Tuesday 10/8/19

1. Grab the Notes & Calculator
2. Take out HW/Calendar.
3. Begin Warm-up
4. Multiplicity Notes
5. Update INB, Multiplicity HW
**Topic:** Vertices and Multiplicity

**What am I learning today?**

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**Warm-Up**

Solve the following polynomial by factoring, then find the following characteristics:

\[ f(x) = 2x^3 + 4x^2 - 8x - 16 \]

\[ (2x^3 + 4x^2) - (8x + 16) \]

\[ 2x^2(x + 2) - 8(x + 2) \]

\[ 2x^2(x + 2) = 0 \]

\[ x + 2 = 0 \]

\[ x = -2 \]

End Behavior =

\[ \text{as } x \to -\infty, f(x) \to -\infty \]

\[ \text{as } x \to \infty, f(x) \to \infty \]

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**Vocabulary**

Every polynomial has a "maximum" number of turns:

**RECALL:** Max. # of turns is **one less** than your degree.

Inversely, the degree of a polynomial is **one more** than the # of turns.

The curves/turns are also called **vertices**.

- Even degrees will always have an **odd** number of turns.
- Odd degrees will always have an **even** number of turns.

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**Examples**

Ex 1: State the degree (even/odd), LC (positive/negative), max # of turns and end behavior.

\[ f(x) = 7x^4 - 3x^2 + 6x - 5 \]

Degree: **Even (4)**

LC: **Pos. (7)**

Max. # of Turns: **3**

End Behavior:

\[ \text{as } x \to -\infty, f(x) \to -\infty \]

\[ \text{as } x \to \infty, f(x) \to \infty \]

Ex 2: State the # of turns, the minimum degree of the polynomial the degree (even/odd), LC (positive/negative) and end behavior.

\[ f(x) \]

\[ \text{# of Turns: } 4 \]

Minimum Degree: **5**

Degree: **Odd**

LC: **Pos.**

End Behavior:

\[ \text{as } x \to -\infty, f(x) \to -\infty \]

\[ \text{as } x \to \infty, f(x) \to \infty \]
**Topic:** Vertices and Multiplicity

**Vocabulary**

The **degree** of a polynomial in factored form can be found by adding the exponents of each zero.

A zero has a **multiplicity**, which refers to the number of times that its associated factor appears in the polynomial (the **EXONENT** of each zero determines its multiplicity).

For Example: \( f(x) = (x + 3)(x - 2) \)

Zeros: \( x = -3 \) (occurring **2** times) & \( x = 2 \) (occurring **1** time)

- a zero with the multiplicity of 1 will **cross** the x-axis
- a zero with the multiplicity of an even number will **touch** the x-axis
- a zero with the multiplicity of an odd number greater than 1 will **snake** through the x-axis.

**Steps to Sketch**

A rough sketch of a polynomial can be made using the following steps:

1. Plot the zeros along the x-axis (hint: put a "c", "t" or "s" at each point depending on its multiplicity)
2. Sketch the end behavior for the left side (from the far left point)
3. Sketch the end behavior for the right side (from the far right point)
4. Sketch the remaining parts of the curve.

**Example**

\( f(x) = (x + 3)(x - 2) \)

Degree: \( 3 \)  
LC: **pos.**

Max. # Turns: **2**

Zeros & their Multiplicity:  
\( x = -3, m=1 \) \( x = 2, m=1 \)

End Behavior:

\[ \text{as } x \to -\infty, f(x) \to -\infty \]

\[ \text{as } x \to \infty, f(x) \to \infty \]

**You Try**

\( f(x) = -(x + 3)^4(x - 1)^2 \)

Degree: \( 6 \)  
LC: **Neg.**

Max. # Turns: **5**

Zeros & their Multiplicity:  
\( x = -3, m=4 \) \( x = 1, m=2 \)

End Behavior:

\[ \text{as } x \to -\infty, f(x) \to -\infty \]

\[ \text{as } x \to \infty, f(x) \to \infty \]