Algebra III
Chapter 2 Note Packet

Name KEY

Section 2.1: Polynomial Functions
Essential Question: 1) What is a polynomial? 2) How do you name a polynomial? 3) How can you evaluate a polynomial given a real #?

Polynomials

-Have nonnegative exponents

-Variables ONLY in Numerator

-General Form $a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2 x^2 + a_1 x^1 + a_0$

Example 1

$27x^5 + 10x^4 - 6x^3 + 2x^2 - x + 7.5$

Terms: $27x^5, 10x^4, -6x^3, 2x^2, -x, 7.5$
(6 terms)

Coefficients: 27, 10, -6, 2, -1, 7.5
(the # in front)

- Always write in Descending order
- **Leading Term** - Term with highest power
- **Leading coefficient** - coefficient of the leading term
- **Degree** of a polynomial - power of the leading term

DEGREE	NAME	EXAMPLE
0	constant	7
1	Linear	$7x$
2	Quadratic	$4x^2 + 7$
3	Cubic	$x^3 - 2x + 5$
4	Quartic	$5x^4 - 3x^3 + x^2$
5	Quintic	$8x^5 - 10$

* highest power = 5, but does not have to have an x^4, x^3, x^2, x or constant

Example 2

Name the term of the polynomial $7x^4 + 10x^3 - 6x^2 + 5x + 11$

Constant: 11 Linear Term: $5x$ Quadratic Term: $-6x^2$

Cubic Term: $10x^3$ Quartic Term: $7x^4$

Reminder: Zeros of a function are where P(x) = 0 (set equation = 0)

Example 3

Decide if the function is a polynomial function and find the zeros.

A) f(x) = 7x - 5

$\boxed{\text{yes}}$

$7x-5=0$

$\boxed{x=5/7}$

B) g(m) = m^3 - 25m

$\boxed{\text{yes}}$

$m^3-25m=0$

$m(m^2-25)=0$

$m(m+5)(m-5)=0$

$\boxed{m=0, \pm 5}$

C) $g(h)=h-\frac{1}{h}$

$\boxed{\text{NO}}$ variable in denom.

$h\left(0=h-\frac{1}{h}\right)$

$0=h^2-1$

$0=(h-1)(h+1)$

$\boxed{h=\pm 1}$

Example 4

Given $f(x)=\frac{x^2-7x+12}{x+5}$

a) Where is the function undefined?

Set denominator = 0

$x+5\neq 0$ $\boxed{x\neq -5}$

b) Find the zeros of the function.

Set numerator = 0

$x^2-7x+12=0$

$(x-4)(x-3)=0$

$\boxed{x=4}$ $\boxed{x=3}$

Example 5

Find the values of function f(x) = $2x^2$ + 15.

a) f(3) = $\boxed{33}$

$2(3)^2+15$

$2(9)+15$

$18+15$

33

b) f(3i) = $\boxed{-3}$

$2(3i)^2+15$

$2(9i^2)+15$

$18\cdot(-1)+15$

$-18+15$

-3

c) f(3n) = $\boxed{18n^2+15}$

$2(3n)^2+15$

$2(9n^2)+15$

$18n^2+15$

d) f(n + 3) = $\boxed{2n^2+12n+33}$

$2(n+3)^2+15$

$2(n+3)(n+3)+15$

$2(n^2+6n+9)+15$

$2n^2+12n+18+15$

$2n^2+12n+33$

Example 6

P(x) = $2x^4 - 3x^3 + x^2 + 6x - 6$

Find P(2) = $2(2)^4-3(2)^3+(2)^2+6(2)-6=\boxed{18}$

Another way to find P(x) is to use Synthetic Substitution

NOTE: You may only use synthetic substitution if x is a real number, x cannot be imaginary or a variable

2	2	-3	1	6	-6
	↓	4	2	6	24
	2	1	3	12	$\boxed{18}$ ← P(2)!

LAST EXAMPLE ☹

Use synthetic substitution to find P(5) given: $f(x) = 6x^3 + 7x - 9$

$$\begin{array}{r|rrrr} 5 & 6 & 0 & 7 & -9 \\ & \downarrow & 30 & 150 & 785 \\ \hline & 6 & 30 & 157 & \boxed{776 = P(5)} \end{array}$$

Section 2.1 Summary:

(1) A polynomial has variables only in the numerator, thus no negative exponents.

A polynomial should be written in descending order.

(2) The name of a polynomial is based on the degree (highest power).

Constant $= x^0$
Linear $= x^1$
Quadratic $= x^2$
Cubic $= x^3$
Quartic $= x^4$
Quintic $= x^5$

(3) To evaluate a polynomial, given a real number you can A) substitute the value in for x and solve

OR B) use synthetic substitution (look @ example 6)