Michigan Leagues of Academic Games
Senior Equations Variations Odd Year

The following two variations will be in effect for every shake:

Sideways Cube: A cube representing a non-zero number may be used sideways in the Goal or a Solution to equal the reciprocal of the number it represents

Upside-Down Cube: In the Goal or a Solution, any numeral may be used upside-down to equal the additive inverse of the number represented by that numeral

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The following may be used in September and October

0 or x Wild: The 0 or x cube may represent any symbol on the cubes, but it must represent the same symbol everywhere it occurs (Goal and Solution). Each Equation-writer must specify in writing the interpretation of the 0 or x cube if it stands for anything other than itself in the Equation. The player selecting this variation specifies whether 0 or x (but not both) is wild for the shake.

Factorial (!): There are two occurrences of the factorial operator (!) available to be used in the Solution and/or the Goal as the Equation-writer chooses to use them. All uses of ! in the Equation must be in writing. *However, if Multiple of k is also chosen for the shake, no factorial may be placed in the Goal.*

Multiple Operations: Every operation sign in Required or Permitted may be used many times in any Solution. If the Factorial variation is also chosen for the shake, an unlimited number of factorial operators may be used in each Solution. At most two factorials may be used in the Goal.

Any Color Exponent: Any numeral on a ___ cube may be used as an exponent without being accompanied by an * (or ^) cube. The player selecting this variation chooses a color: red, blue, green, or black (for example, "Red Exponent").

Base m: Both the Goal and the Solution must be interpreted as base m expressions, where the player choosing this variation specifies m for the shake as eight, nine, ten, eleven or twelve. Two-digit numerals are allowed in Solutions. For bases eleven and twelve, * (or ^) may be used for the digit ten; in base twelve, √ may be used for the digit eleven.

Powers of the Base: 1 (one) may represent any integral power of ten. (If 1 is used in a two-digit numeral, it stands for 1.) If Base m is also chosen, 1 represents any integral power of m.

Number of Factors: xA means "the number of counting number factors of A," where A is a counting number.

Add to Goal: On his turn, instead of a regular move, a player may physically add a cube to the Goal.

The following may be added in November

Multiple of k: A Solution must not equal the Goal but must differ from the Goal by a non-zero multiple of k, where the player choosing this variation specifies k for the shake as a whole number from six to twelve, inclusive.

AB+: The Goal and/or Solution may be or may include a three-cube expression of the form AB+, which is interpreted as a repeating decimal, either as .ABABAB… or as .ABBBBB. When the form AB+ is used in a Solution, the writer must indicate, in either decimal or fractional form, which interpretation of AB+ is being used in the Solution.

Decimal in Goal: Each Equation-writer may determine where decimal points occur in the Goal. Any decimals must be indicated in writing when the Equation is presented. Three consecutive digits may be placed in the Goal, but a decimal point must be placed in front of them, between two of them, or after the third digit in the Goal of any Equation.

Imaginary |(sideways minus) shall represent the imaginary number I (such that i^2 = -1) | may be placed immediate before or immediately after a numeral without the x sign. When this variation is selected, all roots of a^b where a is a complex number and b is a rational number are available. Note: This variation may be chosen even if no – signs (or wild cubes) are in Resources.

÷ as log: ·|· (sideways ÷) represents the log operation. Thus, if A and B are positive real numbers (b ≠ 1), A ·|· B equals $\log_B A$. A sideways ·|· sign means that log must be used; a normal ÷ sign is ambiguous and can be log or normal division.