DeSoto
COUNTY SCHOOLS

Semester Algebra I

Week 6

Name: _____ Date: _____

Combining Like Terms
Algebra 1

We have already seen the process of combining like terms when solving linear equations. In this lesson we will broaden our understanding of what constitutes like terms and how to combine them. First, we review the reasoning process behind combining like linear terms.

Exercise #1: Fill in the blanks for each with the real number property that justifies the particular step.

(1) $6x+2y+3x+4y=6x+3x+2y+4y$ (1) _____

(2) $=(6+3)x+(2+4)y$ (2) _____

$=9x+6y$

Exercise #2: Combine each of the following like terms using the Distributive Property.

(a) $2x+7x=$ (b) $-5x^2y+2x^2y=$ (c) $5x^2+6x+3x^2+4x=$

Clearly **like terms** are those **monomials** in an expression that have the same variables raised to the same power. We should be able to combine them mentally by first identifying like terms and then summing all coefficients of those terms.

Exercise #3: Combine all like terms in the following expressions.

(a) $8x+4-6x-7$ (b) $4y^2-20+3y^2+5$ (c) $3w-2(3-5w)$

(d) $2x^2+3x-7+5x^2-8x+3$ (e) $-3x^2+9x-6+4x^2-2x-8$

Exercise #4: Which of the following expressions cannot be simplified?

(1) $3x+6x$ (3) $3x+6y$

(2) $6y-3y$ (4) $2x^2+7x^2$

_____

We will oftentimes be asked to combine terms either in sums or differences. Differences can be particularly tricky because subtraction is not **commutative**, meaning the order in which you do the subtraction will change the result.

Exercise #5: Which of the following represents the sum of $\left(3x^2-3x+8\right)$ and $\left(-5x^2+4x+2\right)$?

(1) $-8x^2-x+10$ (3) $2x^2-x+10$

(2) $-2x^2+x+10$ (4) $8x^2-7x+6$ _____

Exercise #6: From $\left(7x^2+8x-3\right)$ subtract $\left(4x^2-5x+6\right)$.

(1) $3x^2+3x+3$ (3) $11x^2+13x+3$

(2) $-3x^2+3x+9$ (4) $3x^2+13x-9$ _____

Exercise #7: When $\left(4x^2-8x-3\right)$ is subtracted from $\left(x^2-2x+1\right)$ the result is

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

(2) $3x^2+6x-2$ (4) $-3x^2-6x-2$ _____

Additional Classroom Practice

Simplify by combining.

1. $5x+2y-8x+7y=$

2. $(2x-4)+(5x+9)=$

3. $(2x-y)-(5x+y)=$

4. $3x^2+4x+2+2x^2-5x-1=$

5. $3x^2-5x+1-4x^2+2x+3=$

6. $5x^2+8x-\left(3x^2-2x\right)=$

7. $\left(x^2-2x\right)-\left(3x^2-7x\right)=$

8. From $4x^2+2x-3$ subtract x^2-3.

9. Add
$$\begin{array}{r} 4a^2+2ab+3b^2 \\ \underline{-a^2-3ab+b^2} \end{array}$$

10. Subtract
$$\begin{array}{r} 3y^2+4y-5 \\ \underline{5y^2-2y+1} \end{array}$$

11. $4x^2-\left(6x-\left(3x-2x^2\right)+4\right)=$

12. How much less than $5x^2-3x+2$ is $2x^2+5$?

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Combining Like Terms
Algebra 1 Homework

Skill

Combine as indicated.

1. $9x+7+2x-4=$

2. $4x-3-(3x-2)=$

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

4. $4t-3t^2+5+(-2t^2+3t-5)=$

5. $(12t-9)-(5t-3)=$

6. $(a-6b)-(4a+8b)=$

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

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

9. $y^2+3y^4-5y^2+6y^4=$

10. $5x^2-4xy+6y^2-x^2+3xy+2y^2+xy=$

11. $a^2+3a+5+2a^2-4a-1-5a^2+2a=$

12. $-r^2s^2+2t^2v^2-6r^2s^2-5t^2v^2=$

13. $a+8c+5b-c-8a-5b=$

14. $[-4y+(10-5y)]+2-y=$

15. combine: $2x+4, -3x+2, 5+x$

16. combine: $a^2-5a+25; -a^2+6a+9$

17. combine: $y^3-4y^2z+5yz^2, -2yz^2-4y^3+y^2z$

18. Sum: $-6x^2+3y^2, -4y^2-4xy, 6xy-3x^2+5y^2$

19. Subtract $5x+3y$ from $4x+y$

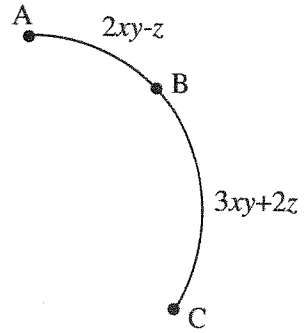
20. From $5x+3y$ subtract $4x+y$

Applications

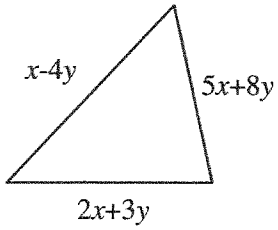
21. Represent the perimeter of a square whose side length is given by the binomial $4x+6$.

22. Represent the perimeter of a rectangle whose width is y and whose length is the binomial $2y-7$.

23. Write the length of the arc $\widehat{ABC}$ as a binomial involving x, y, and z.



24. Express the perimeter of the triangle as a binomial.



25. The perimeter of a triangle is given by the expression $12x^2-4x+15$. Find the third side of the triangle if the other two sides measure $4x^2+3$ and $5x-4$.

Reasoning

26. Recall that two expressions are additive inverses if their sum is equal to zero. Find the additive inverse for each of the following:

(a) $7x-4$ (b) c^2-4c+5

27. What is $-3a+5b$ decreased by $9a+2b$

28. By how much does $4x-3$ exceed $7x+5$?

29. How much greater than x^2-xy is $5x^2+10xy$?

30. What expression must be added to $3x^2-5x+4$ to give the result $7x^2-5x-6$?

31. From the sum of $6x-5$ and $2x+4$ subtract $3x-9$

32. Subtract the sum of $2x^2-3x+4$ and x^2+2x-1 from $6x^2-2x+1$

33. $\left(y^2-4y\right)+\left(6+9y\right)-\left(2y^2-4\right)=$

34. $\left(4x^2y+2xy-3xy^2\right)-\left(4x^2y-4xy+2x^2y\right)$

35. $\left(x^3+3x^2-5x+6\right)-\left(3x^3+8x^2+8\right)$

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Multiplying a Polynomial by a Monomial
Algebra 1

In the previous lessons, you've worked with monomials and their exponent properties. In this lesson we will begin to work with **polynomials**, or expressions that contain more than one monomial. The most common polynomials are **binomials** (those with two monomial terms) and **trinomials** (those with three monomial terms). First, we review the important real number properties associated with multiplying monomials.

Exercise #1: Fill in the blanks for each of the following with the real number property that justifies the particular step.

(1) $(3x^2y)(5x^3y^2) = 3\cdot 5\cdot x^2\cdot x^3\cdot y\cdot y^2$ (1)_____

(2) $= (3\cdot 5)\cdot(x^2\cdot x^3)\cdot(y\cdot y^2)$ (2)_____

(3) $= 15x^5y^3$ (3) Exponent Property of Multiplication

Exercise #2: Simplify each of the following products using real number properties like in Exercise #1.

(a) $(2x^3)(3xy) =$ (b) $(-4y^3z)(2yz^5) =$ (c) $(3abc^2)(2a^2b) =$

Clearly, we would like to be able to do this multiplication without going through each of these steps. It should be clear from the last exercise that you can simply multiply the coefficients together and then add powers on like bases.

Exercise #3: Find the following products.

(a) $(4x^2y^3)(2xy^5) =$ (b) $(5r^2s)(2rs^2) =$ (c) $(-3pt^3)(-6p^2t^2) =$

We now need to be able to multiply polynomials by monomials. You have actually done this before, as the following exercise will illustrate.

Exercise #4: Rewrite the following without parentheses by applying the Distributive Property.

(a) $5(x+4) =$ (b) $-3(2x-7) =$ (c) $-(6-3x) =$

Multiplying monomials with variables over polynomials uses the Distributive Property in the same way.

Exercise #5: Rewrite the following products without parentheses by applying the Distributive Property.

(a) $2x(3x+4)$ (b) $3(2x^2+5x-4)$ (c) $3ab(a^2b+2ab^2)$

Additional Classroom Exercises

Find the product:

1. $(2x^2y)(-x^2y)=$
2. $(3yt)(2y^3t)=$
3. $(5ab^2c)(4a^3b^3c)=$
4. $(-2x^4y^3)(-xy^2)=$
5. $(7p^3r^2t)(3pr^4t^2)=$
6. $(-4r^3x^2)(3r^4x)=$
7. $3(2x-5)=$
8. $-6(x+4)=$
9. $3x(2x+9)=$
10. $5x(x-3)=$
11. $-(x^2-4x+7)=$
12. $2x(5x+7)=$
13. $5ab(4a^2b+2ab-4a)=$
14. $4x^2(5x-4+2x^2)=$
15. $2xy^3(3x^2+4xy-y^2)=$

Distribute and Combine Like Terms:

16. $5x(3x-2)-x(1-3x)=$
17. $3x(2x-7)+2(2x-7)=$
18. $x(x+5)-2(x+5)=$
19. $x(x-3)-3(x-3)=$
20. $x(x+y)-y(x+y)=$

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Multiplying a Polynomial by a Monomial
Algebra 1 Homework

Skill

Find the product:

1. $(6xy)(-2z) =$

2. $(5a^2)(-5a) =$

3. $(-7x^3)(x) =$

4. $(2r^2s^3)(-4r^3s) =$

5. $(-\frac{1}{4}d^2)(24ad) =$

6. $(-2x)^2 =$

7. $(3a^2b)^2 =$

8. $5x(2x-8) =$

9. $6x(3x-\frac{1}{3}) =$

10. $-8\left(\frac{3}{4}x-\frac{1}{2}\right) =$

11. $14\left(\frac{2}{7}p-\frac{1}{2}p^2\right) =$

12. $2ab(6a^3-3b^2) =$

13. $2(x^2-2x+4) =$

14. $3(x^2-2x-8) =$

15. $3x(2x-9) =$

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

Distribute and Combine Like Terms:

17. $4-3(2x+5) =$

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

19. $(3x^2+8x-5)-(-2x^2+4x-10) =$

20. $x(x+7)+4(x+7) =$

21. $2x(3x-4)+5(3x-4) =$

22. $a(a-b)+b(a-b) =$

23. $2x^2(x+4)-3x(5x+1) =$

24. $4x(4x+3)+3(4x+3) =$

Applications

25. If the length of a square can be represented by the monomial $3x$ then:

(a) Express the perimeter of the square as a monomial in terms of x.

(b) Express the area of the square as a monomial in terms of x.

26. The width of a rectangle is represented by w. The length is three more than twice the width.

(a) Express the perimeter of the rectangle as a binomial in terms of w.

(b) Express the area of the rectangle as a binomial in terms of w.

Reasoning

27. Simplify each of the following if possible. If not possible, explain why.

(a) $x^3 + x^4 =$

(b) $x^3 \cdot x^4 =$

(c) $x^4 - x^3 =$

(d) $\dfrac{x^4}{x^3} =$

28. Determine each of the following products by writing them out in an expanded product form. The first is done as an illustration for you.

(a) $\left(x^2\right)^3 = x^2 \cdot x^2 \cdot x^2$

$= x^{2+2+2}$

$= x^{3(2)}$

$= x^6$

(b) $\left(x^3\right)^3 =$

(c) $\left(x^5\right)^2 =$

(d) $\left(x^4\right)^3 =$

29. Fill in the blank for the following Exponent Property:

$$\left(x^a\right)^b = x^{(\_\_\_\_\_)}$$