

2 Solve Equations with Polynomial Expressions

We can use the Distributive Property to solve equations that involve the products of monomials and polynomials.

StudyTip

Combining Like Terms When simplifying a long expression, it may be helpful to put a circle around one set of like terms, a rectangle around another set, a triangle around another set, and so on.

Example 4 Equations with Polynomials on Both Sides

$$\text{Solve } 2a(5a - 2) + 3a(2a + 6) + 8 = a(4a + 1) + 2a(6a - 4) + 50.$$

$$\begin{aligned} 2a(5a - 2) + 3a(2a + 6) + 8 &= a(4a + 1) + 2a(6a - 4) + 50 && \text{Original equation} \\ 10a^2 - 4a + 6a^2 + 18a + 8 &= 4a^2 + a + 12a^2 - 8a + 50 && \text{Distributive Property} \\ 16a^2 + 14a + 8 &= 16a^2 - 7a + 50 && \text{Combine like terms.} \\ 14a + 8 &= -7a + 50 && \text{Subtract } 16a^2 \text{ from each side.} \\ 21a + 8 &= 50 && \text{Add } 7a \text{ to each side.} \\ 21a &= 42 && \text{Subtract 8 from each side.} \\ a &= 2 && \text{Divide each side by 21.} \end{aligned}$$

CHECK

$$\begin{aligned} 2a(5a - 2) + 3a(2a + 6) + 8 &= a(4a + 1) + 2a(6a - 4) + 50 \\ 2(2)[5(2) - 2] + 3(2)[2(2) + 6] + 8 &\stackrel{?}{=} 2[4(2) + 1] + 2(2)[6(2) - 4] + 50 \\ 4(8) + 6(10) + 8 &\stackrel{?}{=} 2(9) + 4(8) + 50 && \text{Simplify.} \\ 32 + 60 + 8 &\stackrel{?}{=} 18 + 32 + 50 && \text{Multiply.} \\ 100 &= 100 \checkmark && \text{Add and subtract.} \end{aligned}$$

GuidedPractice

Solve each equation.

4A. $2x(x + 4) + 7 = (x + 8) + 2x(x + 1) + 12$

4B. $d(d + 3) - d(d - 4) = 9d - 16$

Check Your Understanding

= Step-by-Step Solutions begin on page R13.



Example 1 Find each product.

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

2. $6g^2(3g^3 + 4g^2 + 10g - 1)$

3. $4km^2(8km^2 + 2k^2m + 5k)$

4. $-3p^4r^3(2p^2r^4 - 6p^6r^3 - 5)$

5. $2ab(7a^4b^2 + a^5b - 2a)$

6. $c^2d^3(5cd^7 - 3c^3d^2 - 4d^3)$

Example 2 Simplify each expression.

7. $t(4t^2 + 15t + 4) - 4(3t - 1)$

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

9. $-2d(d^3c^2 - 4dc^2 + 2d^2c) + c^2(dc^2 - 3d^4)$

10. $-5w^2(8w^2x - 11wx^2) + 6x(9wx^4 - 4w - 3x^2)$

Example 3

11. **GRIDDED RESPONSE** Marlene is buying a new plasma television. The height of the screen of the television is one half the width plus 5 inches. The width is 30 inches. Find the height of the screen in inches.

Example 4 Solve each equation.

12. $-6(11 - 2c) = 7(-2 - 2c)$

13. $t(2t + 3) + 20 = 2t(t - 3)$

14. $-2(w + 1) + w = 7 - 4w$

15. $3(y - 2) + 2y = 4y + 14$

16. $a(a + 3) + a(a - 6) + 35 = a(a - 5) + a(a + 7)$

17. $n(n - 4) + n(n + 8) = n(n - 13) + n(n + 1) + 16$



Example 1 Find each product.

18. $b(b^2 - 12b + 1)$

20. $-3m^3(2m^3 - 12m^2 + 2m + 25)$

22. $2pr^2(2pr + 5p^2r - 15p)$

19. $f(f^2 + 2f + 25)$

21. $2j^2(5j^3 - 15j^2 + 2j + 2)$

23. $4t^3u(2t^2u^2 - 10tu^4 + 2)$

Example 2 Simplify each expression.

24. $-3(5x^2 + 2x + 9) + x(2x - 3)$

26. $-4d(5d^2 - 12) + 7(d + 5)$

28. $2j(7j^2k^2 + jk^2 + 5k) - 9k(-2j^2k^2 + 2k^2 + 3j)$

29. $4n(2n^3p^2 - 3np^2 + 5n) + 4p(6n^2p - 2np^2 + 3p)$

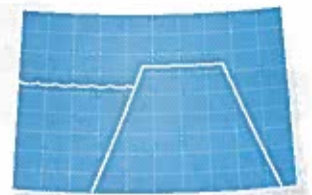
25. $a(-8a^2 + 2a + 4) + 3(6a^2 - 4)$

27. $-9g(-2g + g^2) + 3(g^2 + 4)$

Example 3

30. **DAMS** A new dam being built has the shape of a trapezoid. The base at the bottom of the dam is 2 times the height. The base at the top of the dam is $\frac{1}{5}$ times the height minus 30 feet.

- Write an expression to find the area of the trapezoidal cross section of the dam.
- If the height of the dam is 180 feet, find the area of this cross section.



Example 4 Solve each equation.

31. $7(t^2 + 5t - 9) + t = t(7t - 2) + 13$

32. $w(4w + 6) + 2w = 2(2w^2 + 7w - 3)$

33. $5(4z + 6) - 2(z - 4) = 7z(z + 4) - z(7z - 2) - 48$

34. $9c(c - 11) + 10(5c - 3) = 3c(c + 5) + c(6c - 3) - 30$

35. $2f(5f - 2) - 10(f^2 - 3f + 6) = -8f(f + 4) + 4(2f^2 - 7f)$

36. $2k(-3k + 4) + 6(k^2 + 10) = k(4k + 8) - 2k(2k + 5)$

Simplify each expression.

37. $\frac{2}{3}np^2(30p^2 + 9n^2p - 12)$

38. $\frac{3}{5}r^2t(10r^3 + 5rt^3 + 15t^2)$

39. $-5q^2w^3(4q + 7w) + 4qw^2(7q^2w + 2q) - 3qw(3q^2w^2 + 9)$

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

41. **PARKING** A parking garage charges \$30 per month plus \$0.50 per daytime hour and \$0.25 per hour during nights and weekends. Suppose Trent parks in the garage for 47 hours in January and h of those are night and weekend hours.

- Find an expression for Trent's January bill.
- Find the cost if Trent had 12 hours of night and weekend hours.

42. **CCSS MODELING** Che is building a dog house for his new puppy. The upper face of the dog house is a trapezoid. If the height of the trapezoid is 12 inches, find the area of the face of this piece of the dog house.

