

Index

A

absolute extremum, 119
acceleration
 normal component, 345
 tangential component, 345
acceleration vector, 345
algebraic precedence, 505
alternating harmonic series, 273
anti-parallel vectors, 309
antiderivative, 155
arc length, 339
arc length parameterization, 340
arccosine, 96
arcsine, 94
asymptote, 23, 115
average, 403
average height, 383

B

bell curve, 226
binormal, 344, 436
bounded function, 54

C

cardioid, 242
Cartesian coordinates, 241, 323
Cauchy Principal Value, 220
center of mass, 403
center of mass, 215
centroid, 216, 400

chain rule, 67
characteristic polynomial, 468
chord, 32
circle
 area, 505
 circumference, 505
 equation of, 21, 506
 unit, 21
Clairaut's Theorem, 371
closed paths, 425
completing the square, 505
composition of functions, 27, 45, 67
concave down, 114
concave up, 114
cone
 lateral area, 506
 surface area, 506
 volume, 506
conservative vector field, 424
continuous, 55, 355
convergent sequence, 259
convergent series, 264
coordinates
 Cartesian, 241, 323
 converting rectangular to polar, 242
 cylindrical, 323
 polar, 241, 323
 rectangular, 241, 323
 spherical, 325
cosines
 law of, 307, 506
critical value, 108
cross product, 313

510 Index

cumulative distribution function, 226
curvature, 342
curvature formula, 342, 343
cycloid, 251
cylinder
 lateral area, 506
 surface area, 506
 volume, 506
cylindrical coordinates, 405
cylindrical coordinates, 323

D

definite integral, 159
del (∇), 367
dependent variable, 24
derivative, 34
 dot notation, 132
 Leibniz notation, 49
difference quotient, 32
differentiable, 55, 362
differential, 144
differential equation, 453
 first order, 454
 particular solution, 456
 separable, 456
directional derivative, 367
discrete probability, 223
discriminant, 372
displacement vector, 302
divergence test, 266
Divergence Theorem, 448
divergent sequence, 259
divergent series, 264
domain, 23
dot notation, 132
dot product, 308
double integral, 385

E

ellipse
 area, 505
 equation of, 506
ellipsoid, 239
error estimate, 185
escape velocity, 222
Euler's Method, 464
exp function, 85
expected value, 224
exponential distribution, 227
exponential function, 82

Extreme Value Theorem, 121

F

Fermat's Theorem, 108
flux, 441
frustum, 235
Fubini's Theorem, 387
function, 22
 bounded, 54
 differentiable, 55
 implicit, 90
 linear, 22
 of two variables, 356
 rational, 180
 unbounded, 54
function composition, 27
Fundamental Theorem of Algebra, 111
Fundamental Theorem of Calculus, 153

G

Gabriel's horn, 223, 238
geometric series, 264
global extremum, 119
gradient, 367
greatest integer, 110

H

harmonic series, 267
 alternating, 273
Hooke's Law, 211
hyperbolic cosine, 102
hyperbolic sine, 102
hypercycloid, 252
hypocycloid, 252

I

implicit differentiation, 89, 365
implicit function, 90
improper integral, 219
 convergent, 219
 diverges, 219
incompressible, 434
indefinite integral, 159
independent variable, 24
inflection point, 114
initial condition, 454
initial value problem
 first order, 454
integral

improper, 219
 of $\sec x$, 175
 of $\sec^3 x$, 175
 properties of, 163
 integral sign, 155
 integral test, 270
 integration
 by parts, 176
 Intermediate Value Theorem, 55
 interval of convergence, 283
 inverse function, 82
 inverse sine, 94
 involute, 252

J

Jacobian, 414
 judicious guessing, 471

K

kinetic energy, 221

L

L'Hôpital's Rule, 98
 Lagrange multipliers, 377
 lateral area of a cone, 130
 law of cosines, 307, 506
 law of sines, 506
 Leibniz notation, 49
 level curve, 351
 level set, 352
 level surface, 352
 limit, 41
 limit at infinity, 98
 limit of a sequence, 259
 line integral, 419
 linear approximation, 143
 linearity of the derivative, 60
 local extremum, 107
 local maximum, 107
 local minimum, 107
 logarithm, 82
 logarithmic function, 82
 logistic equation, 458
 long division of polynomials, 182

M

Maclaurin series, 287
 mass, 403

mean, 224, 227
 Mean Value Theorem, 146
 moment, 215, 398, 404

N

Newton, 210
 Newton's law of cooling, 453
 Newton's method, 139–141
 normal, 317, 344
 normal distribution, 231

O

one sided limit, 46
 optimization, 119
 orientable surface, 442
 oriented curve, 427

P

p -series, 270
 parallel vectors, 309
 parallelogram
 and vector sum, 303
 area of, 315, 400, 412
 parametric equations, 250, 320, 330
 partial fractions, 180
 particular solution, 456
 physicists, 132
 point-slope formula, 506
 polar coordinates, 241, 323
 polynomial
 of two variables, 356
 power function, 57
 power rule, 57, 89, 92
 precedence
 of algebraic operations, 505
 probability density function, 225
 product rule, 62, 63
 generalized, 64
 projection, 421
 scalar, 421
 projection of a vector, 309
 properties of integrals, 163

Q

quadratic formula, 505
 quotient rule, 64

R

radian measure, 73

512 Index

radius of convergence, 283
 random variable, 224
 rational function, 66, 180
 rectangular coordinates, 241, 323
 related rates, 131
 resonant frequency, 475
 right hand rule, 316
 Rolle's Theorem, 146

S

scalar multiplication, 304
 scalar projection, 421
 separation of variables, 456
 sequence, 258
 bounded, 262
 bounded above, 262
 bounded below, 262
 convergent, 259
 decreasing, 262
 divergent, 259
 increasing, 262
 monotonic, 262
 non-decreasing, 262
 non-increasing, 262
 of partial sums, 264
 series, 258
 p -series, 270
 absolute convergence, 278
 alternating harmonic, 273
 conditional convergence, 278
 convergent, 264
 divergent, 264
 geometric, 264
 harmonic, 267
 integral test, 270
 interval of convergence, 283
 Maclaurin, 287
 radius of convergence, 283
 Taylor, 290
 Simpson's Rule, 187
 sines
 law of, 506
 slope field, 466
 sphere
 surface area, 506
 volume, 506
 spherical coordinates, 325, 405
 spiral of Archimedes, 243
 squeeze theorem, 77
 standard deviation, 229
 standard normal distribution, 227

standard normal probability density
 function, 226
 steady state part of solution to d.e., 474
 substitution, 409
 subtend, 74
 sum
 of vectors, 303
 sum rule, 61
 surface area, 400

T

tangent line, 32
 Taylor series, 290
 Toricelli's trumpet, 223, 238
 torque, 213
 torus, 238
 transcendental function, 73
 transient part of solution to d.e., 474
 Trapezoid Rule, 185
 triangle inequality, 43, 302
 trigonometric identities, 506

U

unbounded function, 54
 undetermined coefficients, 471
 uniform distribution, 226
 uniform probability density function, 226
 unit binormal, 344
 unit circle, 21
 unit normal, 344
 unit vector, 310, 336

V

variance, 229
 variation of parameters, 461, 475
 vector, 302
 anti-parallel, 309
 cross product, 313
 displacement, 302
 function, 330
 normal to a plane, 317
 parallel, 309
 projection, 309
 scalar multiplication, 304
 sum, 303
 unit, 310
 vector fields, 417
 velocity, 37
 velocity vector, 345

W

witch of Agnesi, 66
work, 209