

# Day 03 Notes on Polynomial Functions & End Behavior

## Polynomial Vocabulary:

**Degree** of a polynomial- the highest exponent in the equation.

**Leading Coefficient**- First coefficient when the equation is in standard form.

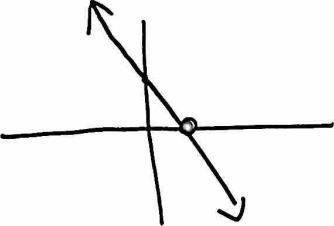
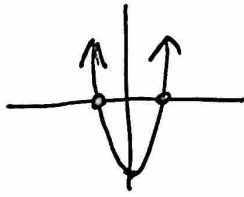
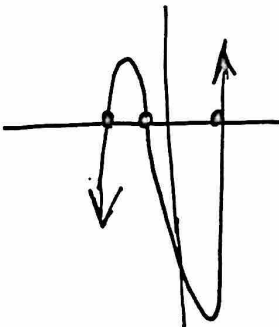
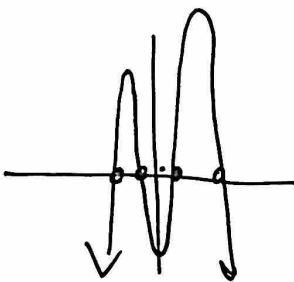
**Increasing Intervals**- The parts of the graph where the value of the function is increasing (going up a roller coaster)

**Decreasing Intervals**- The parts of the graph where the value of the function is decreasing (going down a roller coaster)

**Turning Points**- Where the graph changes between increasing and decreasing intervals.

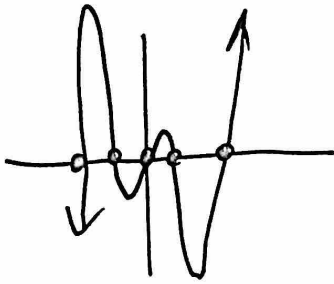
**End Behavior**- What the graph is approaching as it extends infinitely to the right and left.

Master Eq

<p>1. Linear (1<sup>st</sup> Degree) <math>y = -2x + 3</math></p> <p>Y min -10 Y max 10</p>  <p>a) Highlight the <u>decreasing</u> intervals on your sketch.            b) Leading Coefficient: <u>-2</u>            c) Degree Even or Odd? <u>ODD</u>            d) Number of Turning Points? <u>0</u>            e) Arrows the same direction or opposite? <u>OPP.</u></p>	<p>2. Quadratic (2<sup>nd</sup> Degree) <math>y = 3x^2 - 4</math></p> <p>Y min -10 Y max 10</p>  <p>a) Highlight the <u>increasing</u> intervals on your sketch.            b) Leading Coefficient: <u>3</u>            c) Degree Even or Odd? <u>EVEN</u>            d) Number of Turning Points? <u>1</u>            e) Arrows the same direction or opposite? <u>SAME</u></p>
<p>3. Cubic (3<sup>rd</sup> Degree) <math>y = 2x^3 - x^2 - 13x - 6</math></p> <p>Y min -25 Y max 15</p>  <p>a) Highlight the <u>increasing</u> intervals on your sketch.            b) Leading Coefficient: <u>2</u>            c) Degree Even or Odd? <u>ODD</u>            d) Number of Turning Points? <u>2</u>            e) Arrows the same direction or opposite? <u>OPP.</u></p>	<p>4. Quartic (4<sup>th</sup> Degree)  <math>y = -3x^4 + 5x^3 + 17x^2 - 13x - 6</math></p> <p>Y min -15 Y max 35</p>  <p>a) Highlight the <u>decreasing</u> intervals on your sketch.            b) Leading Coefficient: <u>-3</u>            c) Degree Even or Odd? <u>EVEN</u>            d) Number of Turning Points? <u>3</u>            e) Arrows the same direction or opposite? <u>SAME</u></p>

5. Quintic (5<sup>th</sup> Degree)  $y = x^5 - 10x^3 + 9x$

Y min -40  
Y max 45

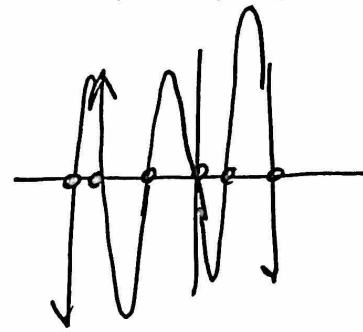


- Highlight the decreasing intervals on your sketch.
- Leading Coefficient: 1
- Degree Even or Odd? ODD
- Number of Turning Points? 4
- Arrows the same direction or opposite? OPP.

6. Hexic (6<sup>th</sup> Degree)

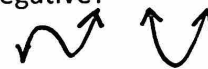

$$y = -x^6 - 2x^5 + 10x^4 + 20x^3 - 9x^2 - 18x$$

Y min -20  
Y max 140



- Highlight the increasing intervals on your sketch.
- Leading Coefficient: -1
- Degree Even or Odd? EVEN
- Number of Turning Points? 5
- Arrows the same direction or opposite? SAME

- What does the sign of leading coefficient tell me about the graph? In other words, what do I know about the graph when it is a positive leading coefficient versus a negative?

+LC : It will go up in the end.   
-LC : It will go down in the end. 

- What does the degree tell me about the arrows (or end behavior)?

EVEN: Arrows will go in same direction  
ODD: Arrows will go in opposite directions.

- What does the degree tell me about the number of turning points?

There will be 1 less turning point  
ex: Degree 8 → 7 turning points

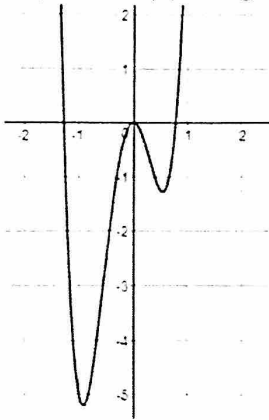
- What does the degree tell me about the number of solutions (x-intercepts)?

The # of solutions will always = the degree  
The max # of x-intercepts will = the degree.

## End Behavior

What happens to  $f(x)$  as  $x$  gets larger and smaller?

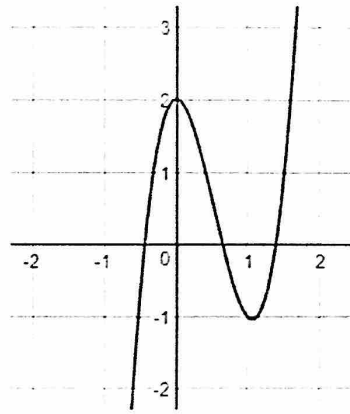
1)



$$\text{As } x \rightarrow \infty \quad \underline{f(x) \rightarrow +\infty}$$

$$\text{As } x \rightarrow -\infty \quad \underline{f(x) \rightarrow +\infty}$$

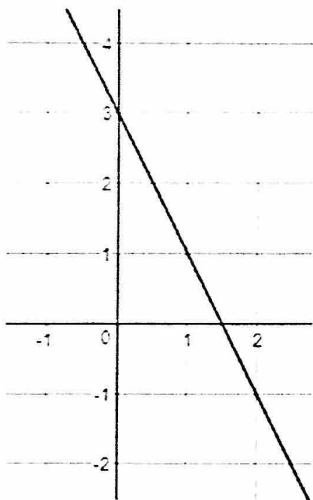
2)



$$\text{As } x \rightarrow \infty \quad \underline{f(x) \rightarrow +\infty}$$

$$\text{As } x \rightarrow -\infty \quad \underline{f(x) \rightarrow -\infty}$$

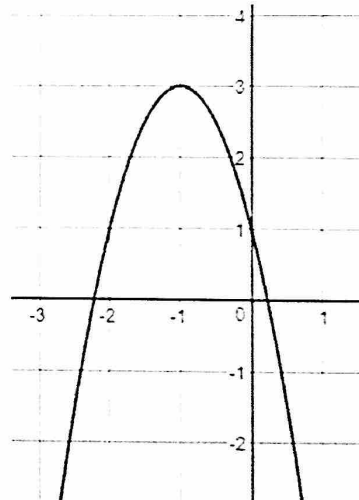
3)



$$\text{As } x \rightarrow \infty \quad \underline{f(x) \rightarrow -\infty}$$

$$\text{As } x \rightarrow -\infty \quad \underline{f(x) \rightarrow +\infty}$$

4)



$$\text{As } x \rightarrow \infty \quad \underline{f(x) \rightarrow -\infty}$$

$$\text{As } x \rightarrow -\infty \quad \underline{f(x) \rightarrow -\infty}$$

5-7: Without graphing the polynomial, fill in the information about the function using the equation.

5.  $y = 8x^3 - 5x^2 + x - 10$

- a) What is the degree? 3  
b) Is the degree even or odd? ODD  
c) What is the leading coefficient? 8  
d) What is the maximum number of turning points? 2  
e) What is the maximum number of zeros? 3  
f) Right side going up or down? UP  
g) End behavior same or opposite? OPP.  
h) End behavior: As  $x \rightarrow \infty$   $f(x) \rightarrow +\infty$   
As  $x \rightarrow -\infty$   $f(x) \rightarrow -\infty$



6.  $y = -2x^4 + 7x^2 + 3x$

- a) What is the degree? 4  
b) Is the degree even or odd? EVEN  
c) What is the leading coefficient? -2  
d) What is the maximum number of turning points? 3  
e) What is the maximum number of zeros? 4  
f) Right side going up or down? DOWN  
g) End behavior same or opposite? SAME  
h) End behavior: As  $x \rightarrow \infty$   $f(x) \rightarrow -\infty$   
As  $x \rightarrow -\infty$   $f(x) \rightarrow -\infty$



7.  $y = x^6 - x^5 + 4x^3 + 9x^2 + 1$

- a) What is the degree? 6  
b) Is the degree even or odd? EVEN  
c) What is the leading coefficient? 1  
d) What is the maximum number of turning points? 5  
e) What is the maximum number of zeros? 6  
f) Right side going up or down? UP  
g) End behavior same or opposite? SAME  
h) End behavior: As  $x \rightarrow \infty$   $f(x) \rightarrow +\infty$   
As  $x \rightarrow -\infty$   $f(x) \rightarrow +\infty$

