Algebra 2 5.4

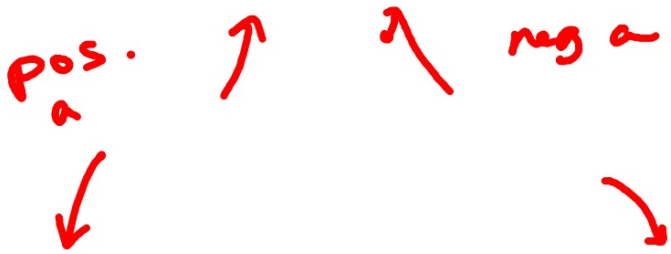
Graph polynomial functions and locate their zeros
Find relative maxima and minima of polynomial functions
Use technology to make graphing process more efficient

polynomial function
zero (of a function)
maximum (pl. maxima)
relative maximum
minimum (pl. minima)
relative minimum
extrema
location principle
turning points

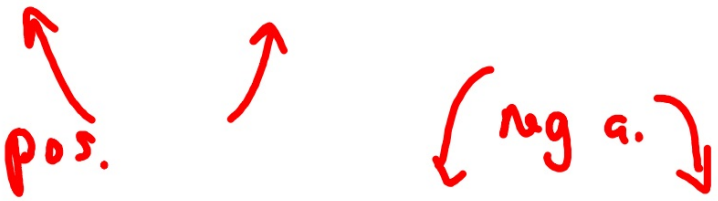
graphing calculators

Parent graphs:

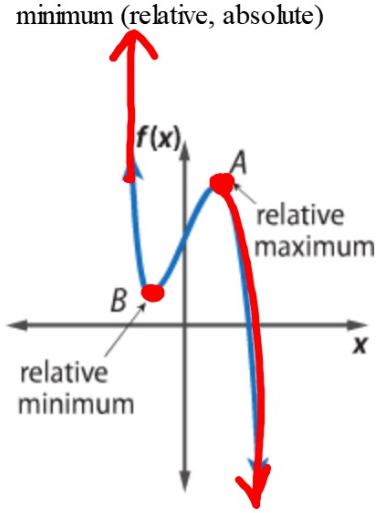
odd functions:
max # of zeros = degree
at least one real zero



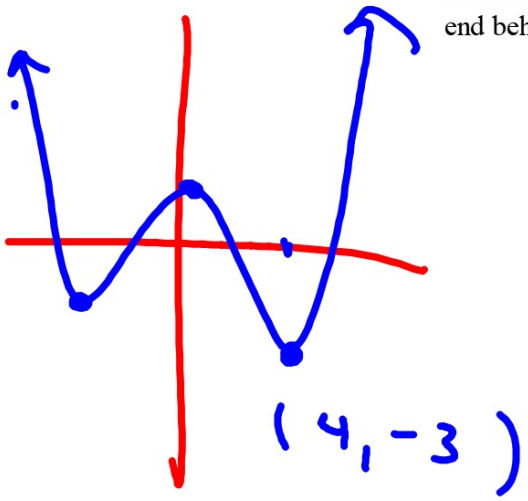
even functions:
max # of zeros = degree
may not have any real zeros

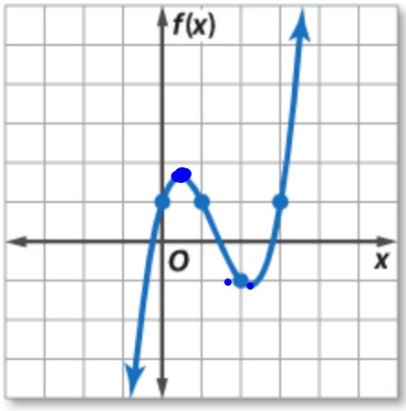


maximum (relative, absolute)
minimum (relative, absolute)



extrema (mountaintops & valleys)
real zeros
end behavior





$f(x) \to \infty$ if $x \to \infty$

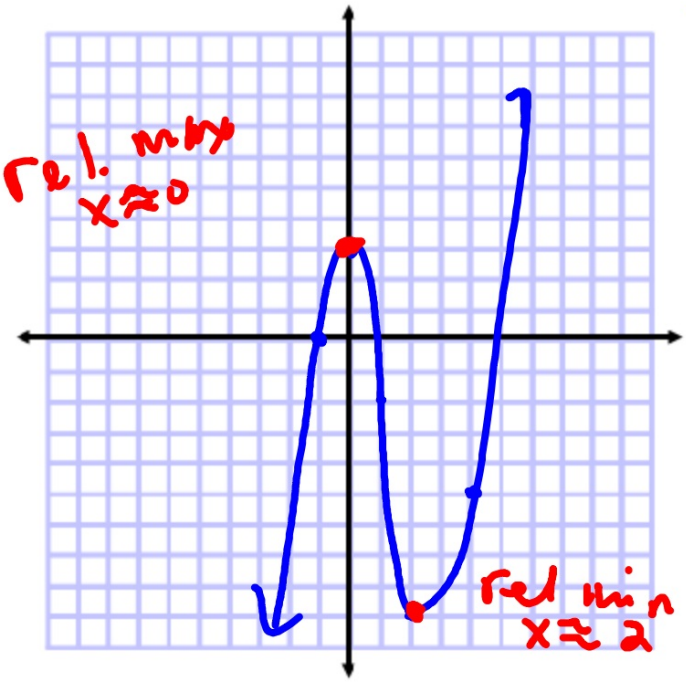
$f(x) \to -\infty$ if $x \to -\infty$

Rel. max $x \approx 0.5$

Rel. min $x \approx 2.2$

Example 3 Maximum and Minimum Points

Graph $f(x) = x^3 - 4x^2 - 2x + 3$. Estimate the x-coordinates at which the relative maxima and relative minima occur.



-1	0
0	3
1	-2
2	-9
3	-12
4	-5
5	18

Why?

Annual attendance at the movies has fluctuated since the first movie theater, the Nickelodeon, opened in Pittsburgh in 1906. Overall attendance peaked during the 1920s, and it was at its lowest during the 1970s. A graph of the annual attendance to the movies can be represented by a polynomial function.

Real-World Example 4 Graph a Polynomial Model

MOVIES Refer to the beginning of the lesson. Annual admissions to movies in the United States can be modeled by the function $f(x) = -0.0017x^4 + 0.31x^3 - 17.66x^2 + 277x + 3005$, where x is the number of years since 1926 and $f(x)$ is the annual admissions in millions.

a. Graph the function.

millions

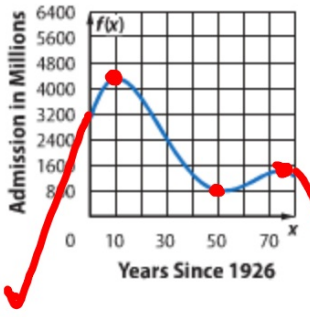
1920

1970

Graph and find an appropriate window

graph on next page

x	$f(x)$
0	3005
10	4302
20	3689
30	2414
40	1317
50	830
60	977
70	1374
80	1229



abs. max $x \approx 10$
highest attendance ≈ 1936

rel. min $x \approx 50$
lowest atten. ≈ 1976

rel. max $x \approx 75$
≈ 2001

b. Describe the turning points of the graph and its end behavior.

c. What trends in movie admissions does the graph suggest? Is it reasonable that the trend will continue indefinitely?

Guided Practice graphing calc

4. **FAX MACHINES** The annual sales of fax machines for home use can be modeled by $f(x) = -0.17x^4 + 6.29x^3 - 77.65x^2 + 251x + 1100$, where x is the number of years after 1990 and $f(x)$ is the annual sales in millions of dollars.

   A. Graph the function.

   B. Describe the turning points of the graph and its end behavior.

   C. What trends in fax machine sales does the graph suggest?

   D. Is it reasonable that the trend will continue indefinitely?

WB 5.4 prac. 1-6