1. lim(x -> 0) sin(x)/x = 1
2. e^(i\*pi) + 1 = 0 (Euler's identity)
3. Integral from 0 to 1 of x^2 dx = 1/3
4. A . B = B . A (Commutative property of multiplication)
5. Nabla . F = 0 (Divergence of a vector field)
6. det(A) = 0 (Determinant of matrix A)
7. e^(λt) (Solution to the differential equation dy/dt = λy)
8. γ(n) = (n-1)! (Gamma function for positive integers)
9. 1/1 + 1/2 + 1/3 + ... + 1/n → ∞ (Harmonic series)
10. [G, G] = G (Commutator subgroup where G is a group)
11. ∇ × F = 0 (Curl of a vector field F)
12. z = re^(iθ) (Polar form of a complex number)
13. P(A ∩ B) = P(A)P(B) for independent events A and B
14. ∂²u/∂t² = c²∂²u/∂x² (One-dimensional wave equation)
15. ∑(n=1 to ∞) 1/n² = π²/6 (Basel problem solution)
16. Euler's Formula: e^(iθ) = cos(θ) + i\*sin(θ)
17. The Fundamental Theorem of Calculus links differentiation and integration
18. A vector space includes operations of vector addition and scalar multiplication
19. The eigenvalues of a matrix are roots of its characteristic equation
20. The probability of the union of two events A and B is P(A ∪ B) = P(A) + P(B) - P(A ∩ B)
21. A function f(x) is continuous at x = a if lim\_(x→a) f(x) = f(a)
22. The Laplace transform converts a time-domain function into a frequency-domain representation
23. If a series ∑a\_n converges, then lim\_(n→∞) a\_n = 0
24. In a group (G, ), for each element a in G, there exists an inverse element a^(-1) such that aa^(-1) = e
25. The surface area of a sphere is 4πr²
26. Stokes' Theorem relates a surface integral over a surface S to a line integral around the boundary curve of S
27. A holomorphic function is complex differentiable in a neighborhood of every point in its domain
28. The Cantor set is an example of a fractal, known for its property of being uncountably infinite yet having zero measure
29. Pascal's Triangle is used to find the coefficients of the binomial expansion
30. The Four Color Theorem states that any map in a plane can be colored using four colors in such a way that regions sharing a common boundary do not share the same color
31. The Sylow theorems provide conditions under which a finite group contains subgroups of a given order
32. The Möbius strip is a surface with only one side and only one boundary component
33. The Riemann Hypothesis proposes that all non-trivial zeros of the analytical continuation of the Riemann zeta function have a real part of 1/2
34. The Fibonacci sequence is defined by the recurrence relation F(n) = F(n-1) + F(n-2), with seed values F(0) = 0, F(1) = 1
35. Erdős numbers measure the collaborative distance in authorship of mathematical papers between an author and prolific mathematician Paul Erdős
36. The Banach-Tarski Paradox shows that a solid ball in 3-dimensional space can be split into a finite number of non-overlapping pieces, which can then be reassembled into two solid balls of the original size
37. The Poincaré Conjecture states that every simply connected, closed 3-manifold is homeomorphic to the 3-sphere
38. Fermat's Last Theorem states that there are no three positive integers a, b, and c that can satisfy the equation aⁿ + bⁿ = cⁿ for any integer value of n greater than 2
39. The Mandelbrot set is the set of complex numbers c for which the function fₙ₊₁ = fₙ² + c does not diverge when iterated from f₀ = 0
40. The Heisenberg Uncertainty Principle in quantum mechanics implies that it is impossible to simultaneously measure the exact position and momentum of a particle
41. A torus can be described as a doughnut-shaped surface of revolution generated by revolving a circle in three-dimensional space
42. Gödel's Incompleteness Theorems suggest that within any sufficiently powerful logical system, there are propositions that cannot be proved or disproved using the axioms of that system
43. The Schwarz lantern paradox shows that a sequence of polyhedral approximations to a smooth surface can converge to the surface in shape but diverge in surface area
44. The Collatz Conjecture posits that the sequence defined by n → n/2 if n is even, and n → 3n + 1 if n is odd, will eventually reach 1 for any positive integer n
45. The concept of mathematical proof involves deriving a statement from axioms and previously established statements using the rules of logic
46. The dot product of two vectors is a scalar quantity that measures the cosine of the angle between them and the product of their magnitudes
47. Euler's characteristic for a convex polyhedron is given by V - E + F = 2, where V is the number of vertices, E is the number of edges, and F is the number of faces
48. The area of a sector of a circle with radius r and angle θ (in radians) is ½r²θ
49. A function f(x) is said to be invertible if there exists a function g(x) such that f(g(x)) = x for all x in the domain of g
50. The number e is the base of the natural logarithm and is approximately equal to 2.71828. It is the limit of (1 + 1/n)ⁿ as n approaches infinity
51. A matrix is said to be orthogonal if its transpose is equal to its inverse
52. The Brouwer Fixed Point Theorem states that any continuous function from a compact convex set to itself has at least one fixed point
53. The harmonic mean of a set of numbers is the reciprocal of the arithmetic mean of the reciprocals of the numbers
54. A set is countably infinite if its elements can be put into a one-to-one correspondence with the natural numbers
55. A topological space is compact if every open cover has a finite subcover
56. Liouville's Theorem states that any bounded entire function must be constant
57. The spectral theorem provides conditions under which a matrix can be diagonalized
58. In probability theory, Bayes' Theorem describes the probability of an event, based on prior knowledge of conditions that might be related to the event
59. A group is abelian if it satisfies the commutative property for all group elements
60. The derivative of the function f(x) = ln(x) is f'(x) = 1/x
61. The volume of a sphere is given by (4/3)πr³
62. A bipartite graph is a graph whose vertices can be divided into two disjoint sets such that every edge connects a vertex in one set to a vertex in the other set
63. Stirling's approximation provides a formula for approximating the factorial of a large number n, showing that n! is approximately √(2πn)(n/e)^n
64. A vector field is conservative if it is the gradient of some scalar function
65. The divergence theorem relates the flux of a vector field through a surface to the divergence of the field in the volume enclosed
66. A manifold is a topological space that locally resembles Euclidean space near each point
67. The Cauchy-Schwarz inequality states that for all vectors u and v of an inner product space, the absolute value of the inner product of u and v is less than or equal to the product of the norms of u and v
68. Euler's totient function φ(n) is defined as the number of positive integers up to n that are relatively prime to n
69. A Boolean algebra is a mathematical structure that captures the essence of logical operations and binary variables
70. The Fundamental Theorem of Algebra states that every non-constant single-variable polynomial with complex coefficients has at least one complex root
71. The area of a trapezoid is given by ½(a + b)h, where a and b are the lengths of the parallel sides, and h is the height
72. A Hamiltonian path in a graph is a path that visits each vertex exactly once
73. The Chinese Remainder Theorem provides conditions under which a system of linear congruences has a solution
74. A group in abstract algebra is a set equipped with an operation that combines any two elements to form a third element, satisfying four conditions: closure, associativity, identity, and invertibility.
75. The Generalized Stokes Theorem generalizes several theorems from vector calculus, including the classical Stokes' theorem and the divergence theorem.
76. Homology and cohomology are concepts in algebraic topology that measure the 'holes' in a topological space, offering insight into its structure.
77. Galois theory explains the solvability of polynomial equations in terms of the symmetry group of their roots.
78. The Nash Equilibrium presents a solution concept in non-cooperative games, where no player can benefit by changing strategies if the others remain unchanged.
79. A metric space is a set where a notion of distance (the metric) between elements of the set is defined.
80. The Banach Fixed Point Theorem guarantees the existence and uniqueness of fixed points in certain spaces, underpinning many areas of mathematical analysis.
81. Langlands Program aims to connect number theory and harmonic analysis through a web of relationships between different areas of mathematics.
82. Cryptography relies on number theory and computational complexity to secure communication, illustrating applied mathematical principles.
83. Knot theory studies mathematical knots, which are embeddings of circles in 3-dimensional space, with applications in various scientific fields.
84. The concept of mathematical beauty relates to the aesthetic and intellectual appeal of certain mathematical proofs or results, reflecting the subjective experience of mathematical discovery.
85. The concept of eigenvalues and eigenvectors is crucial in understanding linear transformations and their properties.
86. In topology, a space is compact if every open cover has a finite subcover, a fundamental property affecting continuity and convergence.
87. The Schwarz lemma in complex analysis offers insights into the behavior of holomorphic functions, demonstrating the constraints on their growth.
88. Differential geometry studies curves, surfaces, and manifolds using the techniques of calculus and linear algebra.
89. The prime number theorem gives a general description of the distribution of prime numbers among the integers.
90. Graph coloring involves assigning colors to elements of a graph, such as vertices or edges, under certain constraints, with applications in scheduling and problem solving.
91. In mathematical logic, Gödel's incompleteness theorems assert limitations on the provability of truths within formal systems.
92. Quantum computing utilizes the principles of quantum mechanics to process information in ways fundamentally different from classical computing.
93. The Monty Hall problem, a probability puzzle, reveals counterintuitive results about decision-making and probability.
94. Catastrophe theory studies how small changes in conditions can cause sudden shifts or 'catastrophes' in the behavior of a system, applicable in various scientific fields.
95. The Bessel function of the first kind satisfies the differential equation x²y'' + xy' + (x² - n²)y = 0
96. Every non-empty set of positive integers has a least element, by the well-ordering principle
97. The Hausdorff dimension of the Cantor set is log(2)/log(3)
98. A smooth manifold is orientable if it has a globally defined nonvanishing volume form
99. The Hilbert space L²([a, b]) consists of all square-integrable functions over the interval [a, b]
100. In the context of Riemannian geometry, the Ricci curvature tensor is the trace of the Riemann curvature tensor