

Index

A

absolute extremum, 103
acceleration
 normal component, 359
 tangential component, 359
acceleration vector, 359
algebraic precedence, 523
alternating harmonic series, 285
anti-parallel vectors, 322
antiderivative, 139
arc length, 244, 353
arc length parameterization, 354
arccosine, 197
arcsine, 196
area
 between curves, 155
 under a curve, 435
 under curve, 135
asymptote, 23, 100
average, 419
average height, 399

B

bell curve, 238
binormal, 358, 451
bounded function, 53

C

cardioid, 254
Cartesian coordinates, 253, 337

Cauchy Principal Value, 232
center of mass, 419
center of mass, 227
centroid, 228, 416
chain rule, 67
characteristic polynomial, 484
chord, 32
circle
 area, 523
 circumference, 523
 equation of, 21, 524
 unit, 21
Clairaut's Theorem, 387
closed paths, 441
completing the square, 523
composition of functions, 27, 45, 67
concave down, 98
concave up, 98
cone
 lateral area, 524
 surface area, 524
 volume, 524
conservative vector field, 440
continuous, 55, 369
convergent sequence, 271
convergent series, 276
coordinates
 Cartesian, 253, 337
 converting rectangular to polar, 254
 cylindrical, 337
 polar, 253, 337
 rectangular, 253, 337
 spherical, 339

528 Index

cosines
 law of, 321, 524
critical point, 92
critical value, 92
cross product, 327
cumulative distribution function, 238
curvature, 356
curvature formula, 356, 357
curve sketching, 91
cycloid, 263
cylinder
 lateral area, 524
 surface area, 524
 volume, 524
cylindrical coordinates, 421
cylindrical coordinates, 337

D

definite integral, 143
del (∇), 381
dependent variable, 24
derivative, 34, 48
 dot notation, 116
 Leibniz notation, 49
 second, 97, 98
difference quotient, 32
differentiable, 55, 376
differential, 128
differential equation, 469
 first order, 470
 particular solution, 472
 separable, 472
direction vector, 333
directional derivative, 382
discrete probability, 235
discriminant, 388
displacement vector, 315
divergence test, 278
Divergence Theorem, 464
divergent sequence, 271
divergent series, 276
domain, 23
dot notation, 116
dot product, 321
double integral, 400

E

ellipse
 area, 523
 equation of, 524

ellipsoid, 251
error estimate, 219
escape velocity, 234
Euler's Method, 480
expected value, 236
exponential distribution, 239
Extreme Value Theorem, 105

F

Fermat's Theorem, 92
flux, 457
frustum, 247
Fubini's Theorem, 403
function, 22
 bounded, 53
 differentiable, 55
 implicit, 82
 linear, 22
 of two variables, 370
 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, 381
greatest integer, 95

H

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

I

implicit differentiation, 82, 379
implicit function, 82
improper integral, 231
 convergent, 231
 diverges, 231
incompressible, 450
indefinite integral, 143

independent variable, 24
 inflection point, 99
 initial condition, 470
 initial value problem
 first order, 470
 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

Jacobian, 430
 judicious guessing, 487

K

kinetic energy, 233

L

L'Hôpital's Rule, 88
 Lagrange multipliers, 393
 lateral area of a cone, 114
 law of cosines, 321, 524
 law of sines, 524
 Leibniz notation, 49
 level curve, 365
 level set, 366
 level surface, 366
 limit, 41
 limit at infinity, 87
 limit of a sequence, 271
 line integral, 435
 linear approximation, 127
 linearity of the derivative, 60
 local extremum, 91
 local maximum, 91
 local minimum, 91
 logistic equation, 474
 long division of polynomials, 216

M

Maclaurin series, 300
 mass, 419
 mean, 236, 239
 Mean Value Theorem, 130
 moment, 227, 414, 420

N

Napier's constant, 188
 Newton, 174
 Newton's law of cooling, 469
 Newton's method, 123–125
 normal, 330, 358
 normal distribution, 244

O

one sided limit, 46
 optimization, 103
 orientable surface, 458
 oriented curve, 443

P

p -series, 282
 parallel vectors, 322
 parallelogram
 and vector sum, 315
 area of, 328, 416, 428
 parametric equations, 262, 333, 344
 partial fractions, 214
 particular solution, 472
 physicists, 116
 point-slope formula, 524
 polar coordinates, 253, 337
 polynomial
 of two variables, 370
 power function, 57
 power rule, 57
 precedence
 of algebraic operations, 523
 probability density function, 237
 product rule, 62, 63
 generalized, 64
 projection, 437
 scalar, 437
 projection of a vector, 322
 properties of integrals, 147

Q

quadratic formula, 523

530 Index

quotient rule, 64

R

radian measure, 73
 radius of convergence, 296
 random variable, 236
 rational function, 66, 214
 rectangular coordinates, 253, 337
 related rates, 115
 resonant frequency, 491
 right hand rule, 329
 Rolle's Theorem, 130

S

scalar multiplication, 316
 scalar projection, 437
 second derivative, 97, 98
 separation of variables, 472
 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, 524
 slope field, 482
 sphere
 surface area, 524

 volume, 524
 spherical coordinates, 339, 421
 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., 490
 substitution, 425
 subtend, 74
 sum
 of vectors, 315
 sum rule, 61
 surface area, 416

T

tangent line, 32
 Taylor series, 302
 Toricelli's trumpet, 235, 250
 torque, 225
 torus, 250
 transcendental function, 73
 transcendental number, 188
 transient part of solution to d.e., 490
 Trapezoid Rule, 219
 triangle inequality, 43, 314
 trigonometric identities, 524

U

unbounded function, 54
 undetermined coefficients, 487
 uniform distribution, 238
 uniform probability density function, 238
 unit binormal, 358
 unit circle, 21
 unit normal, 358
 unit vector, 323, 350

V

variance, 241
 variation of parameters, 477, 491
 vector, 314
 anti-parallel, 322
 cross product, 327
 displacement, 315
 function, 344
 normal to a plane, 330
 parallel, 322
 projection, 322

- scalar multiplication, 316
- sum, 315
- unit, 323
- vector fields, 433
- velocity, 37
- velocity vector, 359

W

- witch of Agnesi, 66
- work, 173