# Descartes' Rule of Signs Worksheet

Positive roots -> negative roots -> nonreal roots | Algebra 2 & Precalculus

Directions: Write polynomials in descending powers. Ignore zero coefficients when counting sign changes. For positive roots, count sign changes in f(x). For negative roots, count sign changes in f(-x). Possible counts decrease by 2. Use the degree to determine how many nonreal zeros may remain.

## Level 1 - Sign Changes & Real Zeros

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| 1. $f(x) = x^4 - 3x^3 + 2x^2 - x + 5$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |
| 2. $f(x) = 2x^5 + x^4 - 4x^3 - 3x^2 + 6x + 1$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |
| 3. $f(x) = x^5 - 2x^4 + 5x^2 - 7$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |
| 4. $f(x) = -x^4 + 3x^3 + 2x^2 - 4x - 8$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |
| 5. $f(x) = x^6 + 2x^5 - 3x^4 - 5x^2 + 4x + 6$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |
| 6. $f(x) = x^4 + 4x^3 + 6x^2 + 4x + 1$<br>Count sign changes in f(x) and f(-x). State the possible numbers of positive and negative real zeros. | Work: |

# Level 2 - Complete the Root Count

Add the possible number of nonreal zeros after finding the positive and negative possibilities.

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| 7. $f(x) = x^5 - 3x^4 - 2x^3 + 6x^2 + 5x - 7$<br>Find possible positive, negative, and nonreal zero counts. | Work: |
| 8. $f(x) = -x^5 + 2x^4 - 3x^2 + 5x - 6$<br>Find possible positive, negative, and nonreal zero counts. | Work: |
| 9. $f(x) = 3x^4 - 2x^3 - 5x^2 + 7x + 1$<br>Find possible positive, negative, and nonreal zero counts. | Work: |
| 10. $f(x) = x^4 - 5x^2 + 4x - 2$<br>Find possible positive, negative, and nonreal zero counts. | Work: |
| 11. $f(x) = 2x^6 - x^5 + 3x^4 - 4x^3 + 5x^2 - 6x + 7$<br>Find possible positive, negative, and nonreal zero counts. | Work: |
| 12. $f(x) = x^5 + 5x^4 - 2x^3 - 8x^2 + 3x + 9$<br>Find possible positive, negative, and nonreal zero counts. | Work: |

# Level 3 - Root Profile Challenge

List every valid (positive, negative, nonreal) profile. Remember that nonreal zeros of real-coefficient polynomials occur in conjugate pairs.

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| 13. $f(x) = x^4 - 4x^3 + 3x^2 - 2x + 5$<br>List every possible root profile: positive real, negative real, and nonreal zeros. | Work: |
| 14. $f(x) = 2x^5 + 3x^4 - 5x^3 + 4x - 6$<br>List every possible root profile: positive real, negative real, and nonreal zeros. | Work: |
| 15. $f(x) = x^6 - x^5 - 6x^4 + 6x^3 + 5x^2 - 5x + 2$<br>List every possible root profile: positive real, negative real, and nonreal zeros. | Work: |
| 16. $f(x) = -2x^5 + 5x^4 - 3x^3 + 4x - 1$<br>List every possible root profile: positive real, negative real, and nonreal zeros. | Work: |
| 17. $f(x) = x^7 - 2x^6 + 3x^4 - 4x^3 + 5x - 6$<br>List every possible root profile: positive real, negative real, and nonreal zeros. | Work: |
| 18. $f(x) = x^7 - 2x^6 + 3x^4 - 4x^3 + 5x^2$<br>List every possible root profile: positive real, negative real, and nonreal zeros. Factor out any zero roots first. | Work: |

Checkpoint: Descartes' Rule gives possible counts, not the actual root values. A zero root is neither positive nor negative; factor x first when the constant term is 0.