2.2: Evaluate Polynomial Functions

- Vocabulary for Polynomials
- Use direct substitution to evaluate the polynomial function
- Use synthetic division to evaluate the polynomial function

Monomial: **a number, a variable, or a product of numbers and variables**

$4, \quad x, \quad 4x,$

Polynomial: an expression involving one or more monomials

Characteristics:
1) whole exponents
2) real coefficients
3) no division by variables

Are these expressions polynomials?

Y a.) $2x^2+4x-3$

Y b.) 0

N c.) $\frac{5}{x^2}$

Y d.) $\frac{x^2}{5}$

N e.) $\sqrt{x} = x^{1/2}$

Y f.) $-3x^2+4x^5$

Common Polynomial Functions

Degree	Type	Examples (in standard form)
0	Constant	$f(x) = 7$
1	Linear	$f(x) = 3x - 5$
+2	Quadratic	$f(x) = 2x^2 + 4x - 3$
3	Cubic	$f(x) = x^3 - 3x^2 + 4x - 8$
4	Quartic	$f(x) = x^4 + 3x^3 - 4x^2 - 3x + 1$
n	n^{th} degree polynomial	

Classifying by degree of largest exponent

p. 95

Classifying by number of terms

Monomial	1 term
Binomial	2 terms
Trinomial	3 terms
Polynomial	≥ 4 terms

Classify by the degree and the number of terms $(x+2)(x+2)$

a.) $4x - 27x^2 + \pi$

Quadratic trinomial

b.) $2x + 7$

linear binomial

c.) 30^4

constant monomial

d.) $(x+2)^2$

Quadratic trinomial

$x^2 + 4x + 4$

e.) $5x^6 - 3x^2 + 4x - 1$

6th degree polynomial

Standard form for a polynomial:

when the terms' exponents are in descending order

$$1 + 3x^4 - x + 2x^3$$

$$3x^4 + 2x^3 - x + 1$$

Leading coefficient: the coefficient of the term with the largest exponent

a.) $1 + 2x - 7x^3 + 3x^2$

leading coeff : -7

Use direct substitution to evaluate the polynomial function for the given value of x.

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

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

$= -8$

Use direct substitution to evaluate the polynomial function for the given value of x.

$$t(x) = 5x^4 + 2x - 8 \; ; \; x = -2$$

$$t(-2) = 5(-2)^4 + 2(-2) - 8$$

$$= 5 \cdot 16 + -4 - 8$$

$$= 80 - 4 - 8$$

$$= 68$$

Use direct substitution to evaluate the polynomial function for the given value of x.

$$g(x) = x^4 - 2x^3 + 3x^2 - 7 \; ; \; x = -2$$

$$g(-2) = (-2)^4 - 2(-2)^3 + 3(-2)^2 - 7$$

$$= 16 + 16 + 12 - 7$$

$$= 32 + 5$$

$$= 37$$

Use synthetic substitution to evaluate the polynomial function for the given value of x.

Make sure the polynomial is in standard form!
Consider if all terms are present

$t(x) = 5x^4 + 2x - 8 \quad ; \; x = -2$

-2	5	0	0	2	-8
	↓	-10	20	-40	76
	5	-10	20	-38	68

$t(-2) = 68$

Use synthetic substitution to evaluate the polynomial function for the given value of x.

$$g(x) = x^4 - 2x^3 + 3x^2 - 7 \quad ; \quad x = -2$$

-2	1	-2	3	0	-7
		-2	8	-22	44
	1	-4	11	-22	37

$$\boxed{g(-2) = 37}$$

Use synthetic substitution to evaluate the polynomial function for the given value of x.

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