

## Index

- $\aleph_0$ , 23, 24  
 $\aleph_1$ , 30, 170  
 $\omega$ , 170  
 $\omega$ -sequence, 13  
 $\pi$ , *see* pi  
 12 Monkeys, 152n  
  
 Alpha Centauri, 65, 66  
 analytic geometry, 141  
 Appel, Kenneth, 153  
 applied mathematics  
   mapping account of, 106–9  
 Arabic notation, 133–4  
 Argand, Jean-Robert, 87n, 164  
 Argand plane, 87n  
 Australian rules football, 169  
 auxiliary hypothesis, 149  
 Azzouni, Jody, 17, 63, 63–8  
  
 Baggins, Bilbo, 57  
 Baker, Alan, 90  
 Balaguer, Mark, 38–9  
 Banach, Stefan, 152  
 Barrow, Isaac, 163  
 Basic Law V, 6n  
 Bayes, Thomas, 155  
 Bayes's Theorem, 155–6  
 Beatles, The, 100n  
 Benacerraf, Paul, 8–13, 40n  
*Big Lebowski, The*, 152n, 157  
 Bigelow, John, 37n  
 bivalence, 7n  
 Bolzano, Bernard, 2, 122  
 Borsuk, Karol, 157  
 Borsuk-Ulam Theorem, 157–8  
  
 Briggs, Rachael, 166n  
 Brouwer, L. E. J., 2  
 Brouwer's Fixed-Point Theorem, 158  
 Brown, James Robert, 133  
 Burali-Forti paradox, 119  
  
 Cantor, Georg, 22  
 Cantor's cardinality paradox, 33, 119, 121  
 Cantor's Theorem, 22–4, 153  
 capture efficiency, 110, 112  
 cardinal numbers, 12n  
 cardinality, 22  
*Casablanca*, 151n  
 categorical, 25  
 Cauchy, Augustin-Louis, 122, 160, 164  
 causal theory of knowledge, 10  
*Citizen Kane*, 151n, 152  
 Cohen, Paul, 31  
 completeness, 21  
 complex numbers, 126  
 confirmational holism, 45, 51, 59  
 conservativeness, 71–2  
 consistency, 21  
 constructivism, *see* intuitionism  
 continuum hypothesis, 30, 30–1, 50  
   independence of, 31, 153  
 conversion efficiency, 111, 112  
 Conway, John, 122  
 countable, 23, 23n, 142  
 Craig's Theorem, 44, 44n  
 cryptography, 166  
 curl, 102n  
  
 Davidson, Donald, 69  
 Davies, Paul, 103

- Davis, Philip J., 21  
 Dedekind, Richard, 5, 5n, 40n  
 Dedekind cuts, 5n  
 denumerable, *see* countable  
 Descartes, René, 140  
 designated truth value, 123  
 Diophantus, 154  
 Dirac, P. A. M., 148  
 Dirac delta function, 147–8  
 Dirichlet, J. P. G. L., 22n  
 Dirichlet's Box Principle, 22n  
 double-negation elimination, 7  
 doubling the cube, 143, 144n  
 Dozier, Lamont, 69n  
 Duhem, Pierre, 149  
 Dyson, Freeman, 99
- e*, 170  
 Eddington, Arthur, 105–6  
 Einstein, Albert, 49  
 empty set, 23, 169  
 epimorphism, 108n  
 epistemic access, 10–11  
   thick, 64  
   thin, 64  
   ultra-thin, 64  
   very thin, 66  
 Erdős, Paul, 1, 72  
 Escher, M. C., 36, 128, 130  
 Euclid, 79, 157, 166  
 Euler, Leonhard, 146, 170  
 Euler characteristic, 146–7  
 Euler's formula  
   algebraic topology, 146–7  
   complex analysis, 88, 146n  
 Euler's identity, 170  
*ex contradictione quodlibet*, 123  
 excluded middle, 7  
 explanation  
   causal, 76  
   extra-mathematical, 75  
   intra-mathematical, 75  
   probabilistic, 76  
   scientific, 76, 95  
   unification account, 72, 77
- explosion, *see ex contradictione quodlibet*  
 Eyjafjallajökull, 76
- Fear and Loathing in Las Vegas*, 148n  
 Fermat, Pierre de, 153  
 Fermat's Last Theorem, 118, 125, 153–4  
 Fibonacci, 169  
 Fibonacci sequence, 169, 169n  
 Field, Hartry, 11, 17, 46, 59–62  
 Fields medal, 77n, 162  
 First Incompleteness Theorem, 27  
 first-order logic, 6n  
 formalism, 4–5, 28, 133–4  
   game, 4  
 fossil record, 67  
 Four-Colour Theorem, 153  
 Frege, Gottlob, 2, 6, 98  
 full-blooded Platonism, 38  
 Fundamental Theorem of Algebra, 141, 147n, 164–5  
 Fundamental Theorem of Arithmetic, 165–6  
 Fundamental Theorems of Calculus, 163–4
- Gauss, Carl Friedrich, 1, 159, 163, 164  
 Gauss's Theorema Egregium, 159–60  
 Geelong football club, 169  
 Gilliam, Terry, 148n  
 Gödel, Kurt, 2, 27  
 Gödel number, 27  
 Gödel sentence, 27  
 Gödel's Incompleteness Theorems, 5, 27–30, 152  
*Godfather, The*, 151n  
 Goldbach, Christian, 168  
 Goldbach's conjecture, 154, 168  
 Golden Ratio, 169  
*Good, the Bad and the Ugly, The*, 152n  
 Gowers, Timothy, 77  
 grounding, 63  
 group axioms, 88–9  
 group theory, 5
- Hadamard, Jacques, 163  
 Hájek, Alan, 166n

- Haken, Wolfgang, 153  
 Hales, Thomas, 91  
 Ham Sandwich Theorem, 158  
 Hardy, G. H., 80n, 151, 167n  
 Hart, W. D., 10  
 Hausdorff space, 108  
 Hersh, Reuben, 103  
 Hertz, Heinrich, 99, 102  
 Hilbert, David, 2, 28, 30, 40n, 60  
 Hilbert problems, 30  
 Hilbert's Hotel, 23, 33  
 Hitchcock, Chris, 166n  
 Hobbes, Thomas, 33n  
*Hobbit, The*, 33, 56  
 Holland, Brian, 69n  
 Holland, Edward, 69n  
 holomorphic function, 160n  
 homomorphism, 108n  
 Honeycomb Theorem, 91  
 Husserl, Edmund, 2
- i*, 170  
 indispensability argument, 41–51,  
 43, 128  
 infinitesimal, 122, 128  
 infinitude of primes, 79–80,  
 157  
 infinity  
 point at, 139–40  
 integers  
 sum of, 82  
 intuitionism, 6–8  
 intuitionistic logic, 125
- Justus, James, 166n
- Kill Bill*, 152  
 Kirkwood, Daniel, 92  
 Kirkwood gaps, 92  
 Kitcher, Philip, 46  
 Klein, Felix, 138  
 Klein bottle, 138, 140  
 Kowalevski, Sophie, 132  
 Kronecker, Leopold, 170
- Lakatos, Imre, 136n, 145–8  
 Laplace operator, 135  
 Laplace's equation, 135  
 Legendre, Adrien-Marie, 162  
 Leibniz, Gottfried, 121, 134, 164  
 Leibniz notation, 134–5  
 Leng, Mary, 68  
 Lennon, John, 100n  
 Leonard of Pisa, 169  
*Leviathan* (Hobbes), 33n  
 Lindemann, Ferdinand von, 143  
 Lindemann's Theorem, 144, 164  
 Locke, John, 33n  
 logic of paradox, *see LP*  
 logicism, 5–6  
 logistic equation, 110, 113  
*Lord of the Rings, The*, 58  
 Lorentz, Hendrik A., 93  
 Lorentz contraction, 92–4  
 Lotka–Volterra equations, 110–12  
 Löwenheim, Leopold, 25  
 Löwenheim–Skolem Theorem, 22–6, 152  
 downward, 25n  
 upward, 25n  
*LP*, 123–5  
 Lucas, J. R., 29
- McCartney, Paul, 100n  
 Maddy, Penelope, 13, 32, 33n, 37, 46,  
 48–51  
 Mariana Trench, 7  
 Martin, Dean, 25  
 Maslow, Abraham, 106  
 mathematical induction, 81–3  
 mathematical realism, *see* Platonism  
 Maxwell, James Clerk, 101, 109  
 Maxwell–Ampère law, 102  
 Mean-Value Theorem, 90, 165  
 Mersenne, Marin, 168  
 Mersenne prime, 168  
 Metamathematics, 21  
 metaphor, 68–71  
 metaphysical nihilism, 68  
 Milky Way, 64  
 Mill, John Stuart, 32, 33, 33n  
 Minkowski, Hermann, 93  
 Minkowski metric, 93, 94, 107  
 Möbius, August, 137

- Möbius strip, 137, 149  
 model, 25n  
 monitoring, 63  
 monomorphism, 108n  
 monster-barring, 147  
 Mortensen, Chris, 122, 128  
 Motown, 69
- naïve set theory, 119–21, 126, 127, 145, 147  
 naturalism, 13, 45  
 Navier–Stokes equation, 107  
 Neilson, Michael, 78  
 neo-logicism, 6  
 Neumann, John von, 12n, 75  
 Neumann ordinals, 12, 86  
 Newton, Isaac, 121, 134, 163  
 Newton notation, 134–5  
 Newton’s law of cooling, 113  
 non-denumerable, *see* uncountable
- Occam’s razor, 86  
 one, 169  
 onomatopoeia, 133, 144  
 ordinal number, 12n  
 Ostwald, Wilhelm, 49
- paraconsistent logic, 120, 123, 125, 126  
 Parsons, Charles, 46  
 Pasadena paradox, 159  
 Peirce, C. S., 2  
 Penrose, Roger, 29, 103  
 Penrose triangle, 128  
 Perelman, Grigori, 162  
 perfect number, 168  
 Perrin, Jean Baptiste, 49  
 pi, 170  
   transcendentality of, *see*  
   Lindemann’s Theorem  
 Pigeonhole Principle, 22n  
 Platonism, 9, 36  
 plenitudinous Platonism, *see* full-blooded  
   Platonism  
 Poincaré, Henri, 2, 40n, 49, 161  
 Poincaré conjecture, 161–2  
 population cycles, 111  
 Poussin, Charles-Jean de la Vallée, 163
- power set, 23  
 Prime Number Theorem, 162–3  
 proof by cases, 80–1  
 proof by contradiction, *see reductio ad  
 absurdum*  
 proof by exhaustion, *see* proof by cases  
 Putnam, Hilary, 14, 26, 40n, 42, 44  
   intellectual dishonesty, 42  
 Pythagoras, 156  
 Pythagoreans, 105, 156
- quantum mechanics, 148  
 Quine, W. V., 13–14, 42, 44, 149  
   mathematical recreation, 44  
   structuralism, 40n  
 Quine–Duhem thesis, *see* confirmational  
   holism
- Ramsey, Frank P., 2  
*reductio ad absurdum*, 8, 156  
   proof by, 79–80  
 refinement, 63, 65  
 relevant logic, 83, 84  
 Residue Theorem, 160–1  
 Resnik, Michael D., 40, 40n  
 Reutersvärd, Oscar, 128  
*Revolver*, 100n  
 Riemann, Bernhard, 158, 167  
 Riemann hypothesis, 163, 167  
 Riemann Rearrangement Theorem,  
   158–9  
 Riemann zeta function, 163, 167  
 Robinson, Abraham, 122  
 robustness, 63  
 Rolle’s Theorem, 80–1  
 Roman notation, 133n  
*Romeo and Juliet*, 144  
 Russell, Bertrand, 2, 6, 55  
 Russell set, 119, 119n  
 Russell’s paradox, 120
- Saturn, 65, 66  
 Second Incompleteness Theorem, 27  
 second-order logic, 6n  
 selection bias, 105  
 self-reference

- set of all sets, 121
- set theory, 5
- Shakespeare, William, 144
- Shapiro, Stewart, 40n
- six, 170
- Skolem, Thoralf, 25
- Skolem paradox, 25–6
- Sober, Elliott, 46, 50–1
- sphere-packing, 91n
- square root of 2
  - irrationality of, 156–7
- squaring the circle, 143–4, 164
- Steiner, Mark, 100
- stereographic projection, 139
- Stranger than Paradise*, 152n, 157
- structuralism
  - ante rem*, 41
  - in re*, 41
- Tacoma Narrows Bridge, 92n
- Tarski, Alfred, 2, 152
- Tarski–Banach Theorem, 8, 152
- Taylor, R. Dean, 69, 69n
- Taylor, Richard, 154
- theory-laden observation, 106n
- Thompson, Hunter S., 148n
- Three Stooges, The, 12n
- tiling, 91n
- Time Machine, The*, 32
- Tolkien, J. R. R., 56, 57, 58
- topology, 136
- torus, 136–7
- transfinite induction, 83n
- trisecting an angle, 143, 144n
- twin prime, 168
- twin prime conjecture, 167–8
- two, 170
- Two Treatises of Government* (Locke), 33n
- Ulam, Stanisław, 157
- uncountable, 24
- uniform semantics, 59
- unrestricted comprehension, 120, 121
- Utilitarianism* (Mill), 32, 33, 33n
- validity, definition of, 123
- Verne, Jules, 99
- Vertigo*, 151n, 152
- Walton, Ken, 69
- Warren Report, 84
- Weierstrass, Karl, 122, 141
- Weierstrass function, 141–2, 147
- Weinberg, Steven, 99
- Wells, H. G., 32
- Weyl, Hermann, 2
- Whitehead, Alfred North, 2, 118
- Wigner, Eugene, 98
- Wiles, Andrew, 118, 154
- Wittgenstein, Ludwig, 2
- Yablo, Stephen, 17, 63, 68–71
- Zermelo, Ernst, 2, 12n
- Zermelo ordinals, 12
- zero, 169
- ZFC, 31, 50, 108, 119, 121, 127