

- [R419] <http://dlmf.nist.gov/25.14>
- [R420] [https://en.wikipedia.org/wiki/Lerch\\_transcendent](https://en.wikipedia.org/wiki/Lerch_transcendent)
- [R421] [https://en.wikipedia.org/wiki/Stieltjes\\_constants](https://en.wikipedia.org/wiki/Stieltjes_constants)
- [R422] Luke, Y. L. (1969), The Special Functions and Their Approximations, Volume 1
- [R423] [https://en.wikipedia.org/wiki/Generalized\\_hypergeometric\\_function](https://en.wikipedia.org/wiki/Generalized_hypergeometric_function)
- [R424] Luke, Y. L. (1969), The Special Functions and Their Approximations, Volume 1
- [R425] [https://en.wikipedia.org/wiki/Meijer\\_G-function](https://en.wikipedia.org/wiki/Meijer_G-function)
- [R426] [https://en.wikipedia.org/wiki/Appell\\_series](https://en.wikipedia.org/wiki/Appell_series)
- [R427] <http://functions.wolfram.com/HypergeometricFunctions/AppellF1/>
- [R428] [https://en.wikipedia.org/wiki/Elliptic\\_integrals](https://en.wikipedia.org/wiki/Elliptic_integrals)
- [R429] <http://functions.wolfram.com/EllipticIntegrals/EllipticK>
- [R430] [https://en.wikipedia.org/wiki/Elliptic\\_integrals](https://en.wikipedia.org/wiki/Elliptic_integrals)
- [R431] <http://functions.wolfram.com/EllipticIntegrals/EllipticF>
- [R432] [https://en.wikipedia.org/wiki/Elliptic\\_integrals](https://en.wikipedia.org/wiki/Elliptic_integrals)
- [R433] <http://functions.wolfram.com/EllipticIntegrals/EllipticE2>
- [R434] <http://functions.wolfram.com/EllipticIntegrals/EllipticE>
- [R435] [https://en.wikipedia.org/wiki/Elliptic\\_integrals](https://en.wikipedia.org/wiki/Elliptic_integrals)
- [R436] <http://functions.wolfram.com/EllipticIntegrals/EllipticPi3>
- [R437] <http://functions.wolfram.com/EllipticIntegrals/EllipticPi>
- [R438] [https://en.wikipedia.org/wiki/Mathieu\\_function](https://en.wikipedia.org/wiki/Mathieu_function)
- [R439] <http://dlmf.nist.gov/28>
- [R440] <http://mathworld.wolfram.com/MathieuBase.html>
- [R441] <http://functions.wolfram.com/MathieuandSpheroidalFunctions/MathieuS/>
- [R442] [https://en.wikipedia.org/wiki/Mathieu\\_function](https://en.wikipedia.org/wiki/Mathieu_function)
- [R443] <http://dlmf.nist.gov/28>
- [R444] <http://mathworld.wolfram.com/MathieuBase.html>
- [R445] <http://functions.wolfram.com/MathieuandSpheroidalFunctions/MathieuC/>
- [R446] [https://en.wikipedia.org/wiki/Mathieu\\_function](https://en.wikipedia.org/wiki/Mathieu_function)
- [R447] <http://dlmf.nist.gov/28>
- [R448] <http://mathworld.wolfram.com/MathieuBase.html>
- [R449] <http://functions.wolfram.com/MathieuandSpheroidalFunctions/MathieuSPrime/>
- [R450] [https://en.wikipedia.org/wiki/Mathieu\\_function](https://en.wikipedia.org/wiki/Mathieu_function)
- [R451] <http://dlmf.nist.gov/28>
- [R452] <http://mathworld.wolfram.com/MathieuBase.html>
- [R453] <http://functions.wolfram.com/MathieuandSpheroidalFunctions/MathieuCPrime/>
- [R454] [https://en.wikipedia.org/wiki/Jacobi\\_polynomials](https://en.wikipedia.org/wiki/Jacobi_polynomials)

- [R455] <http://mathworld.wolfram.com/JacobiPolynomial.html>
- [R456] <http://functions.wolfram.com/Polynomials/JacobiP/>
- [R457] [https://en.wikipedia.org/wiki/Jacobi\\_polynomials](https://en.wikipedia.org/wiki/Jacobi_polynomials)
- [R458] <http://mathworld.wolfram.com/JacobiPolynomial.html>
- [R459] <http://functions.wolfram.com/Polynomials/JacobiP/>
- [R460] [https://en.wikipedia.org/wiki/Gegenbauer\\_polynomials](https://en.wikipedia.org/wiki/Gegenbauer_polynomials)
- [R461] <http://mathworld.wolfram.com/GegenbauerPolynomial.html>
- [R462] <http://functions.wolfram.com/Polynomials/GegenbauerC3/>
- [R463] [https://en.wikipedia.org/wiki/Chebyshev\\_polynomial](https://en.wikipedia.org/wiki/Chebyshev_polynomial)
- [R464] <http://mathworld.wolfram.com/ChebyshevPolynomialoftheFirstKind.html>
- [R465] <http://mathworld.wolfram.com/ChebyshevPolynomialoftheSecondKind.html>
- [R466] <http://functions.wolfram.com/Polynomials/ChebyshevT/>
- [R467] <http://functions.wolfram.com/Polynomials/ChebyshevU/>
- [R468] [https://en.wikipedia.org/wiki/Chebyshev\\_polynomial](https://en.wikipedia.org/wiki/Chebyshev_polynomial)
- [R469] <http://mathworld.wolfram.com/ChebyshevPolynomialoftheFirstKind.html>
- [R470] <http://mathworld.wolfram.com/ChebyshevPolynomialoftheSecondKind.html>
- [R471] <http://functions.wolfram.com/Polynomials/ChebyshevT/>
- [R472] <http://functions.wolfram.com/Polynomials/ChebyshevU/>
- [R473] [https://en.wikipedia.org/wiki/Legendre\\_polynomial](https://en.wikipedia.org/wiki/Legendre_polynomial)
- [R474] <http://mathworld.wolfram.com/LegendrePolynomial.html>
- [R475] <http://functions.wolfram.com/Polynomials/LegendreP/>
- [R476] <http://functions.wolfram.com/Polynomials/LegendreP2/>
- [R477] [https://en.wikipedia.org/wiki/Associated\\_Legendre\\_polynomials](https://en.wikipedia.org/wiki/Associated_Legendre_polynomials)
- [R478] <http://mathworld.wolfram.com/LegendrePolynomial.html>
- [R479] <http://functions.wolfram.com/Polynomials/LegendreP/>
- [R480] <http://functions.wolfram.com/Polynomials/LegendreP2/>
- [R481] [https://en.wikipedia.org/wiki/Hermite\\_polynomial](https://en.wikipedia.org/wiki/Hermite_polynomial)
- [R482] <http://mathworld.wolfram.com/HermitePolynomial.html>
- [R483] <http://functions.wolfram.com/Polynomials/HermiteH/>
- [R484] [https://en.wikipedia.org/wiki/Laguerre\\_polynomial](https://en.wikipedia.org/wiki/Laguerre_polynomial)
- [R485] <http://mathworld.wolfram.com/LaguerrePolynomial.html>
- [R486] <http://functions.wolfram.com/Polynomials/LaguerreL/>
- [R487] <http://functions.wolfram.com/Polynomials/LaguerreL3/>
- [R488] [https://en.wikipedia.org/wiki/Laguerre\\_polynomial#Generalized\\_Laguerre\\_polynomials](https://en.wikipedia.org/wiki/Laguerre_polynomial#Generalized_Laguerre_polynomials)
- [R489] <http://mathworld.wolfram.com/AssociatedLaguerrePolynomial.html>

- [R490] <http://functions.wolfram.com/Polynomials/LaguerreL/>
- [R491] <http://functions.wolfram.com/Polynomials/LaguerreL3/>
- [R492] [https://en.wikipedia.org/wiki/Spherical\\_harmonics](https://en.wikipedia.org/wiki/Spherical_harmonics)
- [R493] <http://mathworld.wolfram.com/SphericalHarmonic.html>
- [R494] <http://functions.wolfram.com/Polynomials/SphericalHarmonicY/>
- [R495] <http://dlmf.nist.gov/14.30>
- [R496] [https://en.wikipedia.org/wiki/Spherical\\_harmonics](https://en.wikipedia.org/wiki/Spherical_harmonics)
- [R497] <http://mathworld.wolfram.com/SphericalHarmonic.html>
- [R498] <http://functions.wolfram.com/Polynomials/SphericalHarmonicY/>
- [R499] [https://en.wikipedia.org/wiki/Spherical\\_harmonics](https://en.wikipedia.org/wiki/Spherical_harmonics)
- [R500] <http://mathworld.wolfram.com/SphericalHarmonic.html>
- [R501] <http://functions.wolfram.com/Polynomials/SphericalHarmonicY/>
- [R502] [https://en.wikipedia.org/wiki/Kronecker\\_delta](https://en.wikipedia.org/wiki/Kronecker_delta)
- [BlogPost] <https://nessgrh.wordpress.com/2011/07/07/tricky-branch-cuts/>
- [R525] M. Bronstein, Symbolic Integration I: Transcendental Functions, Second Edition, Springer-Verlag, 2005, pp. 35-70
- [R526] [http://en.wikibooks.org/wiki/Calculus/Integration\\_techniques](http://en.wikibooks.org/wiki/Calculus/Integration_techniques)
- [R527] <http://www-sop.inria.fr/cafe/Manuel.Bronstein/pmint/index.html>
- [R528] K. Geddes, L. Stefanus, On the Risch-Norman Integration Method and its Implementation in Maple, Proceedings of ISSAC'89, ACM Press, 212-217.
- [R529] J. H. Davenport, On the Parallel Risch Algorithm (I), Proceedings of EURO-CAM'82, LNCS 144, Springer, 144-157.
- [R530] J. H. Davenport, On the Parallel Risch Algorithm (III): Use of Tangents, SIGSAM Bulletin 16 (1982), 3-6.
- [R531] J. H. Davenport, B. M. Trager, On the Parallel Risch Algorithm (II), ACM Transactions on Mathematical Software 11 (1985), 356-362.
- [R532] [https://en.wikipedia.org/wiki/Riemann\\_sum#Methods](https://en.wikipedia.org/wiki/Riemann_sum#Methods)
- [R533] [https://en.wikipedia.org/wiki/Cauchy\\_principal\\_value](https://en.wikipedia.org/wiki/Cauchy_principal_value)
- [R534] <http://mathworld.wolfram.com/CauchyPrincipalValue.html>
- [R535] [https://en.wikipedia.org/wiki/Gaussian\\_quadrature](https://en.wikipedia.org/wiki/Gaussian_quadrature)
- [R536] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/legendre\\_rule/legendre\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/legendre_rule/legendre_rule.html)
- [R537] [https://en.wikipedia.org/wiki/Gauss%E2%80%93Laguerre\\_quadrature](https://en.wikipedia.org/wiki/Gauss%E2%80%93Laguerre_quadrature)
- [R538] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/laguerre\\_rule/laguerre\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/laguerre_rule/laguerre_rule.html)
- [R539] [https://en.wikipedia.org/wiki/Gauss-Hermite\\_Quadrature](https://en.wikipedia.org/wiki/Gauss-Hermite_Quadrature)
- [R540] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/hermite\\_rule/hermite\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/hermite_rule/hermite_rule.html)
- [R541] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/gen\\_hermite\\_rule/gen\\_hermite\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/gen_hermite_rule/gen_hermite_rule.html)
- [R542] [https://en.wikipedia.org/wiki/Gauss%E2%80%93Laguerre\\_quadrature](https://en.wikipedia.org/wiki/Gauss%E2%80%93Laguerre_quadrature)

- [R543] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/gen\\_laguerre\\_rule/gen\\_laguerre\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/gen_laguerre_rule/gen_laguerre_rule.html)
- [R544] [https://en.wikipedia.org/wiki/Chebyshev%E2%80%93Gauss\\_quadrature](https://en.wikipedia.org/wiki/Chebyshev%E2%80%93Gauss_quadrature)
- [R545] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/chebyshev1\\_rule/chebyshev1\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/chebyshev1_rule/chebyshev1_rule.html)
- [R546] [https://en.wikipedia.org/wiki/Chebyshev%E2%80%93Gauss\\_quadrature](https://en.wikipedia.org/wiki/Chebyshev%E2%80%93Gauss_quadrature)
- [R547] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/chebyshev2\\_rule/chebyshev2\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/chebyshev2_rule/chebyshev2_rule.html)
- [R548] [https://en.wikipedia.org/wiki/Gauss%E2%80%93Jacobi\\_quadrature](https://en.wikipedia.org/wiki/Gauss%E2%80%93Jacobi_quadrature)
- [R549] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/jacobi\\_rule/jacobi\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/jacobi_rule/jacobi_rule.html)
- [R550] [http://people.sc.fsu.edu/~jburkardt/cpp\\_src/gegenbauer\\_rule/gegenbauer\\_rule.html](http://people.sc.fsu.edu/~jburkardt/cpp_src/gegenbauer_rule/gegenbauer_rule.html)
- [R551] [https://en.wikipedia.org/wiki/Gaussian\\_quadrature#Gauss.E2.80.93Lobatto\\_rules](https://en.wikipedia.org/wiki/Gaussian_quadrature#Gauss.E2.80.93Lobatto_rules)
- [R552] [http://people.math.sfu.ca/~cbm/aands/page\\_888.htm](http://people.math.sfu.ca/~cbm/aands/page_888.htm)
- [R742] Big O notation
- [R743] [https://en.wikipedia.org/wiki/Residue\\_theorem](https://en.wikipedia.org/wiki/Residue_theorem)
- [R737] [https://en.wikipedia.org/wiki/Gibbs\\_phenomenon](https://en.wikipedia.org/wiki/Gibbs_phenomenon)
- [R738] [https://en.wikipedia.org/wiki/Sigma\\_approximation](https://en.wikipedia.org/wiki/Sigma_approximation)
- [R739] <https://mathworld.wolfram.com/FourierSeries.html>
- [R731] Comtet, Louis: Advanced combinatorics; the art of finite and infinite expansions. Reidel, 1974.
- [R732] Comtet, Louis: Advanced combinatorics; the art of finite and infinite expansions. Reidel, 1974.
- [R733] Formal Power Series - Dominik Gruntz, Wolfram Koepf
- [R734] Power Series in Computer Algebra - Wolfram Koepf
- [R735] Formal Power Series - Dominik Gruntz, Wolfram Koepf
- [R736] Power Series in Computer Algebra - Wolfram Koepf
- [R740] <https://reference.wolfram.com/language/ref/DifferenceDelta.html>
- [R741] Computing Limits of Sequences - Manuel Kauers
- [R762] M. Monagan, R. Pearce, Rational Simplification Modulo a Polynomial Ideal, <http://citeseer.ist.psu.edu/viewdoc/summary?doi=10.1.1.163.6984> (specifically, the second algorithm)
- [R763] <http://researcher.watson.ibm.com/researcher/files/us-fagin/symb85.pdf>
- [R764] D. J. Jeffrey and A. D. Rich, 'Simplifying Square Roots of Square Roots by Denesting' (available at <http://www.cybertester.com/data/denest.pdf>)
- [Roach1996] Kelly B. Roach. Hypergeometric Function Representations. In: Proceedings of the 1996 International Symposium on Symbolic and Algebraic Computation, pages 301-308, New York, 1996. ACM.

- [Roach1997] Kelly B. Roach. Meijer G Function Representations. In: Proceedings of the 1997 International Symposium on Symbolic and Algebraic Computation, pages 205-211, New York, 1997. ACM.
- [Luke1969] Luke, Y. L. (1969), The Special Functions and Their Approximations, Volume 1.
- [Prudnikov1990] A. P. Prudnikov, Yu. A. Brychkov and O. I. Marichev (1990). Integrals and Series: More Special Functions, Vol. 3, Gordon and Breach Science Publisher.
- [R759] [https://en.wikipedia.org/wiki/Morrie%27s\\_law](https://en.wikipedia.org/wiki/Morrie%27s_law)
- [R760] [https://en.wikipedia.org/wiki/List\\_of\\_trigonometric\\_identities#Power-reduction\\_formulae](https://en.wikipedia.org/wiki/List_of_trigonometric_identities#Power-reduction_formulae)
- [R761] <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.657.2478&rep=rep1&type=pdf>
- [R765] Methods to solve  $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ , [online], Available: <http://www.alpertron.com.ar/METHODS.HTM>
- [R766] Solving the equation  $ax^2 + bxy + cy^2 + dx + ey + f = 0$ , [online], Available: <https://web.archive.org/web/20160323033111/http://www.jpr2718.org/ax2p.pdf>
- [R767] Solving the generalized Pell equation  $x^2 - Dy^2 = N$ , John P. Robertson, July 31, 2004, Pages 16 - 17. [online], Available: <https://web.archive.org/web/20160323033128/http://www.jpr2718.org/pell.pdf>
- [R768] A. Nitaj, "L'algorithme de Cornacchia"
- [R769] Solving the diophantine equation  $ax^2 + by^2 = m$  by Cornacchia's method, [online], Available: <http://www.numbertheory.org/php/cornacchia.html>
- [R770] Solving the generalized Pell equation  $x^2 - Dy^2 = N$ , John P. Robertson, July 31, 2004, Page 15. <https://web.archive.org/web/20160323033128/http://www.jpr2718.org/pell.pdf>
- [R771] Solving the equation  $ax^2 + bxy + cy^2 + dx + ey + f = 0$ , John P. Robertson, May 8, 2003, Page 7 - 11. <https://web.archive.org/web/20160323033111/http://www.jpr2718.org/ax2p.pdf>
- [R772] Solving the equation  $ax^2 + bxy + cy^2 + dx + ey + f = 0$ , John P. Robertson, May 8, 2003, Page 7 - 11. <https://web.archive.org/web/20160323033111/http://www.jpr2718.org/ax2p.pdf>
- [R773] Efficient Solution of Rational Conics, J. E. Cremona and D. Rusin, Mathematics of Computation, Volume 00, Number 0.
- [R774] Representing an integer as a sum of three squares, [online], Available: [http://www.proofwiki.org/wiki/Integer\\_as\\_Sum\\_of\\_Three\\_Squares](http://www.proofwiki.org/wiki/Integer_as_Sum_of_Three_Squares)
- [R775] Representing a number as a sum of three squares, [online], Available: <http://schorn.ch/lagrange.html>
- [R776] Representing a number as a sum of four squares, [online], Available: <http://schorn.ch/lagrange.html>
- [R777] Solving the generalized Pell equation  $x^2 - Dy^2 = N$ , John P. Robertson, July 31, 2004, Pages 4 - 8. <https://web.archive.org/web/20160323033128/http://www.jpr2718.org/pell.pdf>
- [R778] Solving the generalized Pell equation  $x^2 - Dy^2 = N$ , John P. Robertson, July 31, 2004, Page 12. <https://web.archive.org/web/20160323033128/http://www.jpr2718.org/pell.pdf>

- [R779] The algorithmic resolution of Diophantine equations, Nigel P. Smart, London Mathematical Society Student Texts 41, Cambridge University Press, Cambridge, 1998.
- [R780] The algorithmic resolution of Diophantine equations, Nigel P. Smart, London Mathematical Society Student Texts 41, Cambridge University Press, Cambridge, 1998.
- [R781] Efficient Solution of Rational Conics, J. E. Cremona and D. Rusin, [online], Available: <http://eprints.nottingham.ac.uk/60/1/kvxefz87.pdf>
- [R782] Gaussian lattice Reduction [online]. Available: <http://home.ie.cuhk.edu.hk/~wkshum/wordpress/?p=404>
- [R783] Efficient Solution of Rational Conics, J. E. Cremona and D. Rusin, Mathematics of Computation, Volume 00, Number 0.
- [R784] Efficient Solution of Rational Conics, J. E. Cremona and D. Rusin, Mathematics of Computation, Volume 00, Number 0.
- [R785] Diophantine Equations, L. J. Mordell, page 48.
- [R786] Representing a number as a sum of four squares, [online], Available: <http://schorn.ch/lagrange.html>
- [R787] Legendre's Theorem, Lagrange's Descent, [http://public.csusm.edu/aitken\\_html/notes/legendre.pdf](http://public.csusm.edu/aitken_html/notes/legendre.pdf)
- [R788] Methods to solve  $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ , [online], Available: <http://www.alpertron.com.ar/METHODS.HTM>
- [R789] Solving the equation  $ax^2 + bxy + cy^2 + dx + ey + f = 0$ , [online], Available: <https://web.archive.org/web/20160323033111/http://www.jpr2718.org/ax2p.pdf>
- [R790] Representing an integer as a sum of three squares, [online], Available: [http://www.proofwiki.org/wiki/Integer\\_as\\_Sum\\_of\\_Three\\_Squares](http://www.proofwiki.org/wiki/Integer_as_Sum_of_Three_Squares)
- [R791] [https://en.wikipedia.org/wiki/Matrix\\_differential\\_equation](https://en.wikipedia.org/wiki/Matrix_differential_equation)
- [R792] [https://en.wikipedia.org/wiki/Defective\\_matrix](https://en.wikipedia.org/wiki/Defective_matrix)
- [R793] [https://en.wikipedia.org/wiki/Jordan\\_matrix](https://en.wikipedia.org/wiki/Jordan_matrix)
- [R794] [https://en.wikipedia.org/wiki/Jordan\\_normal\\_form](https://en.wikipedia.org/wiki/Jordan_normal_form)
- [R795] [https://en.wikipedia.org/wiki/Jordan\\_normal\\_form](https://en.wikipedia.org/wiki/Jordan_normal_form)
- [R796] [https://en.wikipedia.org/wiki/Matrix\\_exponential](https://en.wikipedia.org/wiki/Matrix_exponential)
- [R797] S. A. Abramov, M. Bronstein and M. Petkovsek, On polynomial solutions of linear operator equations, in: T. Levelt, ed., Proc. ISSAC '95, ACM Press, New York, 1995, 290-296.
- [R798] M. Petkovsek, Hypergeometric solutions of linear recurrences with polynomial coefficients, J. Symbolic Computation, 14 (1992), 243-264.
- [R799] M. Petkovsek, H. S. Wilf, D. Zeilberger, A = B, 1996.
- [R800] S. A. Abramov, Rational solutions of linear difference and q-difference equations with polynomial coefficients, in: T. Levelt, ed., Proc. ISSAC '95, ACM Press, New York, 1995, 285-289
- [R801] M. Petkovsek, Hypergeometric solutions of linear recurrences with polynomial coefficients, J. Symbolic Computation, 14 (1992), 243-264.



- [R802] M. Petkovsek, H. S. Wilf, D. Zeilberger,  $A = B$ , 1996.
- [R1] <http://www.euclideanspace.com/maths/algebra/realNormedAlgebra/quaternions/>
- [R2] <https://en.wikipedia.org/wiki/Quaternion>
- [R87] Michael Karr, "Summation in Finite Terms", Journal of the ACM, Volume 28 Issue 2, April 1981, Pages 305-350 <http://dl.acm.org/citation.cfm?doid=322248.322255>
- [R88] [https://en.wikipedia.org/wiki/Summation#Capital-sigma\\_notation](https://en.wikipedia.org/wiki/Summation#Capital-sigma_notation)
- [R89] [https://en.wikipedia.org/wiki/Empty\\_sum](https://en.wikipedia.org/wiki/Empty_sum)
- [R90] [https://en.wikipedia.org/wiki/Absolute\\_convergence](https://en.wikipedia.org/wiki/Absolute_convergence)
- [R91] [https://en.wikipedia.org/wiki/Convergence\\_tests](https://en.wikipedia.org/wiki/Convergence_tests)
- [R92] Michael Karr, "Summation in Finite Terms", Journal of the ACM, Volume 28 Issue 2, April 1981, Pages 305-350 <http://dl.acm.org/citation.cfm?doid=322248.322255>
- [R93] Michael Karr, "Summation in Finite Terms", Journal of the ACM, Volume 28 Issue 2, April 1981, Pages 305-350 <http://dl.acm.org/citation.cfm?doid=322248.322255>
- [R94] [https://en.wikipedia.org/wiki/Multiplication#Capital\\_Pi\\_notation](https://en.wikipedia.org/wiki/Multiplication#Capital_Pi_notation)
- [R95] [https://en.wikipedia.org/wiki/Empty\\_product](https://en.wikipedia.org/wiki/Empty_product)
- [R96] [https://en.wikipedia.org/wiki/Infinite\\_product](https://en.wikipedia.org/wiki/Infinite_product)
- [R97] Michael Karr, "Summation in Finite Terms", Journal of the ACM, Volume 28 Issue 2, April 1981, Pages 305-350 <http://dl.acm.org/citation.cfm?doid=322248.322255>
- [R98] Marko Petkovsek, Herbert S. Wilf, Doron Zeilberger,  $A = B$ , AK Peters, Ltd., Wellesley, MA, USA, 1997, pp. 73-100
- [R99] [https://en.wikipedia.org/wiki/Negative\\_number](https://en.wikipedia.org/wiki/Negative_number)
- [R100] [https://en.wikipedia.org/wiki/Parity\\_%28mathematics%29](https://en.wikipedia.org/wiki/Parity_%28mathematics%29)
- [R101] [https://en.wikipedia.org/wiki/Imaginary\\_number](https://en.wikipedia.org/wiki/Imaginary_number)
- [R102] [https://en.wikipedia.org/wiki/Composite\\_number](https://en.wikipedia.org/wiki/Composite_number)
- [R103] [https://en.wikipedia.org/wiki/Irrational\\_number](https://en.wikipedia.org/wiki/Irrational_number)
- [R104] [https://en.wikipedia.org/wiki/Prime\\_number](https://en.wikipedia.org/wiki/Prime_number)
- [R105] <https://en.wikipedia.org/wiki/Finite>
- [R106] <https://docs.python.org/3/library/math.html#math.isfinite>
- [R107] <http://docs.scipy.org/doc/numpy/reference/generated/numpy.isfinite.html>
- [R108] Gruntz, Dominik. A new algorithm for computing asymptotic series. In: Proc. 1993 Int. Symp. Symbolic and Algebraic Computation. 1993. pp. 239-244.
- [R109] Gruntz thesis - p90
- [R110] [http://en.wikipedia.org/wiki/Asymptotic\\_expansion](http://en.wikipedia.org/wiki/Asymptotic_expansion)
- [R111] [https://en.wikipedia.org/wiki/Algebraic\\_expression](https://en.wikipedia.org/wiki/Algebraic_expression)
- [R112] [https://en.wikipedia.org/wiki/Euclidean\\_algorithm](https://en.wikipedia.org/wiki/Euclidean_algorithm)

- [R113] <https://en.wikipedia.org/wiki/Zero>
- [R114] [https://en.wikipedia.org/wiki/1\\_%28number%29](https://en.wikipedia.org/wiki/1_%28number%29)
- [R115] [https://en.wikipedia.org/wiki/%E2%88%921\\_%28number%29](https://en.wikipedia.org/wiki/%E2%88%921_%28number%29)
- [R116] [https://en.wikipedia.org/wiki/One\\_half](https://en.wikipedia.org/wiki/One_half)
- [R117] <https://en.wikipedia.org/wiki/NaN>
- [R118] <https://en.wikipedia.org/wiki/Infinity>
- [R119] [https://en.wikipedia.org/wiki/E\\_%28mathematical\\_constant%29](https://en.wikipedia.org/wiki/E_%28mathematical_constant%29)
- [R120] [https://en.wikipedia.org/wiki/Imaginary\\_unit](https://en.wikipedia.org/wiki/Imaginary_unit)
- [R121] <https://en.wikipedia.org/wiki/Pi>
- [R122] [https://en.wikipedia.org/wiki/Euler%E2%80%93Mascheroni\\_constant](https://en.wikipedia.org/wiki/Euler%E2%80%93Mascheroni_constant)
- [R123] [https://en.wikipedia.org/wiki/Catalan%27s\\_constant](https://en.wikipedia.org/wiki/Catalan%27s_constant)
- [R124] [https://en.wikipedia.org/wiki/Golden\\_ratio](https://en.wikipedia.org/wiki/Golden_ratio)
- [R125] [https://en.wikipedia.org/wiki/Generalizations\\_of\\_Fibonacci\\_numbers#Tribonacci\\_numbers](https://en.wikipedia.org/wiki/Generalizations_of_Fibonacci_numbers#Tribonacci_numbers)
- [R126] [https://en.wikipedia.org/wiki/Modular\\_multiplicative\\_inverse](https://en.wikipedia.org/wiki/Modular_multiplicative_inverse)
- [R127] [https://en.wikipedia.org/wiki/Extended\\_Euclidean\\_algorithm](https://en.wikipedia.org/wiki/Extended_Euclidean_algorithm)
- [R128] <https://en.wikipedia.org/wiki/Exponentiation>
- [R129] [https://en.wikipedia.org/wiki/Exponentiation#Zero\\_to\\_the\\_power\\_of\\_zero](https://en.wikipedia.org/wiki/Exponentiation#Zero_to_the_power_of_zero)
- [R130] [https://en.wikipedia.org/wiki/Indeterminate\\_forms](https://en.wikipedia.org/wiki/Indeterminate_forms)
- [R131] This implementation detail is that Python provides no reliable method to determine that a chained inequality is being built. Chained comparison operators are evaluated pairwise, using “and” logic (see <http://docs.python.org/reference/expressions.html#not-in>). This is done in an efficient way, so that each object being compared is only evaluated once and the comparison can short-circuit. For example,  $1 > 2 > 3$  is evaluated by Python as  $(1 > 2)$  and  $(2 > 3)$ . The and operator coerces each side into a bool, returning the object itself when it short-circuits. The bool of the `-Than` operators will raise `TypeError` on purpose, because SymPy cannot determine the mathematical ordering of symbolic expressions. Thus, if we were to compute  $x > y > z$ , with  $x$ ,  $y$ , and  $z$  being Symbols, Python converts the statement (roughly) into these steps:
  - (1)  $x > y > z$
  - (2)  $(x > y)$  and  $(y > z)$
  - (3) `GreaterThanObject` and  $(y > z)$
  - (4) `GreaterThanObject.__bool__()` and  $(y > z)$
  - (5) `TypeError`

Because of the and added at step 2, the statement gets turned into a weak ternary statement, and the first object’s `__bool__` method will raise `TypeError`. Thus, creating a chained inequality is not possible.

In Python, there is no way to override the and operator, or to control how it short circuits, so it is impossible to make something like  $x > y >$



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- (1)  $x > y > z$
- (2)  $(x > y)$  and  $(y > z)$
- (3) (GreaterThanObject) and  $(y > z)$
- (4) (GreaterThanObject.\_\_bool\_\_()) and  $(y > z)$
- (5) TypeError

Because of the and added at step 2, the statement gets turned into a weak ternary statement, and the first object’s \_\_bool\_\_ method will raise TypeError. Thus, creating a chained inequality is not possible.

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- [R135] [http://reference.wolfram.com/legacy/v5\\_2/Built-inFunctions/AlgebraicComputation/Calculus/D.html](http://reference.wolfram.com/legacy/v5_2/Built-inFunctions/AlgebraicComputation/Calculus/D.html)
- [R164] [https://en.wikipedia.org/wiki/Cooley%E2%80%93Tukey\\_FFT\\_algorithm](https://en.wikipedia.org/wiki/Cooley%E2%80%93Tukey_FFT_algorithm)
- [R165] <http://mathworld.wolfram.com/FastFourierTransform.html>
- [R166] [https://en.wikipedia.org/wiki/Cooley%E2%80%93Tukey\\_FFT\\_algorithm](https://en.wikipedia.org/wiki/Cooley%E2%80%93Tukey_FFT_algorithm)
- [R167] <http://mathworld.wolfram.com/FastFourierTransform.html>
- [R168] <http://www.apfloat.org/ntt.html>
- [R169] <http://mathworld.wolfram.com/NumberTheoreticTransform.html>
- [R170] [https://en.wikipedia.org/wiki/Discrete\\_Fourier\\_transform\\_\(general%29](https://en.wikipedia.org/wiki/Discrete_Fourier_transform_(general%29)
- [R171] <http://www.apfloat.org/ntt.html>
- [R172] <http://mathworld.wolfram.com/NumberTheoreticTransform.html>
- [R173] [https://en.wikipedia.org/wiki/Discrete\\_Fourier\\_transform\\_\(general%29](https://en.wikipedia.org/wiki/Discrete_Fourier_transform_(general%29)
- [R174] [https://en.wikipedia.org/wiki/Hadamard\\_transform](https://en.wikipedia.org/wiki/Hadamard_transform)
- [R175] [https://en.wikipedia.org/wiki/Fast\\_Walsh%E2%80%93Hadamard\\_transform](https://en.wikipedia.org/wiki/Fast_Walsh%E2%80%93Hadamard_transform)
- [R176] [https://en.wikipedia.org/wiki/Hadamard\\_transform](https://en.wikipedia.org/wiki/Hadamard_transform)
- [R177] [https://en.wikipedia.org/wiki/Fast\\_Walsh%E2%80%93Hadamard\\_transform](https://en.wikipedia.org/wiki/Fast_Walsh%E2%80%93Hadamard_transform)
- [R178] [https://en.wikipedia.org/wiki/M%C3%B6bius\\_inversion\\_formula](https://en.wikipedia.org/wiki/M%C3%B6bius_inversion_formula)

- [R179] <https://people.csail.mit.edu/rrw/presentations/subset-conv.pdf>
- [R180] <https://arxiv.org/pdf/1211.0189.pdf>
- [R181] [https://en.wikipedia.org/wiki/M%C3%B6bius\\_inversion\\_formula](https://en.wikipedia.org/wiki/M%C3%B6bius_inversion_formula)
- [R182] <https://people.csail.mit.edu/rrw/presentations/subset-conv.pdf>
- [R183] <https://arxiv.org/pdf/1211.0189.pdf>
- [R184] [https://en.wikipedia.org/wiki/Convolution\\_theorem](https://en.wikipedia.org/wiki/Convolution_theorem)
- [R185] [https://en.wikipedia.org/wiki/Discrete\\_Fourier\\_transform\\_\(general%29](https://en.wikipedia.org/wiki/Discrete_Fourier_transform_(general%29)
- [R186] [https://en.wikipedia.org/wiki/Convolution\\_theorem](https://en.wikipedia.org/wiki/Convolution_theorem)
- [R187] [https://en.wikipedia.org/wiki/Discrete\\_Fourier\\_transform\\_\(general%29](https://en.wikipedia.org/wiki/Discrete_Fourier_transform_(general%29)
- [R188] [https://www.radioeng.cz/fulltexts/2002/02\\_03\\_40\\_42.pdf](https://www.radioeng.cz/fulltexts/2002/02_03_40_42.pdf)
- [R189] [https://en.wikipedia.org/wiki/Hadamard\\_transform](https://en.wikipedia.org/wiki/Hadamard_transform)
- [R190] <https://people.csail.mit.edu/rrw/presentations/subset-conv.pdf>
- [R191] <https://people.csail.mit.edu/rrw/presentations/subset-conv.pdf>
- [R192] <https://people.csail.mit.edu/rrw/presentations/subset-conv.pdf>
- [R37] <https://docs.scipy.org/doc/numpy/user/basics.types.html>
- [R38] [https://en.wikipedia.org/wiki/Newton%27s\\_method](https://en.wikipedia.org/wiki/Newton%27s_method)
- [R557] [https://en.wikipedia.org/wiki/Quine-McCluskey\\_algorithm](https://en.wikipedia.org/wiki/Quine-McCluskey_algorithm)
- [R558] [https://en.wikipedia.org/wiki/Quine-McCluskey\\_algorithm](https://en.wikipedia.org/wiki/Quine-McCluskey_algorithm)
- [R559] [https://en.wikipedia.org/wiki/Zhegalkin\\_polynomial](https://en.wikipedia.org/wiki/Zhegalkin_polynomial)
- [R560] [https://en.wikipedia.org/wiki/Canonical\\_normal\\_form#Indexing\\_maxterms](https://en.wikipedia.org/wiki/Canonical_normal_form#Indexing_maxterms)
- [R561] [https://en.wikipedia.org/wiki/Canonical\\_normal\\_form#Indexing\\_minterms](https://en.wikipedia.org/wiki/Canonical_normal_form#Indexing_minterms)
- [R744] [https://en.wikipedia.org/wiki/Disjoint\\_sets](https://en.wikipedia.org/wiki/Disjoint_sets)
- [R745] [https://en.wikipedia.org/wiki/Power\\_set](https://en.wikipedia.org/wiki/Power_set)
- [R746] [https://en.wikipedia.org/wiki/Symmetric\\_difference](https://en.wikipedia.org/wiki/Symmetric_difference)
- [R747] [https://en.wikipedia.org/wiki/Interval\\_%28mathematics%29](https://en.wikipedia.org/wiki/Interval_%28mathematics%29)
- [R748] [https://en.wikipedia.org/wiki/Finite\\_set](https://en.wikipedia.org/wiki/Finite_set)
- [R749] [https://en.wikipedia.org/wiki/Union\\_%28set\\_theory%29](https://en.wikipedia.org/wiki/Union_%28set_theory%29)
- [R750] [https://en.wikipedia.org/wiki/Intersection\\_%28set\\_theory%29](https://en.wikipedia.org/wiki/Intersection_%28set_theory%29)
- [R751] [https://en.wikipedia.org/wiki/Cartesian\\_product](https://en.wikipedia.org/wiki/Cartesian_product)
- [R752] <http://mathworld.wolfram.com/ComplementSet.html>
- [R753] [https://en.wikipedia.org/wiki/Symmetric\\_difference](https://en.wikipedia.org/wiki/Symmetric_difference)
- [R754] [https://en.wikipedia.org/wiki/Empty\\_set](https://en.wikipedia.org/wiki/Empty_set)
- [R755] [https://en.wikipedia.org/wiki/Universal\\_set](https://en.wikipedia.org/wiki/Universal_set)
- [R756] [https://en.wikipedia.org/wiki/Power\\_set](https://en.wikipedia.org/wiki/Power_set)
- [R757] [https://en.wikipedia.org/wiki/Axiom\\_of\\_power\\_set](https://en.wikipedia.org/wiki/Axiom_of_power_set)
- [R758] [https://en.wikipedia.org/wiki/Element\\_%28mathematics%29](https://en.wikipedia.org/wiki/Element_%28mathematics%29)

- [R566] Prof. Frank Ben's notes: <https://math.berkeley.edu/~bernd/ban275.pdf>
- [R567] Wikipedia article on Permanent: [https://en.wikipedia.org/wiki/Permanent\\_\(mathematics\)](https://en.wikipedia.org/wiki/Permanent_(mathematics))
- [R568] <https://reference.wolfram.com/language/ref/Permanent.html>
- [R569] Permanent of a rectangular matrix : <https://arxiv.org/pdf/0904.3251.pdf>
- [R570] [https://en.wikipedia.org/wiki/Gram%E2%80%93Schmidt\\_process](https://en.wikipedia.org/wiki/Gram%E2%80%93Schmidt_process)
- [R571] Algorithm 5.4.2, Matrix computations by Golub and Van Loan, 4th edition
- [R572] Complex Matrix Bidiagonalization, <https://github.com/vslobody/Householder-Bidiagonalization>
- [R573] Algorithm 5.4.2, Matrix computations by Golub and Van Loan, 4th edition
- [R574] Complex Matrix Bidiagonalization : <https://github.com/vslobody/Householder-Bidiagonalization>
- [R575] [https://en.wikipedia.org/wiki/Definiteness\\_of\\_a\\_matrix#Eigenvalues](https://en.wikipedia.org/wiki/Definiteness_of_a_matrix#Eigenvalues)
- [R576] <http://mathworld.wolfram.com/PositiveDefiniteMatrix.html>
- [R577] Johnson, C. R. "Positive Definite Matrices." Amer. Math. Monthly 77, 259-264 1970.
- [R578] [https://en.wikipedia.org/wiki/Definiteness\\_of\\_a\\_matrix#Eigenvalues](https://en.wikipedia.org/wiki/Definiteness_of_a_matrix#Eigenvalues)
- [R579] <http://mathworld.wolfram.com/PositiveDefiniteMatrix.html>
- [R580] Johnson, C. R. "Positive Definite Matrices." Amer. Math. Monthly 77, 259-264 1970.
- [R581] [https://en.wikipedia.org/wiki/Definiteness\\_of\\_a\\_matrix#Eigenvalues](https://en.wikipedia.org/wiki/Definiteness_of_a_matrix#Eigenvalues)
- [R582] <http://mathworld.wolfram.com/PositiveDefiniteMatrix.html>
- [R583] Johnson, C. R. "Positive Definite Matrices." Amer. Math. Monthly 77, 259-264 1970.
- [R584] [https://en.wikipedia.org/wiki/Definiteness\\_of\\_a\\_matrix#Eigenvalues](https://en.wikipedia.org/wiki/Definiteness_of_a_matrix#Eigenvalues)
- [R585] <http://mathworld.wolfram.com/PositiveDefiniteMatrix.html>
- [R586] Johnson, C. R. "Positive Definite Matrices." Amer. Math. Monthly 77, 259-264 1970.
- [R587] [https://en.wikipedia.org/wiki/Definiteness\\_of\\_a\\_matrix#Eigenvalues](https://en.wikipedia.org/wiki/Definiteness_of_a_matrix#Eigenvalues)
- [R588] <http://mathworld.wolfram.com/PositiveDefiniteMatrix.html>
- [R589] Johnson, C. R. "Positive Definite Matrices." Amer. Math. Monthly 77, 259-264 1970.
- [R590] W. Zhou & D.J. Jeffrey, "Fraction-free matrix factors: new forms for LU and QR factors". Frontiers in Computer Science in China, Vol 2, no. 1, pp. 67-80, 2008.
- [R591] [https://en.wikipedia.org/wiki/Gaussian\\_elimination](https://en.wikipedia.org/wiki/Gaussian_elimination)
- [R592] [https://en.wikipedia.org/wiki/Moore-Penrose\\_pseudoinverse](https://en.wikipedia.org/wiki/Moore-Penrose_pseudoinverse)
- [R593] [https://en.wikipedia.org/wiki/Moore-Penrose\\_pseudoinverse#Obtaining\\_all\\_solutions\\_of\\_a\\_linear\\_system](https://en.wikipedia.org/wiki/Moore-Penrose_pseudoinverse#Obtaining_all_solutions_of_a_linear_system)
- [R594] [https://en.wikipedia.org/wiki/Rank\\_factorization](https://en.wikipedia.org/wiki/Rank_factorization)

- [R595] Piziak, R.; Odell, P. L. (1 June 1999). "Full Rank Factorization of Matrices". *Mathematics Magazine*. 72 (3): 193. doi:10.2307/2690882
- [R596] [https://en.wikipedia.org/wiki/Hessian\\_matrix](https://en.wikipedia.org/wiki/Hessian_matrix)
- [R597] [https://en.wikipedia.org/wiki/Gram%E2%80%93Schmidt\\_process](https://en.wikipedia.org/wiki/Gram%E2%80%93Schmidt_process)
- [R562] [https://en.wikipedia.org/wiki/Jordan\\_matrix](https://en.wikipedia.org/wiki/Jordan_matrix)
- [R563] <https://blogs.mathworks.com/cleve/2013/04/15/wilkinsons-matrices-2/>
- [R564] J. H. Wilkinson, *The Algebraic Eigenvalue Problem*, Claredon Press, Oxford, 1965, 662 pp.
- [R565] Wikipedia Article on Schur Component : [https://en.wikipedia.org/wiki/Schur\\_complement](https://en.wikipedia.org/wiki/Schur_complement)
- [R598] Cohen, H. *A Course in Computational Algebraic Number Theory*. (See Algorithms 2.4.5 and 2.4.8.)
- [WikiDel] <https://en.wikipedia.org/wiki/Del>
- [R978] [https://en.wikipedia.org/wiki/Dyadic\\_tensor](https://en.wikipedia.org/wiki/Dyadic_tensor)
- [R979] Kane, T., Levinson, D. *Dynamics Theory and Applications*. 1985 McGraw-Hill
- [Dyadics] <https://en.wikipedia.org/wiki/Dyadics>
- [DyadicProducts] [https://en.wikipedia.org/wiki/Dyadic\\_product](https://en.wikipedia.org/wiki/Dyadic_product)
- [DelOperator] <https://en.wikipedia.org/wiki/Del>
- [R599] [https://en.wikipedia.org/wiki/Prime\\_number\\_theorem#Table\\_of\\_.CF.80.28x.29.2C\\_x\\_.2F\\_log\\_x.2C\\_and\\_li.28x.29](https://en.wikipedia.org/wiki/Prime_number_theorem#Table_of_.CF.80.28x.29.2C_x_.2F_log_x.2C_and_li.28x.29)
- [R600] [https://en.wikipedia.org/wiki/Prime\\_number\\_theorem#Approximations\\_for\\_the\\_nth\\_prime\\_number](https://en.wikipedia.org/wiki/Prime_number_theorem#Approximations_for_the_nth_prime_number)
- [R601] [https://en.wikipedia.org/wiki/Skewes%27\\_number](https://en.wikipedia.org/wiki/Skewes%27_number)
- [R602] [https://en.wikipedia.org/wiki/Prime\\_number](https://en.wikipedia.org/wiki/Prime_number)
- [R603] <http://primes.utm.edu/notes/gaps.html>
- [R604] [https://en.wikipedia.org/wiki/Bertrand's\\_postulate](https://en.wikipedia.org/wiki/Bertrand's_postulate)
- [R605] Richard Crandall & Carl Pomerance (2005), "Prime Numbers: A Computational Perspective", Springer, 2nd edition, 229-231
- [R606] Richard Crandall & Carl Pomerance (2005), "Prime Numbers: A Computational Perspective", Springer, 2nd edition, 236-238
- [R607] <http://modular.math.washington.edu/edu/2007/spring/ent/ent-html/node81.html>
- [R608] <https://www.cs.toronto.edu/~yuvalf/Factorization.pdf>
- [R609] [https://en.wikipedia.org/wiki/Unitary\\_divisor](https://en.wikipedia.org/wiki/Unitary_divisor)
- [R610] <http://mathworld.wolfram.com/UnitaryDivisor.html>
- [R611] <http://mathworld.wolfram.com/UnitaryDivisorFunction.html>
- [R612] definition is described in <https://oeis.org/A066272/a066272a.html>
- [R613] formula from <https://oeis.org/A066272>
- [R614] [https://en.wikipedia.org/wiki/Euler%27s\\_totient\\_function](https://en.wikipedia.org/wiki/Euler%27s_totient_function)
- [R615] <http://mathworld.wolfram.com/TotientFunction.html>

- [R616] [https://en.wikipedia.org/wiki/Carmichael\\_function](https://en.wikipedia.org/wiki/Carmichael_function)
- [R617] <http://mathworld.wolfram.com/CarmichaelFunction.html>
- [R618] [https://en.wikipedia.org/wiki/Divisor\\_function](https://en.wikipedia.org/wiki/Divisor_function)
- [R619] <http://mathworld.wolfram.com/UnitaryDivisorFunction.html>
- [R620] [https://en.wikipedia.org/wiki/Square-free\\_integer#Squarefree\\_core](https://en.wikipedia.org/wiki/Square-free_integer#Squarefree_core)
- [R621] <http://mathworld.wolfram.com/PrimeFactor.html>
- [R622] <http://mathworld.wolfram.com/PrimeFactor.html>
- [R623] <http://mathworld.wolfram.com/PerfectNumber.html>
- [R624] [https://en.wikipedia.org/wiki/Perfect\\_number](https://en.wikipedia.org/wiki/Perfect_number)
- [R625] <http://mathworld.wolfram.com/MersennePrime.html>
- [R626] <http://mathworld.wolfram.com/AbundantNumber.html>
- [R627] <http://mathworld.wolfram.com/DeficientNumber.html>
- [R628] [https://en.wikipedia.org/wiki/Amicable\\_numbers](https://en.wikipedia.org/wiki/Amicable_numbers)
- [R629] <http://mathworld.wolfram.com/PartitionFunctionP.html>
- [R630] [https://en.wikipedia.org/wiki/Euler\\_pseudoprime](https://en.wikipedia.org/wiki/Euler_pseudoprime)
- [R631] <http://mersenneforum.org/showpost.php?p=110896>
- [R632] Richard Crandall & Carl Pomerance (2005), "Prime Numbers: A Computational Perspective", Springer, 2nd edition, 135-138
- [R633] [https://oeis.org/wiki/Gaussian\\_primes](https://oeis.org/wiki/Gaussian_primes)
- [R634] W. Stein "Elementary Number Theory" (2011), page 44
- [R635] P. Hackman "Elementary Number Theory" (2009), Chapter C
- [R636] P. Hackman "Elementary Number Theory" (2009), page 76
- [R637] <http://mathworld.wolfram.com/DiscreteLogarithm.html>
- [R638] "Handbook of applied cryptography", Menezes, A. J., Van, O. P. C., & Vanstone, S. A. (1997).
- [R639] [https://en.wikipedia.org/wiki/Continued\\_fraction](https://en.wikipedia.org/wiki/Continued_fraction)
- [R640] [https://en.wikipedia.org/wiki/Periodic\\_continued\\_fraction](https://en.wikipedia.org/wiki/Periodic_continued_fraction)
- [R641] K. Rosen. Elementary Number theory and its applications. Addison-Wesley, 3 Sub edition, pages 379-381, January 1992.
- [R642] [https://en.wikipedia.org/wiki/M%C3%B6bius\\_function](https://en.wikipedia.org/wiki/M%C3%B6bius_function)
- [R643] Thomas Koshy "Elementary Number Theory with Applications"
- [R644] [https://en.wikipedia.org/wiki/Egyptian\\_fraction](https://en.wikipedia.org/wiki/Egyptian_fraction)
- [R645] [https://en.wikipedia.org/wiki/Greedy\\_algorithm\\_for\\_Egyptian\\_fractions](https://en.wikipedia.org/wiki/Greedy_algorithm_for_Egyptian_fractions)
- [R646] <https://www.ics.uci.edu/~eppstein/numth/egypt/conflict.html>
- [R647] [http://ami.ektf.hu/uploads/papers/finalpdf/AMI\\_42\\_from129to134.pdf](http://ami.ektf.hu/uploads/papers/finalpdf/AMI_42_from129to134.pdf)
- [R648] <http://www.numberworld.org/digits/Pi/>



- [R649] <https://pdfs.semanticscholar.org/5c52/8a975c1405bd35c65993abf5a4edb667c1db.pdf>
- [R650] [https://www.rieselprime.de/ziki/Self-initializing\\_quadratic\\_sieve](https://www.rieselprime.de/ziki/Self-initializing_quadratic_sieve)
- [R658] [https://en.wikipedia.org/wiki/Gamma\\_matrices](https://en.wikipedia.org/wiki/Gamma_matrices)
- [R659] [https://en.wikipedia.org/wiki/Pauli\\_matrices](https://en.wikipedia.org/wiki/Pauli_matrices)
- [R668] [https://en.wikipedia.org/wiki/Pauli\\_matrices](https://en.wikipedia.org/wiki/Pauli_matrices)
- [R691] [https://en.wikipedia.org/wiki/Kronecker\\_delta](https://en.wikipedia.org/wiki/Kronecker_delta)
- [Regge58] ‘Symmetry Properties of Clebsch-Gordan Coefficients’, T. Regge, Nuovo Cimento, Volume 10, pp. 544 (1958)
- [Regge59] ‘Symmetry Properties of Racah Coefficients’, T. Regge, Nuovo Cimento, Volume 11, pp. 116 (1959)
- [Edmonds74] A. R. Edmonds. Angular momentum in quantum mechanics. Investigations in physics, 4.; Investigations in physics, no. 4. Princeton, N.J., Princeton University Press, 1957.
- [Rasch03] J. Rasch and A. C. H. Yu, ‘Efficient Storage Scheme for Pre-calculated Wigner 3j, 6j and Gaunt Coefficients’, SIAM J. Sci. Comput. Volume 25, Issue 4, pp. 1416-1428 (2003)
- [Liberatodebrito82] ‘FORTRAN program for the integral of three spherical harmonics’, A. Liberato de Brito, Comput. Phys. Commun., Volume 25, pp. 81-85 (1982)
- [Page52] C. H. Page, [Classes of units in the SI](#), Am. J. of Phys. 20, 1 (1952): 1.
- [Page78] C. H. Page, [Units and Dimensions in Physics](#), Am. J. of Phys. 46, 1 (1978): 78.
- [deBoer79] J. de Boer, [Group properties of quantities and units](#), Am. J. of Phys. 47, 9 (1979): 818.
- [LevyLeblond77] J.-M. Lévy-Leblond, [On the Conceptual Nature of the Physical Constants](#), La Rivista Del Nuovo Cimento 7, no. 2 (1977): 187-214.
- [NIST] [NIST reference on constants, units and uncertainties](#).
- [WikiDyadics] “Dyadics.” Wikipedia, the Free Encyclopedia. Web. 05 Aug. 2011. <<https://en.wikipedia.org/wiki/Dyadics>>.
- [WikiDyadicProducts] “Dyadic Product.” Wikipedia, the Free Encyclopedia. Web. 05 Aug. 2011. <[https://en.wikipedia.org/wiki/Dyadic\\_product](https://en.wikipedia.org/wiki/Dyadic_product)>.
- [Likins1973] Likins, Peter W. Elements of Engineering Mechanics. McGraw-Hill, Inc. 1973. Print.
- [Blajer1994] Blajer, Wojciech, Werner Schiehlen, and Walter Schirm. “A projective criterion to the coordinate partitioning method for multibody dynamics.” Archive of Applied Mechanics 64: 86-98. Print.
- [Kane1983] Kane, Thomas R., Peter W. Likins, and David A. Levinson. Spacecraft Dynamics. New York: McGraw-Hill Book, 1983. Print.
- [Kane1985] Kane, Thomas R., and David A. Levinson. Dynamics, Theory and Applications. New York: McGraw-Hill, 1985. Print.
- [Meijaard2007] Meijaard, J.P., Jim M. Papadopoulos, Andy Ruina, and A.L. Schwab. “Linearized Dynamics Equations for the Balance and Steer of a Bicycle: a Benchmark and Review.” Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences 463.2084 (2007): 1955-982. Print.

- [R669] <https://en.wikipedia.org/wiki/Commutator>
- [R670] Varshalovich, D A, Quantum Theory of Angular Momentum. 1988.
- [R671] [Clebsch-Gordan Coefficients, Spherical Harmonics, and d Functions](#) in P.A. Zyla *et al.* (Particle Data Group), Prog. Theor. Exp. Phys. 2020, 083C01 (2020).
- [R672] Varshalovich, D A, Quantum Theory of Angular Momentum. 1988.
- [R673] Varshalovich, D A, Quantum Theory of Angular Momentum. 1988.
- [R674] <https://en.wikipedia.org/wiki/Commutator>
- [R675] [https://en.wikipedia.org/wiki/Planck\\_constant](https://en.wikipedia.org/wiki/Planck_constant)
- [R676] [https://en.wikipedia.org/wiki/Hermitian\\_adjoint](https://en.wikipedia.org/wiki/Hermitian_adjoint)
- [R677] [https://en.wikipedia.org/wiki/Hermitian\\_transpose](https://en.wikipedia.org/wiki/Hermitian_transpose)
- [R683] [https://en.wikipedia.org/wiki/Inner\\_product](https://en.wikipedia.org/wiki/Inner_product)
- [R678] [https://en.wikipedia.org/wiki/Hilbert\\_space#Direct\\_sums](https://en.wikipedia.org/wiki/Hilbert_space#Direct_sums)
- [R679] [https://en.wikipedia.org/wiki/Fock\\_space](https://en.wikipedia.org/wiki/Fock_space)
- [R680] [https://en.wikipedia.org/wiki/Hilbert\\_space](https://en.wikipedia.org/wiki/Hilbert_space)
- [R681] [https://en.wikipedia.org/wiki/Hilbert\\_space#Tensor\\_products](https://en.wikipedia.org/wiki/Hilbert_space#Tensor_products)
- [R682] [https://en.wikipedia.org/wiki/Hilbert\\_space#Tensor\\_products](https://en.wikipedia.org/wiki/Hilbert_space#Tensor_products)
- [R684] [https://en.wikipedia.org/wiki/Operator\\_%28physics%29](https://en.wikipedia.org/wiki/Operator_%28physics%29)
- [R685] <https://en.wikipedia.org/wiki/Observable>
- [R686] [https://en.wikipedia.org/wiki/Outer\\_product](https://en.wikipedia.org/wiki/Outer_product)
- [R687] Varshalovich, D A, Quantum Theory of Angular Momentum. 1988.
- [R688] Varshalovich, D A, Quantum Theory of Angular Momentum. 1988.
- [R689] [https://en.wikipedia.org/wiki/Bra-ket\\_notation](https://en.wikipedia.org/wiki/Bra-ket_notation)
- [R690] [https://en.wikipedia.org/wiki/Bra-ket\\_notation](https://en.wikipedia.org/wiki/Bra-ket_notation)
- [R660] [https://en.wikipedia.org/wiki/Complex\\_beam\\_parameter](https://en.wikipedia.org/wiki/Complex_beam_parameter)
- [R661] [https://en.wikipedia.org/wiki/Gaussian\\_beam](https://en.wikipedia.org/wiki/Gaussian_beam)
- [R662] [https://en.wikipedia.org/wiki/Ray\\_transfer\\_matrix\\_analysis](https://en.wikipedia.org/wiki/Ray_transfer_matrix_analysis)
- [R663] [https://en.wikipedia.org/wiki/Optical\\_medium](https://en.wikipedia.org/wiki/Optical_medium)
- [R664] [https://en.wikipedia.org/wiki/Jones\\_calculus](https://en.wikipedia.org/wiki/Jones_calculus)
- [R665] [https://en.wikipedia.org/wiki/Mueller\\_calculus](https://en.wikipedia.org/wiki/Mueller_calculus)
- [R666] [https://en.wikipedia.org/wiki/Stokes\\_parameters](https://en.wikipedia.org/wiki/Stokes_parameters)
- [R667] [https://en.wikipedia.org/wiki/Fresnel\\_equations](https://en.wikipedia.org/wiki/Fresnel_equations)
- [R656] [https://en.wikipedia.org/wiki/Transfer\\_function](https://en.wikipedia.org/wiki/Transfer_function)
- [R657] [https://en.wikipedia.org/wiki/Laplace\\_transform](https://en.wikipedia.org/wiki/Laplace_transform)
- [R652] [https://en.wikipedia.org/wiki/Pole%E2%80%93zero\\_plot](https://en.wikipedia.org/wiki/Pole%E2%80%93zero_plot)
- [R653] <https://www.mathworks.com/help/control/ref/lti.impulse.html>
- [R654] <https://www.mathworks.com/help/control/ref/lti.step.html>

- [R655] [https://en.wikipedia.org/wiki/Ramp\\_function](https://en.wikipedia.org/wiki/Ramp_function)
- [R651] <http://homes.civil.aau.dk/jc/FemteSemester/Beams3D.pdf>
- [R957] <http://docs.scipy.org/doc/numpy/reference/ufuncs.html>
- [AOCP] Algorithm 7.1.2.5M in Volume 4A, Combinatorial Algorithms, Part 1, of The Art of Computer Programming, by Donald Knuth.
- [Factorisatio] On a Problem of Oppenheim concerning “Factorisatio Numerorum” E. R. Canfield, Paul Erdos, Carl Pomerance, JOURNAL OF NUMBER THEORY, Vol. 17, No. 1. August 1983. See section 7 for a description of an algorithm similar to Knuth’s.
- [Yorgey] Generating Multiset Partitions, Brent Yorgey, The Monad.Reader, Issue 8, September 2007.
- [R958] TAOCP 4, section 7.2.1.5, problem 64
- [R959] [https://en.wikipedia.org/wiki/Connected\\_component\\_\(graph\\_theory\)](https://en.wikipedia.org/wiki/Connected_component_(graph_theory))
- [R960] [https://en.wikipedia.org/wiki/Tarjan%27s\\_strongly\\_connected\\_components\\_algorithm](https://en.wikipedia.org/wiki/Tarjan%27s_strongly_connected_components_algorithm)
- [R961] [https://en.wikipedia.org/wiki/Method\\_ringing](https://en.wikipedia.org/wiki/Method_ringing)
- [R962] <https://stackoverflow.com/questions/4856615/recursive-permutation/4857018>
- [R963] <http://programminggeeks.com/bell-algorithm-for-permutation/>
- [R964] [https://en.wikipedia.org/wiki/Steinhaus%E2%80%93Johnson%E2%80%93Trotter\\_algorithm](https://en.wikipedia.org/wiki/Steinhaus%E2%80%93Johnson%E2%80%93Trotter_algorithm)
- [R965] Generating involutions, derangements, and relatives by ECO Vincent Vajnovszki, DMTCS vol 1 issue 12, 2010
- [R966] <http://mathworld.wolfram.com/PermutationInvolution.html>
- [R967] T. Beyer and S.M. Hedetniemi: constant time generation of rooted trees, SIAM J. Computing Vol. 9, No. 4, November 1980
- [R968] <https://stackoverflow.com/questions/1633833/oriented-forest-taocp-algorithm-in-python>
- [R969] [https://en.wikipedia.org/wiki/Lexicographically\\_minimal\\_string\\_rotation](https://en.wikipedia.org/wiki/Lexicographically_minimal_string_rotation)
- [R970] <http://mathworld.wolfram.com/Necklace.html>
- [R971] Generating Integer Partitions, [online], Available: <https://jeromekelleher.net/generating-integer-partitions.html>
- [R972] Jerome Kelleher and Barry O’Sullivan, “Generating All Partitions: A Comparison Of Two Encodings”, [online], Available: <https://arxiv.org/pdf/0909.2331v2.pdf>
- [R973] modified from Tim Peter’s version to allow for k and m values: <http://code.activestate.com/recipes/218332-generator-for-integer-partitions/>
- [R974] [https://en.wikipedia.org/wiki/Strongly\\_connected\\_component](https://en.wikipedia.org/wiki/Strongly_connected_component)
- [R975] [https://en.wikipedia.org/wiki/Tarjan%27s\\_strongly\\_connected\\_components\\_algorithm](https://en.wikipedia.org/wiki/Tarjan%27s_strongly_connected_components_algorithm)
- [R976] [https://en.wikipedia.org/wiki/Topological\\_sorting](https://en.wikipedia.org/wiki/Topological_sorting)
- [R977] <https://stackoverflow.com/questions/6116978/python-replace-multiple-strings>
- [R553] [https://en.wikibooks.org/wiki/LaTeX/Colors#The\\_68\\_standard\\_colors\\_known\\_to\\_dvips](https://en.wikibooks.org/wiki/LaTeX/Colors#The_68_standard_colors_known_to_dvips)

- [R554] <https://ipython.readthedocs.io/en/stable/config/details.html#terminal-colors>
- [WikiPappus] “Pappus’s Hexagon Theorem” Wikipedia, the Free Encyclopedia. Web. 26 Apr. 2013. <[https://en.wikipedia.org/wiki/Pappus's\\_hexagon\\_theorem](https://en.wikipedia.org/wiki/Pappus's_hexagon_theorem)>
- [R521] [https://en.wikipedia.org/wiki/Graham\\_scan](https://en.wikipedia.org/wiki/Graham_scan)
- [R522] Andrew’s Monotone Chain Algorithm (A.M. Andrew, “Another Efficient Algorithm for Convex Hulls in Two Dimensions”, 1979) <http://geomalgorithms.com/a10-hull-1.html>
- [R503] [https://en.wikipedia.org/wiki/Director\\_circle](https://en.wikipedia.org/wiki/Director_circle)
- [R504] <https://math.stackexchange.com/questions/108270/what-is-the-equation-of-an-ellipse-that-is-n>
- [R505] [https://en.wikipedia.org/wiki/Ellipse#Equation\\_of\\_a\\_shifted\\_ellipse](https://en.wikipedia.org/wiki/Ellipse#Equation_of_a_shifted_ellipse)
- [R506] [https://en.wikipedia.org/wiki/Polar\\_moment\\_of\\_inertia](https://en.wikipedia.org/wiki/Polar_moment_of_inertia)
- [R507] [https://en.wikipedia.org/wiki/List\\_of\\_second\\_moments\\_of\\_area](https://en.wikipedia.org/wiki/List_of_second_moments_of_area)
- [R508] [https://en.wikipedia.org/wiki/Section\\_modulus](https://en.wikipedia.org/wiki/Section_modulus)
- [R509] <http://mathworld.wolfram.com/SemilatusRectum.html>
- [R510] [https://en.wikipedia.org/wiki/Ellipse#Semi-latus\\_rectum](https://en.wikipedia.org/wiki/Ellipse#Semi-latus_rectum)
- [R511] <https://github.com/sympy/sympy/wiki/A-method-to-return-a-cut-section-of-any-polygon-geom>
- [R512] <http://paulbourke.net/geometry/polygonmesh/#insidepoly>
- [R513] <https://skyciv.com/docs/tutorials/section-tutorials/calculating-the-statical-or-first-moment-of-a?cc=BMD>
- [R514] <https://mechanicalc.com/reference/cross-sections>
- [R515] [https://en.wikipedia.org/wiki/Polar\\_moment\\_of\\_inertia](https://en.wikipedia.org/wiki/Polar_moment_of_inertia)
- [R516] [https://en.wikipedia.org/wiki/Second\\_moment\\_of\\_area](https://en.wikipedia.org/wiki/Second_moment_of_area)
- [R517] [https://en.wikipedia.org/wiki/Section\\_modulus](https://en.wikipedia.org/wiki/Section_modulus)
- [R518] <http://mathworld.wolfram.com/Excircles.html>
- [R519] <http://mathworld.wolfram.com/Exradius.html>
- [R520] <http://mathworld.wolfram.com/Excircles.html>
- [R523] <https://hal.inria.fr/inria-00070025/document>
- [R524] [http://www.risc.jku.at/publications/download/risc\\_2244/DIPLFORM.pdf](http://www.risc.jku.at/publications/download/risc_2244/DIPLFORM.pdf)
- [R555] [https://en.wikipedia.org/wiki/Root\\_system](https://en.wikipedia.org/wiki/Root_system)
- [R556] Lie Algebras and Representation Theory - Humphreys
- [Wester1999] Michael J. Wester, A Critique of the Mathematical Abilities of CA Systems, 1999, <http://www.math.unm.edu/~wester/cas/book/Wester.pdf>
- [R719] J.C. Faugere, P. Gianni, D. Lazard, T. Mora (1994). Efficient Computation of Zero-dimensional Groebner Bases by Change of Ordering
- [R720] [https://en.wikipedia.org/wiki/Cubic\\_function#Trigonometric\\_28and\\_hyperbolic\\_29\\_method](https://en.wikipedia.org/wiki/Cubic_function#Trigonometric_28and_hyperbolic_29_method)
- [R721] [Bronstein93]
- [R722] [ManWright94]

- [R723] [Koepf98]
- [R724] [Abramov71]
- [R725] [Man93]
- [R726] [ManWright94]
- [R727] [Koepf98]
- [R728] [Abramov71]
- [R729] [Man93]
- [R695] [Kozen89]
- [R696] [Monagan93]
- [R697] [Gathen99]
- [R698] [Gathen99]
- [R699] [Gathen99]
- [R700] [Gathen92]
- [R701] [Geddes92]
- [R702] [Gathen99]
- [R703] 'An introduction to the Theory of Numbers' 5th Edition by Ivan Niven, Zuckerman and Montgomery.
- [R704] [Liao95]
- [R705] [Gathen99]
- [R706] [Gathen99]
- [R707] [Weisstein09]
- [R708] [Gathen99]
- [R709] [Wang78]
- [R710] [Geddes92]
- [R711] [Gathen99]
- [R712] J.C. Faugere, P. Gianni, D. Lazard, T. Mora (1994). Efficient Computation of Zero-dimensional Groebner Bases by Change of Ordering
- [R730] A. Bostan, P. Flajolet, B. Salvy and E. Schost "Fast Computation with Two Algebraic Numbers", (2002) Research Report 4579, Institut National de Recherche en Informatique et en Automatique
- [Kozen89] D. Kozen, S. Landau, Polynomial decomposition algorithms, Journal of Symbolic Computation 7 (1989), pp. 445-456
- [Liao95] Hsin-Chao Liao, R. Fateman, Evaluation of the heuristic polynomial GCD, International Symposium on Symbolic and Algebraic Computation (ISSAC), ACM Press, Montreal, Quebec, Canada, 1995, pp. 240-247
- [Gathen99] J. von zur Gathen, J. Gerhard, Modern Computer Algebra, First Edition, Cambridge University Press, 1999
- [Weisstein09] Eric W. Weisstein, Cyclotomic Polynomial, From MathWorld - A Wolfram Web Resource, <http://mathworld.wolfram.com/CyclotomicPolynomial.html>

- [Wang78] P. S. Wang, An Improved Multivariate Polynomial Factoring Algorithm, *Math. of Computation* 32, 1978, pp. 1215-1231
- [Geddes92] K. Geddes, S. R. Czapor, G. Labahn, *Algorithms for Computer Algebra*, Springer, 1992
- [Monagan93] Michael Monagan, In-place Arithmetic for Polynomials over  $\mathbb{Z}_n$ , *Proceedings of DISCO '92*, Springer-Verlag LNCS, 721, 1993, pp. 22-34
- [Kaltofen98] E. Kaltofen, V. Shoup, Subquadratic-time Factoring of Polynomials over Finite Fields, *Mathematics of Computation*, Volume 67, Issue 223, 1998, pp. 1179-1197
- [Shoup95] V. Shoup, A New Polynomial Factorization Algorithm and its Implementation, *Journal of Symbolic Computation*, Volume 20, Issue 4, 1995, pp. 363-397
- [Gathen92] J. von zur Gathen, V. Shoup, Computing Frobenius Maps and Factoring Polynomials, *ACM Symposium on Theory of Computing*, 1992, pp. 187-224
- [Shoup91] V. Shoup, A Fast Deterministic Algorithm for Factoring Polynomials over Finite Fields of Small Characteristic, In *Proceedings of International Symposium on Symbolic and Algebraic Computation*, 1991, pp. 14-21
- [Cox97] D. Cox, J. Little, D. O'Shea, *Ideals, Varieties and Algorithms*, Springer, Second Edition, 1997
- [Ajwa95] I.A. Ajwa, Z. Liu, P.S. Wang, Groebner Bases Algorithm, <https://citeseer.ist.psu.edu/myciteseer/login>, 1995
- [Bose03] N.K. Bose, B. Buchberger, J.P. Guiver, *Multidimensional Systems Theory and Applications*, Springer, 2003
- [Giovini91] A. Giovini, T. Mora, "One sugar cube, please" or Selection strategies in Buchberger algorithm, *ISSAC '91*, ACM
- [Bronstein93] M. Bronstein, B. Salvy, Full partial fraction decomposition of rational functions, *Proceedings ISSAC '93*, ACM Press, Kiev, Ukraine, 1993, pp. 157-160
- [Buchberger01] B. Buchberger, Groebner Bases: A Short Introduction for Systems Theorists, In: R. Moreno-Diaz, B. Buchberger, J. L. Freire, *Proceedings of EUROCAST'01*, February, 2001
- [Davenport88] J.H. Davenport, Y. Siret, E. Tournier, *Computer Algebra Systems and Algorithms for Algebraic Computation*, Academic Press, London, 1988, pp. 124-128
- [Greuel2008] G.-M. Greuel, Gerhard Pfister, *A Singular Introduction to Commutative Algebra*, Springer, 2008
- [Atiyah69] M.F. Atiyah, I.G. MacDonald, *Introduction to Commutative Algebra*, Addison-Wesley, 1969
- [Collins67] G.E. Collins, Subresultants and Reduced Polynomial Remainder Sequences. *J. ACM* 14 (1967) 128-142
- [BrownTraub71] W.S. Brown, J.F. Traub, On Euclid's Algorithm and the Theory of Subresultants. *J. ACM* 18 (1971) 505-514
- [Brown78] W.S. Brown, The Subresultant PRS Algorithm. *ACM Transaction of Mathematical Software* 4 (1978) 237-249
- [Monagan00] M. Monagan and A. Wittkopf, On the Design and Implementation of Brown's Algorithm over the Integers and Number Fields, *Proceedings of ISSAC 2000*, pp. 225-233, ACM, 2000.



- [Brown71] W.S. Brown, On Euclid's Algorithm and the Computation of Polynomial Greatest Common Divisors, J. ACM 18, 4, pp. 478-504, 1971.
- [Hoeij04] M. van Hoeij and M. Monagan, Algorithms for polynomial GCD computation over algebraic function fields, Proceedings of ISSAC 2004, pp. 297-304, ACM, 2004.
- [Wang81] P.S. Wang, A p-adic algorithm for univariate partial fractions, Proceedings of SYMSAC 1981, pp. 212-217, ACM, 1981.
- [Hoeij02] M. van Hoeij and M. Monagan, A modular GCD algorithm over number fields presented with multiple extensions, Proceedings of ISSAC 2002, pp. 109-116, ACM, 2002
- [ManWright94] Yiu-Kwong Man and Francis J. Wright, "Fast Polynomial Dispersion Computation and its Application to Indefinite Summation", Proceedings of the International Symposium on Symbolic and Algebraic Computation, 1994, Pages 175-180 <http://dl.acm.org/citation.cfm?doid=190347.190413>
- [Koepf98] Wolfram Koepf, "Hypergeometric Summation: An Algorithmic Approach to Summation and Special Function Identities", Advanced lectures in mathematics, Vieweg, 1998
- [Abramov71] S. A. Abramov, "On the Summation of Rational Functions", USSR Computational Mathematics and Mathematical Physics, Volume 11, Issue 4, 1971, Pages 324-330
- [Man93] Yiu-Kwong Man, "On Computing Closed Forms for Indefinite Summations", Journal of Symbolic Computation, Volume 16, Issue 4, 1993, Pages 355-376 <http://www.sciencedirect.com/science/article/pii/S0747717183710539>
- [Kapur1994] Deepak Kapur, Tushar Saxena, and Lu Yang. "Algebraic and geometric reasoning using Dixon resultants", In Proceedings of the international symposium on Symbolic and algebraic computation (ISSAC '94), 1994, pages 99-107. [https://www.researchgate.net/publication/2514261\\_Algebraic\\_and\\_Geometric\\_Reasoning\\_using\\_Dixon\\_Resultants](https://www.researchgate.net/publication/2514261_Algebraic_and_Geometric_Reasoning_using_Dixon_Resultants)
- [Palancz08] B Paláncz, P Zaletnyik, JL Awange, EW Grafarend. "Dixon resultant's solution of systems of geodetic polynomial equations", Journal of Geodesy, 2008, Springer, [https://www.researchgate.net/publication/225607735\\_Dixon\\_resultant's\\_solution\\_of\\_systems\\_o](https://www.researchgate.net/publication/225607735_Dixon_resultant's_solution_of_systems_o)
- [Bruce97] Bruce Randall Donald, Deepak Kapur, and Joseph L. Mundy (Eds.). "Symbolic and Numerical Computation for Artificial Intelligence", Chapter 2, Academic Press, Inc., Orlando, FL, USA, 1997, <https://www2.cs.duke.edu/donaldlab/Books/SymbolicNumericalComputation/045-087.pdf>.
- [Stiller96] P Stiller. "An introduction to the theory of resultants", Mathematics and Computer Science, T&M University, 1996, Citeseer, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.590.2021&rep=rep1&type=pdf>.
- [Cohen93] Henri Cohen. "A Course in Computational Algebraic Number Theory", Springer, 1993.
- [R694] Cohen, H. *A Course in Computational Algebraic Number Theory*. (See Algorithms 2.4.5 and 2.4.8.)
- [R713] Cohen, H. *A Course in Computational Algebraic Number Theory*.
- [R714] Cohen, H. *A Course in Computational Algebraic Number Theory*. (See Algorithm 6.2.9.)
- [R715] Cohen, H. *A Course in Computational Algebraic Number Theory*. (See Algorithm 4.8.17.)

- [Cohen00] Cohen, H. *Advanced Topics in Computational Number Theory*.
- [R716] Cohen, H. *A Course in Computational Algebraic Number Theory*. (See Prop. 5.1.3)
- [R717] Cohen, H. *A Course in Computational Algebraic Number Theory*.
- [R718] Cohen, H. *A Course in Computational Algebraic Number Theory* (See Sec. 2.3.2.)
- [JoyOfCats] J. Adamek, H. Herrlich. G. E. Strecker: Abstract and Concrete Categories. The Joy of Cats.
- [FiveLemma] [https://en.wikipedia.org/wiki/Five\\_lemma](https://en.wikipedia.org/wiki/Five_lemma)
- [Xypic] <http://xy-pic.sourceforge.net/>
- [R136] [https://en.wikipedia.org/wiki/Caesar\\_cipher](https://en.wikipedia.org/wiki/Caesar_cipher)
- [R137] <http://mathworld.wolfram.com/CaesarsMethod.html>
- [R138] <https://en.wikipedia.org/wiki/ROT13>
- [R139] [https://en.wikipedia.org/wiki/Affine\\_cipher](https://en.wikipedia.org/wiki/Affine_cipher)
- [R140] <https://en.wikipedia.org/wiki/Atbash>
- [R141] [https://en.wikipedia.org/wiki/Substitution\\_cipher](https://en.wikipedia.org/wiki/Substitution_cipher)
- [R142] [https://en.wikipedia.org/wiki/Vigenere\\_cipher](https://en.wikipedia.org/wiki/Vigenere_cipher)
- [R143] <http://web.archive.org/web/20071116100808/>
- [R144] <http://filebox.vt.edu/users/batman/kryptos.html> (short URL: <https://goo.gl/ijr22d>)
- [R145] [https://en.wikipedia.org/wiki/Hill\\_cipher](https://en.wikipedia.org/wiki/Hill_cipher)
- [R146] Lester S. Hill, Cryptography in an Algebraic Alphabet, The American Mathematical Monthly Vol.36, June-July 1929, pp.306-312.
- [R147] [https://en.wikipedia.org/wiki/Bifid\\_cipher](https://en.wikipedia.org/wiki/Bifid_cipher)
- [R148] [https://en.wikipedia.org/wiki/RSA\\_%28cryptosystem%29](https://en.wikipedia.org/wiki/RSA_%28cryptosystem%29)
- [R149] <http://cacr.uwaterloo.ca/techreports/2006/cacr2006-16.pdf>
- [R150] <https://link.springer.com/content/pdf/10.1007%2FBFb0055738.pdf>
- [R151] <http://www.itiis.org/digital-library/manuscript/1381>
- [R152] [https://en.wikipedia.org/wiki/RSA\\_%28cryptosystem%29](https://en.wikipedia.org/wiki/RSA_%28cryptosystem%29)
- [R153] <http://cacr.uwaterloo.ca/techreports/2006/cacr2006-16.pdf>
- [R154] <https://link.springer.com/content/pdf/10.1007%2FBFb0055738.pdf>
- [R155] <http://www.itiis.org/digital-library/manuscript/1381>
- [R156] [https://en.wikipedia.org/wiki/Morse\\_code](https://en.wikipedia.org/wiki/Morse_code)
- [R157] [https://en.wikipedia.org/wiki/Morse\\_code](https://en.wikipedia.org/wiki/Morse_code)
- [G157] Solomon Golomb, Shift register sequences, Aegean Park Press, Laguna Hills, Ca, 1967
- [M158] James L. Massey, "Shift-Register Synthesis and BCH Decoding." IEEE Trans. on Information Theory, vol. 15(1), pp. 122-127, Jan 1969.
- [R160] [https://en.wikipedia.org/wiki/Rail\\_fence\\_cipher](https://en.wikipedia.org/wiki/Rail_fence_cipher)
- [R161] <https://en.wikipedia.org/wiki/Manifold>

- [R162] G. Sussman, J. Wisdom, W. Farr, Functional Differential Geometry (2013)
- [R163] [https://en.wikipedia.org/wiki/Coordinate\\_system](https://en.wikipedia.org/wiki/Coordinate_system)
- [R692] Adaptive polygonal approximation of parametric curves, Luiz Henrique de Figueiredo.
- [R693] Adaptive polygonal approximation of parametric curves, Luiz Henrique de Figueiredo.
- [R803] [https://en.wikipedia.org/wiki/Discrete\\_uniform\\_distribution](https://en.wikipedia.org/wiki/Discrete_uniform_distribution)
- [R804] <http://mathworld.wolfram.com/DiscreteUniformDistribution.html>
- [R805] [https://en.wikipedia.org/wiki/Bernoulli\\_distribution](https://en.wikipedia.org/wiki/Bernoulli_distribution)
- [R806] <http://mathworld.wolfram.com/BernoulliDistribution.html>
- [R807] [https://en.wikipedia.org/wiki/Coin\\_flipping](https://en.wikipedia.org/wiki/Coin_flipping)
- [R808] [https://en.wikipedia.org/wiki/Binomial\\_distribution](https://en.wikipedia.org/wiki/Binomial_distribution)
- [R809] <http://mathworld.wolfram.com/BinomialDistribution.html>
- [R810] [https://en.wikipedia.org/wiki/Beta-binomial\\_distribution](https://en.wikipedia.org/wiki/Beta-binomial_distribution)
- [R811] <http://mathworld.wolfram.com/BetaBinomialDistribution.html>
- [R812] [https://en.wikipedia.org/wiki/Hypergeometric\\_distribution](https://en.wikipedia.org/wiki/Hypergeometric_distribution)
- [R813] <http://mathworld.wolfram.com/HypergeometricDistribution.html>
- [R814] [https://en.wikipedia.org/wiki/Rademacher\\_distribution](https://en.wikipedia.org/wiki/Rademacher_distribution)
- [R815] [https://en.wikipedia.org/wiki/Geometric\\_distribution](https://en.wikipedia.org/wiki/Geometric_distribution)
- [R816] <http://mathworld.wolfram.com/GeometricDistribution.html>
- [R817] [https://en.wikipedia.org/wiki/Hermite\\_distribution](https://en.wikipedia.org/wiki/Hermite_distribution)
- [R818] [https://en.wikipedia.org/wiki/Poisson\\_distribution](https://en.wikipedia.org/wiki/Poisson_distribution)
- [R819] <http://mathworld.wolfram.com/PoissonDistribution.html>
- [R820] [https://en.wikipedia.org/wiki/Logarithmic\\_distribution](https://en.wikipedia.org/wiki/Logarithmic_distribution)
- [R821] <http://mathworld.wolfram.com/LogarithmicDistribution.html>
- [R822] [https://en.wikipedia.org/wiki/Negative\\_binomial\\_distribution](https://en.wikipedia.org/wiki/Negative_binomial_distribution)
- [R823] <http://mathworld.wolfram.com/NegativeBinomialDistribution.html>
- [R824] [https://en.wikipedia.org/wiki/Skellam\\_distribution](https://en.wikipedia.org/wiki/Skellam_distribution)
- [R825] [https://en.wikipedia.org/wiki/Yule%E2%80%93Simon\\_distribution](https://en.wikipedia.org/wiki/Yule%E2%80%93Simon_distribution)
- [R826] [https://en.wikipedia.org/wiki/Zeta\\_distribution](https://en.wikipedia.org/wiki/Zeta_distribution)
- [R827] [https://en.wikipedia.org/wiki/Arcsine\\_distribution](https://en.wikipedia.org/wiki/Arcsine_distribution)
- [R828] [https://en.wikipedia.org/wiki/Benini\\_distribution](https://en.wikipedia.org/wiki/Benini_distribution)
- [R829] <http://reference.wolfram.com/legacy/v8/ref/BeniniDistribution.html>
- [R830] [https://en.wikipedia.org/wiki/Beta\\_distribution](https://en.wikipedia.org/wiki/Beta_distribution)
- [R831] <http://mathworld.wolfram.com/BetaDistribution.html>
- [R832] [https://en.wikipedia.org/wiki/Noncentral\\_beta\\_distribution](https://en.wikipedia.org/wiki/Noncentral_beta_distribution)
- [R833] <http://reference.wolfram.com/language/ref/NoncentralBetaDistribution.html>

- [R834] [https://en.wikipedia.org/wiki/Beta\\_prime\\_distribution](https://en.wikipedia.org/wiki/Beta_prime_distribution)
- [R835] <http://mathworld.wolfram.com/BetaPrimeDistribution.html>
- [R836] [https://en.wikipedia.org/wiki/Pareto\\_distribution#Bounded\\_Pareto\\_distribution](https://en.wikipedia.org/wiki/Pareto_distribution#Bounded_Pareto_distribution)
- [R837] [https://en.wikipedia.org/wiki/Cauchy\\_distribution](https://en.wikipedia.org/wiki/Cauchy_distribution)
- [R838] <http://mathworld.wolfram.com/CauchyDistribution.html>
- [R839] [https://en.wikipedia.org/wiki/Chi\\_distribution](https://en.wikipedia.org/wiki/Chi_distribution)
- [R840] <http://mathworld.wolfram.com/ChiDistribution.html>
- [R841] [https://en.wikipedia.org/wiki/Noncentral\\_chi\\_distribution](https://en.wikipedia.org/wiki/Noncentral_chi_distribution)
- [R842] [https://en.wikipedia.org/wiki/Chi\\_squared\\_distribution](https://en.wikipedia.org/wiki/Chi_squared_distribution)
- [R843] <http://mathworld.wolfram.com/Chi-SquaredDistribution.html>
- [R844] [https://en.wikipedia.org/wiki/Dagum\\_distribution](https://en.wikipedia.org/wiki/Dagum_distribution)
- [R845] [https://en.wikipedia.org/wiki/Erlang\\_distribution](https://en.wikipedia.org/wiki/Erlang_distribution)
- [R846] <http://mathworld.wolfram.com/ErlangDistribution.html>
- [R847] [https://en.wikipedia.org/wiki/Exponentially\\_modified\\_Gaussian\\_distribution](https://en.wikipedia.org/wiki/Exponentially_modified_Gaussian_distribution)
- [R848] [https://en.wikipedia.org/wiki/Exponential\\_distribution](https://en.wikipedia.org/wiki/Exponential_distribution)
- [R849] <http://mathworld.wolfram.com/ExponentialDistribution.html>
- [R850] <https://en.wikipedia.org/wiki/F-distribution>
- [R851] <http://mathworld.wolfram.com/F-Distribution.html>
- [R852] [https://en.wikipedia.org/wiki/Fisher%27s\\_z-distribution](https://en.wikipedia.org/wiki/Fisher%27s_z-distribution)
- [R853] <http://mathworld.wolfram.com/Fishersz-Distribution.html>
- [R854] [https://en.wikipedia.org/wiki/Fr%C3%A9chet\\_distribution](https://en.wikipedia.org/wiki/Fr%C3%A9chet_distribution)
- [R855] [https://en.wikipedia.org/wiki/Gamma\\_distribution](https://en.wikipedia.org/wiki/Gamma_distribution)
- [R856] <http://mathworld.wolfram.com/GammaDistribution.html>
- [R857] [https://en.wikipedia.org/wiki/Inverse-gamma\\_distribution](https://en.wikipedia.org/wiki/Inverse-gamma_distribution)
- [R858] [https://en.wikipedia.org/wiki/Gompertz\\_distribution](https://en.wikipedia.org/wiki/Gompertz_distribution)
- [R859] <http://mathworld.wolfram.com/GumbelDistribution.html>
- [R860] [https://en.wikipedia.org/wiki/Gumbel\\_distribution](https://en.wikipedia.org/wiki/Gumbel_distribution)
- [R861] [http://www.mathwave.com/help/easyfit/html/analyses/distributions/gumbel\\_max.html](http://www.mathwave.com/help/easyfit/html/analyses/distributions/gumbel_max.html)
- [R862] [http://www.mathwave.com/help/easyfit/html/analyses/distributions/gumbel\\_min.html](http://www.mathwave.com/help/easyfit/html/analyses/distributions/gumbel_min.html)
- [R863] [https://en.wikipedia.org/wiki/Kumaraswamy\\_distribution](https://en.wikipedia.org/wiki/Kumaraswamy_distribution)
- [R864] [https://en.wikipedia.org/wiki/Laplace\\_distribution](https://en.wikipedia.org/wiki/Laplace_distribution)
- [R865] <http://mathworld.wolfram.com/LaplaceDistribution.html>
- [R866] [https://en.wikipedia.org/wiki/L%C3%A9vy\\_distribution](https://en.wikipedia.org/wiki/L%C3%A9vy_distribution)
- [R867] <http://mathworld.wolfram.com/LevyDistribution.html>
- [R868] [https://en.wikipedia.org/wiki/Logistic\\_distribution](https://en.wikipedia.org/wiki/Logistic_distribution)

- [R869] <http://mathworld.wolfram.com/LogisticDistribution.html>
- [R870] [https://en.wikipedia.org/wiki/Log-logistic\\_distribution](https://en.wikipedia.org/wiki/Log-logistic_distribution)
- [R871] <https://en.wikipedia.org/wiki/Lognormal>
- [R872] <http://mathworld.wolfram.com/LogNormalDistribution.html>
- [R873] [https://en.wikipedia.org/wiki/Lomax\\_distribution](https://en.wikipedia.org/wiki/Lomax_distribution)
- [R874] [https://en.wikipedia.org/wiki/Maxwell\\_distribution](https://en.wikipedia.org/wiki/Maxwell_distribution)
- [R875] <http://mathworld.wolfram.com/MaxwellDistribution.html>
- [R876] <https://reference.wolfram.com/language/ref/MoyalDistribution.html>
- [R877] <http://www.stat.rice.edu/~dobelman/textfiles/DistributionsHandbook.pdf>
- [R878] [https://en.wikipedia.org/wiki/Nakagami\\_distribution](https://en.wikipedia.org/wiki/Nakagami_distribution)
- [R879] [https://en.wikipedia.org/wiki/Normal\\_distribution](https://en.wikipedia.org/wiki/Normal_distribution)
- [R880] <http://mathworld.wolfram.com/NormalDistributionFunction.html>
- [R881] [https://en.wikipedia.org/wiki/Pareto\\_distribution](https://en.wikipedia.org/wiki/Pareto_distribution)
- [R882] <http://mathworld.wolfram.com/ParetoDistribution.html>
- [R883] [http://www.mathwave.com/help/easyfit/html/analyses/distributions/power\\_func.html](http://www.mathwave.com/help/easyfit/html/analyses/distributions/power_func.html)
- [R884] [https://en.wikipedia.org/wiki/U-quadratic\\_distribution](https://en.wikipedia.org/wiki/U-quadratic_distribution)
- [R885] [https://en.wikipedia.org/wiki/Raised\\_cosine\\_distribution](https://en.wikipedia.org/wiki/Raised_cosine_distribution)
- [R886] [https://en.wikipedia.org/wiki/Rayleigh\\_distribution](https://en.wikipedia.org/wiki/Rayleigh_distribution)
- [R887] <http://mathworld.wolfram.com/RayleighDistribution.html>
- [R888] [https://en.wikipedia.org/wiki/Reciprocal\\_distribution](https://en.wikipedia.org/wiki/Reciprocal_distribution)
- [R889] [https://en.wikipedia.org/wiki/Student\\_t-distribution](https://en.wikipedia.org/wiki/Student_t-distribution)
- [R890] <http://mathworld.wolfram.com/Studentst-Distribution.html>
- [R891] [https://en.wikipedia.org/wiki/Shifted\\_Gompertz\\_distribution](https://en.wikipedia.org/wiki/Shifted_Gompertz_distribution)
- [R892] [https://en.wikipedia.org/wiki/Trapezoidal\\_distribution](https://en.wikipedia.org/wiki/Trapezoidal_distribution)
- [R893] [https://en.wikipedia.org/wiki/Triangular\\_distribution](https://en.wikipedia.org/wiki/Triangular_distribution)
- [R894] <http://mathworld.wolfram.com/TriangularDistribution.html>
- [R895] [https://en.wikipedia.org/wiki/Uniform\\_distribution\\_%28continuous%29](https://en.wikipedia.org/wiki/Uniform_distribution_%28continuous%29)
- [R896] <http://mathworld.wolfram.com/UniformDistribution.html>
- [R897] [https://en.wikipedia.org/wiki/Uniform\\_sum\\_distribution](https://en.wikipedia.org/wiki/Uniform_sum_distribution)
- [R898] <http://mathworld.wolfram.com/UniformSumDistribution.html>
- [R899] [https://en.wikipedia.org/wiki/Von\\_Mises\\_distribution](https://en.wikipedia.org/wiki/Von_Mises_distribution)
- [R900] <http://mathworld.wolfram.com/vonMisesDistribution.html>
- [R901] [https://en.wikipedia.org/wiki/Inverse\\_Gaussian\\_distribution](https://en.wikipedia.org/wiki/Inverse_Gaussian_distribution)
- [R902] <http://mathworld.wolfram.com/InverseGaussianDistribution.html>
- [R903] [https://en.wikipedia.org/wiki/Weibull\\_distribution](https://en.wikipedia.org/wiki/Weibull_distribution)

- [R904] <http://mathworld.wolfram.com/WeibullDistribution.html>
- [R905] [https://en.wikipedia.org/wiki/Wigner\\_semicircle\\_distribution](https://en.wikipedia.org/wiki/Wigner_semicircle_distribution)
- [R906] <http://mathworld.wolfram.com/WignersSemicircleLaw.html>
- [R907] [https://en.wikipedia.org/wiki/Multivariate\\_normal\\_distribution](https://en.wikipedia.org/wiki/Multivariate_normal_distribution)
- [R908] [https://en.wikipedia.org/wiki/Multivariate\\_Laplace\\_distribution](https://en.wikipedia.org/wiki/Multivariate_Laplace_distribution)
- [R909] [https://en.wikipedia.org/wiki/Generalized\\_multivariate\\_log-gamma\\_distribution](https://en.wikipedia.org/wiki/Generalized_multivariate_log-gamma_distribution)
- [R910] [https://www.researchgate.net/publication/234137346\\_On\\_a\\_multivariate\\_log-gamma\\_distribution\\_and\\_the\\_use\\_of\\_the\\_distribution\\_in\\_the\\_Bayesian\\_analysis](https://www.researchgate.net/publication/234137346_On_a_multivariate_log-gamma_distribution_and_the_use_of_the_distribution_in_the_Bayesian_analysis)
- [R911] [https://en.wikipedia.org/wiki/Generalized\\_multivariate\\_log-gamma\\_distribution](https://en.wikipedia.org/wiki/Generalized_multivariate_log-gamma_distribution)
- [R912] [https://www.researchgate.net/publication/234137346\\_On\\_a\\_multivariate\\_log-gamma\\_distribution\\_and\\_the\\_use\\_of\\_the\\_distribution\\_in\\_the\\_Bayesian\\_analysis](https://www.researchgate.net/publication/234137346_On_a_multivariate_log-gamma_distribution_and_the_use_of_the_distribution_in_the_Bayesian_analysis)
- [R913] [https://en.wikipedia.org/wiki/Multinomial\\_distribution](https://en.wikipedia.org/wiki/Multinomial_distribution)
- [R914] <http://mathworld.wolfram.com/MultinomialDistribution.html>
- [R915] [https://en.wikipedia.org/wiki/Dirichlet\\_distribution](https://en.wikipedia.org/wiki/Dirichlet_distribution)
- [R916] <http://mathworld.wolfram.com/DirichletDistribution.html>
- [R917] [https://en.wikipedia.org/wiki/Ewens%27s\\_sampling\\_formula](https://en.wikipedia.org/wiki/Ewens%27s_sampling_formula)
- [R918] <http://www.stat.rutgers.edu/home/hcrane/Papers/STS529.pdf>
- [R919] [https://en.wikipedia.org/wiki/Negative\\_multinomial\\_distribution](https://en.wikipedia.org/wiki/Negative_multinomial_distribution)
- [R920] <http://mathworld.wolfram.com/NegativeBinomialDistribution.html>
- [R921] [https://en.wikipedia.org/wiki/Normal-gamma\\_distribution](https://en.wikipedia.org/wiki/Normal-gamma_distribution)
- [R922] [https://en.wikipedia.org/wiki/Markov\\_chain#Discrete-time\\_Markov\\_chain](https://en.wikipedia.org/wiki/Markov_chain#Discrete-time_Markov_chain)
- [R923] [https://www.dartmouth.edu/~chance/teaching\\_aids/books\\_articles/probability\\_book/Chapter11.pdf](https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/Chapter11.pdf)
- [R924] <https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470316887.app1>
- [R925] <http://www.columbia.edu/~ww2040/6711F12/lect1023big.pdf>
- [R926] <http://www.columbia.edu/~ww2040/4701Sum07/4701-06-Notes-MCII.pdf>
- [R927] <http://cecas.clemson.edu/~shierd/Shier/markov.pdf>
- [R928] <https://ujcontent.uj.ac.za/vital/access/services/Download/uj:7506/CONTENT1>
- [R929] <https://www.mathworks.com/help/econ/dtmc.classify.html>
- [R930] [https://en.wikipedia.org/wiki/Absorbing\\_Markov\\_chain](https://en.wikipedia.org/wiki/Absorbing_Markov_chain)
- [R931] [http://people.brandeis.edu/~igusa/Math56aS08/Math56a\\_S08\\_notes015.pdf](http://people.brandeis.edu/~igusa/Math56aS08/Math56a_S08_notes015.pdf)
- [R932] <https://lips.cs.princeton.edu/the-fundamental-matrix-of-a-finite-markov-chain/>
- [R933] [https://www.probabilitycourse.com/chapter11/11\\_2\\_6\\_stationary\\_and\\_limiting\\_distributions.php](https://www.probabilitycourse.com/chapter11/11_2_6_stationary_and_limiting_distributions.php)
- [R934] [https://galton.uchicago.edu/~yibi/teaching/stat317/2014/Lectures/Lecture4\\_6up.pdf](https://galton.uchicago.edu/~yibi/teaching/stat317/2014/Lectures/Lecture4_6up.pdf)



- [R935] [https://en.wikipedia.org/wiki/Markov\\_chain#Continuous-time\\_Markov\\_chain](https://en.wikipedia.org/wiki/Markov_chain#Continuous-time_Markov_chain)
- [R936] <http://u.math.biu.ac.il/~amirgi/CTMCnotes.pdf>
- [R937] [https://en.wikipedia.org/wiki/Bernoulli\\_process](https://en.wikipedia.org/wiki/Bernoulli_process)
- [R938] <https://mathcs.clarku.edu/~djoyce/ma217/bernoulli.pdf>
- [R939] [https://www.probabilitycourse.com/chapter11/11\\_0\\_0\\_intro.php](https://www.probabilitycourse.com/chapter11/11_0_0_intro.php)
- [R940] [https://en.wikipedia.org/wiki/Poisson\\_point\\_process](https://en.wikipedia.org/wiki/Poisson_point_process)
- [R941] [https://www.probabilitycourse.com/chapter11/11\\_4\\_0\\_brownian\\_motion\\_wiener\\_process.php](https://www.probabilitycourse.com/chapter11/11_4_0_brownian_motion_wiener_process.php)
- [R942] [https://en.wikipedia.org/wiki/Wiener\\_process](https://en.wikipedia.org/wiki/Wiener_process)
- [R943] [https://en.wikipedia.org/wiki/Gamma\\_process](https://en.wikipedia.org/wiki/Gamma_process)
- [R944] [https://en.wikipedia.org/wiki/Matrix\\_gamma\\_distribution](https://en.wikipedia.org/wiki/Matrix_gamma_distribution)
- [R945] [https://en.wikipedia.org/wiki/Wishart\\_distribution](https://en.wikipedia.org/wiki/Wishart_distribution)
- [R946] [https://en.wikipedia.org/wiki/Matrix\\_normal\\_distribution](https://en.wikipedia.org/wiki/Matrix_normal_distribution)
- [R947] [https://en.wikipedia.org/wiki/Compound\\_probability\\_distribution](https://en.wikipedia.org/wiki/Compound_probability_distribution)
- [R948] [https://en.wikipedia.org/wiki/Entropy\\_\(information\\_theory\)](https://en.wikipedia.org/wiki/Entropy_(information_theory))
- [R949] [https://www.crmarsch.com/static/pdf/Charles\\_Marsh\\_Continuous\\_Entropy.pdf](https://www.crmarsch.com/static/pdf/Charles_Marsh_Continuous_Entropy.pdf)
- [R950] <http://www.math.uconn.edu/~kconrad/blurbs/analysis/entropypost.pdf>
- [R951] <https://en.wikipedia.org/wiki/Coskewness>
- [R952] [https://en.wikipedia.org/wiki/Median#Probability\\_distributions](https://en.wikipedia.org/wiki/Median#Probability_distributions)
- [R953] [https://en.wikipedia.org/wiki/Factorial\\_moment](https://en.wikipedia.org/wiki/Factorial_moment)
- [R954] <http://mathworld.wolfram.com/FactorialMoment.html>
- [R955] <https://en.wikipedia.org/wiki/Kurtosis>
- [R956] <http://mathworld.wolfram.com/Kurtosis.html>



## PYTHON MODULE INDEX

### S

sympy, ??  
 sympy.abc, 884  
 sympy.algebras, 885  
 sympy.assumptions, 186  
 sympy.assumptions.ask, 191  
 sympy.assumptions.assume, 193  
 sympy.assumptions.predicates, 200  
 sympy.assumptions.refine, 197  
 sympy.calculus, 233  
 sympy.calculus.euler, 233  
 sympy.calculus.finite\_diff, 240  
 sympy.calculus.singularities, 234  
 sympy.calculus.util, 244  
 sympy.categories, 2742  
 sympy.categories.diagram\_drawing, 2752  
 sympy.codegen.algorithms, 1157  
 sympy.codegen.approximations, 1122  
 sympy.codegen.ast, 1124  
 sympy.codegen.cfunctions, 1143  
 sympy.codegen.cnodes, 1148  
 sympy.codegen.cutils, 1159  
 sympy.codegen.cxxnodes, 1149  
 sympy.codegen.fnodes, 1149  
 sympy.codegen.futils, 1159  
 sympy.codegen.matrix\_nodes, 1121  
 sympy.codegen.pyutils, 1159  
 sympy.codegen.rewriting, 1118  
 sympy.combinatorics.generators, 287  
 sympy.combinatorics.graycode, 347  
 sympy.combinatorics.group\_constructs, 363  
 sympy.combinatorics.group\_numbers, 355  
 sympy.combinatorics.named\_groups, 352  
 sympy.combinatorics.partitions, 251  
 sympy.combinatorics.perm\_groups, 288  
 sympy.combinatorics.permutations, 257  
 sympy.combinatorics.polyhedron, 332  
 sympy.combinatorics.prufer, 335  
 sympy.combinatorics.subsets, 340  
 sympy.combinatorics.tensor\_can, 365  
 sympy.combinatorics.testutil, 363  
 sympy.combinatorics.util, 356  
 sympy.core.add, 1013  
 sympy.core.assumptions, 923  
 sympy.core.basic, 927  
 sympy.core.cache, 927  
 sympy.core.containers, 1068  
 sympy.core.core, 945  
 sympy.core.evalf, 1065  
 sympy.core.expr, 947  
 sympy.core.exprtools, 1071  
 sympy.core.function, 1039  
 sympy.core.kind, 1073  
 sympy.core.mod, 1018  
 sympy.core.mul, 1009  
 sympy.core.multidimensional, 1039  
 sympy.core.numbers, 981  
 sympy.core.power, 1005  
 sympy.core.random, 1077  
 sympy.core.relational, 1018  
 sympy.core.singleton, 945  
 sympy.core.symbol, 976  
 sympy.core.sympify, 918  
 sympy.core.traversal, 1080  
 sympy.crypto.crypto, 2762  
 sympy.diffgeom, 2799  
 sympy.discrete, 1083  
 sympy.discrete.convolution, 1089  
 sympy.discrete.transforms, 1083  
 sympy.functions, 381  
 sympy.functions.special.bessel, 497  
 sympy.functions.special.beta\_functions, 470  
 sympy.functions.special.elliptic\_integrals, 526  
 sympy.functions.special.error\_functions, 471  
 sympy.functions.special.gamma\_functions, 459  
 sympy.functions.special.mathieu\_functions, 529  
 sympy.functions.special.polynomials, 532

[sympy.functions.special.singularity\\_functions](#), 456  
[sympy.functions.special.zeta\\_functions](#), 514  
[sympy.geometry.curve](#), 2247  
[sympy.geometry.ellipse](#), 2253  
[sympy.geometry.entity](#), 2194  
[sympy.geometry.line](#), 2216  
[sympy.geometry.plane](#), 2303  
[sympy.geometry.point](#), 2202  
[sympy.geometry.polygon](#), 2273  
[sympy.geometry.util](#), 2197  
[sympy.holonomic](#), 2312  
[sympy.integrals](#), 575  
[sympy.integrals.intpoly](#), 617  
[sympy.integrals.meijerint](#), 568  
[sympy.integrals.meijerint\\_doc](#), 564  
[sympy.integrals.transforms](#), 576  
[sympy.interactive](#), 2116  
[sympy.interactive.printing](#), 2119  
[sympy.interactive.session](#), 2116  
[sympy.liealgebras](#), 2326  
[sympy.logic](#), 1160  
[sympy.logic.inference](#), 1184  
[sympy.matrices](#), 1217  
[sympy.matrices.common](#), 1327  
[sympy.matrices.expressions](#), 1369  
[sympy.matrices.expressions.blockmatrix](#), 1380  
[sympy.matrices.immutable](#), 1369  
[sympy.matrices.matrices](#), 1218  
[sympy.matrices.sparse](#), 1364  
[sympy.matrices.sparsetools](#), 1365  
[sympy.ntheory.bbp\\_pi](#), 1531  
[sympy.ntheory.continued\\_fraction](#), 1523  
[sympy.ntheory.digits](#), 1526  
[sympy.ntheory.ecm](#), 1531  
[sympy.ntheory.egyptian\\_fraction](#), 1529  
[sympy.ntheory.factor\\_](#), 1486  
[sympy.ntheory.generate](#), 1476  
[sympy.ntheory.modular](#), 1509  
[sympy.ntheory.multinomial](#), 1511  
[sympy.ntheory.partitions\\_](#), 1513  
[sympy.ntheory.primetest](#), 1513  
[sympy.ntheory.qs](#), 1532  
[sympy.ntheory.residue\\_ntheory](#), 1518  
[sympy.parsing](#), 2122  
[sympy.parsing.sym\\_expr](#), 2130  
[sympy.physics](#), 1533  
[sympy.physics.continuum\\_mechanics.beam](#), 1949  
[sympy.physics.continuum\\_mechanics.truss](#), 2021  
[sympy.physics.control](#), 1890  
[sympy.physics.control.lti](#), 1891  
[sympy.physics.hep.gamma\\_matrices](#), 1589  
[sympy.physics.hydrogen](#), 1533  
[sympy.physics.matrices](#), 1537  
[sympy.physics.mechanics](#), 1675  
[sympy.physics.mechanics.body](#), 1756  
[sympy.physics.mechanics.joint](#), 1770  
[sympy.physics.mechanics.jointsmethod](#), 1780  
[sympy.physics.mechanics.kane](#), 1764  
[sympy.physics.mechanics.lagrange](#), 1767  
[sympy.physics.mechanics.linearize](#), 1787  
[sympy.physics.mechanics.particle](#), 1743  
[sympy.physics.mechanics.rigidbody](#), 1746  
[sympy.physics.mechanics.system](#), 1783  
[sympy.physics.optics.gaussopt](#), 1857  
[sympy.physics.optics.medium](#), 1870  
[sympy.physics.optics.polarization](#), 1871  
[sympy.physics.optics.utils](#), 1880  
[sympy.physics.optics.waves](#), 1887  
[sympy.physics.paulialgebra](#), 1539  
[sympy.physics.qho\\_ld](#), 1539  
[sympy.physics.quantum.anticommutator](#), 1791  
[sympy.physics.quantum.cartesian](#), 1801  
[sympy.physics.quantum.cg](#), 1792  
[sympy.physics.quantum.circuitplot](#), 1840  
[sympy.physics.quantum.commutator](#), 1795  
[sympy.physics.quantum.constants](#), 1796  
[sympy.physics.quantum.dagger](#), 1797  
[sympy.physics.quantum.gate](#), 1842  
[sympy.physics.quantum.grover](#), 1847  
[sympy.physics.quantum.hilbert](#), 1802  
[sympy.physics.quantum.innerproduct](#), 1798  
[sympy.physics.quantum.operator](#), 1807  
[sympy.physics.quantum.operatorset](#), 1812  
[sympy.physics.quantum.piab](#), 1857  
[sympy.physics.quantum.qapply](#), 1814  
[sympy.physics.quantum.qft](#), 1850  
[sympy.physics.quantum.qubit](#), 1850  
[sympy.physics.quantum.represent](#), 1815  
[sympy.physics.quantum.shor](#), 1856  
[sympy.physics.quantum.spin](#), 1820  
[sympy.physics.quantum.state](#), 1832  
[sympy.physics.quantum.tensorproduct](#), 1799  
[sympy.physics.secondquant](#), 1542  
[sympy.physics.sho](#), 1541  
[sympy.physics.units.dimensions](#), 1584  
[sympy.physics.units.prefixes](#), 1586  
[sympy.physics.units.quantities](#), 1587  
[sympy.physics.units.unitsystem](#), 1587  
[sympy.physics.units.util](#), 1588

[sympy.physics.vector](#), 1592  
[sympy.physics.vector.functions](#), 1659  
[sympy.physics.vector.point](#), 1652  
[sympy.physics.wigner](#), 1566  
[sympy.plotting.plot](#), 2820  
[sympy.plotting.pygletplot](#), 2869  
[sympy.polys](#), 2360  
[sympy.polys.numberfields.modules](#), 2716  
[sympy.polys.numberfields.subfield](#), 2711  
[sympy.polys.polyconfig](#), 2643  
[sympy.polys.polyoptions](#), 2642  
[sympy.polys.solvers](#), 2666  
[sympy.printing.aesaracode](#), 2166  
[sympy.printing.c](#), 2140  
[sympy.printing.codeprinter](#), 2183  
[sympy.printing.conventions](#), 2183  
[sympy.printing.cxx](#), 2144  
[sympy.printing.fortran](#), 2147  
[sympy.printing.gtk](#), 2170  
[sympy.printing.jscode](#), 2155  
[sympy.printing.julia](#), 2157  
[sympy.printing.lambdarepr](#), 2170  
[sympy.printing.latex](#), 2170  
[sympy.printing.maple](#), 2154  
[sympy.printing.mathematica](#), 2152  
[sympy.printing.mathml](#), 2175  
[sympy.printing.octave](#), 2160  
[sympy.printing.precedence](#), 2184  
[sympy.printing.pretty](#), 2139  
[sympy.printing.pretty.pretty](#), 2139  
[sympy.printing.pretty.pretty\\_symbology](#), 2184  
[sympy.printing.pretty.stringpict](#), 2186  
[sympy.printing.preview](#), 2181  
[sympy.printing.printer](#), 2135  
[sympy.printing.pycode](#), 2176  
[sympy.printing.python](#), 2177  
[sympy.printing.rcode](#), 2144  
[sympy.printing.repr](#), 2177  
[sympy.printing.rust](#), 2164  
[sympy.printing.str](#), 2178  
[sympy.printing.tree](#), 2178  
[sympy.sets.conditionset](#), 1215  
[sympy.sets.fancysets](#), 1203  
[sympy.sets.powerset](#), 1213  
[sympy.sets.sets](#), 1185  
[sympy.simplify.combsimp](#), 683  
[sympy.simplify.cse\\_main](#), 685  
[sympy.simplify.epathtools](#), 688  
[sympy.simplify.hyperexpand](#), 687  
[sympy.simplify.hyperexpand\\_doc](#), 699  
[sympy.simplify.powsimp](#), 680  
[sympy.simplify.radsimp](#), 670  
[sympy.simplify.ratsimp](#), 678  
[sympy.simplify.simplify](#), 154  
[sympy.simplify.sqrtdenest](#), 684  
[sympy.simplify.trigsimp](#), 679  
[sympy.solvers](#), 836  
[sympy.solvers.inequalities](#), 750  
[sympy.solvers.ode](#), 755  
[sympy.solvers.ode.ode](#), 822  
[sympy.solvers.pde](#), 835  
[sympy.solvers.recurr](#), 853  
[sympy.solvers.solve](#), 858  
[sympy.stats](#), 2873  
[sympy.stats.crv](#), 2981  
[sympy.stats.crv\\_types](#), 2981  
[sympy.stats.frv](#), 2981  
[sympy.stats.frv\\_types](#), 2981  
[sympy.stats.rv](#), 2980  
[sympy.tensor](#), 1387  
[sympy.tensor.array](#), 1387  
[sympy.tensor.array.expressions](#), 1395  
[sympy.tensor.index\\_methods](#), 1406  
[sympy.tensor.indexed](#), 1398  
[sympy.tensor.tensor](#), 1409  
[sympy.tensor.toperators](#), 1423  
[sympy.testing](#), 2027  
[sympy.testing.pytest](#), 2027  
[sympy.testing.randtest](#), 2030  
[sympy.testing.runttests](#), 2030  
[sympy.utilities](#), 2038  
[sympy.utilities.autowrap](#), 2039  
[sympy.utilities.codegen](#), 2046  
[sympy.utilities.decorator](#), 2057  
[sympy.utilities.enumerative](#), 2060  
[sympy.utilities.exceptions](#), 2066  
[sympy.utilities.iterables](#), 2071  
[sympy.utilities.lambdify](#), 2099  
[sympy.utilities.memoization](#), 2110  
[sympy.utilities.misc](#), 2110  
[sympy.utilities.pkgdata](#), 2115  
[sympy.utilities.source](#), 2116  
[sympy.utilities.timeutils](#), 2116  
[sympy.vector](#), 1425





## INDEX

### Symbols

\_\_CoeffExpValueError, 568  
 \_\_TensorManager (class in sympy.tensor.tensor), 1422  
 \_\_abs\_\_ () (sympy.matrices.common.MatrixCommon method), 1327  
 \_\_add\_\_ () (sympy.matrices.common.MatrixCommon method), 1327  
 \_\_add\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2729  
 \_\_add\_\_ () (sympy.polys.numberfields.primes.PrimeIdeal method), 2706  
 \_\_cacheit\_\_ (in module sympy.core.cache), 927  
 \_\_call\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2719  
 \_\_contains\_\_ () (sympy.combinatorics.perm\_groups.PermutationGroup method), 289  
 \_\_getitem\_\_ () (sympy.matrices.common.MatrixCommon method), 1327  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2734  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.InnerEndomorphism method), 2734  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2729  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.InnerEndomorphism method), 2734  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.ModuleHomomorphism method), 2733  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.PowerBasis method), 2725  
 \_\_init\_\_ () (sympy.polys.numberfields.modules.Submodule method), 2726  
 \_\_init\_\_ () (sympy.polys.numberfields.primes.PrimeIdeal method), 2706  
 \_\_init\_\_ () (sympy.polys.numberfields.utilities.AlgIntPower method), 2739  
 \_\_init\_\_ () (sympy.vector.coordsysrect.CoordSys3D method), 1448  
 \_\_init\_\_ () (sympy.vector.orienters.AxisOrienter method), 1466  
 \_\_init\_\_ () (sympy.vector.orienters.BodyOrienter method), 1467  
 \_\_init\_\_ () (sympy.vector.orienters.QuaternionOrienter method), 1469  
 \_\_init\_\_ () (sympy.vector.orienters.SpaceOrienter method), 1468  
 \_\_len\_\_ () (sympy.matrices.common.MatrixCommon method), 1327  
 \_\_mod\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2730  
 \_\_mul\_\_ () (sympy.combinatorics.perm\_groups.PermutationGroup method), 289  
 \_\_mul\_\_ () (sympy.matrices.common.MatrixCommon method), 1327  
 \_\_mul\_\_ () (sympy.polys.numberfields.modules.ModuleElement method), 2730  
 \_\_mul\_\_ () (sympy.polys.numberfields.primes.PrimeIdeal method), 2706  
 \_\_new\_\_ () (sympy.combinatorics.perm\_groups.PermutationGroup static method), 290  
 \_\_new\_\_ () (sympy.core.numbers.AlgebraicNumber static method), 988  
 \_\_pow\_\_ () (sympy.matrices.common.MatrixCommon method), 1328  
 \_\_weakref\_\_ (sympy.combinatorics.perm\_groups.PermutationGroup attribute), 290  
 \_\_weakref\_\_ (sympy.matrices.common.MatrixCommon attribute), 1328  
 af\_parity() (in module sympy.combinatorics.permutations), 286  
 all\_roots() (sympy.polys.rootoftools.ComplexRootOf class method), 2434  
 base\_ordering() (in module sympy.combinatorics.util), 356  
 check\_antecedents() (in module sympy.integrals.meijerint), 568  
 check\_antecedents\_1() (in module sympy.integrals.meijerint), 568  
 check\_antecedents\_inversion() (in module sympy.integrals.meijerint), 569  
 check\_cycles\_alt\_sym() (in module

`sympy.combinatorics.util`), 357  
`_cmp_perm_lists()` (in module `sympy.combinatorics.testutil`), 363  
`_complexes_index()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_complexes_sorted()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_condsimp()` (in module `sympy.integrals.meijerint`), 569  
`_convert_poly_rat_alg()` (in module `sympy.holonomic.holonomic`), 2326  
`_coset_representative()` (`sympy.combinatorics.perm_groups.PermutationGroup` method), 290  
`_count_roots()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_create_lookup_table()` (in module `sympy.integrals.meijerint`), 569  
`_create_table()` (in module `sympy.holonomic.holonomic`), 2326  
`_csrtodok()` (in module `sympy.matrices.sparsetools`), 1365  
`_diff_wrt` (`sympy.core.function.Derivative` property), 1045  
`_distinct_primes_lemma()` (`sympy.combinatorics.perm_groups.PermutationGroup` class method), 290  
`_distribute_gens_by_base()` (in module `sympy.combinatorics.util`), 357  
`_doktocsr()` (in module `sympy.matrices.sparsetools`), 1365  
`_dummy()` (in module `sympy.integrals.meijerint`), 569  
`_dummy_()` (in module `sympy.integrals.meijerint`), 569  
`_elements` (`sympy.combinatorics.perm_groups.PermutationGroup` property), 290  
`_ensure_complexes_init()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_ensure_reals_init()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_eval_cond()` (in module `sympy.integrals.meijerint`), 569  
`_eval_evalf()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_eval_integral()` (`sympy.functions.elementary.integrals.Piecewise` method), 416  
`_eval_is_alt_sym_monte_carlo()` (`sympy.combinatorics.perm_groups.PermutationGroup` method), 290  
`_eval_is_alt_sym_naive()` (`sympy.combinatorics.perm_groups.PermutationGroup` method), 291  
`_eval_is_imaginary()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_eval_is_real()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_exponents()` (in module `sympy.integrals.meijerint`), 569  
`_fast_inverse_laplace()` (in module `sympy.integrals.transforms`), 579  
`_find_splitting_points()` (in module `sympy.integrals.meijerint`), 570  
`_functions` (in module `sympy.integrals.meijerint`), 570  
`_functions()` (in module `sympy.integrals.meijerint`), 570  
`_get_coeff_exp()` (in module `sympy.integrals.meijerint`), 570  
`_get_complexes()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_get_complexes_sqf()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_get_interval()` (`sympy.polys.rootoftools.ComplexRootOf` method), 2434  
`_get_reals()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_get_reals_sqf()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2434  
`_get_roots()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2435  
`_guess_expansion()` (in module `sympy.integrals.meijerint`), 570  
`_handle_precomputed_bsqs()` (in module `sympy.combinatorics.util`), 358  
`_indexed_root()` (`sympy.polys.rootoftools.ComplexRootOf` class method), 2435  
`_inflate_fox_h()` (in module `sympy.integrals.meijerint`), 570  
`_inflate_g()` (in module `sympy.integrals.meijerint`), 571  
`_is_rootof()` (in module `sympy.integrals.meijerint`), 571  
`_is_rootof()` (in module `sympy.integrals.meijerint`), 571  
`_is_rootof()` (in module `sympy.integrals.meijerint`), 571  
`_int_inversion()` (in module `sympy.integrals.meijerint`), 571  
`_is_analytic()` (in module `sympy.integrals.meijerint`), 571

[sympy.integrals.meijerint](#)), 571  
[\\_is\\_exponential\(\)](#) (in module [sympy.solvers.solve](#)), 880  
[\\_is\\_logarithmic\(\)](#) (in module [sympy.solvers.solve](#)), 883  
[\\_linear\\_2eq\\_order1\\_type6\(\)](#) (in module [sympy.solvers.ode.ode](#)), 806  
[\\_linear\\_2eq\\_order1\\_type7\(\)](#) (in module [sympy.solvers.ode.ode](#)), 806  
[\\_meijerint\\_definite\\_2\(\)](#) (in module [sympy.integrals.meijerint](#)), 571  
[\\_meijerint\\_definite\\_3\(\)](#) (in module [sympy.integrals.meijerint](#)), 571  
[\\_meijerint\\_definite\\_4\(\)](#) (in module [sympy.integrals.meijerint](#)), 571  
[\\_meijerint\\_indefinite\\_1\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_modgcd\\_multivariate\\_p\(\)](#) (in module [sympy.polys.modulargcd](#)), 2648  
[\\_mul\\_args\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_mul\\_as\\_two\\_parts\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_my\\_principal\\_branch\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_mytype\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_naive\\_list\\_centralizer\(\)](#) (in module [sympy.combinatorics.testutil](#)), 363  
[\\_new\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_nonlinear\\_2eq\\_order1\\_type1\(\)](#) (in module [sympy.solvers.ode.ode](#)), 818  
[\\_nonlinear\\_2eq\\_order1\\_type2\(\)](#) (in module [sympy.solvers.ode.ode](#)), 818  
[\\_nonlinear\\_2eq\\_order1\\_type3\(\)](#) (in module [sympy.solvers.ode.ode](#)), 819  
[\\_nonlinear\\_2eq\\_order1\\_type4\(\)](#) (in module [sympy.solvers.ode.ode](#)), 819  
[\\_nonlinear\\_2eq\\_order1\\_type5\(\)](#) (in module [sympy.solvers.ode.ode](#)), 820  
[\\_nonlinear\\_3eq\\_order1\\_type1\(\)](#) (in module [sympy.solvers.ode.ode](#)), 820  
[\\_nonlinear\\_3eq\\_order1\\_type2\(\)](#) (in module [sympy.solvers.ode.ode](#)), 820  
[\\_nonlinear\\_3eq\\_order1\\_type3\(\)](#) (in module [sympy.solvers.ode.ode](#)), 821  
[\\_nonlinear\\_3eq\\_order1\\_type4\(\)](#) (in module [sympy.solvers.ode.ode](#)), 821  
[\\_nonlinear\\_3eq\\_order1\\_type5\(\)](#) (in module [sympy.solvers.ode.ode](#)), 822  
[\\_orbits\\_transversals\\_from\\_bsgs\(\)](#) (in module [sympy.combinatorics.util](#)), 359  
[\\_p\\_elements\\_group\(\)](#) ([sympy.combinatorics.perm\\_groups](#).[PermutationGroup](#) method), 291  
[\\_postprocess\\_root\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_preprocess\\_roots\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_print\(\)](#) ([sympy.printing.printer](#).[Printer](#) method), 2138  
[\\_randint\(\)](#) (in module [sympy.core.random](#)), 1079  
[\\_random\\_pr\\_init\(\)](#) ([sympy.combinatorics.perm\\_groups](#).[PermutationGroup](#) method), 291  
[\\_randrange\(\)](#) (in module [sympy.core.random](#)), 1079  
[\\_real\\_roots\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_reals\\_index\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_reals\\_sorted\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_refine\\_complexes\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_remove\\_gens\(\)](#) (in module [sympy.combinatorics.util](#)), 360  
[\\_reset\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) method), 2435  
[\\_rewritel\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_rewrite2\(\)](#) (in module [sympy.integrals.meijerint](#)), 572  
[\\_rewrite\\_inversion\(\)](#) (in module [sympy.integrals.meijerint](#)), 573  
[\\_rewrite\\_saxena\(\)](#) (in module [sympy.integrals.meijerint](#)), 573  
[\\_rewrite\\_saxena\\_1\(\)](#) (in module [sympy.integrals.meijerint](#)), 573  
[\\_rewrite\\_single\(\)](#) (in module [sympy.integrals.meijerint](#)), 573  
[\\_roots\\_trivial\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) class method), 2435  
[\\_set\\_interval\(\)](#) ([sympy.polys.rootof](#).[ComplexRootOf](#) method), 2435  
[\\_solve\\_exponential\(\)](#) (in module [sympy.solvers.solve](#)), 881  
[\\_solve\\_lin\\_sys\(\)](#) (in module [sympy.polys.solvers](#)), 2669  
[\\_solve\\_lin\\_sys\\_component\(\)](#) (in module [sympy.polys.solvers](#)), 2670  
[\\_solve\\_logarithm\(\)](#) (in module

- `sympy.solvers.solve`), 882
- `_sort_variable_count()`  
(`sympy.core.function.Derivative`  
class method), 1045
- `_split_mul()` (in module  
`sympy.integrals.meijerint`), 573
- `_strip()` (in module  
`sympy.combinatorics.util`), 361
- `_strong_gens_from_distr()` (in module  
`sympy.combinatorics.util`), 362
- `_sympy_alt_sym()` (`sympy.combinatorics.perm_groups`  
method), 291
- `_tan1()` (in module `sympy.polys.ring_series`),  
2656
- `_transolve()` (in module  
`sympy.solvers.solve`), 877
- `_union_find_merge()`  
(`sympy.combinatorics.perm_groups`  
method), 292
- `_union_find_rep()`  
(`sympy.combinatorics.perm_groups`  
method), 293
- `_verify()` (`sympy.combinatorics.perm_groups`  
method), 293
- `_verify_bsgs()` (in module  
`sympy.combinatorics.testutil`), 364
- `_verify_centralizer()` (in module  
`sympy.combinatorics.testutil`), 364
- `_verify_normal_closure()` (in module  
`sympy.combinatorics.testutil`), 364
- A**
- `A` (`sympy.physics.optics.gaussopt.RayTransferMatrix`  
property), 1864
- `a` (`sympy.physics.quantum.shor.CMod` prop-  
erty), 1856
- `alpt_theory()` (`sympy.physics.vector.point.Point`  
method), 1652
- `a2idx()` (in module  
`sympy.matrices.matrices`), 1326
- `a2pt_theory()` (`sympy.physics.vector.point.Point`  
method), 1653
- `a_interval` (`sympy.sets.fancysets.ComplexRegion`  
property), 1210
- `abbrev` (`sympy.physics.units.quantities.Quantity`  
property), 1587
- `abelian_invariants()`  
(`sympy.combinatorics.perm_groups`  
method), 294
- `AbelianGroup()` (in module  
`sympy.combinatorics.named_groups`),  
354
- `above()` (`sympy.printing.pretty.stringpict.stringPict`  
method), 2186
- `Abs` (class in `sympy.functions.elementary.complexes`),  
385
- `abs()` (`sympy.polys.domains.domain.Domain`  
method), 2507
- `abs()` (`sympy.polys.polyclasses.DMP`  
method), 2561
- `abs()` (`sympy.polys.polytools.Poly` method),  
2380
- `absorbing_probabilities()`  
(`sympy.stats.DiscreteMarkovChain`  
method), 2945
- `abundance()` (in module  
`sympy.ntheory.factor_`), 1508
- `acc()` (`sympy.physics.vector.point.Point`  
method), 1654
- `accepted_latex_functions` (in module  
`sympy.printing.latex`), 2170
- `acos` (class in `sympy.functions.elementary.trigonometric`),  
396
- `acosh` (class in `sympy.functions.elementary.hyperbolic`),  
406
- `acot` (class in `sympy.functions.elementary.trigonometric`),  
407
- `acoth` (class in `sympy.functions.elementary.hyperbolic`),  
407
- `acsc` (class in `sympy.functions.elementary.trigonometric`),  
399
- `acsch` (class in `sympy.functions.elementary.hyperbolic`),  
408
- `Add` (class in `sympy.core.add`), 1013
- `add()` (`sympy.algebras.Quaternion` method),  
886
- `add()` (`sympy.assumptions.assume.AssumptionsContext`  
method), 195
- `add()` (`sympy.matrices.matrices.MatrixBase`  
method), 1291
- `add()` (`sympy.polys.domains.domain.Domain`  
method), 2507
- `add()` (`sympy.polys.matrices.ddm.DDM`  
method), 2690
- `add()` (`sympy.polys.matrices.domainmatrix.DomainMatrix`  
method), 2672
- `add()` (`sympy.polys.matrices.sdm.SDM`  
method), 2692
- `add()` (`sympy.polys.numberfields.modules.Submodule`  
method), 2727
- `add()` (`sympy.polys.polyclasses.DMF`  
method), 2567
- `add()` (`sympy.polys.polyclasses.DMP`  
method), 2561
- `add()` (`sympy.polys.polytools.Poly` method),  
2381
- `add()` (`sympy.polys.rings.PolyRing` method),  
2553



[add\\_as\\_roots\(\)](#) (`sympy.liealgebras.root_system.RootSystem` method), 2526  
[add\\_gens\(\)](#) (`sympy.polys.rings.PolyRing` method), 2554  
[add\\_ground\(\)](#) (`sympy.polys.polyclasses.DMP` method), 2561  
[add\\_ground\(\)](#) (`sympy.polys.polytools.Poly` method), 2381  
[add\\_member\(\)](#) (`sympy.physics.continuum_mechanics.continuum_mechanics` method), 2021  
[add\\_node\(\)](#) (`sympy.physics.continuum_mechanics.continuum_mechanics` method), 2022  
[add\\_simple\\_roots\(\)](#) (`sympy.liealgebras.root_system.RootSystem` method), 2327  
[adjoint\(\)](#) (`sympy.matrices.common.MatrixCommon` method), 1328  
[adjugate\(\)](#) (`sympy.matrices.matrices.MatrixDeterminant` method), 1227  
[aesara\\_code\(\)](#) (in module `sympy.printing.aesaracode`), 2167  
[aesara\\_function\(\)](#) (in module `sympy.printing.aesaracode`), 2167  
[AesaraPrinter](#) (class in `sympy.printing.aesaracode`), 2166  
[affine\\_rank\(\)](#) (`sympy.geometry.point.Point` static method), 2203  
[airyai](#) (class in `sympy.functions.special.bessel`), 504  
[airyaiprime](#) (class in `sympy.functions.special.bessel`), 508  
[AiryBase](#) (class in `sympy.functions.special.bessel`), 504  
[airybi](#) (class in `sympy.functions.special.bessel`), 506  
[airybiprime](#) (class in `sympy.functions.special.bessel`), 509  
[alg\\_con](#) (`sympy.physics.mechanics.system.SymbolicSystem` property), 1786  
[alg\\_field\\_from\\_poly\(\)](#) (`sympy.polys.domains.domain.Domain` method), 2507  
[algebraic](#), 924  
[algebraic\\_field\(\)](#) (`sympy.polys.domains.AlgebraicField` method), 2543  
[algebraic\\_field\(\)](#) (`sympy.polys.domains.domain.Domain` method), 2508  
[algebraic\\_field\(\)](#) (`sympy.polys.domains.IntegerRing` method), 2526  
[algebraic\\_field\(\)](#) (`sympy.polys.domains.RationalField` method), 2530  
[AlgebraicField](#) (class in `sympy.polys.domains`), 2539  
[AlgebraicHandler](#) (`sympy.assumptions.predicates.sets.AlgebraicHandler` attribute), 232  
[AlgebraicNumber](#) (class in `sympy.core.numbers`), 988  
[AlgebraicPredicate](#) (class in `sympy.assumptions.predicates.sets`), 231  
[AlgIntPowers](#) (class in `sympy.polys.numberfields.utilities`), 2739  
[alignof\(\)](#) (in module `sympy.codegen.cnodes`), 1149  
[all\\_coeffs\(\)](#) (`sympy.polys.polyclasses.DMP` method), 2561  
[all\\_coeffs\(\)](#) (`sympy.polys.polytools.Poly` method), 2381  
[all\\_monoms\(\)](#) (`sympy.polys.polyclasses.DMP` method), 2562  
[all\\_monoms\(\)](#) (`sympy.polys.polytools.Poly` method), 2381  
[all\\_roots\(\)](#) (`sympy.liealgebras.root_system.RootSystem` method), 2327  
[all\\_roots\(\)](#) (`sympy.polys.polytools.Poly` method), 2382  
[all\\_roots\(\)](#) (`sympy.polys.rootoftools.ComplexRootOf` class method), 2435  
[all\\_terms\(\)](#) (`sympy.polys.polyclasses.DMP` method), 2562  
[all\\_terms\(\)](#) (`sympy.polys.polytools.Poly` method), 2382  
[allhints](#) (in module `sympy.solvers.ode`), 767  
[allocated\(\)](#) (in module `sympy.codegen.fnodes`), 1153  
[almosteq\(\)](#) (`sympy.polys.domains.ComplexField` method), 2546  
[almosteq\(\)](#) (`sympy.polys.domains.domain.Domain` method), 2508  
[almosteq\(\)](#) (`sympy.polys.domains.RealField` method), 2545  
[almosteq\(\)](#) (`sympy.polys.rings.PolyElement` method), 2554  
[AlmostLinear](#) (class in `sympy.solvers.ode.single`), 790  
[alternating\(\)](#) (`sympy.combinatorics.generators` method), 287  
[AlternatingGroup\(\)](#) (in module `sympy.combinatorics.named_groups`), 354

altitudes (*sympy.geometry.polygon.Triangle* property), 2294

ambient\_dimension (*sympy.geometry.curve.Curve* property), 2248

ambient\_dimension (*sympy.geometry.entity.GeometryEntity* property), 2194

ambient\_dimension (*sympy.geometry.line.LinearEntity* property), 2216

ambient\_dimension (*sympy.geometry.point.Point* property), 2203

amplitude (*sympy.physics.optics.waves.TWave* property), 1888

an (*sympy.functions.special.hyper.meijerg* property), 524

analytic\_func() (*sympy.matrices.matrices.MatrixBase* method), 1291

ancestors() (*sympy.polys.numberfields.modules.Module* method), 2720

And (*class* in *sympy.logic.boolalg*), 1166

anf\_coeffs() (*in* module *sympy.logic.boolalg*), 1183

ANFform() (*in* module *sympy.logic.boolalg*), 1162

ang\_acc\_in() (*sympy.physics.vector.frame.ReferenceFrame* method), 1629

ang\_vel\_in() (*sympy.physics.mechanics.body.Body* method), 1757

ang\_vel\_in() (*sympy.physics.vector.frame.ReferenceFrame* method), 1629

angle (*sympy.physics.optics.gaussopt.GeometricRay* property), 1863

angle() (*sympy.algebras.Quaternion* method), 887

angle\_between() (*sympy.geometry.line.LinearEntity* method), 2216

angle\_between() (*sympy.geometry.plane.Plane* method), 2304

angle\_between() (*sympy.physics.vector.vector.Vector* method), 1642

angles (*sympy.geometry.polygon.Polygon* property), 2274

angles (*sympy.geometry.polygon.RegularPolygon* property), 2285

angular\_momentum() (*in* module *sympy.physics.mechanics.functions*), 1752

angular\_momentum() (*sympy.physics.mechanics.particle.Particle* method), 1743

angular\_momentum() (*sympy.physics.mechanics.rigidbody.RigidBody* method), 1747

angular\_velocity (*sympy.physics.optics.waves.TWave* property), 1888

AnnihilateBoson (*class* in *sympy.physics.secondquant*), 1542

AnnihilateFermion (*class* in *sympy.physics.secondquant*), 1543

annotated() (*in* module *sympy.printing.pretty.pretty\_symbology*), 2186

ANP (*class* in *sympy.polys.polyclasses*), 2568

AntiCommutator (*class* in *sympy.physics.quantum.anticommutator*), 1791

antidivisor\_count() (*in* module *sympy.ntheory.factor\_*), 1500

antidivisors() (*in* module *sympy.ntheory.factor\_*), 1500

antihermitian, 925

AntiHermitianPredicate (*class* in *sympy.assumptions.predicates.sets*), 231

AntiSymmetricTensor (*class* in *sympy.physics.secondquant*), 1545

aother (*sympy.functions.special.hyper.meijerg* property), 524

ap (*sympy.functions.special.hyper.hyper* property), 522

ap (*sympy.functions.special.hyper.meijerg* property), 524

apart (*in* module *sympy.polys.partfrac*), 2443

apart() (*sympy.core.expr.Expr* method), 947

apart\_list() (*in* module *sympy.polys.partfrac*), 2443

apoapsis (*sympy.geometry.ellipse.Ellipse* property), 2254

apothem (*sympy.geometry.polygon.RegularPolygon* property), 2286

appellf1 (*class* in *sympy.functions.special.hyper*), 525

append() (*sympy.plotting.plot.Plot* method), 2822

applied\_loads (*sympy.physics.continuum\_mechanics.beam* property), 1951

AppliedPredicate (*class* in *sympy.assumptions.assume*), 193

apply() (*sympy.combinatorics.permutations.Permutation* method), 264

apply() (*sympy.printing.pretty.stringpict.prettyForm* static method), 2188

apply() (*sympy.simplify.epathtools.EPath*



method), 688  
 apply\_finite\_diff() (in module sympy.calculus.finite\_diff), 240  
 apply\_force() (sympy.physics.mechanics.body.Body method), 887  
 method), 1758  
 apply\_grover() (in module sympy.physics.quantum.grover), 1848  
 apply\_load() (sympy.physics.continuum\_mechanics.beam.Beam method), 1951  
 apply\_load() (sympy.physics.continuum\_mechanics.beam.Beam3D method), 1983  
 apply\_load() (sympy.physics.continuum\_mechanics.truss.Truss method), 2022  
 apply\_moment\_load() (sympy.physics.continuum\_mechanics.beam.Beam method), 1983  
 apply\_operator() (sympy.physics.secondquantization.SecondQuantization method), 1542  
 apply\_operator() (sympy.physics.secondquantization.SecondQuantization method), 1543  
 apply\_operator() (sympy.physics.secondquantization.SecondQuantization method), 1547  
 apply\_operator() (sympy.physics.secondquantization.SecondQuantization method), 1548  
 apply\_operators() (in module sympy.physics.secondquantization), 1561  
 apply\_support() (sympy.physics.continuum\_mechanics.beam.Beam method), 1952  
 apply\_support() (sympy.physics.continuum\_mechanics.beam.Beam3D method), 2023  
 apply\_torque() (sympy.physics.mechanics.body.Body method), 1760  
 applyfunc() (sympy.matrices.common.MatrixCommon method), 1328  
 applyfunc() (sympy.physics.vector.dyadic.Dyadic method), 1648  
 applyfunc() (sympy.physics.vector.vector.Vector method), 1642  
 approximation() (sympy.core.numbers.NumberSymbol method), 993  
 arbitrary\_point() (sympy.geometry.curve.Curve method), 2248  
 arbitrary\_point() (sympy.geometry.ellipse.Ellipse method), 2254  
 arbitrary\_point() (sympy.geometry.line.LinearEntity method), 2217  
 arbitrary\_point() (sympy.geometry.plane.Plane method), 2304  
 arbitrary\_point() (sympy.geometry.polygon.Polygon method), 2275  
 arc\_coplanar() (sympy.algebras.Quaternion method), 887  
 Arcsin() (in module sympy.stats), 2887  
 are\_collinear() (sympy.geometry.point.Point3D static method), 2212  
 are\_concurrent() (sympy.geometry.line.LinearEntity static method), 2218  
 are\_concurrent() (sympy.geometry.plane.Plane static method), 2305  
 are\_coplanar() (sympy.geometry.point.Point static method), 2203  
 are\_similar() (in module sympy.geometry.util), 2199  
 area() (sympy.geometry.ellipse.Ellipse property), 2255  
 area() (sympy.geometry.polygon.Polygon property), 2275  
 area() (sympy.geometry.polygon.RegularPolygon property), 2286  
 create\_beam() (sympy.physics.continuum\_mechanics.beam.Beam property), 1953  
 create\_beam3d() (sympy.physics.continuum\_mechanics.beam.Beam3D property), 1983  
 arg (class in sympy.functions.elementary.complexes), 386  
 assume() (sympy.solvers.solvers.assume.Assume property), 193  
 assume() (sympy.solvers.solvers.Basic property), 928  
 args (sympy.geometry.polygon.RegularPolygon property), 2286  
 args\_cnc() (sympy.core.expr.Expr method), 947  
 Argument (class in sympy.utilities.codegen), 2047  
 argument (sympy.functions.special.bessel.BesselBase property), 497  
 argument (sympy.functions.special.hyper.hyper property), 522  
 argument (sympy.functions.special.hyper.meijerg property), 524  
 arguments (sympy.assumptions.assume.Assume property), 194  
 array() (in module sympy.codegen.fnodes), 1153  
 array\_form (sympy.combinatorics.permutations.Permutation property), 264  
 array\_form (sympy.combinatorics.polyhedron.Polyhedron property), 332  
 ArrayConstructor (class in sympy.codegen.fnodes), 1149  
 ArrowStringDescription (class in sympy.categories.diagram\_drawing),

2756  
as\_AlgebraicField()  
(sympy.polys.domains.gaussiandomains.GaussianRationalField  
method), 2538  
as\_base\_exp() (sympy.core.function.Function  
method), 1051  
as\_base\_exp() (sympy.core.power.Pow  
method), 1007  
as\_base\_exp() (sympy.functions.elementary.exponential.exp  
method), 413  
as\_coeff\_Add() (sympy.core.add.Add  
method), 1015  
as\_coeff\_add() (sympy.core.add.Add  
method), 1015  
as\_coeff\_Add() (sympy.core.expr.Expr  
method), 948  
as\_coeff\_add() (sympy.core.expr.Expr  
method), 948  
as\_coeff\_Add() (sympy.core.numbers.Number  
method), 982  
as\_coeff\_Add() (sympy.core.numbers.Rational  
method), 986  
as\_coeff\_exponent() (sympy.core.expr.Expr  
method), 949  
as\_coeff\_Mul() (sympy.core.expr.Expr  
method), 948  
as\_coeff\_mul() (sympy.core.expr.Expr  
method), 949  
as\_coeff\_Mul() (sympy.core.mul.Mul  
method), 1010  
as\_coeff\_Mul() (sympy.core.numbers.Number  
method), 982  
as\_coeff\_Mul() (sympy.core.numbers.Rational  
method), 986  
as\_coeff\_Mul() (sympy.matrices.expressions.MatrixExpr  
method), 1370  
as\_coefficient() (sympy.core.expr.Expr  
method), 949  
as\_coefficients\_dict()  
(sympy.core.expr.Expr method),  
951  
as\_content\_primitive()  
(sympy.core.add.Add method), 1015  
as\_content\_primitive()  
(sympy.core.basic.Basic method),  
929  
as\_content\_primitive()  
(sympy.core.expr.Expr method),  
951  
as\_content\_primitive()  
(sympy.core.mul.Mul method), 1010  
as\_content\_primitive()  
(sympy.core.numbers.Rational  
method), 986  
as\_content\_primitive()  
(sympy.core.power.Pow method),  
1007  
as\_Declaration() (sympy.codegen.ast.Variable  
method), 1141  
as\_dict() (sympy.combinatorics.partitions.IntegerPartition  
method), 254  
as\_dict() (sympy.polys.polytools.Poly  
method), 2382  
as\_dummy() (sympy.core.basic.Basic  
method), 929  
as\_explicit() (sympy.matrices.expressions.MatrixExpr  
method), 1370  
as\_expr() (sympy.core.expr.Expr method),  
952  
as\_expr() (sympy.core.numbers.AlgebraicNumber  
method), 990  
as\_expr() (sympy.polys.monomials.Monomial  
method), 2429  
as\_expr() (sympy.polys.numberfields.modules.PowerBasisE  
method), 2732  
as\_expr() (sympy.polys.polytools.Poly  
method), 2383  
as\_expr\_set\_pairs()  
(sympy.functions.elementary.piecewise.Piecewise  
method), 416  
as\_ferrers() (sympy.combinatorics.partitions.IntegerParti  
method), 254  
as\_finite\_difference()  
(sympy.core.function.Derivative  
method), 1046  
as\_immutable() (sympy.matrices.dense.DenseMatrix  
method), 1362  
as\_independent() (sympy.core.expr.Expr  
method), 952  
as\_int() (in module sympy.utilities.misc),  
2110  
as\_leading\_term() (sympy.core.expr.Expr  
method), 955  
as\_list() (sympy.polys.polytools.Poly  
method), 2383  
as\_mutable() (sympy.matrices.dense.DenseMatrix  
method), 1362  
as\_mutable() (sympy.matrices.expressions.MatrixExpr  
method), 1371  
as\_numer\_denom() (sympy.core.add.Add  
method), 1015  
as\_numer\_denom() (sympy.core.expr.Expr  
method), 955  
as\_ordered\_factors()  
(sympy.core.expr.Expr method),  
955  
as\_ordered\_factors() (sympy.core.mul.Mul  
method), 1010