

Binary quadratic forms

12.1. Representation of integers by binary quadratic forms

12.2. Equivalence classes of binary quadratic forms

12.3. Congruence restrictions on the values of a binary quadratic form

12.4. Class numbers

12.5. Class number one

12.6. Additional Exercises: Questions on binary quadratic forms

Automorphisms of binary quadratic forms

Transformations of the upper half-plane

Appendix 12A. Composition rules: Gauss, Dirichlet, and Bhargava

12.7. Composition and Gauss

12.8. Dirichlet composition

12.9. Bhargava composition

Appendix 12B. The class group

12.10. A dictionary between binary quadratic forms and ideals

12.11. Elements of order two in the class group

Appendix 12C. Binary quadratic forms of positive discriminant

12.12. Binary quadratic forms with positive discriminant, and continued fractions

12.13. The set of automorphisms

Appendix 12D. Sums of three squares

12.14. Connection between sums of 3 squares and $h(d)$

12.15. Dirichlet's class number formula

Appendix 12E. Sums of four squares

12.16. Sums of four squares

12.17. Quaternions

12.18. The number of representations

Appendix 12F. Universality

12.19. Universality of quadratic forms

Appendix 12G. Integers represented in Apollonian circle packings

12.20. Combining these linear transformations