Polynomials 1 - Introduction to Polynomial Functions

Standards: A-SSE.1.a, A-SSE.1.b, A-ARP.1

HW#3: Poly 1 #1-10

Learning Targets:

-How can you tell if a function is a polynomial?

-What is a degree and leading coefficient?

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Polynomial Functions:

The standard symbolic form of an nth degree polynomial is given by

$$P(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0$$

$P(x) = 3x^9 - 2x^8 + 7x^6 - 4x^2 - x + 6$

While this general definition may at first seem complicated, the fact is that a polynomial is nothing more than the sum of simple terms, each of the form $a \cdot x^k$

$$P(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2 x^2 + a_1 x + a_0$$

(erase to show)

- A polynomial expressed in "**standard form**" has its terms written in order from **the highest power of x to the lowest power of x** .
- The value of a is called the **coefficient** of the term.
- The term that shows only a coefficient (i.e., a factor of x^k is not shown) is called the **constant** term.
- The largest power, *k*, that appears in the polynomial tells us the **degree** of the polynomial.
- The coefficient of the term with the largest power is called the **leading coefficient** .

An expression is a Polynomial Functions only if:

Exponents: **Whole Numbers**

x cannot be under a radical or in denominator

(erase to show)

Coefficients: **Real Numbers**

no imaginary #s

Example:

State whether the following function is a polynomial function or not. If it is, express it in standard form, then identify the degree, the leading coefficient and the constant term of each polynomial. If it is not, explain why.

A. $p(x) = -x^2 - 9 + \frac{8}{3}x^4 - \frac{5}{3}x + 7x^3$

Yes

$p(x) = \frac{8}{3}x^4 + 7x^3 - x^2 - \frac{5}{3}x - 9$

Degree	4
Leading Coefficient	$\frac{8}{3}$
Constant Term	-9

B. $q(x) = \left(\frac{1}{2}x + 5\right)(2x^2 + 6x)$

Yes

$1x^3 + 3x^2 + 10x^2 + 30x$

$q(x) = x^3 + 13x^2 + 30x + 0$

Degree	3
Leading Coefficient	1
Constant Term	0

C. $f(x) = 3x - \sqrt{5}x^4 + 1 - 2x^2$

Yes

$f(x) = -\sqrt{5}x^4 - 2x^2 + 3x + 1$

Degree	4
Leading Coefficient	$-\sqrt{5}$
Constant Term	1

D. $z(x) = \frac{2}{x^3} + \frac{1}{x^2} - \frac{5}{x}$

Not a polynomial, because exponents are not whole #s.

Degree	
Leading Coefficient	
Constant Term	

Yes

E. $r(x) = (1 - 4x^3)(1 + 4x^3)$

$1 + 4x^3 - 4x^3 - 16x^6$

$r(x) = -16x^6 + 1$

Degree	6
Leading Coefficient	-16
Constant Term	1

F. $t(x) = 7x^{-3} + 5x - 7$

Not a polynomial, because exponents are not whole #s.

Degree	
Leading Coefficient	
Constant Term	

Yes

G. $m(x) = -4x^2 - 8 + 10x^5 + \pi x^9$

$m(x) = \pi x^9 + 10x^5 - 4x^2 - 8$

Degree	9
Leading Coefficient	π
Constant Term	-8