

Index

A

absolute extremum, 117
acceleration
 normal component, 343
 tangential component, 343
acceleration vector, 343
algebraic precedence, 503
alternating harmonic series, 271
anti-parallel vectors, 307
antiderivative, 153
arc length, 337
arc length parameterization, 338
arccosine, 95
arcsine, 94
asymptote, 23, 113
average, 401
average height, 381

B

bell curve, 224
binormal, 342, 434
bounded function, 54

C

cardioid, 240
Cartesian coordinates, 239, 321
Cauchy Principal Value, 218
center of mass, 401
center of mass, 213
centroid, 214, 398

chain rule, 67
characteristic polynomial, 465
chord, 32
circle
 area, 503
 circumference, 503
 equation of, 21, 504
 unit, 21
Clairaut's Theorem, 369
closed paths, 423
completing the square, 503
composition of functions, 27, 45, 67
concave down, 112
concave up, 112
cone
 lateral area, 504
 surface area, 504
 volume, 504
conservative vector field, 422
continuous, 55
convergent sequence, 257
convergent series, 262
coordinates
 Cartesian, 239, 321
 converting rectangular to polar, 240
 cylindrical, 321
 polar, 239, 321
 rectangular, 239, 321
 spherical, 323
cosines
 law of, 305, 504
critical value, 106
cross product, 311

508 Index

cumulative distribution function, 224
curvature, 340
curvature formula, 340, 341
cycloid, 249
cylinder
 lateral area, 504
 surface area, 504
 volume, 504
cylindrical coordinates, 403
cylindrical coordinates, 321

D

definite integral, 157
del (∇), 365
dependent variable, 24
derivative, 34
 dot notation, 130
 Leibniz notation, 49
difference quotient, 32
differentiable, 55, 359
differential, 142
differential equation, 451
 first order, 452
 particular solution, 454
 separable, 454
directional derivative, 365
discrete probability, 221
discriminant, 370
displacement vector, 300
divergence test, 264
Divergence Theorem, 446
divergent sequence, 257
divergent series, 262
domain, 23
dot notation, 130
dot product, 306
double integral, 383

E

ellipse
 equation of, 504
ellipsoid, 237
error estimate, 183
escape velocity, 220
Euler's Method, 461
exp function, 85
expected value, 222
exponential distribution, 225
exponential function, 82
Extreme Value Theorem, 119

F

Fermat's Theorem, 106
flux, 440
frustum, 233
Fubini's Theorem, 385
function, 22
 bounded, 54
 differentiable, 55
 implicit, 89
 linear, 22
 of two variables, 354
 rational, 177
 unbounded, 54
function composition, 27
Fundamental Theorem of Algebra, 109
Fundamental Theorem of Calculus, 151

G

Gabriel's horn, 221, 236
geometric series, 262
global extremum, 117
gradient, 365
greatest integer, 108

H

harmonic series, 265
 alternating, 271
Hooke's Law, 209
hyperbolic cosine, 101
hyperbolic sine, 101
hypercycloid, 250
hypocycloid, 250

I

implicit differentiation, 89, 363
implicit function, 89
improper integral, 217
 convergent, 217
 diverges, 217
incompressible, 433
indefinite integral, 157
independent variable, 24
inflection point, 112
initial condition, 452
initial value problem
 first order, 452
integral
 improper, 217

of $\sec x$, 173
 of $\sec^3 x$, 173
 properties of, 161
 integral sign, 153
 integral test, 268
 integration
 by parts, 174
 Intermediate Value Theorem, 55
 interval of convergence, 281
 inverse function, 82
 inverse sine, 94
 involute, 250

J

Jacobian, 411
 judicious guessing, 468

K

kinetic energy, 219

L

L'Hôpital's Rule, 97
 Lagrange multipliers, 375
 lateral area of a cone, 128
 law of cosines, 305, 504
 law of sines, 504
 Leibniz notation, 49
 level curve, 349
 level set, 350
 level surface, 350
 limit, 41
 limit at infinity, 97
 limit of a sequence, 257
 line integral, 417
 linear approximation, 141
 linearity of the derivative, 60
 local extremum, 105
 local maximum, 105
 local minimum, 105
 logarithm, 82
 logarithmic function, 82
 logistic equation, 456
 long division of polynomials, 179

M

Maclaurin series, 285
 mass, 401
 mean, 222, 225

Mean Value Theorem, 144
 moment, 213, 396, 402

N

Newton, 208
 Newton's law of cooling, 451
 normal, 315, 342
 normal distribution, 229

O

one sided limit, 46
 optimization, 117
 orientable surface, 440
 oriented curve, 425

P

p -series, 268
 parallel vectors, 307
 parallelogram
 and vector sum, 301
 area of, 313, 398, 410
 parametric equations, 248, 318, 328
 partial fractions, 177
 particular solution, 454
 physicists, 130
 point-slope formula, 504
 polar coordinates, 239, 321
 polynomial
 of two variables, 354
 power function, 57
 power rule, 57, 88, 92
 precedence
 of algebraic operations, 503
 probability density function, 223
 product rule, 62, 63
 generalized, 64
 projection, 419
 scalar, 419
 projection of a vector, 307
 properties of integrals, 161

Q

quadratic formula, 503
 quotient rule, 64

R

radian measure, 73
 radius of convergence, 281

510 Index

random variable, 222
rational function, 66, 177
rectangular coordinates, 239, 321
related rates, 129
resonant frequency, 472
right hand rule, 314
Rolle's Theorem, 144

S

scalar multiplication, 302
scalar projection, 419
separation of variables, 454
sequence, 256
 bounded, 260
 bounded above, 260
 bounded below, 260
 convergent, 257
 decreasing, 260
 divergent, 257
 increasing, 260
 monotonic, 260
 non-decreasing, 260
 non-increasing, 260
 of partial sums, 262
series, 256

p-series, 268
 absolute convergence, 276
 alternating harmonic, 271
 conditional convergence, 276
 convergent, 262
 divergent, 262
 geometric, 262
 harmonic, 265
 integral test, 268
 interval of convergence, 281
 Maclaurin, 285
 radius of convergence, 281
 Taylor, 288

Simpson's Rule, 185
sines
 law of, 504
slope field, 463
sphere
 surface area, 503
 volume, 503
spherical coordinates, 323, 403
spiral of Archimedes, 241
squeeze theorem, 77
standard deviation, 227
standard normal distribution, 225
standard normal probability density
 function, 224

steady state part of solution to d.e., 470
substitution, 407
subtend, 74
sum
 of vectors, 301
sum rule, 61
surface area, 398

T

tangent line, 32
Taylor series, 288
Toricelli's trumpet, 221, 236
torque, 211
torus, 236
transcendental function, 73
transient part of solution to d.e., 470
triangle inequality, 43, 300
trigonometric identities, 504

U

unbounded function, 54
undetermined coefficients, 468
uniform distribution, 224
uniform probability density function, 224
unit normal, 342
unit binormal, 342
unit circle, 21
unit vector, 308, 334

V

variance, 227
variation of parameters, 459, 472
vector, 300
 anti-parallel, 307
 cross product, 311
 displacement, 300
 function, 328
 normal to a plane, 315
 parallel, 307
 projection, 307
 scalar multiplication, 302
 sum, 301
 unit, 308
vector fields, 415
velocity, 37
velocity vector, 343

W

witch of Agnesi, 66

work, 207