Index

A

absolute extremum, 119
acceleration
  normal component, 345
  tangential component, 345
acceleration vector, 345
algebraic precedence, 507
alternating harmonic series, 273
anti-parallel vectors, 309
antiderivative, 155
arc length, 232, 339
arc length parameterization, 340
arccosine, 96
arcsine, 94
area
  between curves, 191
  under a curve, 421
  under curve, 151
asymptote, 23, 115
average, 405
average height, 385

B

bell curve, 226
binormal, 344, 437
bounded function, 54

C

cardioid, 242
Cartesian coordinates, 241, 323
Cauchy Principal Value, 220
center of mass, 405
center of mass, 215
centroid, 216, 402
chain rule, 67
characteristic polynomial, 470
chord, 32
circle
  area, 507
  circumference, 507
  equation of, 21, 508
  unit, 21
Clairaut’s Theorem, 372
closed paths, 427
completing the square, 507
composition of functions, 27, 45, 67
concave down, 114
concave up, 114
cone
  lateral area, 508
  surface area, 508
  volume, 508
conservative vector field, 426
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, 508
critical value, 108
cross product, 313
cumulative distribution function, 226
curvature, 342
curvature formula, 342, 343
curve sketching, 107
cycloid, 251
cylinder
  lateral area, 508
  surface area, 508
  volume, 508
cylindrical coordinates, 407
cylindrical coordinates, 323

D

definite integral, 159
del (∇), 367
dependent variable, 24
derivative, 34, 48
dot notation, 132
  Leibniz notation, 49
  second, 112, 113
difference quotient, 32
differentiable, 55, 362
differential, 144
differential equation, 455
  first order, 456
  particular solution, 458
  separable, 458
directional derivative, 367
discrete probability, 223
discriminant, 373
displacement vector, 303
divergence test, 266
Divergence Theorem, 450
divergent sequence, 259
divergent series, 264
domain, 23
dot notation, 132
dot product, 308
double integral, 386

E

elipse
  area, 507
  equation of, 508
ellipsoid, 239
error estimate, 185
escape velocity, 222
Euler’s Method, 466
exp function, 85
expected value, 224
exponential distribution, 227
exponential function, 82
Extreme Value Theorem, 121

F

Fermat’s Theorem, 108
flux, 443
frustum, 235
Fubini’s Theorem, 389
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
hypocycloid, 252
hyperycloid, 252

I

implicit differentiation, 89, 365
implicit function, 90
improper integral, 219
  convergent, 219
  diverges, 219
incompressible, 436
indefinite integral, 159
independent variable, 24
inflection point, 114
initial condition, 456
initial value problem
  first order, 456
integral
  improper, 219
  indefinite, 159
  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, 284
inverse function, 82
inverse sine, 94
involute, 252

\( J \)

Jacobian, 416
judicious guessing, 473

\( K \)

kinetic energy, 221

\( L \)

L'Hôpital's Rule, 98
Lagrange multipliers, 378
lateral area of a cone, 130
law of cosines, 307, 508
law of sines, 508
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, 421
linear approximation, 143
linearity of the derivative, 60
local extremum, 107
local maximum, 107
local minimum, 107
logarithm, 82
logarithmic function, 82
logistic equation, 460
long division of polynomials, 182

\( M \)

Maclaurin series, 288
mass, 405
mean, 224, 227
Mean Value Theorem, 146
moment, 215, 400, 406

\( N \)

Newton, 210
Newton's law of cooling, 455
Newton's method, 139–141
normal, 317, 344
normal distribution, 232

\( O \)

one sided limit, 46
optimization, 119
orientable surface, 444
oriented curve, 429

\( P \)

\( p \text{-series}, 270 \)
parallel vectors, 309
parallelogram
  and vector sum, 303
  area of, 315, 402, 414
parametric equations, 250, 320, 330
partial fractions, 180
particular solution, 458
physicists, 132
point-slope formula, 508
polar coordinates, 241, 323
polynomial
  of two variables, 356
power function, 57
power rule, 57, 89, 92
precedence
  of algebraic operations, 507
probability density function, 225
product rule, 62, 63
  generalized, 64
projection, 423
  scalar, 423
projection of a vector, 309
properties of integrals, 163
Index

Q
quadratic formula, 507
quotient rule, 64

R
radian measure, 73
radius of convergence, 284
random variable, 224
rational function, 66, 180
rectangular coordinates, 241, 323
related rates, 131
resonant frequency, 477
right hand rule, 316
Rolle’s Theorem, 146

S
scalar multiplication, 304
scalar projection, 423
second derivative, 112, 113
separation of variables, 458
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, 284
Maclaurin, 288
radius of convergence, 284
Taylor, 290
Simpson’s Rule, 187
sines
  law of, 508
slope field, 468
sphere
  surface area, 508
  volume, 508
spherical coordinates, 325, 407
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., 476
substitution, 411
subtend, 74
sum
  of vectors, 303
sum rule, 61
surface area, 402

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., 476
Trapezoid Rule, 185
triangle inequality, 43, 302
trigonometric identities, 508

U
unbounded function, 54
undetermined coefficients, 473
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, 463, 477
vector, 302
  anti-parallel, 309
cross product, 313
displacement, 303
function, 330
  normal to a plane, 317
parallel, 309
projection, 309
scalar multiplication, 304
sum, 303
unit, 310
vector fields, 419
velocity, 37
velocity vector, 345

W

witch of Agnesi, 66
work, 209