LESSON 18 Like Terms • Addition of Like Terms

18.A like terms

Like terms are terms that have the same variables in the same form or in equivalent forms so that the terms (excluding numerical coefficients) **represent the same number regardless of the nonzero values assigned to the variables.** Let us look at the indicated sum of terms

$$4xmp - 2pmx + 6mxp$$

Now whether terms are **like terms** or not does not depend on the signs of the terms or on the values of the numerical coefficients. So we will not consider the + and − signs or the numbers 4, 2, and 6. We just need to know if

$$xmp, \quad pmx, \quad \text{and} \quad mxp$$

are in the same form or equivalent forms and if each expression represents the same number regardless of the nonzero values that are assigned to the variables. We state the following:

1. They are in equivalent forms, for they have the same variables in the form of an indicated product, and the order of multiplication of the factors does not affect the value of the product.
2. They represent the same number regardless of the nonzero values assigned to the variables.

We will not attempt to prove the second statement but will demonstrate it with one set of values for the variables. If we let $x = 4$, $m = 2$, and $p = 6$, we have

xmp	pmx	mxp
$4 \cdot 2 \cdot 6$	$6 \cdot 2 \cdot 4$	$2 \cdot 4 \cdot 6$
48	48	48

Thus, $4xmp$, $-2pmx$, and $6mxp$ are like terms because the variables represent the same number regardless of the nonzero real number replacements used for the variables.

18.B addition of like terms

The extension of the distributive property of Lesson 17 can be rewritten as

$$ba + ca + da + \cdots = (b + c + d + \cdots)a$$

We note that a is a common factor of each of the terms on the left and is written outside the parentheses on the right. If we look at the indicated sum of terms

$$4xmp - 2pmx + 6mxp$$

we see that the factor xmp is a factor of all three terms and can be treated in the same manner as the a factor on the left side of the statement or restatement of the distributive property.

Thus we can write the sum of three terms as a product of $(4 - 2 + 6)$ and xmp, as shown here.

$$4xmp - 2pmx + 6mxp = (4 - 2 + 6)xmp = 8xmp$$

The factors of the three variables in the expression $8xmp$ can be written in any order without changing the *value* of the expression. Thus, any of the following would be equally acceptable.

$$8xmp \quad 8xpm \quad 8mxp \quad 8mpx \quad 8pmx \quad 8pxm$$

The above is a rather detailed approach to justify the following statement:

To add like terms, we algebraically add the numerical coefficients.

Thus to add

$$4xmp - 2pmx + 6mxp$$

we simply add the numerical coefficients 4, –2, and +6 to get $8xmp$.

$$4xmp - 2pmx + 6mxp = 8xmp$$

example 18.1 Simplify by adding like terms: $3x + 5 - xy + 2yx - 5x$

solution The first term and the fifth term are like terms, and the third term and the fourth term are like terms. If we add these terms, we get

$$\mathbf{-2x + xy + 5}$$

example 18.2 Simplify by adding like terms: $3xy + 2xyz - 10yx - 5yzx$

solution The first term and the third term are like terms and may be added. Also, the second term and the fourth term are like terms and may be added. If we add these terms, we get

$$\mathbf{-7yx - 3xyz}$$

example 18.3 Simplify by adding like terms: $4 + 7mxy + 5 + 3yxm - 15$

solution We add like terms and get

$$\mathbf{-6 + 10mxy}$$

example 18.4 Simplify by adding like terms: $3x - x - y + 5 - 2y - 3x - 10 - 8y$

solution We add the x terms, the y terms, and the numbers and get

$$\mathbf{-x - 11y - 5}$$

example 18.5 Simplify by adding like terms: $-3 + xmy - y - 5 + 8ymx - 3y - 14$

solution We add the y terms, the xmy terms, and the numbers in any order and get

$$\mathbf{-22 - 4y + 9myx}$$

Of course, the letters myx could be in any order.

practice Simplify by adding like terms:

a. $-2xy + 3x + 4 - 4yx - 2x$

b. $2xyz + 3xy - 5zyx$

c. $3yac - 2ac + 6acy$

d. $4 - x - 2xy + 3x - 7yx$

problem set 18

1. (17) What is a term of an algebraic expression?

2. (18) When can terms of an algebraic expression be called like terms?

3. (18) Which of the following terms are like terms?

(a) $2xmp$ (b) xmy (c) $-4pmx$ (d) $3mxp$

4. (17) Use the letters a, b, and c and parentheses to write the distributive property.

5. (4) Use two unit multipliers to convert 1500 centimeters to feet.

6. (10) Use two unit multipliers to convert 1250 square inches to square feet.

7. (3) The perimeter of a rectangle is 76 inches. The length of the rectangle is 22 inches. Find the width of the rectangle.

8. (8) The diameter of a circle is 18 feet. Find the area of the circle.

Simplify by adding like terms:

9. (18) $3xyz + 2zxy - 7zyx + 2xy$

10. (18) $4x + 3 - 2xy - 5x - 7 + 4yx$

Expand by using the distributive property:

11. (17) $(4 + 2y)x$

12. (17) $3x(y - 2m)$

13. (17) $2p(xy - 3k)$

Evaluate:

14. (14) $-a(x - a)$ if $a = -3$ and $x = 6$

15. (14) $-x - (-a)(a - x)$ if $x = -2$ and $a = 4$

16. (14) $-p(-x) - px$ if $p = -3$ and $x = 4$

17. (14) $-x(-y) - xy$ if $x = 3$ and $y = -2$

18. (14) $(-a)(b)(-a + b)$ if $a = 6$ and $b = -3$

Simplify:

19. (12) $-6 - 2(-3)(-1) - 5(3 - 2 - 2)$

20. (13) $-\{3(-2)(-4 + 2) - [3 - (-2)]\}$

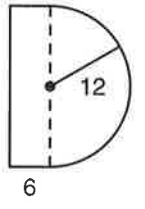
21. (13) $-4 - (-2) - [-(-2)] - |-3|$

22. (12) $-3 - 2(-4 + 7) - 5 - |-2 - 5|$

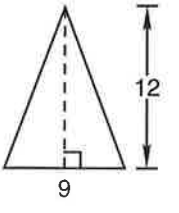
23. (12) $\dfrac{-2(-3 + 7)}{(-2)(-3)}$

24. (12) $\dfrac{-2 - 2(3) + 10}{3 - (-2)(-3)}$

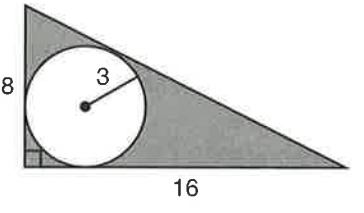
25. (3) Find the perimeter of this figure. Corners that look square are square. Dimensions are in yards.



26. (8) Find the area of this isosceles triangle. Dimensions are in centimeters.



27. (8) Find the area of the shaded portion of this right triangle. Dimensions are in meters.



Simplify:

28. (4) 0.304×12.5

29. (4) $\dfrac{0.09338}{0.046}$

30. (15) Find the surface area of this right rectangular prism. Dimensions are in inches.

