Index

Acceleration, 49
Amplitude, 134
Applications,
  of first order and higher degree equations, 75–77
  geometric, 41–48, 75–77, 133, 136, 178
    polar coordinates, 42, 46
    rectangular coordinates, 41, 44, 45
    trajectories, 43, 47, 48
  of linear equations, 133–156
    electric circuits, 136, 151-154
    geometric, 133, 136
    horizontal beams, 134–136, 145–151
    oscillatory motion, 133, 134, 137, 138, 140-143
  of total and simultaneous equations, 178–185
  physical, 49–60, 133–156, 178–185
    electric circuits, 57, 58, 136, 151–154, 183
    hanging cable, 144
    horizontal beam, 134–136, 145–151
    motion along a straight line, 49, 54–56, 138
    motion of a complex system, 139
    motion of a pendulum, 137
    oscillatory motion, 133, 134
    springs, 140–143
  Approximation,
    numerical, 186–196
  Arbitrary constant, 1, 78, 231, 232, 234
  Arbitrary function, 232-236
  Auxiliary system, 239

Beams,
  horizontal, 134–136, 145–151
Bernoulli's equation, 35, 37
Bessel equation, 222, 227, 228
Bessel functions, 222, 228

Cauchy linear equation, 108, 109, 113
Cauchy (Ordinary) Differential Equation, 269
C-discriminant, 69–74
Characteristic equation
  complex roots, 83, 85
  distinct real roots 83, 84
  repeated roots, 83, 85
Characteristic Roots, 83, 85
Charpit's method, 247, 253
Clairaut equation, 62, 64, 65, 71, 75, 76, 124
Complementary function 79, 257–259, 261–263, 266, 267, 269–272
Complete differential, 12
Complete solution,
  of ordinary differential equation, 79
  of partial differential equation, 240, 244–253
Conditions,
  for exactness 24, 165
  for integrability, 164, 167–170
  for linear independence, 78, 80, 81

Damping factor, 134
Degree, of differential equation 1, 61
Derivatives,
  ordinary, 1
  partial, 1

Differential equation,
  Bernoulli, 35, 37
  Bessel, 222, 227, 228
  Clairaut (see Clairaut equation)
    62, 64, 65, 71, 75, 76, 124
  conditions for solubility of, 7
  definition, 1
  exact 12, 24–34, 123, 129–131
  extended Clairaut, 234, 246
  first order, fitst degree, 12–40
    exact equations, 12, 24–34
    homogeneous equations, 15–18
    linear equations, 35–40
    linear but not homogeneous, 16, 19, 20
    miscellaneous substitutions, 16, 21
    variables separable, 13, 15–23
  first order, higher degree, 61–66
  first order, simultaneous, 189, 193, 194
  Gauss, 223, 229
  homogeneous ordinary, 15, 17, 18, 78, 82–86
  homogeneous partial, 255–264
  Legendre, 220, 221, 224–226
  Legendre linear, 108–110
  linear with constant coefficients, 87–107
    short methods, 99–107
    systems of, 157–163
    undetermined coefficients, 93, 96–98
    variation of Parameters, 93–96
  linear,
    homogeneous with constant coefficients, 82–86
    or order one, 13, 35–40
    of order n, 78–81, 122–132
    of order two, 111–121, 199, 202–205
    partial, first order, 238–243, 277
    partial, higher, order, 276–293
    with variable coefficients, 108–132
  non-homogeneous, partial, irreducible, 268, 269, 272, 273
  non-homogeneous, partial, reducible, 265–268, 270–272
  non-linear partial, 238, 244–254, 280
  numerical solution, 186–196
  ordinary, 1, 157
  origin of, 1–6
  partial 1, 157, 231–293
    order of, 231
  partial, first order, 238–254
  partial, higher order,
    constant coefficients, 255-275
    variable coefficients, 276–293
  solutions of, 7–11
  solutions in series, 197–211
  systems of, 157–163
  total, 164–177
Direction field, 8
Discriminant, 69–74
Discriminant relation, 69, 70
D-Notation, 82

Electric circuits, 57, 58, 136, 151–154, 183
Exact differential, 24, 25

Exact equations, 12, 24–34, 123, 129–131
  reduction to, 24
Existence theorem, 7
Extended Clairaut equation, 234, 246
Extraneous equation, 68
Extraneous loci, 67–74

First derivative method, 187, 191
Force, 49
Frequency, 134
Functions,
  Bessel, 222, 228
  complementary, 79, 257, 266
  homogeneous, 15

Gauss equation, 223, 229
General solution,
  of ordinary differential equation, 7
  of partial differential equation,
  238–242, 244, 245, 256, 257, 265–267

Harmonic motion, 133, 134, 137, 138, 140–143
Homogeneous equation, 15–18
Homogeneous function, 15
Homogeneous linear equation, 78–86, 255–264
Hooke's law, 55
Hypergeometric series, 223

Indicial equation, 208, 210, 212
  Roots Differing by an Integer, 212
  Roots Equal, 210
Infinite series, 197
Integral curve, 7–9, 41, 43
Integration factor, 12, 24
Integration in Series, 197–205, 206–219
Intermediate integral, 280
Irreducible equation, 265, 268, 269, 272, 273

Kutta's Simpson's method, 188, 193, 195

Lagrange system, 239
Laplace's transformation, 278, 279, 286, 287, 292
Large values of x, 208, 216
Legendre equation, 220, 221, 224–226
Legendre linear equation, 108–110
Legendre polynomial, 221, 226
Linear equation (*see also* Differential equation, linear) with Variable Coefficients:
Cauchy & Legendre Linear Equations,
  108–110
  Equations of the second order, 111–121
  exact equations, 123, 129–132
  dependent variable absent, 122, 124
  independent variable absent, 122, 125, 126
  particular integral known, 123, 126–128
Loci, extraneous, 68
Locus,
  cusp, 69, 73
  nodal, 69, 70, 72
  tac, 69, 72

Mass, 49
Monge's Equations, 281, 282, 288, 289
Monge's method, 288, 292

Newton's law of cooling, 51
Newton's second law of motion, 49
Non-homogeneous linear equation, 16, 19
Non-homogeneous linear partial differential equation,
  reducible, 265–268, 270–272
  irreducible, 268, 269, 272, 273
  with Constant Coefficients, 265–275
Non-linear partial differential equation,
  244–254, 280
Numerical Approximations to Solutions, 186–195

Operators, factorization of, 112
Order,
  of differential equation, 1, 5
  reduction of, 122
Origin,
  of ordinary differential equation, 1–6
  of partial differential equation, 231
Orthogonal trajectories, 43, 47, 48

Parameters, variation of, 93, 94
Partial differential equations, 1, 231–237
Partial fractions, method of, 88
Particular Integral, 79, 257, 266
Particular integral curve, 41
Particular solution, 7, 9, 11, 79
p-discriminant, 69–74
Period, 134
Picard's method, 186, 189, 190, 193
Point,
  ordinary, 199
  regular singular, 206
  singular, 199, 206
Primitive, 1–4

Recursion formula, 198
Reduction of order, 122
Rodrigues' Formula, 224, 225
Runge's method, 188, 192, 194

Separation of variable, 13, 15–23
Series,
  hypergeometric, 223
  solution in, 197
  Taylor, 187, 191, 194

Short methods,
  ordinary differential equation, 99–107
  partial differential equation, 266
Simultaneous equations, 157–163
Singular solution, 7, 67–74, 244
Solutions,
  complete, 79, 240, 244
  general, 7, 11, 238, 242, 244
  linearly independent, 78
  particular, 7
  in series, 197
  singular, 7, 64–74, 244
Springs, 140
Steady-state phenomenon, 134
S.I. System, 49
System of equations, 157–163

Taylor series, 187, 190, 191, 194
Total differential equation, 164–177
Trajectories, 43
Transient phenomenon, 134

Undetermined coefficients, method of,
  93, 96, 98, 258

Variables separable, 13, 15–23
Variation of parameters, 93, 94, 98