

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, 351
arc length parameterization, 352
arccosine, 197
arcsine, 196
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
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
 polar, 253, 335
 rectangular, 253, 335
 spherical, 337
cosines
 law of, 319, 520
critical value, 92
cross product, 325

524 Index

cumulative distribution function, 238
curvature, 354
curvature formula, 354, 355
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
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, 314
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
hypercycloid, 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
initial condition, 468
initial value problem
 first order, 468
integral
 improper, 231
 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, 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

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
 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
 subtrand, 74
 sum
 of vectors, 315
 sum rule, 61
 surface area, 414

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., 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, 314
 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