NAME

Module 11 Simplifying Algebraic Expressions with Polynomials
Lesson 3 Adding and Subtracting Polynomials

Find each sum or difference either horizontally or vertically. Write answers in simplest form.

1. $(2y - 4) + (6y - 2)$

$8y - 6$

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

$x + 1$

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

$2x^2 + 2x + 1$

4. $(x^5 - 6) - (x^3 + 3)$

$x^5 - x^3 - 9$

5. $(2r^2 + 7r - 3) - (-5r^2 + 3r + 4)$

$7r^2 + 4r - 7$

6. $(12b^2 + 7b + 6) + (9b^2 + 5b - 2)$

$21b^2 + 12b + 4$

7. $(2k - 1) - (4k^2 + 3k - 7)$

$-4k^2 - k + 6$

8. $(9q^2 + 6q + 3) - (5q^2 - q + 5)$

$4q^2 + 7q - 2$

9. $(8k^2 + 4k - 9) + (5k^2 + 4k + 9)$

$13k^2 + 8k$

10. $(5c^2 - 9c + 7) - (-2c^2 + 3)$

$7c^2 - 9c + 4$

11.
$$\begin{array}{r} 3r^2 - 5r + 19 \\ +\ 7r^2 + 10r + 12 \\ \hline \end{array}$$

$10r^2 + 5r + 31$

12.
$$\begin{array}{r} -10x^2 - 5x + 6 \\ -\ (-5x^2 + 12x + 2) \\ \hline \end{array}$$

$-5x^2 - 17x + 4$

13. $(21q^2r + 15qr^2 - 6) + (13q^2r - 3qr^2 + 5)$ $34q^2r + 12qr^2 - 1$

14. $(9c^2d^2 - 6cd^3 + 4cd) - (-3c^2d^2 + 10cd^3 - 9cd)$ $12c^2d^2 - 16cd^3 + 13cd$

15. $(14x^2 - 9xy + 20y^2) + (12x^2 + 15xy - 17y^2)$ $26x^2 + 6xy + 3y^2$

16. $(5y^2z^3 + 7y^3z + 8) - (-2y^2z - 6yz)$ $5y^2z^3 + 7y^3z + 2y^2z + 6yz + 8$

17. $(a^2b^2 + 7ab - 9) - (a^2b^2 - 7ab + 9)$ $14ab - 18$

18. $(4m^2n - 3mn + 8) + (6m^2n + 14mn - 7)$ $10m^2n + 11mn + 1$

19. $\left(\frac{4}{5}r^2 - \frac{9}{10}s^2 - \frac{1}{4}rs\right) - \left(-\frac{2}{3}r^2 + \frac{1}{4}s^2 - \frac{1}{3}rs\right)$ $\frac{22}{15}r^2 - \frac{23}{20}s^2 + \frac{1}{12}rs$

20. $(-0.02a^2 - 4.3b^2 + 0.13ab) + (0.01a^2 + 5.2b^2 - 1.4ab)$

$-0.01a^2 + 0.9b^2 - 1.27ab$

Journal

1. Find two trinomials whose sum is zero and find two trinomials whose difference is zero. Compare and contrast the pairs of trinomials.
2. Stephanie does not like to subtract. Explain to her how she can use addition to subtract polynomials.
3. Add $(2x^2 + 5x + 6)$ and $(-3x^2 - 2x + 7)$ vertically and horizontally. Is the answer the same? Why?
4. Explain how to the check the answers when adding and subtracting polynomials.
5. Explain the importance of using like terms when adding and subtracting polynomials.

Cumulative Review

Simplify.

1. $2a(b^6c^4)^3$ **$2ab^{18}c^{12}$**
2. $\frac{4^5}{4^8}$ **$\frac{1}{64}$**
3. $\frac{6x^5y^2}{4x^2y^3}$ **$\frac{3x^3}{2y}$**
4. $\left(\frac{5^{-3}a^3b^4}{b^5}\right)^0$ **1**

Write in scientific notation.

5. 2,670,000,000 **2.67×10^9**
6. 0.00000000365 **3.65×10^{-9}**

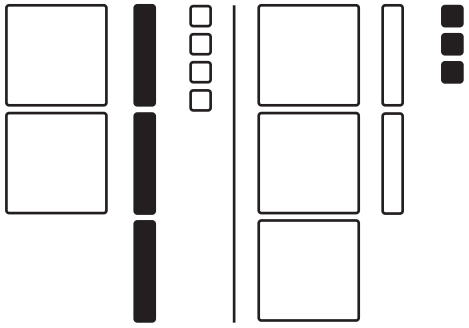
Multiply or divide as indicated. Write answers in scientific notation.

7. $(4.3 \times 10^6)(5 \times 10^{-2})$ **2.15×10^5**
8. $(4.32 \times 10^{-2})(2.6 \times 10^{10})$ **1.1232×10^9**
9. $\frac{4.5 \times 10^2}{1.5 \times 10^{-5}}$ **3×10^7**
10. $\frac{2.5 \times 10^6}{5.0 \times 10^{-3}}$ **5×10^8**

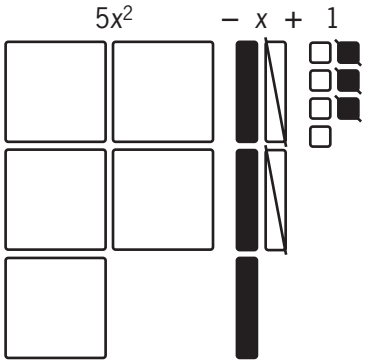
Manipulatives

Manipulatives can be used to add and subtract polynomials.
Add:
$(2x^2 - 3x + 4) + (3x^2 + 2x - 3)$.
Begin by modeling each polynomial. Here, the shaded tiles represent negative values, and the unshaded tiles represent positive values.

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



Then, rearrange and count the tiles. Finish by canceling zero pairs.



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

Use manipulatives to find each sum or difference.

1. $(3x - 4) + (2x + 2)$

$5x - 2$

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

$6x^2 - 3x - 6$

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

$2x^2 - x - 2$

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

$-2x^2 + 5x - 5$

Possible Journal Answers

1. The sum of $(2x^2 + 5x - 3)$ and $(-2x^2 - 5x + 3)$ is zero. The difference of $(2x^2 - 5x - 3)$ and $(2x^2 - 5x - 3)$ is zero. The pair of trinomials whose sum is zero has terms that have opposite signs but are otherwise identical. The pair of trinomials whose difference is zero has identical terms.

2. Instead of subtracting, Stephanie can change the signs of the terms in the second polynomial and use the rules for addition.

3. $(2x^2 + 5x + 6) + (-3x^2 - 2x + 7) = 2x^2 - 3x^2 + 5x - 2x + 6 + 7 = -x^2 + 3x + 13$

$$\begin{array}{r} 2x^2 + 5x + 6 \\ +\ -3x^2 - 2x + 7 \\ \hline -x^2 + 3x + 13 \end{array}$$

Yes, the answer is the same. When adding horizontally or vertically, the operation does not change, only the method. So, the answers are identical.

4. To check the answer to an addition problem, subtract one of the polynomials from the sum. The difference is the other polynomial. To check the answer to a subtraction problem, add the difference to the second polynomial. The answer is the first polynomial.

5. Only like terms may be added or subtracted. When there are no like terms in an expression, the polynomial is in simplest form.