Algebra 2 5.4

x^3 x^4 x^5

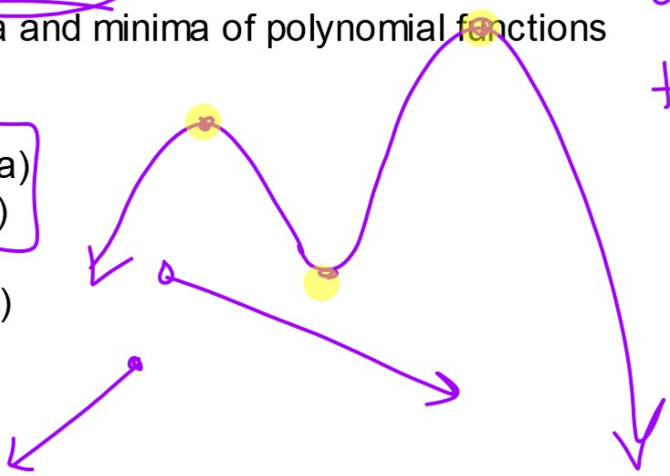
Graph polynomial functions and locate their zeros

$d-1=tp$

Find relative maxima and minima of polynomial functions

$tp+1=d$

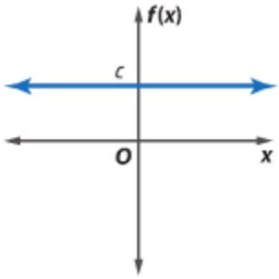
polynomial function
~~zero (of a function)~~
maximum (pl. maxima)
minimum (pl. minima)
extrema
continuous (function)
location principle
turning points



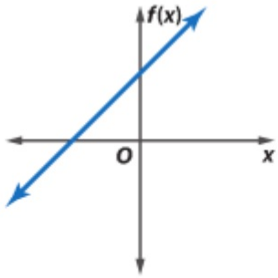
Kroon says

2 Graphs of Polynomial Functions The general shapes of the graphs of several polynomial functions show the *maximum* number of times the graph of each function may intersect the x-axis. This is the same number as the degree of the polynomial.

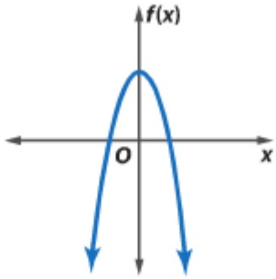
Constant function
Degree 0



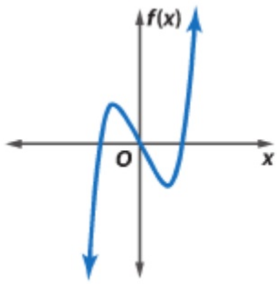
Linear function
Degree 1



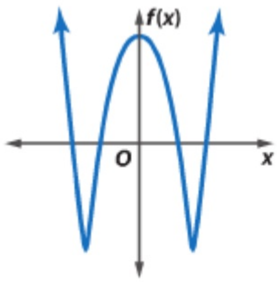
Quadratic function
Degree 2



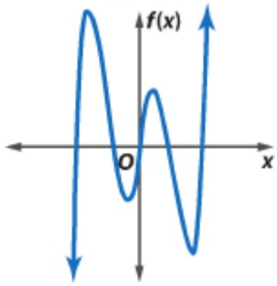
Cubic function
Degree 3



Quartic function
Degree 4



Quintic function
Degree 5

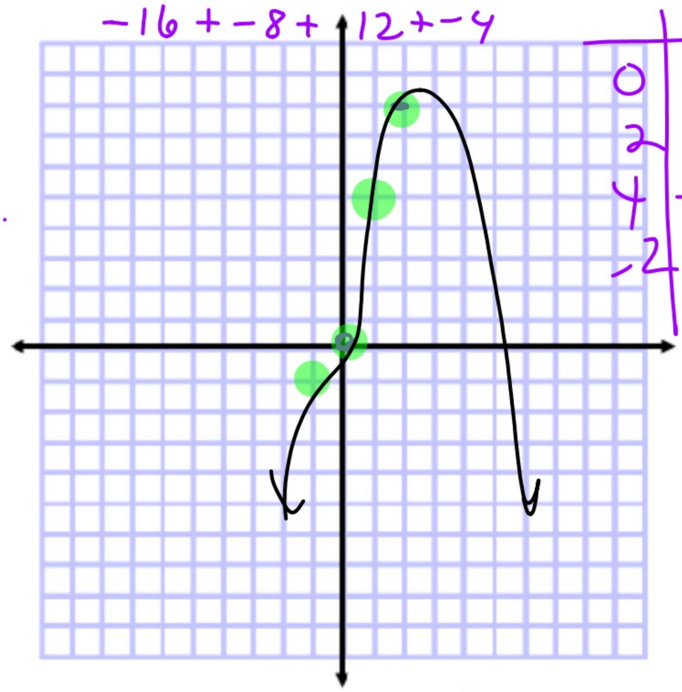


Example 1 Graph of a Polynomial Function

Graph $f(x) = -x^4 + x^3 + 3x^2 + 2x$ by making a table of values.

$-1(\quad)(\quad x\quad)(\quad)$

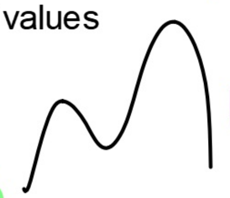
$-16 + -8 + 12 + -4$



0	0
2	8
4	-136
-2	-16

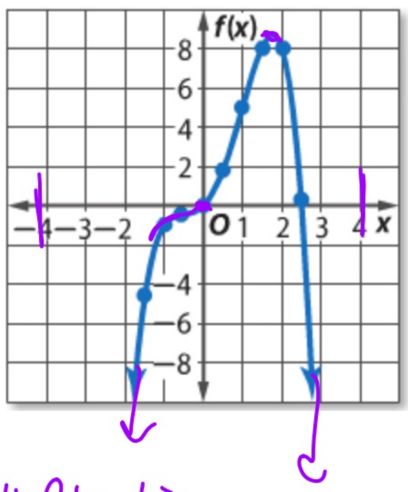
- parent graph
- turning points
- y-intercept
- end behavior
- table of values

0



Try -10 < x < 10 ish

(next)



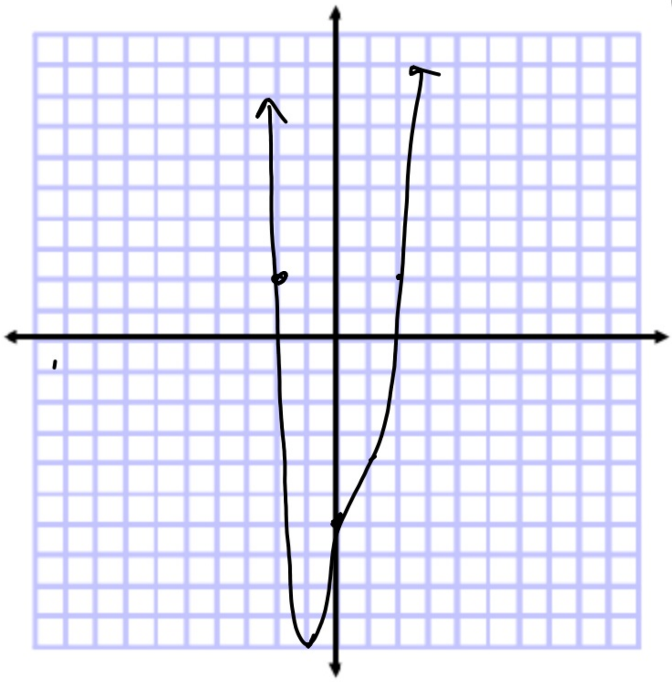
inflection pt.

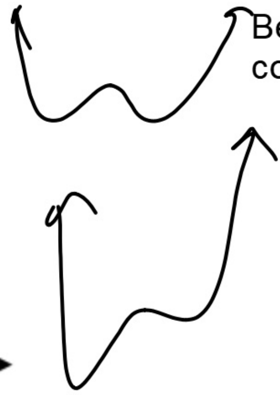
Table
(2nd graph)

Use technology (table) to find table of values (use ordered pairs to graph)

GuidedPractice

1. Graph $f(x) = x^4 - x^3 - 2x^2 + 4x - 6$ by making a table of values.





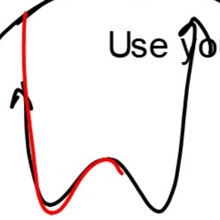
Before using calculator consider the following:

- parent graph
- # of turning points
- y-intercept
- end behavior
- table of values

see next

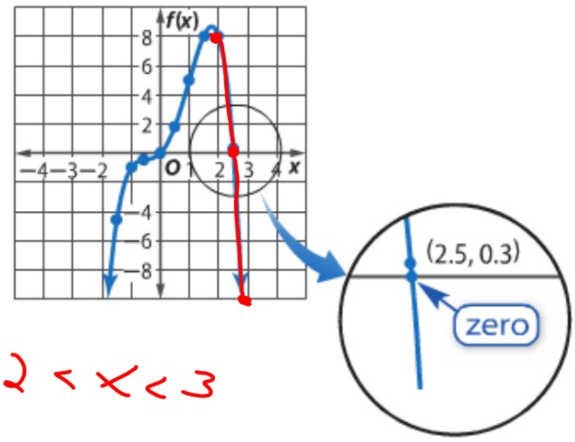
Why bother to think about the parent graph first?

Use your gc to graph f(x) = 2x^4 - 20x^3 -25x^2 + 8x +3



How do you know that you are seeing everything?

In Example 1, one of the zeros occurred at $x = 0$. Another zero occurred between $x = 2.5$ and $x = 3.0$. Because $f(x)$ is positive for $x = 2.5$ and negative for $x = 3.0$ and all polynomial functions are continuous, we know there is a zero between these two values. (zoom in...)



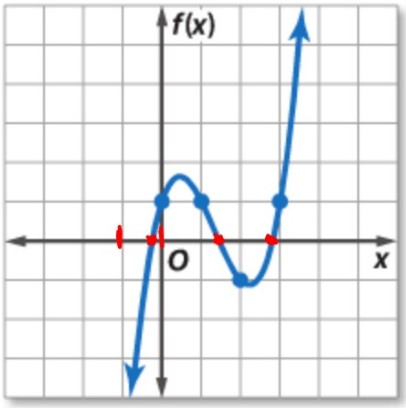
y

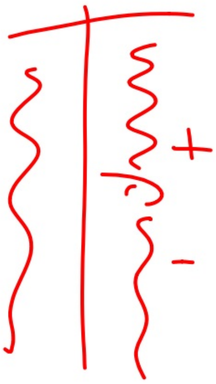
So, if the value of $f(x)$ *changes signs* from one value of x to the next, then there is a zero between those two x-values. This idea is called the **Location Principle**.

$2 < x < 3$

$+ \quad -$

Where does y-coord change from positive to negative?





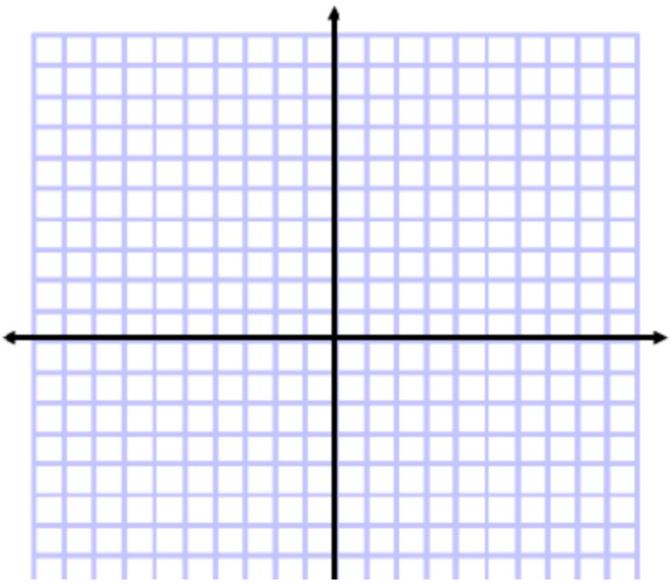
$-1 < x < 0$ $1 < x < 2$ $2 < x < 3$

Where do y-coords change from - to +? (table)
Indicates a crossing point.

Example 2 Locate Zeros of a Function

Determine consecutive integer values of x between which each real zero of $f(x) = x^3 - 4x^2 + 3x + 1$ is located. Then draw the graph.

parent graph
turning points
y-intercept
end behavior
table of values
(next)

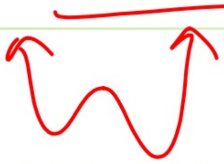


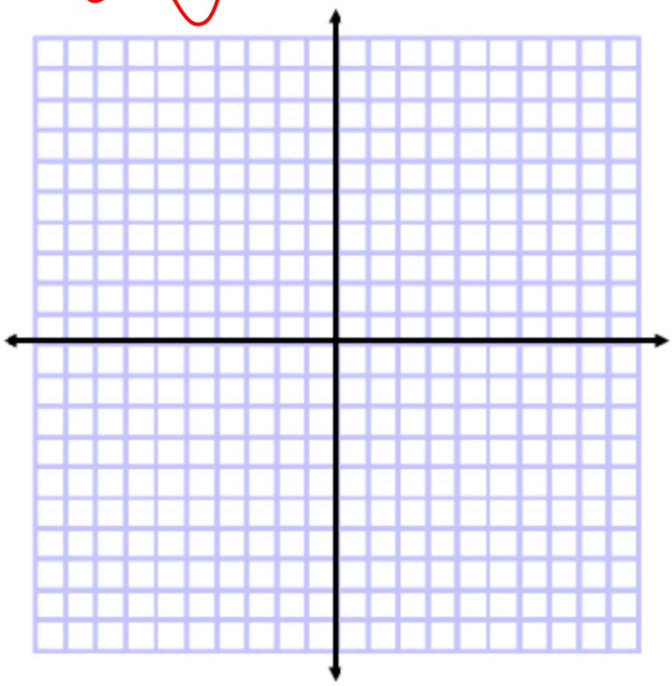
tenth

table set

Guided Practice

2. Determine ~~consecutive integer values~~ of x between which each real zero of the function $f(x) = x^4 - 3x^3 - 2x^2 + x + 1$ is located. Then draw the graph.



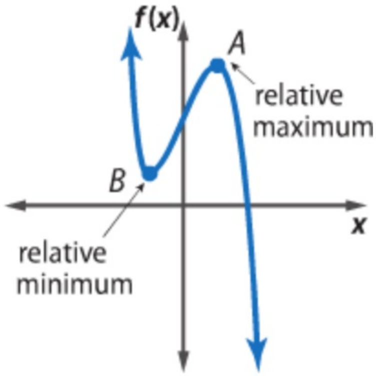


$0 < x < 1$

$3 < x < 4$

5.4 P.334

15-31 odd

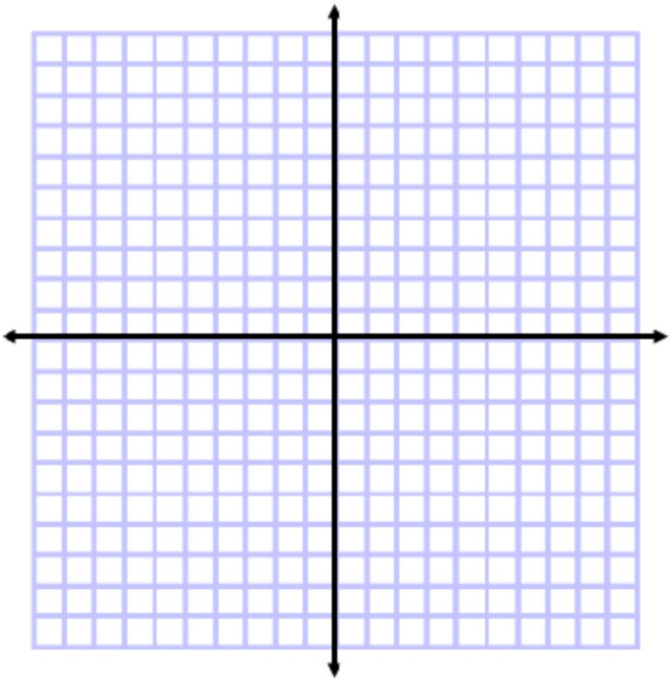


relative vs absolute

Turning points

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.



GuidedPractice

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