PAP Algebra 2 Name: _____

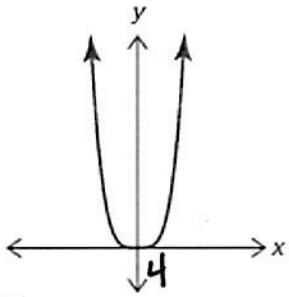
Sec. 4.4 – Polynomial Characteristics

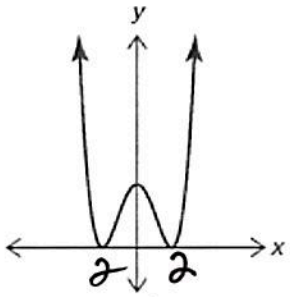
The **absolute maximum** is the highest point in the entire graph, and the **absolute minimum** is the lowest point in the entire graph. The set of absolute maximums, absolute minimums, relative maximums, and relative minimums may also be referred to as **extrema**. (relative extrema: list of all)

Determine the number of extrema for each polynomial:

4th Degree Polynomials $g_1(x) = x^4$ $g_2(x) = x^4 - 3x^2$

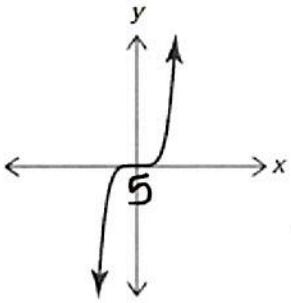
ABSolute

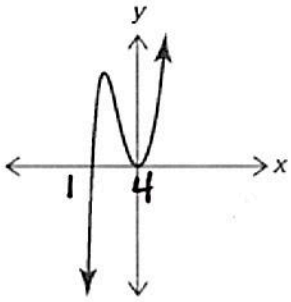


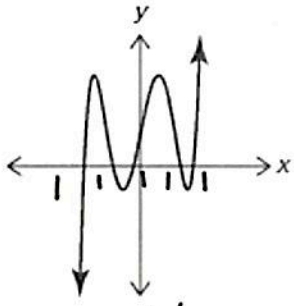


Number of Extrema: 1 2

5th Degree Polynomials $f_1(x) = x^5$ $f_2(x) = x^5 + 4x^2$ $f_3(x) = x^5 - 5x^3 + 5x + 1.18$



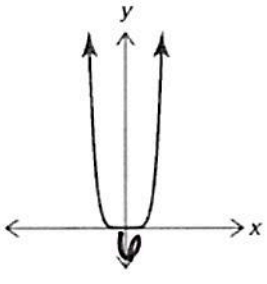


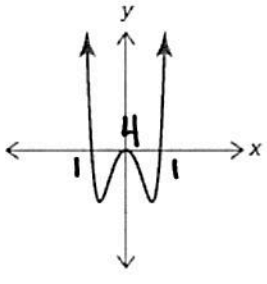


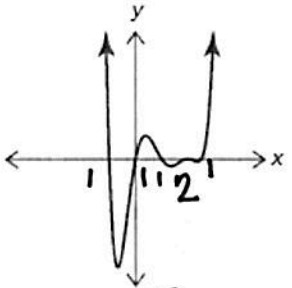
Number of Extrema: 0 2 4

6th Degree Polynomials $h_1(x) = x^6$ $h_2(x) = x^6 - 3x^2$ $h_3(x) = 2x^6 - 13x^5 + 26x^4 - 7x^3 - 2$

ABSolute







Number of Extrema: 1 3 5

What observations do you notice about the possible number of extrema and the degree of the polynomial?

even degree polynomials have odd Extrema
odd degree poly have 0 + even extrema

List the possible number of extrema for each polynomial below:

a. 9th degree polynomial

9, 6, 5, 4, 3, 2, 0

b. 18th degree polynomial

17, 15, . . . , 1

c. *n*th degree odd polynomial

n-1, n-3, . . 0

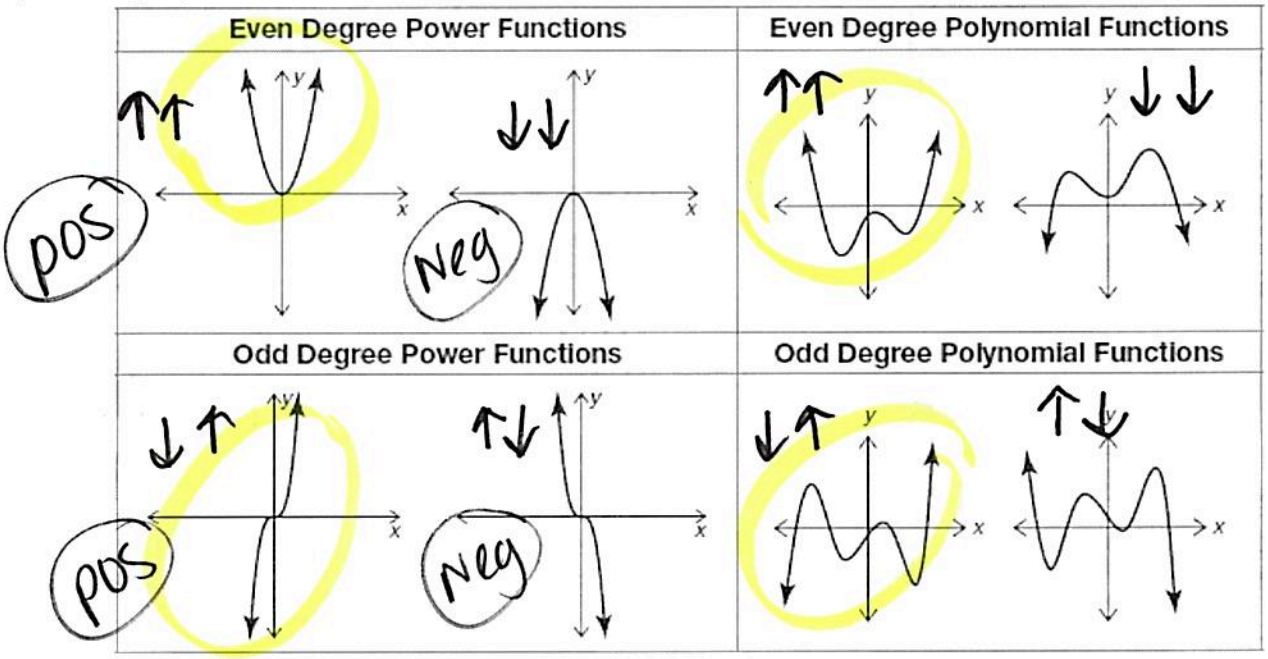
d. *n*th degree even polynomial

n-1, n-3, ... 1

Go back to the front page, and label the multiplicity of all roots. They must add up to the degree of the polynomial.

remember Bounce = even# cross = 1 twist = odd > 1

Analyze the graphs shown.



Label the end behavior of the graphs above.

What conclusions can you make about the end behavior of all <u>even degree</u> polynomials?

Start + end the same

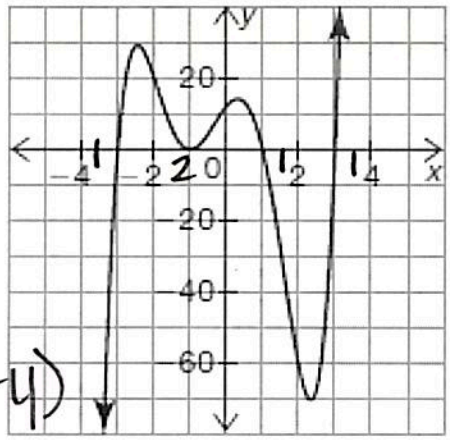
What conclusions can you make about the end behavior of all <u>odd degree</u> polynomials?

Start + end different

positive finish up!!

negative finish down!!

Example 1: Consider the graph shown.



a. is the *a*-value of this function positive or negative?

positive (finish up)

b. Is the degree of the function even or odd?

odd (start + end different)

c. What is the least possible degree for the function?

5 (count + multiplicity)

d. State the domain and range of the function.

$\mathbb{R}$ $\mathbb{R}$

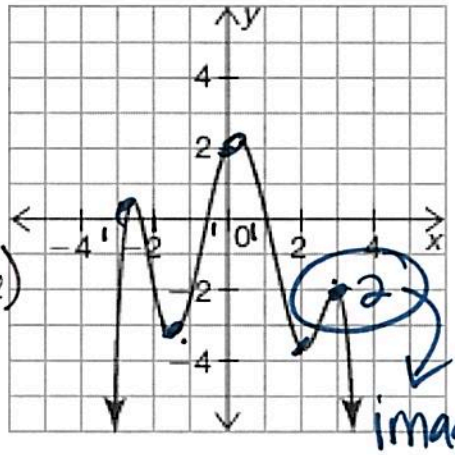
e. Determine the number of relative extrema for the graph.

4

f. Determine the number of absolute extrema for the graph.

none

Example 2: Consider the graph shown.



a. is the *a*-value of this function positive or negative?

Negative (finish down)

b. Is the degree of the function even or odd?

even (starts + Ends the same)

* c. What is the least possible degree for the function?

6

d. State the domain and range of the function.

$\mathbb{R}$ $(-\infty, 2.5]$

e. Determine the number of relative extrema for the graph.

5

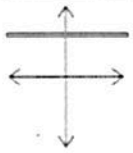
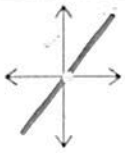
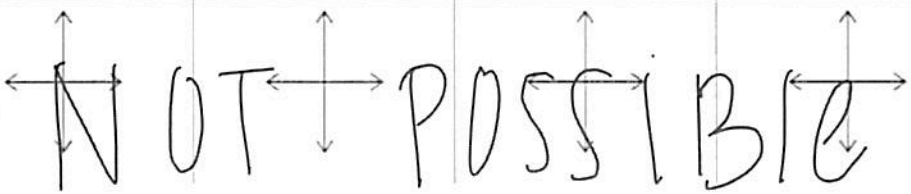
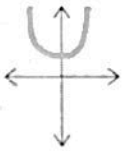
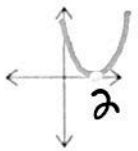
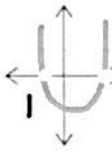
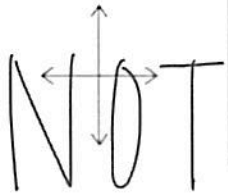
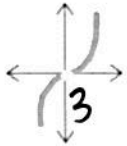
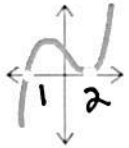
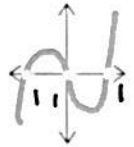
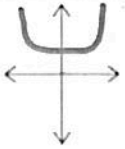
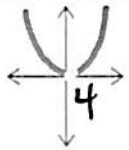
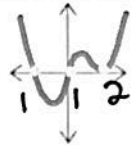
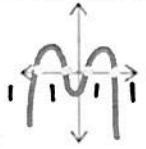
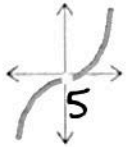
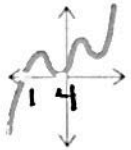
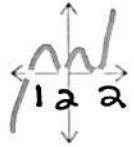
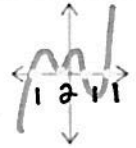
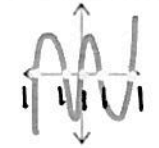
degree must be 1 more than extrema

f. Determine the number of absolute extrema for the graph.

1

add multiplicities....

The following chart shows a sketch of the basic shape on each set of axes given the number of zeros. Why do you think some sketches are not possible?

	No Zeros	1 Zero	Exactly 2 Zeros	Exactly 3 Zeros	Exactly 4 Zeros	Exactly 5 Zeros
Linear at most 1						
Quadratic at most 2						
Cubic at most 3						
Quartic at most 4						
Quintic at most 5						

PAP Algebra 2
Evaluate: Polynomial Characteristics

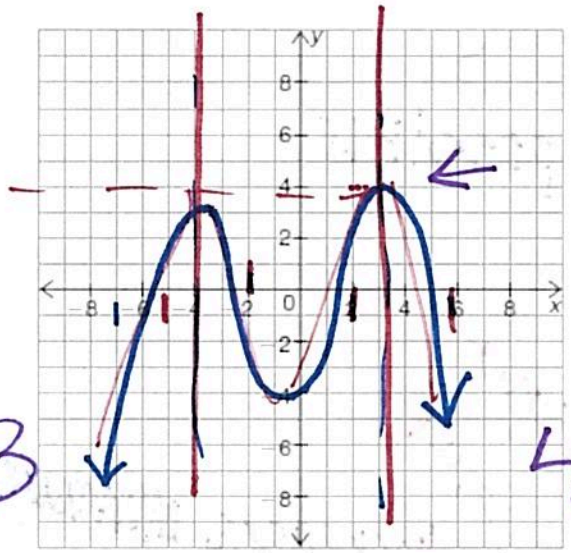
add word problems

Name: Mrs. Benton

. Use the coordinate plane to sketch a graph with the characteristics given. If the graph is not possible to sketch, explain why.

a. Characteristics:

- degree 4
- starts in quadrant III
- ends in quadrant IV
- relative maximum at $x = -4$
- absolute maximum at $x = 3$



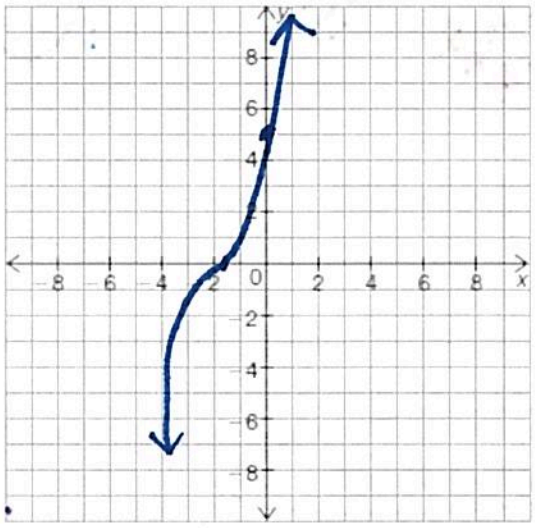
m4

3

4

b. Characteristics:

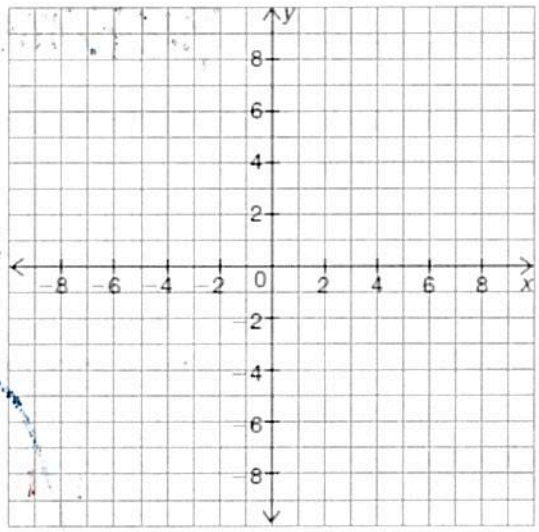
- always increasing
- y-intercept at 5
- x-intercept at -1.7



c. Characteristics:

- odd degree
- increases to $x = -3$, then decreases to $x = 3$, then increases
- absolute maximum at $y = 4$

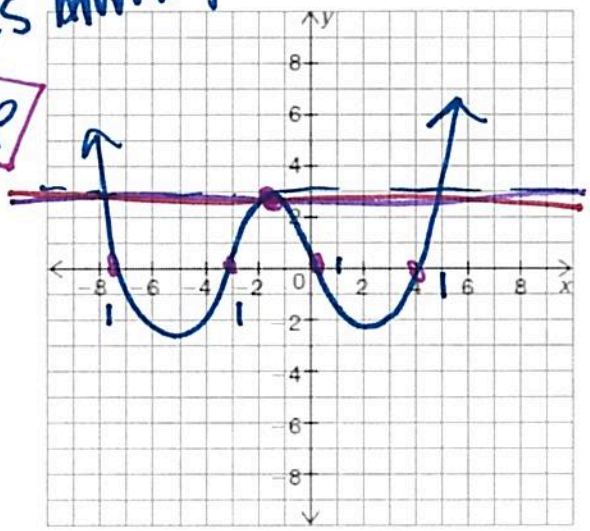
Not possible



d. Characteristics:

- as $x \to \infty$, $f(x) \to \infty$
- as $x \to -\infty$, $f(x) \to \infty$
- 4 x-intercepts
- relative maximum at $y = 3$

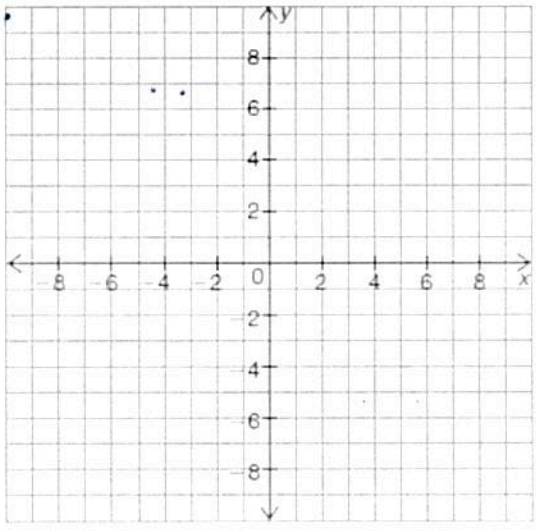
right, up, increases always, up, up, left, up



e. Characteristics:

- x-intercepts at -2, 2 and 5
- negative a value
- degree 2

Not possible

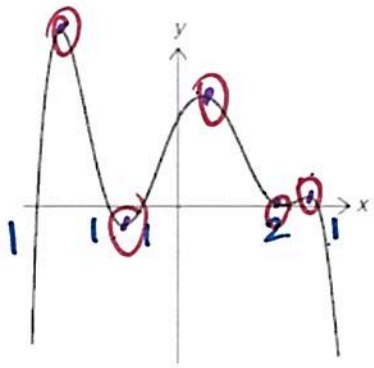


2. Analyze each graph. Circle the function(s) which could model the graph. Describe your reasoning to either eliminate or choose each function.

a.

$f_1(x) = -3x^5 - 2x^2 + 4x + 7$

there are 5 extrema



$f_2(x) = -(x + 2)(x + 1.5)(x + 0.5)(x - 2.5)^2(x - 3)$

m6

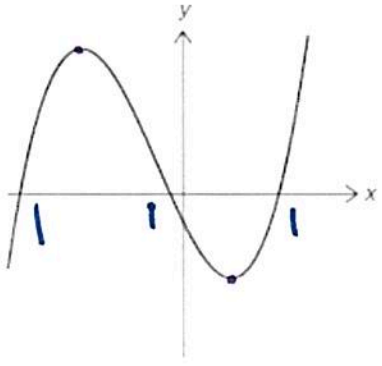
$f_3(x) = -3x^4 - 2x^2 + 4x + 7$

5 extrema

b.

$f_1(x) = 0.5(x + 7)(x + 1)(x - 5) - 3$

-7 -1 5



$f_2(x) = -2(x + 7)(x + 1)(x - 5) - 3$

ends going ↑

$f_3(x) = 2(x + 7)(x + 1)(x - 5)(x - 3)$

Can't be degree 4