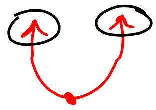
Name: ______________________ Date: ______________ **Unit 6 Class Work**

"End Behavior" of Polynomials Class Work

Objective: *You will be able to describe the end behavior of any given polynomial, even without having to graph the entire polynomial.*

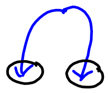
THE DEGREE OF A FUNCTION CAN BE EVEN OR ODD.
LET'S LOOK AT EVEN DEGREE FIRST.

Think of a function of even degree that you have seen in the past... Quadratic $y=x^2$



Sketch the shape of this function's graph to the right.
What can you conclude about how both ends of the graph behave? both are the same and going up

Sketch the shape of this function's graph if the leading coefficient were negative.
What can you conclude about how both ends of the graph behave? $y=-x^2$
both are the same & going down



☆ For **even** functions with **positive** coefficients,
as x approaches the left, y goes up
and as x approaches the right, y goes up.

**What is another way to write "y?"* f(x)

~ Another way to describe the end behavior is:
as x approaches the left, f(x) goes up
and as x approaches the right, f(x) goes up.

**"Left" is also known as* $-\infty$ *"Right" is also known as* ∞.

**"Down" is also known as* $-\infty$*, "Up" is also known as* ∞.

~ Another way to say this is:
As x approaches $-\infty$, f(x) goes to ∞
And as x approaches ∞, f(x) goes to ∞

*A quicker way to write "approaches," or "goes" is using an →

The quickest way to describe the end behavior is...

As $x \to -\infty, f(x) \to \infty$
As $x \to \infty, f(x) \to \infty$

☆ Describe the end behavior for **even** functions with **negative** coefficients.

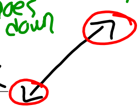
In words...

As x goes left, F(x) goes down.
As x goes right, f(x) goes down

In the simplest format...

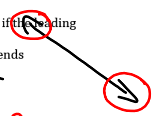
As $x \to -\infty, f(x) \to -\infty$
As $x \to \infty, f(x) \to -\infty$

Think of a function of odd degree that you have seen in the past... Linear $y=x$



Sketch the shape of this function's graph to the right.
What can you conclude about how both ends of the graph behave? opposite directions
down ⇒ up

Sketch the shape of this function's graph if the leading coefficient were negative.
What can you conclude about how both ends of the graph behave? $y=-x$
opposite
up ⇒ down



☆ Describe the end behavior for **odd** functions with **positive** coefficients.

In words...

As x goes left, Y goes down.
As x goes right, Y goes up.

In the simplest format...

As $x \to -\infty, f(x) \to -\infty$
As $x \to \infty, f(x) \to \infty$

☆ Describe the end behavior for **odd** functions with **negative** coefficients.

In words...

As x goes left, Y goes up
As x goes right, Y goes down.

In the simplest format...

As $x \to -\infty, f(x) \to \infty$.
As $x \to \infty, f(x) \to -\infty$

Name: ______________________ Date: ________________ **Unit 6 Class Work**

General End Behavior

	Even Degree same	Odd Degree opposite
Positive Leading Coefficient up	Sketch: Description: As $x \to -\infty, f(x) \to \infty$ As $x \to \infty, f(x) \to \infty$ Reminders:	Sketch: Description: As $x \to -\infty, f(x) \to -\infty$ As $x \to \infty, f(x) \to \infty$ Reminders: *think of a line
Negative Leading Coefficient down	Sketch: Description: As $x \to -\infty, f(x) \to -\infty$ As $x \to \infty, f(x) \to -\infty$ Reminders:	Sketch: Description: As $x \to -\infty, f(x) \to \infty$ As $x \to \infty, f(x) \to -\infty$ Reminders:

Practice: Describe and sketch the end behavior of each of the polynomials below.

*Term w/ highest degree is the only one that matters.

1. $f(x) = 8x^5 - 2x^3 + 9$

pos/neg $\boxed{8}x^5$ even/odd

pos, up; odd, opposite

2. $g(x) = -8 + 5x^4 - x$

$+5x^4$ even

pos.

3. $h(x) = 2x^3 - 10x^8$

4. $p(x) = x^2 + 1$

5. $r(x) = (p \circ h)(x)$

*plug in h(x) to p(x) for x

$(2x^3 - 10x^8)^2 + 1$

*only need $(-10x^8)^2 = -10x^8 \cdot -10x^8$

pos x^{16} even

6. $n(x) = h(x)f(x)$

*multiply

*only need

$-10x^8 \cdot 8x^5$

$-80x^{13}$

neg. odd

7. $m(x) = 8x - 4x^9$

8. $j(x) = m(x)h(x)$

9. $(p \circ g)(x)$

$23x^8$

b(x) is m(x)r(x) and has end behavior:

*What could r(x) be?!

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4. $p(x) = x^2 + 1$

5. $r(x) = (p \circ h)(x)$

As $x \to -\infty, f(x) \to \infty$

As $x \to \infty, f(x) \to \infty$

6. $n(x) = h(x)f(x)$

As $x \to -\infty, f(x) \to \infty$

As $x \to \infty, f(x) \to -\infty$

7. $m(x) = 8x - 4x^9$

8. $j(x) = m(x)h(x)$

As $x \to -\infty, f(x) \to -\infty$

As $x \to \infty, f(x) \to \infty$

9. $(p \circ g)(x)$

b(x) is m(x)r(x) and has end behavior:

*What could r(x) be?!

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9. $(p \circ g)(x)$