

5-5 Subtract Polynomials

Name _____

Date _____

To subtract polynomials, add the opposite of the subtrahend. You can subtract polynomials horizontally or vertically.

Subtract: $(x^2 + 4x + 7) - (-2x^2 - 3)$

Subtract polynomials horizontally.

$$\begin{aligned} &(x^2 + 4x + 7) - (-2x^2 - 3) \\ &= (x^2 + 4x + 7) + (2x^2 + 3) \quad \leftarrow \text{Add the opposite.} \\ &= (x^2 + 2x^2) + 4x + (7 + 3) \quad \leftarrow \text{Group like terms.} \\ &= 3x^2 + 4x + 10 \quad \leftarrow \text{Combine like terms.} \end{aligned}$$

So the difference is $3x^2 + 4x + 10$.

Subtract: $(x^2 + 4xy - 5y^2) - (-2x^2 - 3xy + 4y^2)$

Subtract polynomials vertically.

$$\begin{array}{r} x^2 + 4xy - 5y^2 \\ -(-2x^2 - 3xy + 4y^2) \\ \hline \end{array}$$

To subtract, add the opposite.

$$\begin{array}{r} x^2 + 4xy - 5y^2 \quad \leftarrow \text{Arrange in columns.} \\ + 2x^2 + 3xy - 4y^2 \\ \hline 3x^2 + 7xy - 9y^2 \quad \leftarrow \text{Add.} \end{array}$$

So the difference is $3x^2 + 7xy - 9y^2$.

Find the difference. Write the difference in standard form.

1. $(7k + 6) - (-2k + 3)$

$$\begin{aligned} &(7k + 6) - (-2k + 3) = (7k + 6) + [-(-2k + 3)] \\ &(7k + 6) + (2k - 3) = 7k + 2k + 6 - 3 \\ &\qquad\qquad\qquad 9k + 3 \end{aligned}$$

2. $(-3v^2 + 7) - (2v^2 + 4)$

$$\begin{aligned} &(-3v^2 + 7) + (-2v^2 - 4) \\ &(-3v^2 - 2v^2) + (7 - 4) \\ &\qquad\qquad\qquad -5v^2 + 3 \end{aligned}$$

3. $(17k^2 - 23) - (9k^2 - 25)$

$$\begin{aligned} &(17k^2 - 23) + (-9k^2 + 25) \\ &(17k^2 - 9k^2) + (-23 + 25) \\ &\qquad\qquad\qquad 8k^2 + 2 \end{aligned}$$

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

$$\begin{aligned} &(x^2 + 6) + (-3x^2 + 2) \\ &(x^2 - 3x^2) + (6 + 2) \\ &\qquad\qquad\qquad -2x^2 + 8 \end{aligned}$$

5. $(7x^2 - 12) - (4x^2 - 21)$

$$\begin{aligned} &(7x^2 - 12) + (-4x^2 + 21) \\ &(7x^2 - 4x^2) + (-12 + 21) \\ &\qquad\qquad\qquad 3x^2 + 9 \end{aligned}$$

6. $(x^2 - 8x) - (4x - 5x^2)$

$$\begin{aligned} &(x^2 - 8x) + (-4x + 5x^2) \\ &(x^2 + 5x^2) + (-8x - 4x) \\ &\qquad\qquad\qquad 6x^2 - 12x \end{aligned}$$

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

$$\begin{aligned} &(3x^2 + 2x) + (-4x + 6x^2) \\ &(3x^2 + 6x^2) + (2x - 4x) \\ &\qquad\qquad\qquad 9x^2 - 2x \end{aligned}$$

8. $(7x^2 - 24y^2) - (-11x^2 - 12y^2)$

$$\begin{aligned} &(7x^2 - 24y^2) + (11x^2 + 12y^2) \\ &(7x^2 + 11x^2) + (-24y^2 + 12y^2) \\ &\qquad\qquad\qquad 18x^2 - 12y^2 \end{aligned}$$

9. $(-5p^2 + 13q^2) - (9q^2 - 22p^2)$

$$\begin{aligned} &(-5p^2 + 13q^2) + (-9q^2 + 22p^2) \\ &(-5p^2 + 22p^2) + (13q^2 - 9q^2) \\ &\qquad\qquad\qquad 17p^2 + 4q^2 \end{aligned}$$

10. $(4a^2 + 9ab) - (-4ab + 2a^2)$

$$\begin{aligned} &(4a^2 + 9ab) + (4ab - 2a^2) \\ &(4a^2 - 2a^2) + (9ab + 4ab) \\ &\qquad\qquad\qquad 2a^2 + 13ab \end{aligned}$$

11. $(4a^2b^2 + 6a) - (9a^2b^2 - 3a)$

$$\begin{aligned} &(4a^2b^2 - 9a^2b^2) + (6a + 3a) \\ &\qquad\qquad\qquad -5a^2b^2 + 9a \end{aligned}$$

12. $(4ab^2 - 3a^2) - (9ab^2 + 2a^2)$

$$\begin{aligned} &(4ab^2 - 3a^2) + (-9ab^2 - 2a^2) \\ &(-3a^2 - 2a^2) + (4ab^2 - 9ab^2) \\ &\qquad\qquad\qquad -5a^2 - 5ab^2 \end{aligned}$$

13. $(2x^2 + 6x - 14) - (8x^2 + 11x + 12)$

$$\begin{aligned} &(2x^2 + 6x - 14) + [-(8x^2 + 11x + 12)] \\ &(2x^2 + 6x - 14) + (-8x^2 - 11x - 12) \\ &\qquad\qquad\qquad -6x^2 - 5x - 26 \end{aligned}$$

14. $(x^2 + 19x - 4) - (6x^2 - 8x + 13)$

$$\begin{aligned} &(x^2 + 19x - 4) + (-6x^2 + 8x - 13) \\ &(x^2 - 6x^2) + (19x + 8x) + (-4 - 13) \\ &\qquad\qquad\qquad -5x^2 + 27x - 17 \end{aligned}$$



Find the difference. Write the difference in standard form.

$$\begin{aligned} 15. (f^2 - f + 4) - (-8f^2 + 3f - 2) \\ (f^2 - f + 4) + (8f^2 - 3f + 2) \\ (f^2 + 8f^2) + (-f - 3f) + (4 + 2) \\ 9f^2 - 4f + 6 \end{aligned}$$

$$\begin{aligned} 17. (4x^2 + 7x - 3) - (2x^2 - 7x - 2) \\ (4x^2 + 7x - 3) + (-2x^2 + 7x + 2) \\ (4x^2 - 2x^2) + (7x + 7x) + (-3 + 2) \\ 2x^2 + 14x - 1 \end{aligned}$$

$$\begin{aligned} 19. (3x^2 - 2x + 4) - (-3x^2 + 4x - 2) \\ (3x^2 - 2x + 4) + (3x^2 - 4x + 2) \\ (3x^2 + 3x^2) + (-2x - 4x) + (4 + 2) \\ 6x^2 - 6x + 6 \end{aligned}$$

$$\begin{aligned} 21. (3t^2 - 6t - 8) - (13t^2 - 10t) \\ (3t^2 - 6t - 8) + (-13t^2 + 10t) \\ (3t^2 - 13t^2) + (-6t + 10t) - 8 \\ -10t^2 + 4t - 8 \end{aligned}$$

$$\begin{aligned} 23. (-3xy^2 + 4xy - x^2) - (5xy^2 - 6xy + x^2) \\ (-3xy^2 + 4xy - x^2) + (-5xy^2 + 6xy - x^2) \\ (-x^2 - x^2) + (-3xy^2 - 5xy^2) + (4xy + 6xy) \\ -2x^2 - 8xy^2 + 10xy \end{aligned}$$

$$\begin{aligned} 25. (-2x^2 - 8xy + 3y^2) - (7x^2 - 12y^2) \\ (-2x^2 - 8xy + 3y^2) + (-7x^2 + 12y^2) \\ (-2x^2 - 7x^2) - 8xy + (3y^2 + 12y^2) \\ -9x^2 - 8xy + 15y^2 \end{aligned}$$

$$\begin{aligned} 27. (7cd^2 + 4d - 2c) - (3cd^2 - 6d - 2c) \\ (7cd^2 + 4d - 2c) + (-3cd^2 + 6d + 2c) \\ (7cd^2 - 3cd^2) + (-2c + 2c) + (4d + 6d) \\ 4cd^2 + 10d \end{aligned}$$

$$\begin{aligned} 16. (3x^2 - 9x + 13) - (7x^2 - x + 11) \\ (3x^2 - 9x + 13) + (-7x^2 + x - 11) \\ (3x^2 - 7x^2) + (-9x + x) + (13 - 11) \\ -4x^2 - 8x + 2 \end{aligned}$$

$$\begin{aligned} 18. (2x^2 + 9x - 6) - (3x^2 - 3x + 6) \\ (2x^2 + 9x - 6) + (-3x^2 + 3x - 6) \\ (2x^2 - 3x^2) + (9x + 3x) + (-6 - 6) \\ -x^2 + 12x - 12 \end{aligned}$$

$$\begin{aligned} 20. (5x^3 - 9x - 22) - (7x^3 - 4x - 9) \\ (5x^3 - 9x - 22) + (-7x^3 + 4x + 9) \\ (5x^3 - 7x^3) + (-9x + 4x) + (-22 + 9) \\ -2x^3 - 5x - 13 \end{aligned}$$

$$\begin{aligned} 22. (2z^2 - 9z + 5) - (3z^2 + 17) \\ (2z^2 - 9z + 5) + (-3z^2 - 17) \\ (2z^2 - 3z^2) - 9z + (5 - 17) \\ -z^2 - 9z - 12 \end{aligned}$$

$$\begin{aligned} 24. (-6c^2 + 4d^2) - (3c^2 + 11cd - 2d^2) \\ (-6c^2 + 4d^2) + (-3c^2 - 11cd + 2d^2) \\ (-6c^2 - 3c^2) - 11cd + (4d^2 + 2d^2) \\ -9c^2 - 11cd + 6d^2 \end{aligned}$$

$$\begin{aligned} 26. (7wv^2 - 9w - 6wv) - (4wv^2 + 2w + 6wv) \\ (7wv^2 - 9w - 6wv) + (-4wv^2 - 2w - 6wv) \\ (7wv^2 - 4wv^2) + (-6wv - 6wv) + (-9w - 2w) \\ 3wv^2 - 12wv - 11w \end{aligned}$$

$$\begin{aligned} 28. (2x^2 + 4xy - 7) - (4x^2 + 3xy - 11) \\ (2x^2 + 4xy - 7) + (-4x^2 - 3xy + 11) \\ (2x^2 - 4x^2) + (4xy - 3xy) + (-7 + 11) \\ -2x^2 + xy + 4 \end{aligned}$$

Problem Solving

Write a polynomial in simplified form to represent each situation.

29. Kina sold 4 more than three times as many tickets as Layla. Tori sold 7 less than twice as many as Layla. If Layla sold t tickets, how many more tickets did Kina sell than Tori?

Let t = number of tickets.

Kina: $3t + 4$; Tori: $2t - 7$

$(3t + 4) - (2t - 7)$; $3t - 2t + 4 + 7$; $t + 11$

Kina sold $t + 11$ more tickets than Tori.

30. Mrs. Vargas is 4 years less than 4 times her daughter Ana's age. Mrs. Vargas' son Leo is 3 years more than two times Ana's age. If Ana is a years old, what is the difference between Mrs. Vargas' age and her son's age.

Mrs. Vargas: $4a - 4$; Leo: $2a + 3$

$(4a - 4) - (2a + 3)$; $4a - 2a - 4 - 3$; $2a - 7$

The difference is $2a - 7$ years.

MENTAL MATH

31. The sum of two polynomials is $3x^2 - 2xy + 6$. One of the polynomial addends is $x^2 + 3xy + 4$. What is the other addend?

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