VISUALIZING

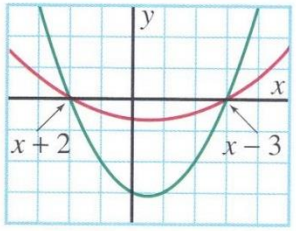
Zeros and Roots of Polynomial Functions

The x-intercepts of the graph of a polynomial function $y = f(x)$ are the *zeros* of the function and the *roots* of the corresponding equation $f(x) = 0$.

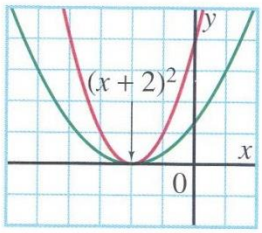
Polynomial functions that have the same zeros and are vertical *expansions* or *compressions* of each other belong to the same *family* and have equations of the form $y = af(x)$.

Each diagram shows two polynomial functions whose graphs intersect the x-axis. Factors of the corresponding equations are indicated on the graphs.

Quadratic

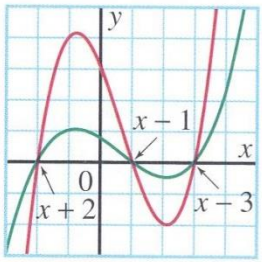


$f(x) = a(x + 2)(x - 3)$
Zeros of f: -2, 3
Roots of $f(x) = 0$: -2, 3

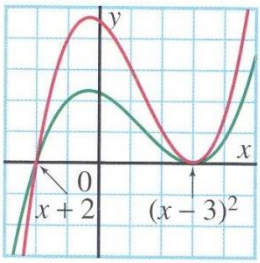


$f(x) = a(x + 2)^2$
Zero of f: -2 (of order 2)
Roots of $f(x) = 0$: -2 (double root)

Cubic

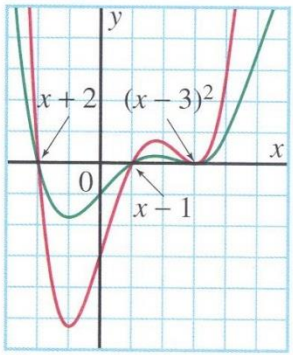


$f(x) = a(x + 2)(x - 1)(x - 3)$
Zeros of f: -2, 1, 3
Roots of $f(x) = 0$: -2, 1, 3

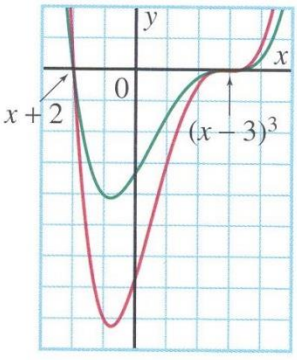


$f(x) = a(x + 2)(x - 3)^2$
Zeros of f: -2, 3 (of order 2)
Roots of $f(x) = 0$: -2, 3 (double root)

Quartic



$f(x) = a(x + 2)(x - 1)(x - 3)^2$
Zeros of f: -2, 1, 3 (of order 2)
Roots of $f(x) = 0$: -2, 1, 3 (double root)



$f(x) = a(x + 2)(x - 3)^3$
Zeros of f: -2, 3 (of order 3)
Roots of $f(x) = 0$: -2, 3 (triple root)