# COMMON MATHEMATICAL NOTIONS

1. Answers should be exact and simplified. For more information on valid answer formats, see the Acceptable Answer Formats document.
2. On the Power Round, the word *compute* only calls for an answer; no explanation or proof is needed. Unless otherwise stated, all other questions require explanation or proof.
3. If a diagram is given with a problem, it is not necessarily drawn to scale.
4. In a triangle ABC, the vertices are called $A$, $B$, and $C$. The sides are called $a$, $b$, and $c$, with side $a$ opposite vertex $A$, side $b$ opposite vertex $B$, and side $c$ opposite vertex $C$. If a polygon is called $ABCDEF$, its vertices will occur in that order around the polygon. This convention holds for all namings of polygons.
5. Unless otherwise noted, polygons (including triangles) are simple and non-degenerate.
6. If *complex numbers* are used in a problem, $i$ denotes $\sqrt{-1}$.
7. The *real part* and the *imaginary part* of a complex number $z$ are denoted by $\operatorname{Re} z$ and $\operatorname{Im} z$ respectively. If $z = a + bi$ where $a$ and $b$ are real, then $\operatorname{Re} z = a$ and $\operatorname{Im} z = b$.
8. *Logs* are base $e$ unless otherwise indicated. When logs are used in a different base, a subscript will be used, as in $\log_{10} 2$. Base $e$ logs may also be written as $\ln 2$.
9. The word *prime* refers to positive numbers only. Note that 1 is not a prime.
10. *Divisors* and *factors* of an integer refer to positive numbers only. *Proper divisors* of an integer refer to divisors that are less than that integer.
11. A *lattice point* is a point such that all of its coordinates are integers.
12. If a problem refers to the *digits* of a number, those digits are underlined to distinguish the digits of a number from the product of the digits. For example, $\underline{3}\,\underline{1}\,\underline{A}\,\underline{B}$ refers to a four digit number and not the product $3 \cdot 1 \cdot A \cdot B$.
13. *Combinations* will denoted by $\binom{n}{k}$; this is the number of ways to choose $k$ things from $n$ things.
14. The expressions $\arcsin x$, $\sin^{-1} x$, $\arccos x$, $\cos^{-1} x$, $\arctan x$, $\tan^{-1} x$ refer to the principal values of these inverse trigonometric functions. This means that $-\frac{\pi}{2} \le \sin^{-1} x \le \frac{\pi}{2}$, $0 \le \cos^{-1} x \le \pi$, and $-\frac{\pi}{2} \le \tan^{-1} x \le \frac{\pi}{2}$.
15. If a trigonometric problem does not specify the use of degrees, all trigonometric expressions are given in radians.
16. The *floor function* (or *greatest integer function*) is denoted by $\lfloor x \rfloor$, and it is defined as $\lfloor x \rfloor = n$ when $n \le x < n+1$. Similarly, the *ceiling function* (or *least integer function*) is denoted by $\lceil x \rceil$, and it is defined as $\lceil x \rceil = n$ when $n - 1 < x \le n$.
17. The *fractional part* is denoted by $\{x\}$, and it is defined as $\{x\} = x - \lfloor x \rfloor$.
18. *Intervals* are written as a pair of numbers. Round brackets indicate that the endpoint is excluded, while square brackets indicate that the endpoint is included. For example, the interval $(2, 3]$ denotes $\{x : 2 < x \le 3\}$.
19. The *greatest lower bound* of a set is the largest number that is less than or equal to every number of the set. For example, the greatest lower bound of the intervals $(2, 3)$ and $[2, 3]$ are both 2. The *least upper bound* of a set is the largest number that is greater than or equal to every number of the set. For example, the least upper bound of intervals $(2, 3)$ and $[2, 3]$ are both 3.
20. $\max\{a_1, a_2, \ldots, a_n\}$ denotes the largest element in a set, and $\min\{a_1, a_2, \ldots, a_n\}$ denotes the smallest element in a set.