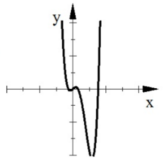
End-Behavior of a polynomial:

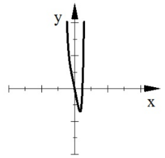
Description of how the FAR left end and the FAR right end of the graph is behaving.

The ends of a polynomial can only do one of two things: Increase or Decrease

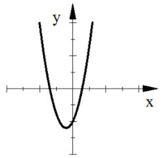
C. $y = 0.5x^4 - 2x^3 + x$



G. $y = 2x^6 - 5x$



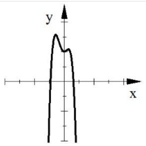
L. $y = x^2 + 2x - 5$



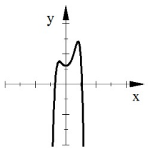
What do these graphs and equations have in common?

Degrees are all EVEN
Leading Coefficients are all POSITIVE
All have the same END BEHAVIOR

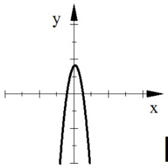
B. $y = -x^4 - x^3 + 2x^2 + 5$



F. $y = -0.1x^6 + 0.2x^5 + x^2 + 3$



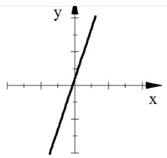
K. $y = -3x^2 + x + 4$



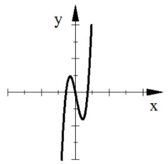
What do these graphs and equations have in common?

Degrees are all EVEN
Leading Coefficients are all NEGATIVE
All have the same END BEHAVIOR

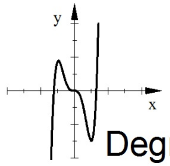
E. $y = 3x + 1$



H. $y = 2x^3 - x^2 - 5x$



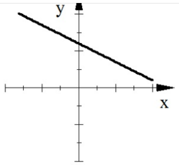
J. $y = 0.1x^5 - x^3 - 0.25x^2$



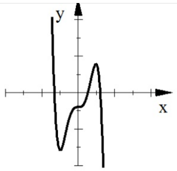
What do these graphs and equations have in common?

Degrees are all ODD
Leading Coefficients are all POSITIVE
All have the same END BEHAVIOR

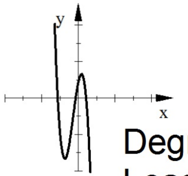
A. $y = -0.5x + 6$



D. $y = -0.1x^5 + x^3 - 2$



I. $y = -2x^3 - 4x^2 + 5x + 2$



What do these graphs and equations have in common?

Degrees are all ODD
Leading Coefficients are all NEGATIVE
All have the same END BEHAVIOR

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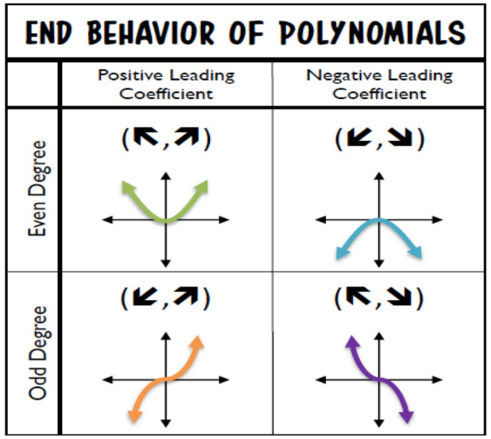
End Behavior of a polynomial is determined by:

Whether Degree is ODD or EVEN

And whether the Leading Coefficient is POSITIVE or NEGATIVE



Other notation to describe End Behavior

Positive Even End Behavior:

$$As\ \ x \to +\infty,\ then\ \ P(x) \to\ +\infty$$

- as x approaches +∞
- as x increases
- as you move farther to the right

- y approaches +∞
- y increases
- graph goes up

$$As\ \ x \to -\infty,\ then\ \ P(x) \to\ +\infty$$

- as x approaches -∞
- as x decreases
- as you move farther to the left

- y approaches +∞
- y increases
- graph goes up

↖ ↗

Positive Odd End Behavior:

$$As \;\; x \to +\infty, \;\; then \;\; P(x) \to +\infty$$

To the right and up

$$As \;\; x \to -\infty, \;\; then \;\; P(x) \to -\infty$$

To the left and down

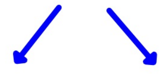
Negative Even End Behavior:

$$As \;\; x \to +\infty, \;\; then \;\; P(x) \to -\infty$$

To the right and down

$$As \;\; x \to -\infty, \;\; then \;\; P(x) \to -\infty$$

To the left and down



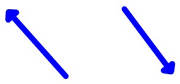
Negative Odd End Behavior:

$$As \;\; x \to +\infty, \;\; then \;\; P(x) \to -\infty$$

To the right and down

$$As \;\; x \to -\infty, \;\; then \;\; P(x) \to +\infty$$

To the left and up



Even Degree: Left and Right ends do the same thing.

they either go up on both sides or
go down on both sides

Odd Degree: Left and Right ends do different things.

If one side goes up the other side will go down

An object is shot into the air. The height of the object as a function of time is modeled by the equation below. Use the graphing calculator to find the maximum height (ft) of the object and the time(sec) it takes to reach that max ht.

Round to the nearest hundredth.

$y = -2x^2 + 36x + 5$

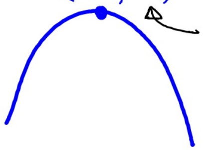
You could graph this quadratic on a graphing calculator and use find the coordinates of the vertex or you could do the following:

Max height: 167

Time to max ht: 9

LOS: $x = \frac{-b}{2a} = \frac{-36}{-4} = 9$

(9, 167)



$y = -2(9)^2 + 36(9) + 5 = 167$

Given the two quadratics f(x) shown in the table and the $g(x) = 2x^2 - 12x - 5$

x	–4	–2	0	2	4	6	8
$f(x)$	113	41	–7	–31	–31	–7	41

y-int → (–7); y-int (–5)

1. Which quadratic has the lowest minimum?

since the table indicates that the vertex of f(x) must lie between the points (2,-31) and (4,-31) and f(x) is an upwards opening parabola the vertex must be below -31

the vertex of g(x) is the point (3,-23)

(3, -23)

LOS: $x = -b/2a = \frac{12}{4} = 3$

$g(3) = -23$

2. Find the y-intercept for each function.

f(x) y-int = -7

g(x) y-int = – 5

Use this function: $f(x) = -x^3 + 2x^2 + 5x - 6$

Which interval has the greatest rate of change.

a. $-3 \le x \le -1$

$\frac{24 + 8}{-3 + 1} = \frac{32}{-2}$

rate of change = -16

b. $1 \le x \le 2$

$\frac{4 - 0}{2 - 1} = \frac{4}{1}$

rate of change = 4

X	Y
-3	24
-1	-8
1	0
2	4

The interval in (a) is greater. The negative value only indicates a direction. The fact 16>4 means that part of the graph is steeper, i.e. greater rate of change

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Odd, Even, or Neither Numerically

$y = |x^5 - 2x^3 + x|$

X	Y
1	$\lvert (1)^5 - 2(1)^3 + (1) \rvert = \lvert 1 - 2 + 1 \rvert = \lvert 0 \rvert = 0$
-1	$\lvert (-1)^5 - 2(-1)^3 + (-1) \rvert = \lvert -1 + 2 - 1 \rvert = \lvert 0 \rvert = 0$

Since opposite x values lead to the same y value, this function appears to be EVEN.

Odd, Even, or Neither Algebraically

$y = x^4 + 6x^2 - 7x$

$f(-x) = (-x)^4 + 6(-x)^2 - 7(-x)$

$= x^4 + 6x^2 + 7$

This is neither the original function nor the opposite of the original function. Therefore, this function is NEITHER odd nor even.