

## **MIDDLE** Equations® Variations 2018-19

1. Sideways A cube representing a non-zero number may be used sideways in the Goal or Solution to equal the reciprocal of that number.
2. Upside-down A cube representing a number may be used upside-down in the Goal or Solution to equal the additive inverse of that number.
3. 0 Wild The 0 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 cube if it stands for anything other than 0 in the Equation.
4. 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.
5. Multiple Operations Any operation sign not in Forbidden (or the Goal) 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.
6. 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, or ten. Two-digit numerals are allowed in Solutions.
7. Multiple of  $k$  A Solution must not equal the Goal but must differ from the Goal by a non-zero integer multiple of  $k$ , where the player choosing this variation specifies  $k$  for the shake as a whole number from six to eleven, inclusive. The Goal must not be greater than  $1000_{\text{ten}}$  or less than  $-1000_{\text{ten}}$ .
8. Number of Factors  $x_A$  means “the number of counting number factors of  $A$ ,” where  $A$  is a counting number and  $A$  is less than or equal to  $1000_{\text{ten}}$ .
9. Exponent Any numeral on a \_\_\_ cube may be used as an exponent without being accompanied by an \* (or ^) cube. The player selecting this variation fills the blank in the previous sentence with one of the colors red, blue, green, or black.
10. 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  $m$ .

**DO NOT MARK THIS SHEET!**