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
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
<table>
<thead>
<tr>
<th>Term</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>cosines</td>
<td>319, 520</td>
</tr>
<tr>
<td>cumulative distribution function</td>
<td>238</td>
</tr>
<tr>
<td>curvature</td>
<td>354</td>
</tr>
<tr>
<td>curvature formula</td>
<td>354, 355</td>
</tr>
<tr>
<td>curve sketching</td>
<td>91</td>
</tr>
<tr>
<td>cycloid</td>
<td>263</td>
</tr>
<tr>
<td>cylinder</td>
<td></td>
</tr>
<tr>
<td>lateral area</td>
<td>520</td>
</tr>
<tr>
<td>surface area</td>
<td>520</td>
</tr>
<tr>
<td>volume</td>
<td>520</td>
</tr>
<tr>
<td>cylindrical coordinates</td>
<td>419</td>
</tr>
<tr>
<td>cylindrical coordinates</td>
<td>335</td>
</tr>
<tr>
<td>escape velocity</td>
<td>234</td>
</tr>
<tr>
<td>Euler's Method</td>
<td>478</td>
</tr>
<tr>
<td>expected value</td>
<td>236</td>
</tr>
<tr>
<td>exponential distribution</td>
<td>239</td>
</tr>
<tr>
<td>Extreme Value Theorem</td>
<td>105</td>
</tr>
<tr>
<td>Fermat's Theorem</td>
<td>92</td>
</tr>
<tr>
<td>flux</td>
<td>455</td>
</tr>
<tr>
<td>frustum</td>
<td>247</td>
</tr>
<tr>
<td>Fubini's Theorem</td>
<td>401</td>
</tr>
<tr>
<td>function</td>
<td>22</td>
</tr>
<tr>
<td>bounded</td>
<td>54</td>
</tr>
<tr>
<td>differentiable</td>
<td>55</td>
</tr>
<tr>
<td>implicit</td>
<td>82</td>
</tr>
<tr>
<td>linear</td>
<td>22</td>
</tr>
<tr>
<td>of two variables</td>
<td>368</td>
</tr>
<tr>
<td>rational</td>
<td>214</td>
</tr>
<tr>
<td>unbounded</td>
<td>54</td>
</tr>
<tr>
<td>function composition</td>
<td>27</td>
</tr>
<tr>
<td>Fundamental Theorem of Algebra</td>
<td>95</td>
</tr>
<tr>
<td>Fundamental Theorem of Calculus</td>
<td>137</td>
</tr>
<tr>
<td>Gabriel's horn</td>
<td>235, 250</td>
</tr>
<tr>
<td>geometric series</td>
<td>276</td>
</tr>
<tr>
<td>global extremum</td>
<td>103</td>
</tr>
<tr>
<td>gradient</td>
<td>379</td>
</tr>
<tr>
<td>greatest integer</td>
<td>94</td>
</tr>
<tr>
<td>harmonic series</td>
<td>279</td>
</tr>
<tr>
<td>alternating</td>
<td>285</td>
</tr>
<tr>
<td>Hooke's Law</td>
<td>175</td>
</tr>
<tr>
<td>hyperbolic cosine</td>
<td>199</td>
</tr>
<tr>
<td>hyperbolic sine</td>
<td>199</td>
</tr>
<tr>
<td>hypercycloid</td>
<td>264</td>
</tr>
<tr>
<td>hypocycloid</td>
<td>264</td>
</tr>
<tr>
<td>implicit differentiation</td>
<td>82, 377</td>
</tr>
<tr>
<td>implicit function</td>
<td>82</td>
</tr>
<tr>
<td>improper integral</td>
<td>231</td>
</tr>
<tr>
<td>convergent</td>
<td>231</td>
</tr>
<tr>
<td>diverges</td>
<td>231</td>
</tr>
<tr>
<td>incompressible</td>
<td>448</td>
</tr>
<tr>
<td>indefinite integral</td>
<td>143</td>
</tr>
<tr>
<td>independent variable</td>
<td>24</td>
</tr>
<tr>
<td>inflection point</td>
<td>98</td>
</tr>
<tr>
<td>indefinite integral</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

$J$

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
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, 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, 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