

Lesson 2.6- Objective: SWBAT determine the end behavior of a polynomial function.

Kickoff

Complete questions 2 & 6 in yesterday's packet!

2) $a^2 + 3a + 2 < -3(a+2)$

$a^2 + 3a + 2 < -3a - 6$
 $a^2 + 6a + 8 < 0$
 $(a+4)(a+2) < 0$
 $a = -4 \quad a = -2$

$(-3)^2 + 3(-3) + 2 < -3(-3) - 6$
 $12 < 9$
 $12 > 9$ ✓

$a^2 + 6a + 9 = 8 + 9$
 $(a+3)^2 = 1$
 $a+3 = \pm 1$

$a+3 = 1 \quad a+3 = -1$
 $a = -2 \quad a = -4$

⑤ $3x^2 + 7x - 2 < 0$
 $3x^2 + 7x - 2 < 0$
 $(3x+6)(x-2) < 0$
 $3x(x+2) < (x+2)(x-2)$
 $(3x+1)(x+2) < 0$
 $3x+1=0 \quad x+2=0$
 $x = -1/3 \quad x = -2$
 $x < -2 \quad -2 < x < -1/3 \quad x > -1/3$
 $3x^2 + 7x - 2 < 0$
 $(3x-1)(x+2) < 0$
 $3x-1=0 \quad x+2=0$
 $x = 1/3 \quad x = -2$
 $x < -2 \quad -2 < x < 1/3 \quad x > 1/3$

⑥ $2x^2 + 9x + 18 > 0$
 $2x^2 + 9x + 18 > 0$
 $9 = \frac{81 \pm \sqrt{81 - 4(2)(18)}}{2(2)}$
 $9 = \frac{81 \pm \sqrt{81 - 144}}{4}$
 $9 = \frac{9 \pm 3i}{4}$
 $\frac{9+3i}{4} < x < \frac{9-3i}{4}$

⑦ $x^2 + 4 \geq 2x^2 - 3x - 4$
 $-x^2 + 4 \geq -3x - 4$
 $5 \geq -3x - 8$
 $13 \geq -3x$
 $-4 \leq x \leq 13$

6) $x^2 < 8$
 $x = \pm \sqrt{8}$
 $(-\sqrt{8}, \sqrt{8})$
 $[-3] \quad -\sqrt{8} \quad 0 \quad \sqrt{8} \quad [3]$
 $-3^2 < 8$
 $9 < 8$
 $0^2 < 8$
 $0 < 8$
 $3^2 < 8$
 $9 < 8$

The **degree** of a polynomial is the **highest exponent** in the equation.

The **leading coefficient** of a polynomial is the coefficient in front of the variable that includes the degree of the polynomial.

Try this: Determine the degree and leading coefficient

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

LC: -1
 D: 3

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

$(2x-3)(2x-3)$
 $4x^2$
 LC: 4
 D: 2

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

$-x(2x)^2$
 $-4x^3$
 LC: -4
 D: 3

End Behavior of a Polynomial- $f(x) = ax^n$

Think about the basic quadratic and cubic functions when completing the end behavior!!

-When "n" is **odd** and $a > 0$ then:

$x \rightarrow -\infty \quad f(x) \rightarrow -\infty$
 $x \rightarrow \infty \quad f(x) \rightarrow \infty$

-When "n" is **odd** and $a < 0$ then:

$x \rightarrow -\infty \quad f(x) \rightarrow \infty$
 $x \rightarrow \infty \quad f(x) \rightarrow -\infty$

-When "n" is **even** and $a > 0$ then:

$x \rightarrow -\infty \quad f(x) \rightarrow \infty$
 $x \rightarrow \infty \quad f(x) \rightarrow \infty$

-When "n" is **even** and $a < 0$ then:

$x \rightarrow -\infty \quad f(x) \rightarrow -\infty$
 $x \rightarrow \infty \quad f(x) \rightarrow -\infty$

Quiz Friday

- ① Forms of a quadratic
- ② End Behavior
- ③ Multiplicity
- ④ Sketching a polynomial
* without a calculator!
- ⑤ Quadratic Inequalities

To determine end behavior, use the leading coefficient test!

Leading Coefficient Test:

Degree

If the degree is even, the ends will be:
 - always positive
 - always negative

If the degree is odd the ends be:
 - both positive + negative
 - (1, 3)
 - (2, 4)

Coefficient:

If the leading coefficient is **negative**
 negative (2, 4)
 positive (1, 3)

End Behavior:

Determine the following as x decreases then f(x) increases or decreases
 x increases then f(x) increases or decreases

"n" is an Even Degree			
Leading Coefficient Positive Example: $f(x) = 3x^2 - 6x + 9$ LC: 3 D: 4 $x \rightarrow -\infty$ $f(x) \rightarrow \infty$ $x \rightarrow \infty$ $f(x) \rightarrow \infty$		Leading Coefficient Negative Example: $f(x) = -5x^2 - x + 1$ LC: -5 D: 4 $x \rightarrow -\infty$ $f(x) \rightarrow -\infty$ $x \rightarrow \infty$ $f(x) \rightarrow -\infty$	
"n" is an Odd Degree			
Leading Coefficient Positive Example: $f(x) = 4x^3 - 6x^2 + 9x - 8$ LC: 4 D: 5 $x \rightarrow -\infty$ $f(x) \rightarrow -\infty$ $x \rightarrow \infty$ $f(x) \rightarrow \infty$		Leading Coefficient Negative Example: $f(x) = -x^3 - 6x^2 + 12$ LC: -1 D: 7 $x \rightarrow -\infty$ $f(x) \rightarrow \infty$ $x \rightarrow \infty$ $f(x) \rightarrow -\infty$	

1) $f(x) = x^2 + 4x - 5$
 Degree 2 Even or Odd
 Leading Coefficient 1
 End Behavior
 $x \rightarrow \infty$ $f(x) \rightarrow \infty$
 $x \rightarrow -\infty$ $f(x) \rightarrow \infty$

2) $f(x) = 8x^2 - 2x^4$
 Degree 4 Even or Odd
 Leading Coefficient -2
 End Behavior
 $x \rightarrow \infty$ $f(x) \rightarrow -\infty$
 $x \rightarrow -\infty$ $f(x) \rightarrow -\infty$

3) $f(x) = x^2(x - 4)$
 Degree _____ Even or Odd
 Leading Coefficient _____
 End Behavior

4) $f(x) = -x(x - 2)^2(x + 2)^2$
 Degree _____ Even or Odd
 Leading Coefficient _____
 End Behavior

5) $f(x) = -x(x + 1)(x - 2)^2(x - 3)$
 Degree _____ Even or Odd
 Leading Coefficient _____
 End Behavior

6) $f(x) = -x^3 - 10x^2 + 25x$
 Degree _____ Even or Odd
 Leading Coefficient _____
 End Behavior

