

Index

A
absolute extremum, 103
acceleration
 normal component, 357
 tangential component, 357
acceleration vector, 357
algebraic precedence, 519
alternating harmonic series, 285
anti-parallel vectors, 321
antiderivative, 139
arc length, 244, 351
arc length parameterization, 352
arccosine, 197
arcsine, 196
area
 between curves, 155
 under a curve, 433
 under curve, 135
asymptote, 23, 99
average, 417
average height, 397

B
bell curve, 238
binormal, 356, 449
bounded function, 54

C
cardioid, 254
Cartesian coordinates, 253, 335

Cauchy Principal Value, 232
center of mass, 417
center of mass, 227
centroid, 228, 414
chain rule, 67
characteristic polynomial, 482
chord, 32
chord, 32
circle
 area, 519
 circumference, 519
 equation of, 21, 520
 unit, 21
Clairaut's Theorem, 384
closed paths, 439
completing the square, 519
composition of functions, 27, 45, 67
concave down, 98
concave up, 98
cone
 lateral area, 520
 surface area, 520
 volume, 520
conservative vector field, 438
continuous, 55, 367
convergent sequence, 271
convergent series, 276
coordinates
 Cartesian, 253, 335
 converting rectangular to polar, 254
 cylindrical, 335, 335
 polar, 253, 335
 rectangular, 253, 335
 spherical, 337

523

Index 525

initial condition, 468
initial value problem
 first order, 468
integral
 improper, 231
 indefinite, 143
 of $\sec x$, 209
 of $\sec^3 x$, 209
 properties of, 147
integral sign, 139
integral test, 282
integration
 by parts, 210
Intermediate Value Theorem, 55
interval of convergence, 296
inverse sine, 196
involute, 264

J
Jacobi, 428
judicious guessing, 485

K
kinetic energy, 233

L
L'Hôpital's Rule, 88
Lagrange multipliers, 390
lateral area of a cone, 114
law of cosines, 319, 520
law of sines, 520
Leibniz notation, 49
level curve, 363
level set, 364
level surface, 364
limit, 41
limit at infinity, 87
limit of a sequence, 271
line integral, 433
linear approximation, 127
linearity of the derivative, 60
local extremum, 91
local maximum, 91
local minimum, 91
logistic equation, 472
long division of polynomials, 216

M
Maclaurin series, 300

mass, 417
mean, 236, 239
Mean Value Theorem, 130
moment, 227, 412, 418

N
Napier's constant, 188
Newton, 174
Newton's law of cooling, 467
Newton's method, 123–125
normal, 329, 356
normal distribution, 244

O
one sided limit, 46
optimization, 103
orientable surface, 456
oriented curve, 441

P
 p -series, 282
parallel vectors, 321
parallelogram
 and vector sum, 315
 area of, 327, 414, 426
parametric equations, 263, 332, 342
partial fractions, 214
particular solution, 470
physicists, 116
point-slope formula, 520
polar coordinates, 253, 335
polynomial
 of two variables, 368
power function, 57
power rule, 57
precedence
 of algebraic operations, 519
probability density function, 237
product rule, 62, 63
 generalized, 64
projection, 435
 scalar, 435
projection of a vector, 321
properties of integrals, 147

Q
quadratic formula, 519
quotient rule, 64

524 Index

cosines
 law of, 319, 520
critical value, 92
cross product, 325
cumulative distribution function, 238
curvature, 354
curvature formula, 354, 355
curve sketching, 91
cycloid, 263
cylinder
 lateral area, 520
 surface area, 520
 volume, 520
cylindrical coordinates, 419
cylindrical coordinates, 335

D
definite integral, 143
del (∇), 379
dependent variable, 24
derivative, 34, 48
 dot notation, 116
 Leibniz notation, 49
 second, 97
difference quotient, 32
differentiable, 55, 374
differential, 128
differential equation, 467
 first order, 468
 particular solution, 470
 separable, 470
directional derivative, 379
discrete probability, 235
discriminant, 385
displacement vector, 315
divergence test, 278
Divergence Theorem, 462
divergent sequence, 271
divergent series, 276
domain, 23
dot notation, 116
dot product, 320
double integral, 398

E
ellipse
 area, 519
 equation of, 520
ellipsoid, 251
error estimate, 219

escape velocity, 234
Euler's Method, 478
expected value, 236
exponential distribution, 239
Extreme Value Theorem, 105

F
Fermat's Theorem, 92
flux, 455
frustum, 247
Fubini's Theorem, 401
function, 22
 bounded, 54
 differentiable, 55
 implicit, 82
 linear, 22
 of two variables, 368
 rational, 214
 unbounded, 54
function composition, 27
Fundamental Theorem of Algebra, 95
Fundamental Theorem of Calculus, 137

G
Gabriel's horn, 235, 250
geometric series, 276
global extremum, 103
gradient, 379
greatest integer, 94

H
harmonic series, 279
 alternating, 285
Hooke's Law, 175
hyperbolic cosine, 199
hyperbolic sine, 199
hypercycle, 264
hypocycloid, 264

I
implicit differentiation, 82, 377
implicit function, 82
improper integral, 231
 convergent, 231
 diverges, 231
incompressible, 448
indefinite integral, 143
independent variable, 24
inflection point, 98

526 Index

R
radian measure, 73
radius of convergence, 296
random variable, 236
rational function, 66, 214
rectangular coordinates, 253, 335
related rates, 115
resonant frequency, 489
right hand rule, 328
Rolle's Theorem, 130

S
scalar multiplication, 316
scalar projection, 435
second derivative, 96, 97
separation of variables, 470
sequence, 270
 bounded, 274
 bounded above, 274
 bounded below, 274
 convergent, 271
 decreasing, 274
 divergent, 271
 increasing, 274
 monotonic, 274
 non-decreasing, 274
 non-increasing, 274
 of partial sums, 276
series, 270
 p -series, 282
 absolute convergence, 290
 alternating harmonic, 285
 conditional convergence, 290
 convergent, 276
 divergent, 276
 geometric, 276
 harmonic, 279
 integral test, 282
 interval of convergence, 296
 Maclaurin, 300
 radius of convergence, 296
 Taylor, 302
Simpson's Rule, 221
sines
 law of, 520
slope field, 480
sphere
 surface area, 520
 volume, 520
spherical coordinates, 337, 419
spiral of Archimedes, 255

squeeze theorem, 77
standard deviation, 241
standard normal distribution, 239
standard normal probability density
 function, 238
steady state part of solution to d.e., 488
substitution, 423
subtend, 74
sum
 of vectors, 315
sum rule, 61
surface area, 414

T
tangent line, 32
Taylor series, 302
Torricelli's trumpet, 235, 250
torque, 225
torus, 250
transcendental function, 73
transcendental number, 188
transient part of solution to d.e., 488
Trapezoid Rule, 219
triangle inequality, 43, 314
trigonometric identities, 520

U
unbounded function, 54
undetermined coefficients, 485
uniform distribution, 238
uniform probability density function, 238
unit binormal, 356
unit circle, 21
unit normal, 356
unit vector, 322, 348

V
variance, 241
variation of parameters, 475, 489
vector, 314
 anti-parallel, 321
 cross product, 325
 displacement, 315
 function, 342
 normal to a plane, 329
 parallel, 321
 projection, 321
 scalar multiplication, 316
 sum, 315

unit, 322
vector fields, 431
velocity, 37
velocity vector, 357

W

witch of Agnesi, 66
work, 173