

Index

- \emptyset , 247
- $\binom{n}{k}$, 229
- AA similarity, 102
- AAS congruence, 100
- abscissa, 143
- absolute value, 191
- abstract algebra, 66, 210
- altitude, 95
- angle bisector, 94
- Angle Bisector Theorem, 103
- angle chasing, 133
- angle of rotation, 174
- angles, 84–92
 - acute, 85
 - alternate interior, 86
 - central, 87
 - complementary, 85
 - corresponding, 86, 100
 - exterior, 87
 - in a triangle, 86
 - inscribed, 88, 89
 - marking, 86
 - obtuse, 85
 - reflex, 85
 - remote interior, 87
 - right, 85
 - same-side interior, 86
 - straight, 85
 - supplementary, 85
 - vertical, 86
- angular velocity, 82
- annulus, 138
- apex, 167
- apothem, 130
- arc, 81
 - length of, 87
 - major, 81
- minor, 81
- area, 136–140
 - of a circle, 81
 - of a circular segment, 87
 - of a hexagon, 130
 - of a parallelogram, 121
 - of a rectangle, 122
 - of a sector, 87
 - of a square, 123
 - of a trapezoid, 119
 - of an octagon, 139
- arithmetic mean, 217, 236
- arithmetic series, 211
- ASA congruence, 100
- associativity, 207, 210
- average, 236
- base case, 256
- Bell's Inequality, 205
- Bell, J.S., 205
- binary, 41
- binary operations, 206
- Binomial Theorem, 233
- boxes, 163
- \mathbb{C} , 246
- nC_k , 229
- calculus, 142
- Cardano, 66
- cardinality of a set, 247
- Cartesian coordinates, 143
- ceiling function, 193
- center
 - in coordinates, 150
- centroid, 94, 137
 - in coordinates, 152, 153
- chord, 81, 155
- circle, 82

- area of, 81
- circumscribed, 95
- inscribed, 94
- circles, 81–150
 - concentric, 81
 - plotting, 150
 - secant to, 81
 - sector of, 81
 - segment of, 81
 - tangent to, 81
- circular reasoning, 92, 259
- circular segment, 81
 - area of, 87
- circumcenter, 95
- circumcircle, 95, 129
- circumference, 81
- circumscribed circle, 95
- closed form, 259
- coefficient, 17
- collinearity, 84
- combinations, 229
- combinatorial identity, 231
- commutativity, 207
- comparison test, 214
- complement, 247
- completing the square, 56, 203
- complex conjugate, 15
- complex numbers, 13–15, 79
 - as roots of quadratics, 57
- composite numbers, 39
- concentric circles, 81
- concurrent, 94
- cone, 167
- congruence
 - of triangles, 99–101
- conjectures, 51
- conjugate roots, 57
- conjugate, complex, 15
- constant, 17
- continuous function, 192
- contrapositive, 255
- convergence, of a series, 214
- converse, 123, 255
- conversion factors, 31
- coordinates, 143
- coplanar, 160
- corresponding angles, 100
- cosecant, 105
- cosine, 105
- cotangent, 105
- counting, 221–232
 - circular arrangements, 226
 - distinguishability and, 228
 - multiplicative principle of, 221
- cube, 162
- cubic equations
 - solution of, 66
- cylinder, 165
- $d(n)$, 223
- Dalton, John, 38
- decibels, 12
- degeneracy, 96
- degree, 17
- degrees, 84
- Democritus, 38
- denominator, 75
- Descartes, Rene, 143
- diagonal, 118, 127
- diameter, 81
- difference of squares, 55
- dilation, 177
- Dirichlet's Principle, 257
- discriminant, 57
- distance formula, 149
- distance problems, 23
- distinct, 252
- distortion, 176
- distributivity, 207
- divergence, of a series, 214
- divisibility, 39, 45
- divisors, 39
 - number of, 223
- dodecahedron, 168
- domain, 188
- dummy variable, 215, 216, 246
- ϵ , 246
- Elements*, Euclid's, 117
- ellipse, 83, 176
- equations
 - linear, 17–24

- quadratic, 52–63
- systems of, 19
 - solving by elimination, 19
 - solving by substitution, 19
- equilateral triangle
 - area of, 111
- equivalence relation, 209
- Euclid, 117
- Euler's identity, 74
- Euler, Leonhard, 51
- expected value, 243
- exponents, 1–5
 - base of, 1
 - fractional, 3
 - negative, 1
- Exterior Angle Theorem, 87
- extraneous roots, 59
- factorial, 225
- factoring, 52, 67–70, 207
- Fermat numbers, 51
- Fermat's Last Theorem, 51
- Fibonacci sequence, 217
- fixed point, 174
- floor function, 192
- fractional part, 193
- fractions, 75
 - comparison of, 77
 - converting to decimal, 76
 - reduction of, 77
- frequency, 237
- functions, 187–195
 - even, 190
 - graphing, 188
 - odd, 190
 - transformations, 194
 - with cases, 193
- Fundamental Theorem of Algebra, 79
- Galois, Evariste, 66
- Gauss, K. F., 261
- geometric mean, 218, 236
- geometric series, 212
 - infinite, 214
- geometrical transformation, 173
- Goldbach's conjecture, 51
- great circle of a sphere, 161
- greatest common factor, 48
- greatest integer function, 192
- group theory, 210
- hexadecimal, 41
- hexagon, 130
 - area of, 130
- hexahedron, 168
- histogram, 237
- HL congruence, 100
- homothecy, 177
- hypotenuse, 93
- i*, 13
- icosahedron, 168
- Ideal Gas Law, 38
- identity, 207
- if and only if, 253
- iff, 253
- Im, 15
- image, 173
- imaginary numbers, 79
 - pure, 13
 - square roots of, 62
- imaginary part, 15
- incenter, 94
- incircle, 94, 129, 156
- independent variable, 188
- inequalities, 197–203
 - absolute value, 202
 - functions and, 202
 - linear, 198
 - quadratic, 199
 - reciprocals and, 198
 - trivial, 203
- inequality
 - nonstrict, 197
 - strict, 197
- inradius, 94
- inscribed circle, 94
- integer, 75
 - nonnegative, 75
- interest, 34
- intersection, 247
- interval notation, 201

- inverses, 208
- irrational numbers, 78
 - approximation of, 78
- lateral surface area, 160
- least common multiple, 48
- lemmas, 253
- lines, 84
 - and coordinates, 144
 - of symmetry, 175
 - parallel, 86, 113, 148
 - perpendicular, 85, 113, 148
 - plotting, 148
 - skew, 160
 - slope of, 146
- LL congruence, 100
- logarithms, 10–12
 - and exponentials, 10
- lowest terms, 77
- map, 173
- mathematical induction, 74, 217, 256
- maximization, 253
- median, 94, 124
 - of a trapezoid, 118
- median, statistical, 236
- midpoint, 84
- minimization, 253
- minutes, 84
- mode, 236
- modular arithmetic, 42
- Napier, John, 12
- natural numbers, 75
- necessary and sufficient, 254
- nontrivial, 253
- null set, 247
- number theory, 39
- numerator, 75
- octagon
 - area of, 139
- octahedron, 168
 - volume of, 169
- operations, 206–209
 - binary, 206
- order of operations, 206
- ordered pair, 19, 143
- ordinate, 143
- orthocenter, 95
- orthogonal lines, 85
- overcounting, 223, 229
- nP_k , 225
- paradox, 220, 251
- parallel lines, 86, 104, 113, 148
- parallelepiped, 163
- parallelogram, 120
 - area of, 121
- partial sums, 214
- percent, 33
 - increase or decrease, 34
- perimeter, 94
- permutation, 225
- perpendicular bisector, 95
- perpendicular lines, 85, 113, 148
- π , 81
- Pigeonhole Principle, 257
- plane, 160
- polar coordinates, 144
- polygons, 127–131
 - diagonals of, 127
 - regular, 127
 - area of, 130
 - circumradius of, 130
 - inradius of, 130
 - similar, 104
- polyhedron, 168
- polynomials, 63, 191
 - roots of, 79
- power of a point, 155–158
- prime factorization, 223
- primes, 39
- prism, 165
 - right, 165
- probability, 238–243, 245
 - multiplication and, 240
- proportionality
 - constant of, 29
- proportions, 28–36
 - direct, 28
 - inverse, 29
 - joint, 29

- manipulation of, 30
 - pyramid, 166
 - Pythagorean Theorem, 97, 105, 112
 - Pythagorean triple, 98
 - \mathbb{Q} , 246
 - quadrants, 144
 - quadratic formula, 57
 - quadrilaterals, 118–125
 - circumscribed, 156
 - concave, 118
 - convex, 118
 - diagonals of, 118
 - orthodiagonal, 118
 - quantum mechanics, 205
 - \mathbb{R} , 246
 - radians, 85
 - radical, 3
 - conjugate, 8
 - radius, 81
 - in coordinates, 150
 - range, of a function, 189
 - range, statistical, 236
 - ratio, 28, 212
 - rational numbers, 7, 75
 - rationalizing denominators, 7
 - ray, 84
 - Re, 15
 - real numbers, 79
 - real part, 15
 - rectangle, 122
 - area of, 122
 - recursion, 217
 - reflection, 145, 175
 - in a point, 175
 - reflexivity, 209
 - relations, 209
 - relatively prime, 48
 - repeating decimals, 75
 - rigorous proof, 253
 - roots, 52, 63
 - extraneous, 59
 - rotation, 145, 174
 - Russell's paradox, 251
 - Σ , 215
- SA congruence, 100
 - SAS congruence, 99
 - SAS similarity, 102
 - secant (trigonometric), 105
 - secant to a circle, 155
 - seconds, 84
 - sector, 81
 - area of, 87
 - segment, 84
 - segment, of a circle, 81
 - semiperimeter, 94
 - sequence, 211, 216
 - recursive, 217
 - series, 211
 - arithmetic, 211
 - sum of, 212
 - convergent, 214
 - divergent, 214
 - geometric, 212
 - sum of, 213
 - infinite, 213
- sets, 246–250
 - complement of, 247
 - intersection of, 247
 - size of, 247
 - union of, 247
 - similarity
 - area and, 136
 - of polygons, 104
 - of triangles, 102–104
 - similitude, 177
 - sine, 105
 - slant height, 167
 - slope, 146
 - slope-intercept form, 146
 - space, 160
 - sphere, 161
 - square, 123
 - area of, 123
 - square root, 3
 - SSS congruency, 99
 - SSS similarity, 102
 - statistics, 236–238
 - strict inequality, 197
 - subset, 249
 - summation notation, 215

- surface area, 160
 - of a box, 163
 - of a cone, 167
 - of a cube, 162
 - of a cylinder, 165
 - of a prism, 165
 - of a pyramid, 166
 - of a sphere, 161
- symmetry, 175
 - line of, 175
 - point, 175
- symmetry of a relation, 209
- tangent (trigonometric), 105
- tangent to a circle, 155
- Tartaglia, 66
- tetrahedron, 168
 - volume of, 168
- the BIG PICTURE, 12, 38, 51, 66, 74, 83, 117, 142, 205, 210, 220, 245, 251, 261
- total surface area, 160
- transcendental numbers, 79
- transitivity, 209
- translation, 145, 173
- transversal line, 86
- trapezoid, 118
 - area, 119
 - isosceles, 119
 - median, 118
- Triangle Inequality, 96
- triangles, 93–115
 - 30°-60°-90°, 106
 - 45°-45°-90°, 106
 - acute, 93
 - altitude of, 95
 - area, 102
 - area of, 109
 - centroid of, 94, 137
 - circumcenter of, 95
 - circumcircle of, 95
 - circumradius of, 95
 - congruence of, 99–101
 - degenerate, 96
 - equilateral, 93
 - area of, 111
 - in coordinates, 152
- incenter of, 94
- incircle of, 94
- inradius of, 109, 156
- isosceles, 93
- median of, 94, 124
- obtuse, 93
- orthocenter of, 95
- right, 93, 100
 - circumcenter of, 96
 - median of, 96
- scalene, 93
- similarity of, 102–104
- trivial, 253
- Trivial Inequality, 203
- Uncertainty Principle, 205
- union, 247
- variable, 17
- Venn diagrams, 248
- volume, 160
 - of a box, 163
 - of a cone, 167
 - of a cube, 162
 - of a cylinder, 165
 - of a prism, 165
 - of a pyramid, 166
 - of a sphere, 161
 - of a tetrahedron, 168
 - of an octahedron, 169
- without loss of generality, 252
- word problems, 22–24
- work problems, 23
- working backwards, 91
- x -intercept, 145
- y -intercept, 145
- \mathbb{Z} , 246
- Zeno's paradoxes, 220
- zeroes, 52