

Michigan League of Academic Games  
**GUIDE TO BASIC EQUATIONS**

**MATERIALS**

|                            |  |
|----------------------------|--|
| Playing mat (see diagram), | one-minute timer, 24 cubes (6 of each color) |
| Red 0, 1, 2, 3, +, -       | Blue 0, 1, 2, 3, x, ÷                        |
| Green 4, 5, 6, *, x, -     | Black 7, 8, 9, √, +, ÷                       |

|           |           |          |
|-----------|-----------|----------|
| RESOURCES |           |          |
| FORBIDDEN | PERMITTED | REQUIRED |

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GOAL

**EXPONENTS AND ROOTS**

In the game of Equations, the \* or ^ cube is used to represent the exponent operation. (Note: older games used the \* symbol, newer versions use the ^ symbol.)  $5^2$  is represented as  $5 * 2$  or  $5 ^ 2$  and has a value of 25. If the ^ symbol is used, the only acceptable orientation of the ^ is upward, not sideways or pointing down.

The √ symbol is used for the root operation.  $\sqrt{81}$  represents the square root of 81 and has a value of 9. The expression  $4 \sqrt{81}$  represents the fourth root of 81 and has a value of 3.

**NOTE:** In the Minor and Elementary divisions (grade 6 and below) version of Equations, the following rules apply:

If \* or ^ is used for raising to a power, both base and power must be whole numbers (0, 1, 2, 3, 4, ...). If √ is used for the root operation, the index must be a counting number (1, 2, 3, 4, ...) and the base and total value must be whole numbers.

**ROLLING FOR FIRST**

Two or three player games will be played. All players roll a red cube to determine who goes first. If a player rolls an operation, that player is out and does not reroll. The player with the highest number is the Goal Setter. If there is a tie for first place only, those players will roll again. After first is determined, the play continues clockwise. The player to the left of the Goal Setter is next.

### BEGINNING A SHAKE

A shake consists of rolling the cubes, setting the Goal, and moving cubes until a Challenge is made and settled or the last cube is moved to the board (see Last Game Procedure). A shake begins as soon as the stall for rolling the cubes (turning the timer over and announcing “stall”) or a player has picked up the cubes to roll them. Once the cubes are rolled to form the Resources for the shake, no player may alter the face of the cubes nor obstruct the other players’ view of any cubes remaining in Resources. If cubes fall outside the Resources area of the playing mat when rolled, only the Goal Setter can carefully move them into the Resources section, taking care not to turn over any cubes.

### SETTING THE GOAL

The Goal Setter will roll all 24 cubes and set the goal.

The goal may be:

- a single digit number - ex 8
- a two digit number – ex 23
- a three digit number – ex 345
- an expression - ex  $3 \times 4$  ex  $(4 \times 5) + 2$
- to show the use of parentheses on the Goal line, leave a space between the groupings – ex  $4 \times 5 + 2 = (4 \times 5) + 2$
- The goal may not contain more than 6 cubes.
- The Goal setter has 2 minutes to set the Goal.
- Once a cube touches the Goal line, it cannot be moved back to Resources. The Goal Setter may rearrange the cubes.
- When finished, the Goal Setter will say “goal set”.
- If the two minute time limit expires, the Goal is considered set.

### ORDER OF OPERATIONS

In Basic Equations, order of operations is used to interpret a Goal or Equation. The order is parentheses first, roots and exponents (moving left to right), multiplication and division (moving left to right), and addition and subtraction (moving left to right). It is the responsibility of the Goal Setter and Equation Writer to ensure parentheses are added as needed.

### MAKING A MOVE

The player to the left of the Goal Setter is the first mover. That player has 2 minutes to make a move or challenge. This will give the mover time to study the Resources and write possible solutions for the Goal. The mover will move a cube to one of the three areas of the playing mat.

| FORBIDDEN | PERMITTED | REQUIRED |
|-----------|-----------|----------|
|           |           |          |

Forbidden – Cubes in this area **may not** be used in a Solution.

Permitted – Cubes in this area **may** be used in a Solution.

Required - Cubes in this area **must** be used in a Solution.

### **BONUS MOVE**

A player may choose to make a bonus move and move 2 cubes on his turn. The player should say "Bonus" before moving. The first cube moved must go to Forbidden. The second cube can be moved anywhere on the board (Forbidden, Permitted, Required, or the Goal).

### **TIME LIMITS FOR MOVES**

The first player after the Goal is set has 2 minutes to make a move or challenge. All players after the first have a 1 minute time limit.

### **ILLEGAL PROCEDURE**

A move that violates a procedure is labeled an illegal procedure. Examples include: moving out of turn, moving two cubes without calling Bonus.

The player who charges Illegal Procedure must specify what caused the Illegal Procedure within 15 seconds. The Mover must correct the error within 10 seconds (ex. return the cube(s) to Resources and, if necessary, make another move). There is no penalty assessed.

If another legal move has been made before the Illegal Procedure is noticed, that move insulates the Illegal Procedure and play continues.

### **CALLING A CHALLENGE**

The game stops when a Challenge has been made.

- You do not have to wait for your turn to challenge.
- The only player who cannot challenge is the player who made the last move. If a player challenges himself, the incorrect challenge is set aside and the shake continues.
- The third player must declare which player he agrees with before the two minute time allowed to write Equations expires. If the third player agrees with a player who has to write an Equation, he must also present his Equation at the end of the second minute. This player may indicate his intention by stating if he is or is not presenting an Equation, by stating whether he agrees with the Mover or the Challenger, or presenting or not presenting an Equation.
- A flub ball (challenge block) will be placed equidistant from all players. To challenge, a player must pick up the ball. If he has not picked up the ball, he has not challenged.
- The Challenger **must** pick up the "challenge block" or "flub ball" and state his challenge. If both players challenge at the same time, the player with the "flub ball" in his hand is the Challenger.
- A player must not pick up the "flub ball" unless he intends to challenge. If a player does not specify a legitimate challenge, a one point penalty is enforced and play continues.
- The Challenge block or flub ball should not be picked up for any reason but to challenge. If it is necessary to move the flub ball closer to all players, they should move it with a pencil and/or announce their intention.

### **CHALLENGES**

**IMPOSSIBLE**- Call this challenge when you believe a Solution cannot be made.

- The Mover has the burden of proof and must write a Solution.
- If the Joiner agreed with the Mover, he also has to write a Solution.
- Solution writers have two minutes to write and present an Equation.

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- Equations must be written in the form Solution = Goal or Goal = Solution. The writer must include all grouping symbols (parentheses, brackets, etc.) in his Equation.

**NOW** – Call this challenge when you believe a Solution can be written with the cubes available on the board and at most, one more cube from Resources.

- The Challenger has the burden of proof and must write an Equation.
- The third player may choose to write an Equation within the two minute writing time.
- Equation writers have two minutes to write an Equation.

Note - Do not call Now if there are one or fewer cubes left in Resources. If a player calls Now with one or fewer cubes in Resources, it is set aside , and play continues. (See Last Cube Played)

### WRITING AND CHECKING AN EQUATION

After a valid Challenge, at least one player must write an Equation.

- After a Now Challenge, the Challenger must write an Equation. The Mover may not present an Equation.
- After an Impossible Challenge, the Mover must write an Equation. The Challenge may not present an Equation.
- In a three player match, the Third Party must decide whether to agree with the Challenger or the Mover. If the player with who the Third Party agrees must write an Equation, then the Third party must also write an Equation.
- The Third Party must indicate by the end of the two minutes for writing Equations whether she is presenting an Equation. The Third Party may not retract her declaration once she has indicated whether or not she will present an Equation.
- The Third Party may indicate by stating whether or not he will present an Equation, by indicating which party (Mover or Challenger) he agrees with, either verbally or by pointing to the party, or by presenting or not presenting an Equation when the time for writing Equations expires.

To be correct, a Solution must be a legal expression that satisfies the following criteria.

- The Solution must be part of a complete Equation in this form:

$$\text{Solution} = \text{Goal}$$

Note: This is the recommended form but the form Goal = Solution will be accepted.

- The Solution must equal the interpretation of the Goal, using Order of Operations.
- The Solution uses the cubes correctly
  - The solution contains at least two cubes.
  - The solution uses all the cubes in Required.

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- The Solution uses no cubes in Forbidden.
- The Solution may use one or more cubes from Permitted.
- After a Now challenge, the Solution must contain at most one cube from Resources.
- After an Impossible challenge, any cube in Resources may be used in the Solution.
- The Solution contains only one digit numerals.
- All Equations must be presented before any is checked.
  - Once a player presents an Equation to the opponents, she may make no further corrections or additions, even if the time for writing Equations has not expired.
  - Each Equation writer must circle the Equation to be checked. A writer who forgets to circle the Equation must do so immediately when asked by an opponent.

Within the time for checking an Equation, opponents must accept or reject the Equation. If the Equation is rejected, an opponent must show that it violates at least one of the criteria listed below. An Equation is correct if not opponent shows that it is incorrect.

In a three player match, a player who does not present an Equation for a shake scores 2 if he accepts another player's Equation as correct and that Equation is proven wrong by the other player.

All Equations are in writing. Players must not physically move the cubes from Required, Permitted, Forbidden and Resources to form the Equation to be checked. This causes arguments over where each cube was played.

A player who claims an opponent's Equation is not correct must give at least one of the following reasons.

- The Goal has no legal interpretation
  - The Goal contains more than six cubes
  - The Goal contains a four or more digit number.
  - The Goal is mathematically impossible. ex  $7 \div 0$
  - The Goal is not allowed. ex Elem/ Minor  $3 \sqrt{9}$
- The Solution does not equal the Goal.

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- The Equation writer did not use appropriate cubes based on their placement on the playing mat. (ex did not use a 5 in Required, used a x when all x cubes were placed in Forbidden)
- The solution uses less than 2 cubes.
- The Equation writer used cubes that were not available.

One or both of the checkers may ask a judge to determine whether the Solution equals the Goal. However, no further objections to the Equation will be allowed even if the time limit for checking has not expired.

### LAST CUBE PROCEDURE

- If one cube remains in Resources, the next Mover must either play that cube to Required or Permitted or challenge Impossible.
- When the cube has been moved, each player has two minutes to write an Equation.
- The last cube in Resources may not be moved to Forbidden. If a player does so, any challenge that is made is set aside and the cube is returned to Resources. There is no penalty.
- An opponent may challenge Impossible against the player who moved the last cube from Resources to Required or Permitted provided the challenge is made by the end of the first minute for writing Equations. If the challenge is made, the Mover (and the Third Party if siding with the Mover) has the rest of the original two minutes to write an Equation.
- An Impossible challenge made after the first minute is an illegal procedure and is set aside.

**SCORING**

|                                  |       |                       |                             |       |
|----------------------------------|-------|-----------------------|-----------------------------|-------|
| Challenger correct               | 6 pts |                       | Mover correct               | 6 pts |
| Challenger wrong                 | 2 pts |                       | Mover wrong                 | 2 pts |
|                                  |       |                       |                             |       |
| Joiner correct (with Challenger) | 4 pts | Joiner wrong<br>2 pts | Joiner correct (with Mover) | 6 pts |
| Last Cube Procedure              | 4 pts |                       | Last Cube Procedure         | 2 pts |
| Equation correct                 |       |                       | Equation incorrect          |       |

**TIME LIMITS**

|   |            |
|---|------------|
| Rolling cubes and Setting the Goal  | 2 minutes  |
| First move after Goal is set  | 2 minutes  |
| All other moves   | 1 minute   |
| Stating a valid challenge after picking up flub ball                            | 15 seconds |
| Deciding whether to challenge Impossible when no more cubes remain in Resources | 1 minute   |
| Writing a Equation  | 2 minutes  |
| Checking each Equation  | 2 minutes  |

**TOURNAMENT SCORING**

At the end of a 30 minute round, the tournament official will call a 5 minute warning. At that time, finish the shake you are playing but do not start another shake. A shake is considered to be started if the cubes have been rolled.

After 5 minutes, the tournament director will announce that the round is now over. At that time, if a game has not ended in a Challenge, each player has two minutes to write a Equation for the Goal using all Required cubes and any other available cubes. A correct Equation will score 4 points; an incorrect Equation will score 2 points.

When the last challenge or last cube has been played and scored, the players will total their scores. The player with the highest score receives 6 team points, the second place will receive 4 points, and the low score receives 2 points. This method will equalize the different raw scores at each table. The raw score varies depending on the number of shakes played.

The three players are splitting a total of 12 points. A two player game will split 10 points.

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**SCORING CHART**

|                      | HIGH RAW SCORE | MIDDLE RAW SCORE | LOW RAW SCORE |
|----------------------|----------------|------------------|---------------|
| ALL DIFFERENT SCORES | 6              | 4                | 2             |
| TIE FOR FIRST PLACE  | 5              | 5                | 2             |
| TIE FOR SECOND PLACE | 6              | 3                | 3             |
| THREE WAY TIE        | 4              | 4                | 4             |
| 2 PLAYER GAME        | 6              | 4                |               |
| 2 PLAYER TIE         | 5              | 5                |               |