

# MBMT Mathematical Conventions

March 30, 2019

## 1 Vocabulary

1. An integer is a whole number that can be zero, negative, or positive. The integers are  $\dots, -2, -1, 0, 1, 2, \dots$
2. A circle is *inscribed* in a shape if it touches each side of the shape at exactly one point and is inside the shape. A circle that is inscribed in a triangle is called the triangle's *incircle*. A circle is *circumscribed* about a shape if each vertex of the shape lies on the circle. A circle that is circumscribed about a triangle is called the triangle's *circumcircle*.
3. The multiples of a positive integer  $k$  are numbers of the form  $mk$  where  $m$  is an integer. The factors or divisors of a positive integer  $k$  are the positive integers  $d$  such that  $k/d$  is an integer.
4. A prime number is a positive integer that has exactly two factors: 1 and itself.
5. If two numbers or objects are selected independently and at random, this means that they are selected at random, and that how one is selected doesn't affect how the other is selected.
6. A real number is a rational number or an irrational number.  $-1$ ,  $2.5$ , and  $\pi$  are all real numbers. Unless you've learned about complex numbers, every number you know of is a real number.

## 2 Notation

1. Given a sequence,  $a_n$  denotes the  $n$ th term of the sequence, where  $n$  is a positive integer. For example, in the sequence  $1, 1, 2, 3$ ,  $a_1 = 1$ ,  $a_2 = 1$ ,  $a_3 = 2$ , and  $a_4 = 3$ .
2.  $n!$  refers to the product of all positive integers up through  $n$ . For example,  $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ .
3. Certain questions will ask for an answer as an ordered pair, ordered triple, or ordered  $k$ -tuple, where  $k$  is a positive integer. Ordered  $k$ -tuples are entities of the form  $(a, b, c, \dots)$ , where there are  $k$  numbers in total. Ordered pairs are ordered 2-tuples, and ordered triples are ordered 3-tuples. Any answer in the form of an ordered  $n$ -tuple **MUST** include the parentheses and commas.
4. In a geometry problem, the notation  $AB$  can refer to either line  $AB$  or the distance between  $A$  and  $B$ . **This is in contrast to definitions taught in school.**

5. An overline such as  $\overline{ABCD}$  denotes the number with digits  $A$ ,  $B$ ,  $C$ , and  $D$ . For example, if  $A = 1$ ,  $B = 2$ ,  $C = 3$ , and  $D = 4$ , then  $\overline{ABCD} = 1234$ .

### 3 Answer Forms

We will accept any answer which is reasonably simplified and correct. “Reasonably simplified” means that a very large amount of computation must be performed to reach an objectively simpler form. Examples of acceptable answers are

- 984
- 1000
- $10^{74}$
- $1/2$  or 0.5
- $\sqrt{2}/2$  or  $1/\sqrt{2}$
- $7^{24}$
- 2018!

Examples of unacceptable answers are

- $24 \times 41$
- $10^3$
- $2/4$
- $\sqrt{8}/4$
- $49^{12}$
- $2019!/2019$

If there is debate among graders as to whether an answer is reasonably simplified, it will usually be resolved in the favor of the contestant. **The important thing to keep in mind is that some problems may have answers which are not feasibly computable, like  $7^{24}$ .**