Unit 2: Polynomials
Guided Notes

KEY
Name

Period

If found, please return to Mrs. Brandley's room, M-8.

Concept 1: Terms and Definitions of Polynomials

Word Bank: **constant** **variable** **leading coefficient** **polynomial** **term**

monomial **binomial** **trinomial** **degree** **operations**

standard form **degree of a polynomial** **coefficient** **like terms**

1. A variable is a symbol for a number we don't know yet.

Examples: x $3x^2$

Non-Examples: 3 $\boxed{7}x$

2. A term is a single number or variable, or numbers and variables multiplied together separated by addition or subtraction.

Examples: $\underline{3x} + \underline{7}$ $2x^2$

Non-Examples: $\underline{3x+3}$ $\underline{5}x$

3. A polynomial is an expression with constant(s) and/or variable(s) that are combined using addition, subtraction, multiplication, and whole number exponents.

Examples: $3x^2$ $7x^2-5x+2$

Non-Examples: $x^{1/2}-7$ $\sqrt{x3}+5$

4. A monomial is a polynomial with one term.

Examples: $3x^2$ 7 $-6y$

Non-Examples: $3x+2$ $7x^2-5x+1$

5. A binomial is two monomials combined together with addition or subtraction. It is a polynomial with two terms.

Examples: $x+5$ $3x^2-2$

Non-Examples: 5 x^2-5x+1

6. A trinomial is three monomials combined together with addition or subtraction. It is a polynomial with three terms.

Examples: x^2-5x+1

$-7x^3+2x-5$

Non-Examples: $3x$

$7x-5$

Generally when there are more than three terms in a polynomial, we just say that it is a polynomial with that number of terms. For example if the polynomial has four terms, we would say, "it is a polynomial with four terms."

7. The degree of a monomial is the sum of all the exponents on the variables within that term.

Examples: $7x^5$ $2x^2+1$

$3x^2y^5$

Non-Examples x^5-2x^2+1

$3x^2y^5$

8. When the monomials within a polynomial are organized by degree in descending order, the polynomial is said to be in Standard Form.

Examples: $3x^2-x+5$

x^6+3x^2-1

Non-Examples $x-3x^2+5$

$3x^2-1+x^6$

9. The degree of a polynomial is the degree of the highest degree monomial within that polynomial.

Examples: x^5-x^7+2

Non-Examples: x^6-x^7+2

10. A Coefficient is the numerical part of a monomial.

Examples: $3x$ $-7x^2$

Non-Examples: $3x$ $-7x$

Scanned by CamScanner

11. The leading coefficient is the numeric part of the monomial with the highest degree within a polynomial. When the polynomial is written in standard form, it is the coefficient of the leading term.

Examples: $\underline{5}x^2-3x+1$

Non-Examples: $5x^2\underline{-3}x+1$

12. A constant is a monomial that doesn't include any variables. It is strictly numeric.

Examples: 7 5 -2

Non-Examples $3x^2$ $-5y$

13. Two or more terms of a polynomial that have the exact same variables raised to the exact same exponents in the exact same combinations (once they are simplified) are said to be like terms

Examples: $3x$ & $7x$

$8y^3$ & $-9y^3$

Non-Examples $3x$ & $3y$

$4x^2$ & $-3x$

Within a polynomial we can add together two monomials if they are like terms.

14. Adding or subtracting more than one polynomial together are examples of operations that can be performed on polynomials, or more specifically, the terms (or monomials) within the polynomials that are like terms.

Examples: $+$ $-$ $\times$ $\div$

Non-Examples: $\sqrt{}$

Put the following polynomials in standard form:

15. $-3+4x^5$

$4x^5-3$

16. $4+8x^3-2x^2+3x$

$8x^3-2x^2+3x+4$

17. $3x^3-2+8x^5-6x^2$

$8x^5+3x^3-6x^2-2$

Name each polynomial by degree and number of terms. Identify its' leading coefficient and constant.

Example: $4x^2 + 5$ 2nd degree binomial. LC: 4 C: 5

18. $3x^4$ 4th degree monomial LC: 3 C: 0

19. $5x^2 - 6x + 1$ 2nd degree trinomial LC: 5 C: 1

20. $x^5 - 6$ 5th degree binomial LC: 1 C: -6

21. $9 + 7x^3 - 4x$ 3rd degree trinomial LC: 7 C: 9

Remember: integers are the whole numbers and their opposites {...-4, -3, -2, -1, 0, 1, 2, 3, 4...}

22. Pick two integers and write them here: 7 and -3

a. Add them: 7 + -3 = 4

b. Subtract them: 7 – -3 = 10

c. Multiply them: 7 x -3 = -21

d. Divide them: 7 ÷ -3 = -7/3

23. What does it mean that the integers are **closed** under addition, subtraction, and multiplication?

When you add, subtract, or multiply any two integers, the resulting answer is an integer.

24. What does it mean that the integers are not closed under division? Show an example.

It is possible to divide two integers and have the answer not be an integer.
EX: 1/2

Throughout this unit, try to discover if polynomials are closed under any operations and if so, which ones.

Concept 2: Adding Polynomials

Add the following:

1. $7 + 9 =$ 16 2. $3x + (-7x) =$ $-4x$ 3. $-4x^2 + 8x^2 =$ $4x^2$ 4. $6x^3 + (-2x^3) =$ $4x^3$

5. $(6x^3 - 4x^2 + 3x + 7) + (-2x^3 + 8x^2 - 7x + 9) =$ $4x^3 + 4x^2 - 4x + 16$

Try the following examples with your group, with a partner, or by yourself:

6. $(x^3 - 2x^2 + 9x) + (-7x + 9) =$ $x^3 - 2x^2 + 2x + 9$

7. $(-8x^2 + 3x + 6) + (-2x^3 + 5x^2 + x - 4) =$ $-2x^3 - 3x^2 + 4x + 2$

8. $(6x^3 - 2x^2 + x + 3) + (-4x^3 + 8x^2 - 5x + 6) =$ $2x^3 + 6x^2 - 4x + 9$

9. Are polynomials closed under addition? YES NO

Subtracting Polynomials

Subtract the following:

10. $7 - (-3) =$ 10 11. $2x - (-8x) =$ $10x$ 12. $3x^2 - 2x^2 =$ x^2

13. $(3x^2 + 2x + 7) - (2x^2 - 8x - 3) =$ $x^2 + 10x + 10$

Try the following examples with your group, with a partner, or by yourself:

14. $(x^3 - 4x^2 + 9x) - (-7x + 5) =$ $x^3 - 4x^2 + 16x - 5$

15. $(-8x^2 + 3x + 6) - (-5x^3 + 2x^2 + x - 7) =$ $5x^3 - 10x^2 + 2x + 15$

16. $(7x^3 - 2x^2 + 3x + 6) - (9x^3 + 3x^2 - 7x + 2) =$ $-2x^3 - 5x^2 + 10x + 4$

17. Are polynomials closed under subtraction? YES NO

Concept 3: Multiplying Polynomials

Multiplying Monomials

1. $7 \times 9 =$ 63 2. $x^2 \times x^7 =$ x^9 3. $3x^5 \times 4 =$ $12x^5$ 4 $6x^3 \times 3x^5 =$ $18x^8$

Multiplying a Monomial and Binomial or Trinomial

5. $8(x^3 - 4x) =$ $8x^3 - 32x$

6. $4x^2(3x^3 + 6x^2 - 2x + 5) =$ $12x^5 + 24x^4 - 8x^3 + 20x^2$

Multiplying Binomials

7. $(x + 3)(x - 4) =$ $x^2 + 3x - 4x - 12$

8. $(4x^2 + 4)(3x - 2) =$ $12x^3 - 8x^2 + 12x - 8$

Multiplying a Binomial and Trinomial

9. $(x + 3)(4x^2 + 7x - 1) =$ $4x^3 + 7x^2 - x + 12x^2 + 21x - 3$

$= 4x^3 + 19x^2 + 20x - 3$

10. $(2x^2 + 3)(x^2 + 3x - 4) =$ $2x^4 + 6x^3 - 8x^2 + 3x^2 + 9x - 12$

$= 2x^4 + 6x^3 - 5x^2 + 9x - 12$

Multiplying Trinomials

11. $(x^2 - 5x + 4)(3x^2 - 2x - 2) =$ $3x^4 - 17x^3 + 20x^2 + 2x - 8$

12. $(3x^3 - 2x^2 + 7)(4x^2 + x - 3) =$ $12x^5 - 5x^4 - 11x^3 + 34x^2 + 7x$

13. Are polynomials closed under multiplication? YES NO

Concept 4: Dividing Polynomials

4th grade Flashback: Long division

1. $656 \div 4$ $4\overline{)656}$ = 164; 4, 25, 24, 16 — **164**

2. $487 \div 32$ $32\overline{)487}$ = 015; 32, 167, 160, 7 — **15 R 7**, **15 7/32**

3. $528 \div 24$ $24\overline{)528}$ = 022; 48, 48, 48, 0 — **22**

Polynomial Long Division

4. $(20x^2 + 4x) \div 4x$

$4x\overline{)20x^2+4x}$ = $5x+1$

$20x^2$

$0+4x$

$4x$

0

5. $(p^3 + 6p^2 + p - 2) \div (p + 1)$

$p+1\overline{)p^3+6p^2+p-2}$ = $p^2+5p-4+\frac{2}{p+1}$

p^3+p^2

$5p^2+p$

$5p^2+5p$

$-4p-2$

$-4p-4$

2

6. $(5b^5 - b^4 - 15b + 6) \div (5b - 1)$

$5b-1\overline{)5b^5-b^4-15b+6}$ = $b^4-3+\frac{3}{5b-1}$

$5b^5-b^4$

$-15b+6$

$-15b+3$

3

Synthetic Division

7. ~~$(20x^2 + 4x + x)$~~ $\div 4x$ 8. $(p^3 + 6p^2 + p - 2) \div (p + 1)$ 9. $(5b^5 - b^4 - 15b + 6) \div (5b - 1)$

-1	1	6	1	-2
		-1	-5	4
	1	5	-4	2

$p^2+5p-4+\frac{2}{p+1}$

When can you use synthetic division?

1st degree polynomial & a=1