

Index

- Abridged reading, 201
 Actuarial notation, 25, 198–200
 Adjustments, abruptness, 30, 54, 92, 177, 180–1
 Sheppard's, 29, 30, 46, 51, 75, 92, 179
 Allin, S. H. J. W., 32
 Alsace-Lorraine, 162
 Annuity experience, 90
 values, 32–3
 Approximate formulae, 95–7
 Approximation, Newton's, 143, 145
 to distribution of correlation coefficient, 161

 Barton, D. E., 120, 176
 Beta function, 56, 182–4
 incomplete, 56
 Binomial series, 1, 6, 36, 110–12
 standard error in, 156
 Bivariate surface, normal, 139–50, 185–7, 188
 Pearson, 137–9
 translation (S_{IJ}), 147–50
 Type AA, 145–7
 Block diagram, 5
 British Offices Tables, 18
 Brownlee, J., 183
 Bruns, H., 111
 Brunt, D., 194

 Carlisle Table, 89
 Census, 197
 Centroid vertical, 17–18, 54, 65
 Charlier, C. V. L., 111, 112, 117
 Checking calculations, 15–16
 Chi-squared, 167 *et seq.*, 186
 minimum, 195–7
 test, 173–5; table for goodness-of-fit, values of P, 207
 Commutation columns, 199
 Comrie, L. J., 59
 Conditional frequency distribution, 137, 148
 Correlation coefficient, 137, 152–3, 156–7
 estimation of, 141–5
 standard error, 161
 transformation of, 161
 Covariance, 137
 Cramer, H., 115, 196
 Crelle's tables, 100, 102
 Cricket scores, 92
 Criteria for type of Pearson curve, 41

 Curve, advantages of systems of, 2
 calculation, 47 *et seq.*
 frequency, 4 *et seq.*, 37 (see also Pearson's curves)
 Gaussian, 41, 70
 J-shaped, 41, 44, 48, 52, 67, 79, 117–19, 162, 179–80, 195
 J-shaped, twisted, 53, 94–5, 180
 of error, normal, 41, 44, 70–4, 76, 78, 103, 110, 115, 141, 153, 166, 188–92, 193
 probability, 41, 70
 rectangular, 86, 88
 transition types, 43–4, 70–95
 trapezoidal, 89
 uniform, 86, 88
 U-shaped, 41, 44, 52, 95, 119, 131

 David, F. N., 161, 175
 De Moivre, A., 70
 Degrees of freedom, 167
 Dennis, K. E. R., 120
 Deviation from symmetry, see Skewness, proportional, 1
 mean, 9–10, 39
 standard, 8–10, 39, 152–4
 Differential equation, 35
 of Pearson curves, 37, 201
 Dirichlet distributions, 139
 Distributions, chance, 110
 exponential, 179–80 (see also Pearson Type X)
 frequency, 4–11
 mean of, 6–8, 10
 mode of, 8, 10
 symmetrical, 60, 75
 Distributions of deaths, 4, 82
 entrants, limited payment policies, 67
 existing at close of observation, 5
 exposed to risk, 4, 5, 173
 number of wives, 79
 reserves, 71
 sums assured, 71
 unexpired term, 75
 withdrawals, 5, 108, 134
 Donald, D. W. A. 198
 Duration, actual, 4
 curate, 4, 5, 198

 Edgeworth curves (Type Ab), 114, 116, 118, 119–20, 146
 Edgeworth, F. Y., 111, 114

- Efficiency, 195
 Euler-Maclaurin expansion, 177–80
 Type A (Aa or Gram-Charlier), 111–12, 115, 116, 119–21, 146–7, 172
 Type Ab (Edgeworth), 114, 116, 118, 119–20, 146–7
 Type B (Charlier), 112–14, 116, 117, 172
 Expected deaths, 198
 Exponential distribution, 179–80 (see also Pearson Type X)
 Exposed to risk, 196, 198; distributions of, 4, 5, 173
- Factorial moments, 21, 22
 Fisher, R. A., 161, 194
 Force of mortality, 12, 37, 196, 199
 Fraser, D. A. S., 175
 Freedom, degrees of, 167
 Frequency, 10
 conditional, 137, 148
 curves, 4 *et seq.*, 37; further reading, 203 (see also Pearson's curves)
 distribution, 4 *et seq.*
 marginal, 135
 polygons, 4
 surfaces, 135 *et seq.*; further reading, 204; bivariate normal, 139–50, 185–7, 188; Pearson, 137–9; translation (S_{IJ}), 147–50; Type AA, 145–7
- Gamma function, 52, 75, 182–4
 incomplete, 56, 183–4
 table of log of, 208–9
 Gauss, C. F., 70
 Gaussian curve, 41, 70
 Geometrical progression, 1, 6, 92, 179, 200
 Goodness of fit, 165–76
 further reading, 204
 table for χ^2 test of, 207
 Graduation, 2, 12, 24, 48, 55, 71, 76, 89, 92, 94, 173, 196, 198
 formulae for, 13, 35
 Gram, J. P., 112
 Great numbers, law of, 111
 Groups, 2, 14, 102
- HM Table, distribution, 170, 199
 Hardy, Sir G. F., 18, 75, 106
 Hartley, H. O., 16, 202
 Henderson, R., 159
 Hermite polynomials, 112
 High contact, 27–30, 49, 178
 mathematical definition, 28
 High order moments, 39–40
- Histogram, 4
 Hooker, P. F., 198
 Hypergeometric series, 36, 110–11
- Incomplete beta function, 56
 gamma function, 56, 183–4
- J-shaped curve, 41, 44, 48, 52, 67, 79, 117–19, 162, 179–80, 195
 twisted, 53, 94–5, 180
 Johnson, N. L., 123, 173
- Kapteyn, J. C., 111
 Khamis, S. H., 114
 King, G., 82, 170
- Laplace, P. S., 70
 Law of great numbers, 111
 small numbers, 112
 Least squares, method of, 193–4
 Lidstone, G. J., 22, 75, 171, 200
 Limited payment policies, entrants, 67, 68
 Logarithms, use of, 50, 51
 Lognormal, 123, 124–6
 line, 124
 Longley-Cook, L. H., 198
- Macdonnell, W. R., 144
 Mackenzie Lees, M., 99
 Maclaurin's theorem, 35
 Makeham's hypothesis, 12, 103, 196, 199
 Marginal curve, 135
 Marriage rates, 99
 Martin, E. S., 181
 Massey, F. J., 176
 Maximum likelihood, method of, 194
 Mean, 6, 8, 11
 deviation, 9, 39
 standard error of, 157
 Median regression, 149
 Method of least squares, 193–4
 maximum likelihood, 194–5
 minimum, 2, 197–7
 moments 12 *et seq.*, 34; further reading, 203
 percentile points, 131–3, 197
 summation, 18 *et seq.*, 53, 99
 translation, 115, 122 *et seq.*
- Mixture of normal curves, 103–6
 Mode, 8
 Model office, 200
 Moments, 14
 calculation of, 14 *et seq.*, 181
 centroid vertical, about the, 17, 54, 65
 corrections of, 29, 177, 181
 factorial, 21–2

216 Index

- Moments—(contd.)
 formulæ for, 51
 high order, 39–40
 inertia, 13
 method of, 12 *et seq.*
 notation for, 15
*n*th, 14
 ordinates, of, 14
 summations of, 18 *et seq.*
 Mortality, force of, 37, 196, 199
 variations in Sweden, 196
- Negative frequencies, 120
 Newton's approximation method, 143, 145
 Neyman, J., 175
 Nicholson, C., 141
 Normal bivariate surface, 139–50, 185–7, 88
 curve of error, 41, 44, 70–4, 76, 78, 103, 110, 115, 141, 153, 166, 188–92, 193; table, 207
 mixture, 103–6
- OM Table distribution, 170, 198
 ONM^(b) Table, 100, 105, 198
 Owen, D. B. 141
- Pairman, E., 177
 Pearson curves, differential equation, 37, 201
 Type I, 42, 45, 51–8, 95, 102, 106–9, 115, 116, 131, 132, 134, 138, 139, 171–2, 180; II, 43, 45, 74–7, 78, 95, 115, 118, 131, 138, 139; III, 43, 45, 78–81, 98, 99, 100, 114, 116, 120, 138, 139, 171, 178, 183, 184; IV, 42, 45, 58–66, 83, 118, 120, 126, 128, 130, 134, 138; V, 44, 45, 81–5, 171; VI, 43, 45, 67–70, 126, 138, 139; VII, 45, 77–8, 139; VIII, 46, 85–9; IX, 46, 89–91; X, (exponential), 46, 89, 91–2, 179; XI, 46, 92–3; XII, 94
 surfaces, 137–9
 Pearson, E. S., 16, 95, 134, 202
 Pearson, K., 16, 39, 41, 111, 117, 167, 177, 202
 Percentile points, method of, 131–3, 197
 Poisson series, 112
 Polygons, frequency, 4
 Probable error, 154
 Probability, 1
 curve, 41, 70
 elementary, 2
 Product moment, 136
 reduced, 136
- Quadrature formulæ, 25–6, 28, 47, 76, 102, 108–9
- Rates, 98
 Rectangular curve, 86, 88
 Regression, 137, 138
 linear, 138
 median, 149
 Rhodes, E. C., 120
 Runs of signs, 174
- Sampling, 162–3
 S_B system, 123, 125, 130–34
 S_U system, 123, 125, 126–30, 211
 compared with Type IV, 130, 134
 Seal, H. L., 175
 Semi-invariants, 21, 112, 114
 Shenton, L. R., 195
 Sheppard, W. F., 72
 Sheppard's adjustments, 29, 30, 46, 51, 75, 92, 179
 formula, 141
 Simpson's rule, 47, 55, 76
 Skewness, 9–10, 48
 of Pearson curves, 39
 Small numbers, law of, 112
 Smirnov, N., 176
 'Smooth' test, 175
 Soper, H. E., 167
 Statistical tables, 2
 Standard deviation, 8–10, 39, 152–4
 Standard errors, 151 *et seq.*; further reading, 204
 of estimator of $\sqrt{\beta_1}$, 161
 of estimator of β_2 , 161
 mean, 157
 Steffenson, J. F., 114–15
 Summation of moments, 19–21
 Summation method, 18 *et seq.*, 53, 99
 Sutton's sickness tables, 60
- Tetley, H., 174
 Tiku, M. L., 114
 Transformation of correlation coefficient, 161
 Transition types, 43–4, 70–95
 Transition, method of, 115, 122 *et seq.*
 Trapezoidal curve, 89
 Tukey, J. W., 95, 134
 Twisted J-shaped curve, 53, 94–5, 180
 Type A expansion, 111–20
 B expansion, 112–20
- U-shaped curve, 41, 44, 52, 95, 119, 131
 Uniform curve, 86, 88
 Uven, M. J. van, 137
- Variance, 9
 Wold, H., 196