

Sample Problems

Simplify each of the following by combining like terms.

1. $3x + 8x$

2. $4a - 7a$

3. $-p + 3 + 3p$

4. $2b - 3 + 5b + 10 - b$

5. $2m - 1 - 9m + 1$

6. $3a + b - 2 - 3a - 10b - 2$

7. $x + 1 - 2x + 3 - 3x - 4 + 4x$

8. $3p - q - 3p - q$

9. $3x^2 - 5x + 2 - x^2 + x - 2$

10. $\frac{2}{3}x - 1 - x + \frac{2}{5}$

11. $ab - 2a + 5b - a + b - ab + 3a$

12. $-x + 4 - x + 6 + 5x$

Practice Problems

Simplify each of the following by combining like terms.

1. $3a - 5 - 7a + 1 + a$

2. $3x - 5 + 5x - 3 - 8x + 8$

3. $m^2 - m + 1 - m^2 + 5m$

4. $\frac{1}{2}x - \frac{1}{3}x + 1$

5. $-1 + p + q - p + 2q + 3$

6. $5a - 2 + b - ab + a - b$

7. $\frac{1}{2}x + \frac{1}{2}y - \frac{1}{2}x + \frac{1}{2}y$

8. $2r - R + r + 2R - 1$

9. $-x + 3 - 5x + 1$

10. $x - y + 2z + 3x - 2y - z$

11. $3y^2 - y - 2 + y^2 + y + 2 - 5y^2$

Sample Problems - Answers

- 1.) $11x$ 2.) $-3a$ 3.) $2p + 3$ 4.) $6b + 7$ 5.) $-7m$ 6.) $-9b - 4$ 7.) 0 8.) $-2q$
 9.) $2x^2 - 4x$ 10.) $-\frac{1}{3}x - \frac{3}{5}$ 11.) $6b$ 12.) $3x + 10$

Practice Problems - Answers

- 1.) $-3a - 4$ 2.) 0 3.) $4m + 1$ 4.) $\frac{1}{6}x + 1$ 5.) $3q + 2$ 6.) $6a - ab - 2$ 7.) y
 8.) $R + 3r - 1$ 9.) $-6x + 4$ 10.) $4x - 3y + z$ 11.) $-y^2$

Sample Problems - Solutions

1. $3x + 8x$

Solution: $3x$ and $8x$ are like terms. We add the coefficients, 3 and 8 and that is how many x we have:
 $3x + 8x = (3 + 8)x = 11x$. We usually just write

$$3x + 8x = 11x$$

2. $4a - 7a$

Solution: We can re-write $4a - 7a$ as an addition: $4a - 7a = 4a + (-7)a$. In other words, the coefficients are 4 and -7 . $4a$ and $-7a$ are like terms. We add the coefficients, 4 and -7 and that is how many a we have: The rigorous notation that follows the definitions is

$$4a - 7a = 4a + (-7)a = (4 + (-7))a = -3a$$

but we usually just write

$$4a - 7a = -3a$$

3. $-p + 3 + 3p$

Solution: We can re-write $-p$ and $3p$ are like terms and can be combined. However, the number 3 can not be combined with the other two terms. The first term, $-p$ has coefficient -1 . Recall that addition is commutative and so we can rearrange the terms so that like terms are grouped together.

$$-p + 3 + 3p = -1p + 3p + 3 = (-1 + 3)p + 3 = 2p + 3$$

We usually just write

$$-p + 3 + 3p = 2p + 3$$

4. $2b - 3 + 5b + 10 - b$

Solution: Recall that addition is commutative and so we can rearrange the terms so that like terms are grouped together. Also, we can re-write subtractions as additions with negative coefficients. Then we add the coefficients in like terms.

$$\begin{aligned} 2b - 3 + 5b + 10 - b &= 2b + 5b + (-1)b + (-3) + 10 \\ &= (2 + 5 + (-1))b + (-3 + 10) \\ &= 6b + 7 \end{aligned}$$

We do not have to re-write subtractions as above. The following computation is also perfectly acceptable:

$$\begin{aligned} 2b - 3 + 5b + 10 - b &= 2b + 5b - b - 3 + 10 \\ &= 6b + 7 \end{aligned}$$

5. $2m - 1 - 9m + 1$

Solution: Recall that addition is commutative and so we can rearrange the terms so that like terms are grouped together. Also, we can re-write subtractions as additions with negative coefficients. Then we add the coefficients in like terms.

$$\begin{aligned} 2m - 1 - 9m + 1 &= 2m - 9m - 1 + 1 \\ &= -7m + 0 \\ &= -7m \end{aligned}$$

6. $3a + b - 2 - 3a - 10b - 2$

Solution: This problem contains three groups of unlike terms: $3a$ and $-3a$ are like terms, $-b$ and $-10b$ are like terms, and -2 and -2 are like terms. When we combine $3a$ and $-3a$, we get $0a$ which is 0.

$$\begin{aligned} 3a + b - 2 - 3a - 10b - 2 &= 3a - 3a + b - 10b - 2 - 2 \\ &= 0a - 9b - 4 \\ &= -9b - 4 \end{aligned}$$

7. $x + 1 - 2x + 3 - 3x - 4 + 4x$

Solution:

$$\begin{aligned} x + 1 - 2x + 3 - 3x - 4 + 4x &= x - 2x - 3x + 4x + 1 + 3 - 4 \\ &= (1 - 2 - 3 + 4)x + (1 + 3 - 4) \\ &= 0x + 0 = 0 \end{aligned}$$

8. $3p - q - 3p - q$

Solution: $3p$ and $-3p$ are like terms and $-q$ and $-q$ are like terms.

$$3p - q - 3p - q = 3p - 3p - q - q = 0p - 2q = -2q$$

9. $3x^2 - 5x + 2 - x^2 + x - 2$

Solution: x^2 and x and 1 are all unlike terms.

$$\begin{aligned} 3x^2 - 5x + 2 - x^2 + x - 2 &= 3x^2 - x^2 - 5x + x + 2 - 2 \\ &= 2x^2 - 4x + 0 = 2x^2 - 4x \end{aligned}$$

$$10. \frac{2}{3}x - 1 - x + \frac{2}{5}$$

Solution: We add the coefficients. The operations are $\frac{2}{3} - 1$ and $-1 + \frac{2}{5}$

$$\frac{2}{3} - 1 = \frac{2}{3} - \frac{3}{3} = \frac{2-3}{3} = \frac{-1}{3} = -\frac{1}{3} \quad \text{and} \quad -1 + \frac{2}{5} = \frac{-5}{5} + \frac{2}{5} = \frac{-5+2}{5} = \frac{-3}{5} = -\frac{3}{5}$$

$$\begin{aligned} \frac{2}{3}x - 1 - x + \frac{2}{5} &= \frac{2}{3}x - x - 1 + \frac{2}{5} \\ &= \left(\frac{2}{3} - 1\right)x + \left(-1 + \frac{2}{5}\right) \\ &= -\frac{1}{3}x - \frac{3}{5} \end{aligned}$$

$$11. ab - 2a + 5b - a + b - ab + 3a$$

Solution: a , b , and ab are all unlike terms. We will have three groups of like terms.

$$\begin{aligned} ab - 2a + 5b - a + b - ab + 3a &= ab - ab - 2a - a + 3a + 5b + b \\ &= (1 - 1)ab + (-2 - 1 + 3)a + (5 + 1)b \\ &= 0ab + 0a + 6b = 6b \end{aligned}$$

$$12. -x + 4 - x + 6 + 5x$$

Solution:

$$-x + 4 - x + 6 + 5x = -x - x + 5x + 4 + 6 = 3x + 10$$