

## Combining Like Terms

### Objective 1

### Learn how to Combine and Identify Like Terms

Terms like  $3x$  and  $5x$  are considered to be like terms because the variable parts are identically the same. The variable part is "x".

To find the sum  $3x + 5x$ , we simply add the numeric parts. The variable parts **remained unchanged**. We can use the Distributive Property to demonstrate the process.

$$3x + 5x = x(3 + 5) = x(8) = 8x$$

Suppose we have  $4y^2 - y^2$  or  $4y^2 - 1y^2$ . Since the variable parts are exactly alike, we can combine these two terms as follows.

$$4y^2 - y^2 = y^2(4 - 1) = y^2(3) = 3y^2$$

The terms  $8b^2$  and  $2b$  are not like terms since the variable parts are not identically the same. Similarly,  $5x^2$  and  $3y^2$  are not like terms. Note the following.

$$8b^2 - 2b = \text{Cannot Combine}$$

$$5x^2 + 3y^2 = \text{Cannot Combine}$$

**Example 1:** Combine like terms if possible.

a)  $2x + 7x$

f)  $8n^3 + 6n^3 - 3n^3$

b)  $\frac{2}{x} + \frac{5}{x}$

g)  $\frac{8}{b^2} + \frac{6}{b^2} - \frac{3}{b^2}$

c)  $3a^2 - 7a^2$

h)  $3ab^2 - 7ab^2 + ab^2$

d)  $8a^2 - 11b^2$

i)  $14x^2y^3 - 10x^2y^3$

e)  $25p^3q^2 - 15p^2q^3$

j)  $a^7b^5c^4 - a^7b^5c^4$

## Objective 2 Combine Like Terms within an Expression

Suppose we are asked to simplify the expression  $12x - 7 - 6x + 3$  by combining like terms.

Remember that the rules for **Order of Operations** state we must work **left to right** when we have additions and subtractions. But we are unable to do this with the expression  $12x - 7 - 6x + 3$  since the first two terms  $12x$  and  $7$  are not like terms!

However, if we rewrite the subtractions as "adding negative quantities", we can then rearrange terms within the expression.

Remember, subtracting a negative number is the same as adding its opposite! Applying this technique to an expression is demonstrated below.

$$12x - 7 - 6x + 3$$
$$12x + (-7) + (-6x) + 3$$

Having the expression  $12x + (-7) + (-6x) + 3$ , we can now rearrange the expression as follows.

$$12x + (-7) + (-6x) + 3$$

$$12x + (-6x) + (-7) + 3$$

Note: You can rearrange terms within an expression when all the terms are being added.

Since all the terms are now being added, we can now combine like terms as shown below.

$$\underbrace{12x + (-6x)}_{6x} + \underbrace{(-7) + 3}_{(-4)}$$

$$6x - 4$$

Once you completely understand the process of combining like terms within an expression, you can start using "Kung Fu math" to quickly simplify an expression. Below is how a black belt in "Kung Fu math" would work the problem. Can you explain how this student did not follow the rules of **Order of Operations** and get the right answer?

$$\boxed{12x} - \boxed{7} - \boxed{6x} + \boxed{3}$$

$$\boxed{6x - 4}$$

**Example 2:** Simplify each expression by combining like terms.

a)  $8a - 4a - 6 - 2$

f)  $-a - b - 3a + 5 - 4b$

b)  $3x - 5 - x - 7$

g)  $-8 - 7 - 5 - 2$

c)  $-5 + a^2 - 10 - 4a^2$

h)  $-(-8p) - 3q - 4p + 6q$

d)  $-8x - 7 - (-5x) - (-2)$

i)  $-10y^3 - 10x^2 - 10y^2$

e)  $7p^3 - q^2 - 10p^3 + 5q^2$

j)  $a^2b^2 - b^2c^2 + a^2c^2$