Fundamental Theorem of Algebra

a polynomial of degree n has n roots.

→ BUT you have to count multiplicity of roots
(for example, double roots count as 2)

→ AND ALSO you have to count complex (non-real) roots

degree the highest exponent on x
(if you write the polynomial in factored form)

root / zero / x-intercept ← all the same thing!

a value of x that makes the polynomial 0.

factors

(x − #)(x − #) … where the #s are the roots

complex roots = roots that are non-real complex numbers

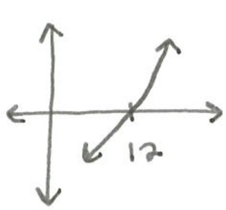
note: non-real complex roots come in complex conjugate pairs.
so if a + bi is a root, then a − bi is also a root.

one error in each half

Multiplicity of roots

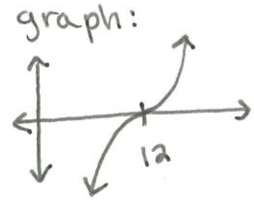
single root

example:
root = 12
factor = (x − 12)



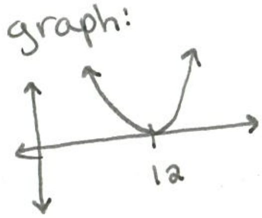
double root

root = 12
factors: $(x-12)^2$
or (x − 12)(x − 12)
graph:



triple root

root = 12
factors: $(x-12)^3$
or (x − 12)(x − 12)(x − 12)
graph:



quadruple root

looks like double root
but flatter / boxier

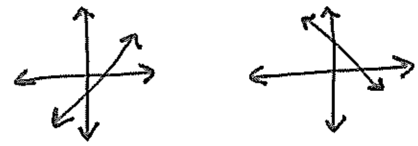
quintuple root

looks like triple root
but flatter / boxier

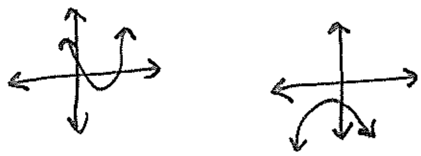
one error on this page

Graphs of polynomials of different degrees

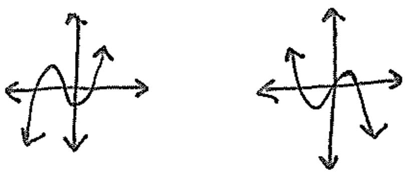
degree 1 (linear): graph is a line



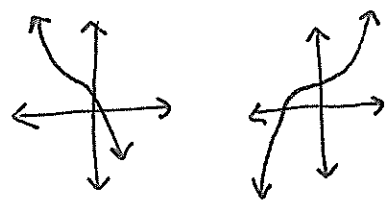
degree 2 (quadratic): graph is a parabola



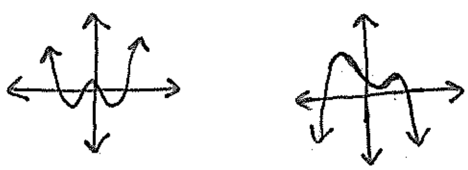
degree 3 (cubic):



could also be less bumpy like:

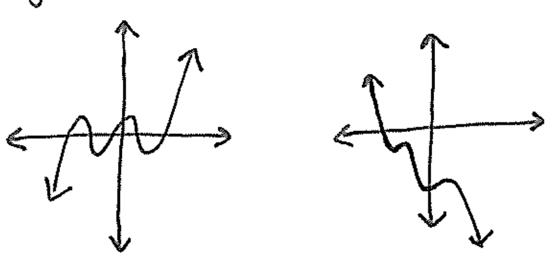


degree 4 (quartic):



could also be less bumpy and look like a parabola, but flatter

degree 5 (quintic):



could also be less bumpy and look like a cubic

the higher the degree, the less bumpy the graph.