Multiplying Polynomials Worksheet

Algebra 1 · distribute, FOIL, box method and special products

Name _____ **Date** _____ **Score** _____ **/ 40**

THE RULE

Multiply **every term** in the first polynomial by **every term** in the second, then combine like terms. When you multiply powers of the same letter, **add the exponents**: $x^2 \cdot x^3 = x^5$.

FOIL (two binomials only): **F**irst, **O**uter, **I**nner, **L**ast. $(x+3)(x+5) = x^2 + 5x + 3x + 15 = x^2 + 8x + 15$

WORKED EXAMPLE — the box method for $(2x+3)(x-4)$

	x	-4
$2x$	$2x^2$	$-8x$
3	$3x$	-12

Step 1. Write one factor across the top and one down the side.

Step 2. Multiply to fill each box: $2x \cdot x = 2x^2$, $2x \cdot (-4) = -8x$, ...

Step 3. Add the boxes and combine like terms:

$2x^2 - 8x + 3x - 12 = \blacktriangleright\, 2x^2 - 5x - 12$

SECTION A Monomial times polynomial

Distribute the monomial to every term inside the brackets.

1 $3x(x+5)$

_____

_____

_____

= _____

2 $-2x(4x-7)$

_____

_____

_____

= _____

3 $5x^2(2x^2-3x+1)$

_____

_____

_____

= _____

4 $-4y(y^2+2y-6)$

_____

_____

_____

= _____

5 $2ab(3a-5b)$

_____

_____

_____

= _____

6 $x^3(x^2-4x+9)$

_____

_____

_____

= _____

7 $-3x^2(-x^2+2x-5)$

_____

_____

_____

= _____

8 $6m^2n(2m-3n^2)$

_____

_____

_____

= _____

Practise free online: ► Distributive Property Worksheet ► Completing the Square Worksheet ► Math Worksheets

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/

Multiplying Polynomials Worksheet

Multiplying binomials (FOIL or box method)

SECTION B Binomial times binomial

Use FOIL or a box. You should get four products before you combine like terms.

9 $(x + 3)(x + 5)$

=

10 $(x - 4)(x + 6)$

=

11 $(x - 7)(x - 2)$

=

12 $(2x + 1)(x + 4)$

=

13 $(3x - 2)(x + 5)$

=

14 $(4x - 3)(2x - 1)$

=

15 $(5x + 2)(3x - 4)$

=

16 $(x + 2y)(x - 3y)$

=

17 $(2a - b)(3a + 4b)$

=

18 $(x^2 + 3)(x - 2)$

=

THE MISTAKE TO AVOID

Multiplying only the firsts and the lasts. $(x + 3)(x + 5)$ is *not* $x^2 + 15$: the outer and inner products $5x + 3x$ give the middle term $8x$. Watch the signs too: $(x - 4)(x + 6)$ has $6x - 4x = +2x$ in the middle.

Practise free online: ► Distributive Property Worksheet ► Completing the Square Worksheet ► Math Worksheets

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/

Multiplying Polynomials Worksheet

Special products · binomial times trinomial

SPECIAL PRODUCTS — patterns worth knowing

$(a+b)^2 = a^2 + 2ab + b^2$ $(a-b)^2 = a^2 - 2ab + b^2$ $(a+b)(a-b) = a^2 - b^2$

A square is *not* just the squares of the two terms: $(x+6)^2 \neq x^2 + 36$. The middle term $2ab$ is always there.

SECTION C Special products

Use a pattern, or multiply it out to check.

19 $(x+6)^2$

=

20 $(x-5)^2$

=

21 $(3x+2)^2$

=

22 $(2x-7y)^2$

=

23 $(x+9)(x-9)$

=

24 $(4x-3)(4x+3)$

=

25 $(5a+2b)(5a-2b)$

=

26 $(x^2-1)(x^2+1)$

=

SECTION D Binomial times trinomial

Each term of the binomial multiplies all three terms of the trinomial: six products, then combine.

27 $(x+2)(x^2+3x-4)$

=

28 $(x-3)(x^2-2x+5)$

=

29 $(2x+1)(3x^2-x+4)$

=

30 $(x-4)(x^2+4x+16)$

=

31 $(3x-2)(2x^2+5x-1)$

=

32 $(a+3)(a^2-a-6)$

=

Practise free online: ► Distributive Property Worksheet ► Completing the Square Worksheet ► Math Worksheets

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/

Multiplying Polynomials Worksheet

Longer products · area and volume problems

SECTION E Longer products

With three factors, multiply two of them first, then multiply the result by the third.

33 $(x^2 + 2x - 3)(x^2 - x + 2)$

=

34 $(x + 1)(x + 2)(x + 3)$

=

35 $(x - 2)^3$

=

36 $(x + 3)(x - 3)(x^2 + 9)$

=

SECTION F Area and volume

Write the product, multiply it out and combine like terms.

37 A rectangle is $(3x + 2)$ cm long and $(x - 4)$ cm wide. Write its area as a polynomial.

Answer

38 A square garden has sides of $(2x + 5)$ m. Write its area as a polynomial.

Answer

39 A box is x in wide, $(x + 3)$ in long and $(2x - 1)$ in tall. Write its volume as a polynomial.

Answer

40 A photo x by $(x+1)$ in sits in a frame that measures $(2x+3)$ by $(x + 5)$ in overall. Write the area of the frame border (frame minus photo).

Answer

Next step: factoring undoes multiplying. The completing the square worksheet on notesofmath.com uses $(x+a)^2 = x^2+2ax+a^2$ in reverse.

Practise free online: ► Distributive Property Worksheet ► Completing the Square Worksheet ► Math Worksheets

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/

Answer Key

Every product written out, then like terms combined — all answers checked

SECTION A Monomial times polynomial

1. $3x(x+5)$
► $= 3x^2 + 15x$

2. $-2x(4x-7)$
► $= -8x^2 + 14x$

3. $5x^2(2x^2-3x+1)$
► $= 10x^4 - 15x^3 + 5x^2$

4. $-4y(y^2+2y-6)$
► $= -4y^3 - 8y^2 + 24y$

5. $2ab(3a-5b)$
► $= 6a^2b - 10ab^2$

6. $x^3(x^2-4x+9)$
► $= x^5 - 4x^4 + 9x^3$

7. $-3x^2(-x^2+2x-5)$
► $= 3x^4 - 6x^3 + 15x^2$

8. $6m^2n(2m-3n^2)$
► $= 12m^3n - 18m^2n^3$

SECTION B Binomial times binomial

9. $(x+3)(x+5)$
$= x^2 + 5x + 3x + 15$
► $= x^2 + 8x + 15$

10. $(x-4)(x+6)$
$= x^2 + 6x - 4x - 24$
► $= x^2 + 2x - 24$

11. $(x-7)(x-2)$
$= x^2 - 2x - 7x + 14$
► $= x^2 - 9x + 14$

12. $(2x+1)(x+4)$
$= 2x^2 + 8x + x + 4$
► $= 2x^2 + 9x + 4$

13. $(3x-2)(x+5)$
$= 3x^2 + 15x - 2x - 10$
► $= 3x^2 + 13x - 10$

14. $(4x-3)(2x-1)$
$= 8x^2 - 4x - 6x + 3$
► $= 8x^2 - 10x + 3$

15. $(5x+2)(3x-4)$
$= 15x^2 - 20x + 6x - 8$
► $= 15x^2 - 14x - 8$

16. $(x+2y)(x-3y)$
$= x^2 - 3xy + 2xy - 6y^2$
► $= x^2 - xy - 6y^2$

17. $(2a-b)(3a+4b)$
$= 6a^2 + 8ab - 3ab - 4b^2$
► $= 6a^2 + 5ab - 4b^2$

18. $(x^2+3)(x-2)$
► $= x^3 - 2x^2 + 3x - 6$

SECTION C Special products

19. $(x+6)^2$
$= x^2 + 6x + 6x + 36$
► $= x^2 + 12x + 36$

20. $(x-5)^2$
$= x^2 - 5x - 5x + 25$
► $= x^2 - 10x + 25$

21. $(3x+2)^2$
$= 9x^2 + 6x + 6x + 4$
► $= 9x^2 + 12x + 4$

22. $(2x-7y)^2$
$= 4x^2 - 14xy - 14xy + 49y^2$
► $= 4x^2 - 28xy + 49y^2$

23. $(x+9)(x-9)$
$= x^2 - 9x + 9x - 81$
► $= x^2 - 81$

24. $(4x-3)(4x+3)$
$= 16x^2 + 12x - 12x - 9$
► $= 16x^2 - 9$

25. $(5a+2b)(5a-2b)$
$= 25a^2 - 10ab + 10ab - 4b^2$
► $= 25a^2 - 4b^2$

26. $(x^2-1)(x^2+1)$
$= x^4 + x^2 - x^2 - 1$
► $= x^4 - 1$

Practise free online: ► Distributive Property Worksheet ► Completing the Square Worksheet ► Math Worksheets

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/

Answer Key

Binomial times trinomial, longer products and word problems

SECTION D Binomial times trinomial

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

$= x^3+3x^2-4x+2x^2+6x-8$

► $= x^3+5x^2+2x-8$

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

$= x^3-2x^2+5x-3x^2+6x-15$

► $= x^3-5x^2+11x-15$

29. $(2x+1)(3x^2-x+4)$

$= 6x^3-2x^2+8x+3x^2-x+4$

► $= 6x^3+x^2+7x+4$

30. $(x-4)(x^2+4x+16)$

$= x^3+4x^2+16x-4x^2-16x-64$

► $= x^3-64$

31. $(3x-2)(2x^2+5x-1)$

$= 6x^3+15x^2-3x-4x^2-10x+2$

► $= 6x^3+11x^2-13x+2$

32. $(a+3)(a^2-a-6)$

$= a^3-a^2-6a+3a^2-3a-18$

► $= a^3+2a^2-9a-18$

SECTION E Longer products

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

$= x^4-x^3+2x^2+2x^3-2x^2+4x-3x^2+3x-6$

► $= x^4+x^3-3x^2+7x-6$

34. $(x+1)(x+2)(x+3)$

$= (x^2+3x+2)(x+3)$

$= x^3+3x^2+3x^2+9x+2x+6$

► $= x^3+6x^2+11x+6$

35. $(x-2)^3$

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

$= x^3-2x^2-4x^2+8x+4x-8$

► $= x^3-6x^2+12x-8$

36. $(x+3)(x-3)(x^2+9)$

$= (x^2-9)(x^2+9)$

$= x^4+9x^2-9x^2-81$

► $= x^4-81$

SECTION F Area and volume

37. $(3x+2)(x-4) = 3x^2-12x+2x-8$

► Area $= 3x^2-10x-8$

38. $(2x+5)(2x+5) = 4x^2+10x+10x+25$

► Area $= 4x^2+20x+25$

39. $x(x+3) = x^2+3x$

$(x^2+3x)(2x-1) = 2x^3-x^2+6x^2-3x$

► Volume $= 2x^3+5x^2-3x$

40. $(2x+3)(x+5) = 2x^2+13x+15$

$x(x+1) = x^2+x$

$(2x^2+13x+15)-(x^2+x)$

► Border $= x^2+12x+15$

© notesofmath.com — CC BY-NC-SA 4.0

By Abu Abdul Rahman, NotesOfMath. Free to copy, print and adapt for non-commercial educational use, with attribution — CC BY-NC-SA 4.0: creativecommons.org/licenses/by-nc-sa/4.0/