DeSoto
COUNTY SCHOOLS

Algebra 2

Week 3

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples

MONOMIALS

- A **monomial** is a number, variable, or a product of numbers and variables.
- Examples: $4,\ 7x,\ 3x^2$
- Use the **EXPONENT RULES** to simplify monomial expressions:

NAME	RULE	EXAMPLE
Product Rule	$a^m \cdot a^n = a^{m+n}$	$x^2 \cdot x^7 = x^9$
Power Rule	$(a^m)^n = a^{m \cdot n}$	$(x^2)^7 = x^{14}$
Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{x^7}{x^2} = x^5$
Negative Exponent Rule	$a^{-m} = \frac{1}{a^m}$	$x^{-2} = \frac{1}{x^2}$
Zero Exponent Rule	$a^0 = 1$ $(0^0 = \text{undefined})$	$(7x^2)^0 = 1$

When **ADDING OR SUBTRACTING** monomials, **COMBINE LIKE TERMS!**

EXAMPLES

1. $5x^2 \cdot -7x^6$

$-35x^8$

2. $(-2a^3b)^2 \cdot 8ab^9$

$4a^6b^2 \cdot 8ab^9$

$32a^7b^{11}$

3. $\frac{54m^6n^4}{3m^2n} - 10m^4n^3$

$18m^4n^3 - 10m^4n^3$

$8m^4n^3$

4. $2k^4 \cdot 10k^{-7}$

$20k^{-3}$

$\frac{20}{k^3}$

5. $\left(\frac{2}{3}r^2s^7\right)^2 \cdot \left(\frac{1}{6}r^3s\right)$

$\frac{4}{9}r^4s^{14} \cdot \frac{1}{6}r^3s$

$= \frac{2}{27}r^7s^{15}$

6. $\left(\frac{14w^{12}}{7w^3}\right)^{-1}$

$\frac{7w^3}{14w^{12}}$

$\frac{1}{2w^9}$

7. $\frac{15x^{10}y^4}{24x^{12}y^3}$

$\frac{5x^{-2}y}{8}$

$\frac{5y}{8x^2}$

8. $\left(\frac{c}{c^2}\right)^4 \cdot (-3c)^4$

$\frac{c^4}{c^8} \cdot 81c^4$

81

9. Give an example of two monomials with a quotient of $\frac{-3n^2}{m}$

$\frac{-36m^4n^7}{12m^5n^5}$

POLYNOMIALS

- A **polynomial** is the sum or difference of many monomials.
- The **highest exponent** of a polynomial is called the degree.
- **Standard Form:** Always write with exponents in descending order!

Write the polynomials below in standard form:

10. $-k^5-1+8k-3k^3+\frac{1}{4}k^2$ $-k^5-3k^3+\frac{1}{4}k^2+8k-1$

11. $18a^2b^2+7ab-b^2+4a^3$ $4a^3+18a^2b^2+7ab-b^2$

12. $5xy^2-x^2+9x^3y-y^4+2$ $9x^3y-x^2+5xy^2-y^4+2$

CLASSIFYING POLYNOMIALS

Degree	
0	Constant
1	linear
2	quadratic
3	Cubic
4	quartic
5	quintic

Number of Terms	
1	monomial
2	binomial
3	trinomial
4+	polynomial

Polynomials are **classifed by degree** (highest exponent) and **number of terms**. Use the charts to the left to classify each polynomial below.

13. $-3x+1$ linear, binomial

14. $9x^5-x^4+2x$ quintic, trinomial

15. 24 Constant, monomial

16. $\frac{1}{2}x^3-2x^2+4x+15$ Cubic, polynomial

17. $-x^2-18x+31$ quadratic, trinomial

18. $-\frac{3}{2}x^4$ quartic, monomial

19. Give an example of a cubic binomial. $\frac{3}{5}x^3+\frac{7}{6}x$

20. Give an example of a linear monomial. $-5x$

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Adding & Subtracting Polynomials

① **COMBINE LIKE TERMS!** (Watch out for subtraction problems!)

② Write your answer in **STANDARD FORM.**

1. $(3x^2+11x+4)+(-5x+x^2-13)$

$4x^2+6x-9$

2. $(9n^3-4n^2+2n-10)+(-2n^2+n+7)$

$9n^3-6n^2+3n-3$

3. $(5k^3-2k^2+2k)-(2k^2+2k+17)$

$5k^3-4k^2+17$

4. $(y+4y^2-3)-(1+2y^2-5y-y^3)$

y^3+2y^2+6y-4

5. Subtract $(-10ab+7a^2-b^2)$ from $(8b^2+ab-2a^2)$.

$(8b^2+ab-2a^2)-(-10ab+7a^2-b^2)$

$= \boxed{-9a^2+11ab+9b^2}$

Multiplying Polynomials

① **DISTRIBUTE** or **FOIL.**

② **COMBINE LIKE TERMS!**

③ Write your answer in **STANDARD FORM.**

6. $(w-7)(w^2+2w+1)$

$w^3+2w^2+w-7w^2-14w-7$

$= \boxed{w^3-5w^2-13w-7}$

7. $(2x+1)(4-9x)-2x(3x+11)$

$8x-18x^2+4-9x-6x^2-22x$

$= \boxed{-24x^2-23x+4}$

8. $-3(a+5)(a-2)(a+8)$

$(-3a-15)(a^2+6a-16)$

$=-3a^3-18a^2+48a-15a^2-90a+240$

$= \boxed{-3a^3-33a^2-42a+240}$

9. $(2c+5d)^3$

$(2c+5d)(2c+5d)(2c+5d)$

$=(2c+5d)(4c^2+20cd+25d^2)$

$=8c^3+40c^2d+50cd^2+20c^2d+100cd^2+125d^3$

$= \boxed{8c^3+60c^2d+150cd^2+125d^3}$

Name: _____ **Unit 5:** Polynomial Functions

Date: _____ **Bell:** _____ **Homework 1:** Monomials & Polynomials

Directions: Simplify the monomials below. Final answers should contain positive exponents only.

1. Subtract $-3n^2$ from $-7n^2$

2. $(-8x^4y^3)\cdot(2x^5y^2)+7x^9y^5$

3. $(-4a^3b^2)^2\cdot(3a^2b)$

4. $5c^{-7}d^2\cdot(-cd^2)^4$

5. $\dfrac{18w^4x^9}{14w^5x^5}$

6. $\dfrac{15x^2y\cdot -6x^7y}{(3xy)^2}$

7. Write two monomials with a product of $-84a^6b^{10}$.

8. The side length of a cube can be represented by the expression $2x^5$. If the side length is doubled, write an expression to represent the new volume of the cube.

Directions: Write in standard form if needed, then classify the polynomial.

9. $25-9m^2-m+4m^3$

10. $-\dfrac{1}{2}k^3+\dfrac{3}{4}k^5$

11. $14y^2-x^2-3xy$

12. $9x$

Directions: Simplify. Final answers should be written in standard form.

13. $(8x^3-6x^4+3)-(3x^3-3+8x^4)$

14. $(2a^2b-5b^3+4a^4b^2)-(7b^3+8a^4b^2-7a^2b)$

15. $-3x(5x+1)(8-2x)$

16. $(a+b)(3a-b)(2a+7b)$

17. $(1-2n)^3-7n(n^2-2)$

18. $4(2-3w)(w^2-2w+10)$

19. $\dfrac{-42x^{10}y^5+12x^8y^3-6x^2y}{6x^2y}$

20. $\dfrac{16a^4-40a^2+24a}{12a^3}$

21. The length, width, and height of a rectangular prism can be represented by the expressions $(x + 3)$, $(x + 7)$ and $(x - 1)$. Write an expression to represent the surface area of the prism.

22. The area of a triangle can be represented by the expression $14x^5 + 63x^2$. If the base is $7x^2$, write an expression to represent its height.

FACTORING GUIDE

Check for a **GCF** first!

2 terms

DIFFERENCE OF SQUARES

$a^2 - b^2$

$(a+b)(a-b)$

$y^2 - 9 = (x+3)(x-3)$

$16x^4 - 25 = (4x^2+5)(4x^2-5)$

$48x^2 - 3 = 3(16x^2-1) = 3(4x+1)(4x-1)$

SUM OF CUBES

$a^3 + b^3$

$(a+b)(a^2-ab+b^2)$

$x^3+27 = (x+3)(x^2+3x+9)$

$8x^6+1 = (2x^2+1)(4x^4-2x^2+1)$

$216x^3 + 125y^3 = (6x+5y)(36x^2-30xy+25y^2)$

DIFFERENCE OF CUBES

$a^3 - b^3$

$(a-b)(a^2+ab+b^2)$

$64 - x^3 = (4-x)(16+4x+x^2)$

$27x^3 - 8 = (3x-2)(9x^2+6x+4)$

$512x^3 - 8 = 8(64x^3-1) = 8(4x-1)(16x^2+4x+1)$

3 terms

TRINOMIALS $(a = 1)$

multiplies to "c", adds to "b"

$x^2 - 6x + 5 = (x-5)(x-1)$

$3x^2 + 3x - 60 = 3(x^2+x-20) = 3(x+5)(x-4)$

TRINOMIALS $(a > 1)$

multiplies to "a·c", adds to "b"

$2x^2 + 15x - 77 = (2x-7)(x+11)$

$6x^2 - 13x - 28 = (2x-7)(3x+4)$

$9x^2 + 30x + 25 = (3x+5)(3x+5)$

4 terms

TRY GROUPING!

find gcf of each part, then factor binomials

$x^3 - 2x^2 + 6x - 12 = x^2(x-2) + 6(x-2) = (x^2+6)(x-2)$

$x^3 + x^2 - 9x - 9 = x^2(x+1) - 9(x+1) = (x^2-9)(x+1) = (x+3)(x-3)(x+1)$

Group Members:	Per: _____

Review: Factoring Polynomials

Directions: Work together to factor each polynomial **completely**! Do not divide up the work! Each person should be participating. At the end of class, one person's paper will be chosen at random and graded for the group.

2 terms

1. $8a^3 + 1$	**2.** $x^4 - 100y^2$
3. $m^3 - 64$	**4.** $27w^5 - 75w$
5. $125c^4 + cd^3$	**6.** $p^6q^4 - q^7$
7. $5a^4 - 245$	**8.** $10x^8y^2 + 80x^2y^5$

3 terms

9. $x^4 + 2x^2 - 63$	**10.** $a^4 - 3a^2 + 2$

11. $x^3 - 12x^2 + 36x$	**12.** $2m^4 - 10m^2 - 28$
13. $5x^4 - 10x^2 - 315$	**14.** $3u^5 - 9u^3 - 84u$
15. $3a^4 + 16a^2 + 20$	**16.** $8n^4 - 2n^2 - 1$

4 terms

17. $x^3 - 2x^2 + x - 2$	**18.** $6b^3 - 3b^2 + 4b - 2$
19. $2w^3 + 3w^2 - 6w - 9$	**20.** $x^5 + 5x^2 - 4x^3 - 20$

Name: _____ **Unit 5:** Polynomial Functions

Date: _____ **Bell:** _____ **Homework 4:** Factoring Polynomials

Directions: Complete the following rules.

1. Difference of Squares: $a^2 - b^2 =$ _____

2. Sum of Cubes: $a^3 + b^3 =$ _____

3. Difference of Cubes: $a^3 - b^3 =$ _____

4. How can you tell if you have completely factored a polynomial? _____

_____

Directions: Factor each polynomial **completely.** Make sure to check for a **GCF** first.

5. $x^4 - 36$	**6.** $64c^3 + 1$
7. $k^3 - 27$	**8.** $54x^3 + 250y^3$
9. $3m^4 - 48n^2$	**10.** $a^7b^2 - ab^2$
11. $x^3y^2 - 343y^5$	**12.** $9y^7 - 144y$

To **simplify rational expressions**, find factors in the numerator and denominator that are the same and then write them as fractions equal to 1. For example,

$$\frac{6}{6}=1 \qquad \frac{x^2}{x^2}=1 \qquad \frac{(x+2)}{(x+2)}=1 \qquad \frac{(3x-2)}{(3x-2)}=1$$

Notice that the last two examples involved binomial sums and differences. **Only** when sums or differences are **exactly** the same does the fraction equal 1. The rational expressions below **cannot** be simplified:

$$\frac{(6+5)}{6} \qquad \frac{x^3+y}{x^3} \qquad \frac{x}{x+2} \qquad \frac{3x-2}{2}$$

As shown in the examples below, most problems that involve simplifying rational expressions will require that you **factor** the numerator and denominator.

Note that in all cases we assume the denominator does not equal zero, so in Example 4 below the simplification is only valid provided $x \neq -6$ or 2. For more information, see examples 1 and 2 in the Math Notes box in Lesson 3.2.4.

One other special situation is shown in the following examples:

$$\frac{-2}{2}=-1 \qquad \frac{-x}{x}=-1 \qquad \frac{-x-2}{x+2} \Rightarrow \frac{-(x+2)}{x+2} \Rightarrow -1 \qquad \frac{5-x}{x-5} \Rightarrow \frac{-(x-5)}{x-5} \Rightarrow -1$$

Again assume the denominator does not equal zero.

Example 1

$$\frac{12}{54}=\frac{2\cdot 2\cdot 3}{2\cdot 3\cdot 3\cdot 3}=\frac{2}{9} \text{ since } \frac{2}{2}=\frac{3}{3}=1$$

Example 2

$$\frac{6x^3y^2}{15x^2y^4}=\frac{2\cdot 3\cdot x^2\cdot x\cdot y^2}{5\cdot 3\cdot x^2\cdot y^2\cdot y^2}=\frac{2x}{5y^2}$$

Example 3

$$\frac{12(x-1)^3(x+2)}{3(x-1)^2(x+2)^2}=\frac{4\cdot 3(x-1)^2(x-1)(x+2)}{3(x-1)^2(x+2)(x+2)}$$

$$=\frac{4(x-1)}{(x+2)} \text{ since } \frac{3}{3}, \frac{(x-1)^2}{(x-1)^2}, \text{ and } \frac{x+2}{x+2}=1$$

Example 4

$$\frac{x^2-6x+8}{x^2+4x-12}=\frac{(x-4)(x-2)}{(x+6)(x-2)}$$

$$=\frac{(x-4)}{(x+6)} \text{ since } \frac{(x-2)}{(x-2)}=1$$

Problems

Simplify each of the following expressions completely. Assume the denominator does not equal zero.

1. $\dfrac{2(x+3)}{4(x-2)}$
2. $\dfrac{2(x-3)}{6(x+2)}$
3. $\dfrac{2(x+3)(x-2)}{6(x-2)(x+2)}$
4. $\dfrac{4(x-3)(x-5)}{6(x-3)(x+2)}$
5. $\dfrac{3(x-3)(4-x)}{15(x+3)(x-4)}$
6. $\dfrac{15(x-1)(7-x)}{25(x+1)(x-7)}$
7. $\dfrac{24(y-4)(y-6)}{16(y+6)(6-y)}$
8. $\dfrac{36(y+4)(y-16)}{32(y+16)(16-y)}$
9. $\dfrac{(x+3)^2(x-2)^4}{(x+3)^4(x-2)^3}$
10. $\dfrac{(5-x)^2(x-2)^2}{(x+5)^4(x-2)^3}$
11. $\dfrac{(5-x)^4(3x-1)^2}{(x-5)^4(3x-2)^3}$
12. $\dfrac{12(x-7)(x+2)^4}{20(x-7)^2(x+2)^5}$
13. $\dfrac{x^2+5x+6}{x^2+x-6}$
14. $\dfrac{2x^2+x-3}{x^2+4x-5}$
15. $\dfrac{x^2+4x}{2x+8}$
16. $\dfrac{24(3x-7)(x+1)^6}{20(3x-7)^3(x+1)^5}$
17. $\dfrac{x^2-1}{(x+1)(x-2)}$
18. $\dfrac{x^2-4}{(x+1)^2(x-2)}$
19. $\dfrac{x^2-4}{x^2+x-6}$
20. $\dfrac{x^2-16}{x^3+9x^2+20x}$
21. $\dfrac{2x^2-x-10}{3x^2+7x+2}$

Fractions

Name _____

Date _____ Period _____

Reduce each fraction to lowest terms. Assume no denominator is 0.

1. $\frac{r(t+2)}{r(t-7)}$ $\frac{t+2}{t-7}$

2. $\frac{a(b+1)}{a(b-1)}$

3. $\frac{m(n+t)}{n(n+t)}$

4. $\frac{c(r+s)}{d(r+s)}$

5. $\frac{3x+xy}{4x+xy}$

6. $\frac{2y+xy}{3y+xy}$

7. $\frac{ab+ac}{b^2+bc}$

8. $\frac{mx-my}{nx-ny}$

9. $\frac{6x+21}{8x+28}$

10. $\frac{27y-81}{15y-45}$

11. $\frac{3a^2bm-a^2bn}{2a^2bm+a^2bn}$

12. $\frac{3xmn^2-2mn^2}{3xmn^2+2mn^2}$

13. $\frac{15x^4y^2+6x^3y^2}{6x^4y^2-15x^3y^3}$

14. $\frac{15a^3b+10a^2b^2}{10a^3b-25a^2b^2}$

15. $\frac{42x^3y^4+18x^2y^6}{18x^3y^4-12x^2y^6}$

16. $\frac{27m^2n^5-63mn^7}{18m^2n^5+27mn^7}$

17. $\frac{5a^2-25a}{35a-7a^2}$

18. $\frac{10bx-30by}{27by-9bx}$

19. $\frac{30x^2y^2-20x^2y}{14xy^2-21xy^3}$

20. $\frac{120a^3b^2n-75a^3b^2m}{40abm-64abn}$

21. $\frac{12abx^2+6abx-30ab}{36a^2bx^2-12a^2bx+108a^2b}$

22. $\frac{36m^2nx^2+84m^2nx-24m^2n}{18mn^2x^2-81mn^2x+27mn^2}$

23. $\frac{r^2-3r-10}{r^2-r-6}$

24. $\frac{m^2+5m-24}{m^2+3m-40}$

25. $\frac{2p^2-pq-3q^2}{6p^2-11p+3q^2}$

26. $\frac{3a^2-5a-2}{3a^2-14a-5}$