to get the most three tokens in a row or trying to block your opponent?
- Discuss what would happen if both teams used the same strategy throughout the game.
- Discuss what might happen if opposing teams let each other know whether they would play offensively or defensively.

# Square the Die Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

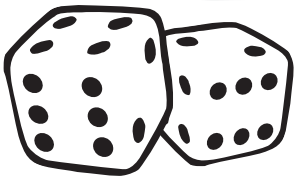
1. *Toss a die.* ***Square*** *the number (multiply the number by itself—for example, 3 × 3).*
2. *Place a token on the square number.*
3. *If a number is taken, lose a turn.*
4. *The first team to get three tokens in a row wins the game.*
5. *Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| **36** | **25** | **16** |
| **4** | **9** | **4** |
| **25** | **16** | **1** |

# Square Two Dice Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

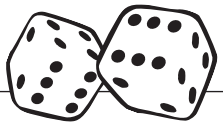


1. *Toss 2 dice. Find the sum.*
2. *Square the sum (multiply the sum by itself—for example, 7 × 7).*
3. *Place a token on the square number.*
4. *If the number is taken, lose a turn.*
5. *The first team to get three tokens in a row wins the game.*
6. *Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| **36** | **25** | **121** |
| **64** | **49** | **9** |
| **100** | **16** | **81** |

# Closest Square Number

## Tic-Tac-Toe



1. *Toss 2 red dice and find the sum. Toss 2 green dice and find the sum.*
2. *Multiply the sum of the red dice by the sum of the green dice.*
3. *Place a token on the square number closest to the product.*
4. *If the number is taken, lose a turn.*
5. *The first team to get three tokens in a row wins the game.*
6. *Play 3 games. The team winning 2 out of 3 games wins.*

**How to Play**

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

| | | |
|---|---|---|
| **36** | **25** | **121** |
| **64** | **49** | **9** |
| **100** | **16** | **81** |

# One-Die Square Root Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

1. *Toss a die. The tossed number is the solution to which square root expression? Find it on the chart.*
2. *Place a token on that expression.*
3. *If the expression is taken, lose a turn.*
4. *The first team to get three tokens in a row wins the game.*
5. *Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| $\sqrt{36}$ | $\sqrt{25}$ | $\sqrt{16}$ |
| $\sqrt{4}$ | $\sqrt{9}$ | $\sqrt{4}$ |
| $\sqrt{25}$ | $\sqrt{16}$ | $\sqrt{1}$ |

# Two-Dice Square Root Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

1. *Toss the dice. Find the sum.*
2. *The sum is the solution to which square root expression? Find it on one of the grids.*
3. *Place a token on that expression.*
4. *If the square root expression is taken, lose a turn.*
5. *The first team to get three tokens in a row wins the game.*
6. *Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| $\sqrt{36}$ | $\sqrt{25}$ | $\sqrt{121}$ |
| $\sqrt{64}$ | $\sqrt{49}$ | $\sqrt{9}$ |
| $\sqrt{100}$ | $\sqrt{16}$ | $\sqrt{81}$ |

# Die × Die + or –1 Prime Number Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

*1. Toss 2 dice. Find the product. Either add 1 to the product or subtract 1 from the product.*

*2. If that number is a prime number, place a token on the number.*

*3. If the number is not prime, or the prime number has a token on it, lose a turn.*

*4. The first team to get three tokens in a row wins the game.*

*5. Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| 7 | 13 | 29 |
| 2 | 11 | 5 |
| 3 | 23 | 19 |

# One-Die Factorial (!)

## Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

*1. Toss a die.*

*2. Place a token on the factorial of the number tossed.*

$1! = 1$ $2! = 2 \times 1$ $3! = 3 \times 2 \times 1$

$4! = 4 \times 3 \times 2 \times 1$ $5! = 5 \times 4 \times 3 \times 2 \times 1$ $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$

*3. If the factorial has a token on it, lose a turn.*

*4. The first team to get three tokens in a row wins the game.*

*5. Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| **720** | **120** | **24** |
| **2** | **6** | **2** |
| **120** | **24** | **1** |

# Tic-Tac-Toe

## One-Die Summation (Σ)

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.

**How to Play**

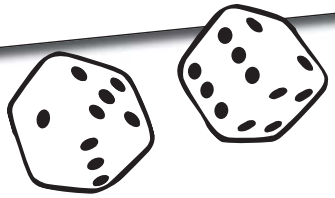
1. *Toss a die. Place a token on the* ***summation (Σ)*** *of the number tossed.*
   $\Sigma 1 = 1$ $\Sigma 2 = 2 + 1$ $\Sigma 3 = 3 + 2 + 1$
   $\Sigma 4 = 4 + 3 + 2 + 1$ $\Sigma 5 = 5 + 4 + 3 + 2 + 1$ $\Sigma 6 = 6 + 5 + 4 + 3 + 2 + 1$
2. *If the* ***summation*** *is already taken, lose a turn.*
3. *The first team to get three tokens in a row wins.*
4. *Play 3 games. The team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| **21** | **15** | **10** |
| **3** | **6** | **3** |
| **21** | **10** | **1** |

# Positive and Negative Numbers

## Tic-Tac-Toe

- Each team tosses a die.
- Higher number goes first.
- Each team chooses a color token.



**How to Play**

1. *Toss a green die and a red die. Compute the sum or difference. Example: green die = 3, red die = –5. Compute: (+3) + (–5) = –2.*
2. *Place a token on the number.*
3. *If the number is not available, lose a turn.*
4. *First team to get three tokens in a row wins the game.*
5. *Play 3 games. Team winning 2 out of 3 games wins.*

| | | |
|---|---|---|
| **–2** | **+1** | **–3** |
| **+3** | **0** | **+2** |
| **–4** | **+5** | **–1** |