# 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. $6m^2n(2m-3n^2)$ = _____



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# 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.

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# 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** $(a+3)(a^2-a-6)$

= _____

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# 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.*

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

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# 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 $= x^2+12x+15$

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