

INDEX

- Acceleration distribution in a lamina, 349
 Acceleration formulæ, 31, 52, 175, 177
 Acceleration of molecule at instantaneous centre, 349
 Accessibility, 228
 in gravitational field, 271
 in harmonic field, 235
 in uniform field, 232
 Anisotropic oscillator, 185
 Aphelion, 249
 Apses, 249
 projection from, 270
 Apsidal angle, 250
 Apsidal distances, 249, 281
 Apsidal quadratic, 269
 Areas, theorem of, 247
 Atwood's machine, 145
- Bend on a rotating wire, 353
 Bouncing ball, 157
 Brachistochrone, 218
- Central orbits, 245–300
 Centre of percussion, 417
 Centrifugal force, 189
 Centroides, 344
 Circle, motion in a, 177, 187
 Classification of motions in a rectangular field, 95
 Coefficient of restitution, 150
 Collision diagram, 325
 Collision of smooth spheres, on a line, 150
 in a plane, 323
 Collisions of the second kind, 323, 327
 Components of a vector, 18
 Compound pendulum, 375
 Conservation of energy, 77; *see also* Equation of energy
 Conservation of momentum, 150, 245, 393, 421, 464, 478
 Conservative field, 46, 72, 197
 Conservative forces, 443
 Constraints, 203, 399, 447
 Convergent integrals, 89
- Coriolis, theorem of, 353
 Cotes' spirals, 287
 Crossed fields, 308
 Cyclic coordinate, 212
 Cycloid, 113, 216
- d'Alembert's principle, 369
 generalization of, 430
 Damped harmonic motion, 130
 Deflexion of a plumb-line, 189
 Derivative of a vector, 23
 Derivative, vectorial character of, 25
 Differential equation of an orbit, 281, 293, 295
 Dimensional analysis, 489
 Dimensional formula, 488
 Dimensionless quantities, 491
 Directed lengths, 5
 Directed modulus, 9
 Directed quantities, 6
 Displacement of a lamina, 338
 Displacement of a particle, 11
 Divergent integrals, 89
 Door-stop, 421
 Drops from a capillary tube, 495
 Dynamical similarity, 494
 Dynamical system, 429
- Eccentric circular cam, 83
 Electron, motion of an, 168
 Elliptic orbit
 centres of force not a focus, 299
 of an isotropic oscillator, 181, 185
 Newtonian, 262–73, 282–6
 Energy, communicated by impulses, 419, 480
 equation or integral of, 75, 146, 202–3, 374, 397, 441
 lost at impact, 154
 three forms of the equation of, 133, 314, 446
 Energy level, 203
 Enveloping ellipse
 in a gravitational field, 271
 in a harmonic field, 235
 Enveloping parabola, 232, 234
 Epoch constant, 58

- Equations of motion, 36
 of pendulum or fly-wheel, 374
 plane motion, 180, 198; of rigid body, 386–7
 rectilinear motion, 53
 of a system, 432
- Equilibrium, points of
 on a line, 96, 102
 in a plane, 237
- Equipomental bodies, 365
- Equipotentials, 199
- Equivalence of two force systems, 357
- Equivalent simple pendulum, 84, 376
- External forces, 141, 320, 365
- Fermat's principle, 175, 205
- Field of force, 41, 71
 non-conservative, 306
 rectilinear motion in, 71–114
- Galileo, 38
- Gradient, 44
- Graphs relating to rectilinear motion, 53
- Gravitational field, 74
 motion in, 259–79
 rectilinear motion in, 111–13
- Gyroscopic forces, 307
- Harmonic attraction in a harmonic field, 73, 79, 90, 108, 181, 185, 221
- Harmonic motion, 79–82, 90, 108
 amplitude and phase, 82
- Harmonic oscillator, 79–82, 108
- Hodograph, 173
- Horse-power, 44
- Hyperbolic orbit, 266, 275
- Impact parameter, 267
- Impulses
 on a particle, 148
 on a rigid body, 414–24
 on a system, 476–81
- Inflexion circle, 349
- Initial motion, 392
- Instantaneous centre, 343
 equation for moments about, 401–3
 velocity of, 346
- Internal forces, 141, 320, 365
- Internal stresses in a moving body, 406
- Inverse-cube law, 286–90
- Inverse-square law, 259–78, 282–6
- Isochronous property of the cycloid, 216
- Isotropic oscillator, 180, 181, 185, 235
- Joule, 43, 489
- Kater's pendulum, 378
- Kelvin's theorem, 424
- Kepler's equation, 273
- Kepler's laws, 259
- Kinetic energy, 58, 75, 145
- Kineton, 32, 172
 system, 359, 369, 373, 385
- König's formula, 146, 397, 449
- Lagrange's formula, 146, 449
- Lagrangian coordinates, 455
- Lamina, motion of a, 336–55
- Law of gravitation, 74, 111, 201, 260
- Laws of Motion
 First, 32
 Second, 32, 34
 Third, 141
- Level curves, 199
- Libration motion, 88–93
- Limitation motion, 93
- Lines of force, 199
- Lines of quickest descent, 206–7
 in harmonic field, 221
- Localized vector quantities, 6, 359
- Mean motion, 266
- Measure, 1
 change of, 488
- Modulus
 of a spring, 74
 of a vector, 7
- Molecule of zero acceleration, 351
- Momentary ellipse, 364
- Moment equation for a system, 433
- Moments of inertia, 362
- Momentum, 58, 172
- Motion of a body relative to a seized point, 379
- Motion of a solid, 395
- Motor car, 124–6, 435–41
- Moving axes, 470
- Moving origin, 468

- Nearly circular orbit, 251–4, 273–4
 Newtonian base, 36
 Newtonian orbit, 262–78, 282–6
 Newton's *Principia*, 362
 Newton's theorem on revolving orbits, 292, 295
 Normal coordinates, 453–4
 Normal modes, 453–4
- Oscillations, small
 forced and free, 127
 on a line, 102–7
 of a system with two freedoms, 186
 of a vibrating system (Example), 452–4
- Parabolic orbit, 275
 Parabolic trajectory in a uniform field, 181, 184, 228–31
 Parallel axes theorem, 363
 Pendulum
 rigid, 375
 simple, 208
 Perihelion, 249
 Pile driver, 156
 Position vector, 11, 31, 172
 Potential function, 71–4, 198
 uniformity of, 201
 Power, 42, 123
 Products of inertia, 362
 Projectiles, 228–31
 Projection of a vector, 19
- Radius of gyration, 363
 Reaction of pivot on pendulum, 404
 Reduction of a system of localized vector quantities, 357–9
 change of origin, 360
 Relative instantaneous centre, 352
 Relative motion, 178
 Repulsion proportional to distance, 109
 Resisting medium, motion on a line, 117–23
 motion in a plane, 309–14
 Resonance, 127
 Resultant of two displacements of a lamina, 339
 Reversibility, 56, 78, 190
 Rigid (or compound) pendulum, 375
 Rotation of the earth, 189
 Rotations of a rigid body, 12
 Rough surface, motion of a particle on a, 304
- Saddle point, 238
 Scalar product, 20
 Scalar quantities, 1
 Seconds pendulum, 377
 Simple equivalent pendulum, 376
 Simple pendulum, 208–13
 illustrating dimensional analysis, 493
 in a harmonic field, 222
 with unilateral constraint, 213
 Snell's law, 175, 205
 Solid spheres, attraction of, 279
 Stability of circular orbit, 253
 Stability of equilibrium, 96–102, 237
- Statics
 of a particle, 11
 of a rigid body, 357
 Superposition of impulse systems, 418
- Terminal velocity, 119
 Two particles moving
 on a line, 141–8
 in a plane, 320–30
- Uniform field, 72, 108, 181, 184
 motion in a, 228–38
 Uniform scale of measurement, 1
 uniqueness, 3
 Unilateral constraint, 205, 213, 222
 Units, 4, 37, 43, 486
 change of, 487
- Variable mass, 162–9
 Vector algebra, 15–22
 Vector calculus, 23–30
 Vector diagram, 7
 Vector product, 248
 Vector quantities, 8
 Vectors of directed quantities, 6
 Velocity distribution in a lamina, 340
 Velocity formulæ, 27, 172, 174
- Wandering point theorems, first, 342
 second, 353
 Watt, 43
 Wind-tunnel experiments, 494
 Work, 39, 42
 done in displacement of a lamina, 361, 366