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 **Name**: _____

What am I learning today?

Warm-Up

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

$f(x) = 2x^3 + 4x^2 - 8x - 16$ → $(2x^3+4x^2)(-8x-16)$

$2x^2(x+2)-8(x+2)$

$(2x^2-8)(x+2)=0$

"zeros"

Solutions/X-Intercepts:

x = -2 x = -2 x = 2

Degree (even/odd) = _____

LC (pos./neg.) = _____

Max. # Turns = 2

End Behavior =

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

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

$2x^2-8=0$ $x+2=0$

$2x^2=8$ $x=-2$

$\sqrt{x^2}=\sqrt{4}$ $(-2,0)$

$x=\pm 2$

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.

Vertices

#Turns: 4

Deg: 5

Deg: 4

Examples

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

$f(x) = \boxed{7x^4} - 3x^2 + 6x - 5$

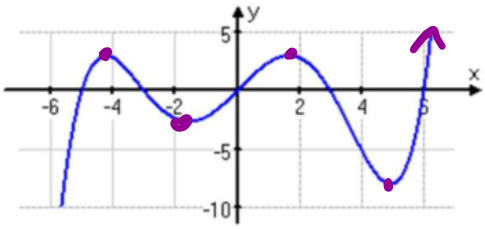
Degree: Even (4) LC: Pos. (7)

Max. # of Turns: 3

End Behavior: as $x \to -\infty$, $f(x) \to \infty$

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.



# of Turns: 4

Minimum Degree: 5

Degree: odd LC: Pos.

End Behavior: as $x \to -\infty$, $f(x) \to -\infty$

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

Topic: Vertices and Multiplicity **Date:** _____

Vocabulary

Multiplicity

The **degree** of a polynomial in factored form can be found by add 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 **EXPONENT** of each zero determines its multiplicity)

$x+3=0$
$x=-3$
$x-2=0$
$x=2$

For Example: $f(x) = (x + 3)^2(x - 2)^1$ Deg: 3 (odd)

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

(-3,0) (2,0)

- a zero with the multiplicity of 1 will cross the x-axis (bounce)
- 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. (cross)

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

$x-3=0$
$x=3$
$x+2=0$
$x=-2$

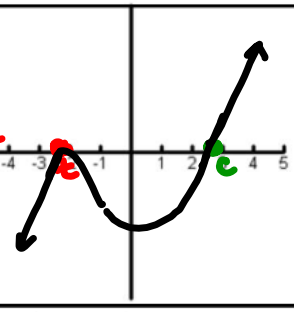
$f(x) = (x - 3)^1(x + 2)^2$

Degree: 3 (odd) LC: pos.

Max. # Turns: 2

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

End Behavior: as $x \to -\infty$, $f(x) \to \infty$; as $x \to \infty$, $f(x) \to \infty$



You Try

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

Degree: _____ LC: _____

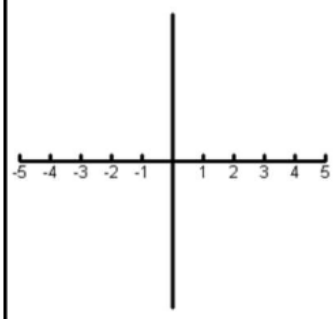
Max. # Turns: _____

Zeros & their Multiplicity:

_____

_____

End Behavior:



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

Degree: 6 (Ev.) LC: Neg.

Max. # Turns: 5

Zeros & their Multiplicity:

x=0 (m=1) c
x=4 (m=2) t
x=-1 (m=3) c

End Behavior: as $x \to -\infty$, $f(x) \to -\infty$; as $x \to \infty$, $f(x) \to -\infty$

$x=0$
$x-4=0$
$x=4$
$x+1=0$
$x=-1$