F (1) Let $x, y \in \mathbb{R}$. The negation of the statement "If x and y are rational, then xy is rational" is "If x and y are rational, then xy is irrational".

F (2) If a sequence $\{a_n\}_{n=1}^{\infty}$ converges to 5, then for all natural numbers n, $a_n > 4$.

T (3) There is a set S of irrational numbers such that $\sup(S) = 2$.

T (4) The sequence $\left\{\dfrac{3n^2 - 4n + 7}{6n^2 + 1}\right\}_{n=1}^{\infty}$ converges to $1/2$.

T (5) The supremum of the set $\{1/n \mid n \in \mathbb{N}\}$ is 1.

F (6) If a sequence $\{a_n\}_{n=1}^{\infty}$ converges to L, then there is some $N \in \mathbb{R}$ such that for all natural numbers $n > N$, $a_n = L$.

F (7) Every increasing sequence is convergent.

F (8) If a sequence is not bounded below, then it diverges to $-\infty$.

T (9) If $\{a_n\}_{n=1}^{\infty}$ converges, then $\left\{\dfrac{a_n}{n} + 2\right\}_{n=1}^{\infty}$ converges to 2.

T (10) There is a set S of real numbers such that $\sup(S)$ exists, but $\sup(S) \notin S$.

F (11) If $a < b$ are real numbers, there is an integer $n \in \mathbb{Z}$ such that $a < n < b$.

F (12) Every set of real numbers that is bounded above has a supremum.

T (13) For every real number L there is a sequence $\{a_n\}_{n=1}^{\infty}$ such that $a_n \neq L$ for all $n \in \mathbb{N}$ and converges to L.

T (14) One can prove that $2^n \geq 1 + n$ for all natural numbers n by showing that $2^1 \geq 1 + 1$ then assuming $2^k \geq 1 + k$ and deducing $2^{k+1} \geq 2 + k$.

F (15) The negation of "$\{a_n\}_{n=1}^{\infty}$ is a monotone sequence" is "there exists $n \in \mathbb{N}$ such that $a_n > a_{n+1}$ and $a_n < a_{n+1}$".

F (16) If $\{a_n\}_{n=1}^{\infty}$ diverges to $+\infty$ and $\{b_n\}_{n=1}^{\infty}$ diverges to $-\infty$, then $\{a_n + b_n\}_{n=1}^{\infty}$ converges to 0.

F (17) If $\{a_n^2\}_{n=1}^{\infty}$ converges to 1, then $\{a_n\}_{n=1}^{\infty}$ converges.

T (18) If $\{a_n\}_{n=1}^{\infty}$ and $\{b_n\}_{n=1}^{\infty}$ are convergent sequences, then $\{a_n + b_n\}_{n=1}^{\infty}$ is a convergent sequence.

F (19) Every set of real numbers satisfies the property that "for all $x \in S$, there exists a real number y such that $y^2 < x$".

T (20) Every nonempty set of integers that is bounded below has a smallest element (i.e., a minimum element).

T (21) If $S \subseteq \mathbb{R}$ is bounded above, then there is a natural number b such that b is an upper bound for S.

F (22) The supremum of the set $\{-1/n \mid n \in \mathbb{N}\}$ is -1.

F (23) Every convergent sequence is either increasing or decreasing.

F (24) A sequence of positive numbers can converge to a negative number.

T (25) If $\{a_n\}_{n=1}^{\infty}$ diverges to $+\infty$ and $\{b_n\}_{n=1}^{\infty}$ converges, then $\{a_n + b_n\}_{n=1}^{\infty}$ diverges to $+\infty$.

T (26) Let $x, y \in \mathbb{R}$. The contrapositive of the statement "If x and y are rational, then xy is rational" is "If xy is irrational, then x is irrational or y is irrational".

T (27) Every set of real numbers satisfies the property that "for all $x \in S$, there exists a real number y such that $x < y^2$".

F (28) The negation of the statement "for all $x \in S$, there exists a real number y such that $x < y^2$" is "for all $x \in S$, there exists a real number y such that $x \geq y^2$".

F (29) To prove the formula $1 + \frac{1}{2} + \cdots + \frac{1}{2^n} = 2 - \frac{1}{2^n}$ for all natural numbers n, it suffices to show that $1 + \frac{1}{2} + \cdots + \frac{1}{2^k} = 2 - \frac{1}{2^k}$ implies $1 + \frac{1}{2} + \cdots + \frac{1}{2^{k+1}} = 2 - \frac{1}{2^{k+1}}$.

T (30) A sequence of positive numbers can converge to zero.

F (31) If $\{a_n\}_{n=1}^{\infty}$ diverges and $\{b_n\}_{n=1}^{\infty}$ converges, then $\{a_n b_n\}_{n=1}^{\infty}$ diverges.

F (32) Every nonempty set of real numbers has a smallest element (i.e., a minimum element).

T (33) A sequence of rational numbers can converge to an irrational number.

F (34) A sequence of integers can converge to an irrational number.