# ELMALG: Polynomials and Factoring

Introduction to Statistics · C-ID ELMALG · numberbender.com

Name: _____ Date: _____ Score: / 30

**Learning Objectives**

- Apply the laws of exponents (product, quotient, power)
- Multiply polynomials using FOIL and the distributive property
- Factor polynomials using GCF and trinomial patterns
- Simplify polynomial expressions

*Simplify each expression completely. Show all steps and circle your final answer.*

## Exponent rules

**1.** Simplify: x^7 * x^2. Express as a single power of x.

$x^7 \cdot x^2$

Answer: _____

**2.** Simplify using the quotient rule: x^5 / x^2 (assume x is not 0)

$x^5 \div x^2$

Answer: _____

**3.** A scientist writes x^11 / x^5 in her formula. Simplify to a single power.

$x^{11} \div x^5$

Answer: _____

**4.** Simplify: x^4 * x^2. Express as a single power of x.

$x^4 \cdot x^2$

Answer: _____

**5.** Simplify using the quotient rule: x^8 / x^6 (assume x is not 0)

$x^8 \div x^6$

Answer: _____

**6.** A scientist writes x^8 / x^3 in her formula. Simplify to a single power.

$x^8 \div x^3$

Answer: _____

**7.** Simplify: x^6 * x^3. Express as a single power of x.

$x^6 \cdot x^3$

Answer: _____

**8.** Simplify using the quotient rule: x^9 / x^5 (assume x is not 0)

$x^9 \div x^5$

Answer: _____

**9.** A scientist writes x^7 / x^5 in her formula. Simplify to a single power.

$x^7 \div x^5$

Answer: _____

## Factoring out the GCF

**10.** Factor completely by pulling out the greatest common factor: 4x^2 + 32x

$4x^2 + 32x$

Answer: _____

**11.** The area of a rectangle is 2x^2 + 18x square units. Factor the expression to find possible dimensions.

$2x^2 + 18x$

Answer: _____

**12.** Factor completely by pulling out the greatest common factor: 2x^2 + 10x

$2x^2 + 10x$

Answer: _____

**13.** The area of a rectangle is 6x^2 + 18x square units. Factor the expression to find possible dimensions.

$6x^2 + 18x$

Answer: _____

**14.** Factor completely by pulling out the greatest common factor: 5x^2 + 30x

$5x^2 + 30x$

Answer: _____

**15.** The area of a rectangle is 2x^2 + 14x square units. Factor the expression to find possible dimensions.

$$2x^2 + 14x$$

Answer: _____

## Adding and subtracting polynomials

**16.** Add: (3x^2 + 2x + 4) + (5x^2 + 8x + 5)

$$(3x^2 + 2x + 4) + (5x^2 + 8x + 5)$$

Answer: _____

**17.** Subtract: (7x^2 + 8x + 4) - (3x^2 + 5x + 2)

$$(7x^2 + 8x + 4) - (3x^2 + 5x + 2)$$

Answer: _____

**18.** Add: (1x^2 + 6x + 5) + (5x^2 + 1x + 2)

$$(1x^2 + 6x + 5) + (5x^2 + 1x + 2)$$

Answer: _____

**19.** Subtract: (7x^2 + 6x + 4) - (2x^2 + 1x + 2)

$$(7x^2 + 6x + 4) - (2x^2 + 1x + 2)$$

Answer: _____

**20.** Add: (1x^2 + 2x + 4) + (4x^2 + 7x + 3)

$$(1x^2 + 2x + 4) + (4x^2 + 7x + 3)$$

Answer: _____

**21.** Subtract: (8x^2 + 10x + 8) - (1x^2 + 5x + 2)

$$(8x^2 + 10x + 8) - (1x^2 + 5x + 2)$$

Answer: _____

## Multiplying polynomials (FOIL)

**22.** Multiply using FOIL: (1x + 3)(2x + 1).

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

Answer: _____

**23.** Multiply using FOIL: (4x + 5)(3x + 4)

$$(4x + 5)(3x + 4)$$

Answer: _____

**24.** Expand: (x + 2)(x - 7).

$$(x + 2)(x - 7)$$

Answer: _____

**25.** Multiply using FOIL: (1x + 1)(3x + 4).

$$(1x + 1)(3x + 4)$$

Answer: _____

**26.** Multiply using FOIL: (3x + 5)(2x + 5)

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

Answer: _____

**27.** Expand: (x + 4)(x - 2).

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

Answer: _____

**28.** Multiply using FOIL: (3x + 1)(1x + 2).

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

Answer: _____

**29.** Multiply using FOIL: (1x + 5)(4x + 8)

$$(1x + 5)(4x + 8)$$

Answer: _____

**30.** Expand: (x + 3)(x - 5).

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

Answer: _____

# ELMALG: Polynomials and Factoring

ANSWER KEY & SOLUTIONS

Introduction to Statistics · C-ID ELMALG · numberbender.com

*Topics: Multiplying polynomials (FOIL), Factoring out the GCF, Adding and subtracting polynomials, Exponent rules. All answers verified by independent computation.*

## Solutions

## Exponent rules

**1.** Simplify: x^7 * x^2. Express as a single power of x.

$x^7 \cdot x^2$

→ *Product rule: x^m * x^n = x^(m+n) = x^9.*

**Answer:** $x^9$

**2.** Simplify using the quotient rule: x^5 / x^2 (assume x is not 0)

$x^5 \div x^2$

→ *Quotient rule: x^m / x^n = x^(m-n).*
→ *m = 5, n = 2. So x^5 / x^2 = x^3.*

**Answer:** $x^3$

**3.** A scientist writes x^11 / x^5 in her formula. Simplify to a single power.

$x^{11} \div x^5$

→ *Quotient rule: x^m / x^n = x^(m-n). Here m = 11, n = 5.*
→ *x^11 / x^5 = x^6.*

**Answer:** $x^6$

**4.** Simplify: x^4 * x^2. Express as a single power of x.

$x^4 \cdot x^2$

→ *Product rule: x^m * x^n = x^(m+n) = x^6.*

**Answer:** $x^6$

**5.** Simplify using the quotient rule: x^8 / x^6 (assume x is not 0)

$x^8 \div x^6$

→ *Quotient rule: x^m / x^n = x^(m-n).*
→ *m = 8, n = 6. So x^8 / x^6 = x^2.*

**Answer:** $x^2$

**6.** A scientist writes x^8 / x^3 in her formula. Simplify to a single power.

$x^8 \div x^3$

→ *Quotient rule: x^m / x^n = x^(m-n). Here m = 8, n = 3.*
→ *x^8 / x^3 = x^5.*

**Answer:** $x^5$

**7.** Simplify: x^6 * x^3. Express as a single power of x.

$x^6 \cdot x^3$

→ *Product rule: x^m * x^n = x^(m+n) = x^9.*

**Answer:** $x^9$

**8.** Simplify using the quotient rule: x^9 / x^5 (assume x is not 0)

$x^9 \div x^5$

→ *Quotient rule: x^m / x^n = x^(m-n).*
→ *m = 9, n = 5. So x^9 / x^5 = x^4.*

**Answer:** $x^4$

---

**9.** A scientist writes x^7 / x^5 in her formula. Simplify to a single power.

$x^7 \div x^5$

→ *Quotient rule: x^m / x^n = x^(m-n). Here m = 7, n = 5.*
→ *x^7 / x^5 = x^2.*

**Answer:** $x^2$

---

## Factoring out the GCF

**10.** Factor completely by pulling out the greatest common factor: 4x^2 + 32x

$4x^2 + 32x$

→ *Find the GCF of 4x^2 and 32x: GCF = 4x.*
→ *Factor it out: 4x^2 + 32x = 4x(x + 8).*

**Answer:** $4x(x + 8)$

**11.** The area of a rectangle is 2x^2 + 18x square units. Factor the expression to find possible dimensions.

$2x^2 + 18x$

→ *Factor out the GCF of 2x^2 and 18x: GCF = 2x.*
→ *Dimensions: 2x(x + 9).*

**Answer:** $2x(x + 9)$

**12.** Factor completely by pulling out the greatest common factor: 2x^2 + 10x

$2x^2 + 10x$

→ *Find the GCF of 2x^2 and 10x: GCF = 2x.*
→ *Factor it out: 2x^2 + 10x = 2x(x + 5).*

**Answer:** $2x(x + 5)$

**13.** The area of a rectangle is 6x^2 + 18x square units. Factor the expression to find possible dimensions.

$6x^2 + 18x$

→ *Factor out the GCF of 6x^2 and 18x: GCF = 6x.*
→ *Dimensions: 6x(x + 3).*

**Answer:** $6x(x + 3)$

**14.** Factor completely by pulling out the greatest common factor: 5x^2 + 30x

$5x^2 + 30x$

→ *Find the GCF of 5x^2 and 30x: GCF = 5x.*
→ *Factor it out: 5x^2 + 30x = 5x(x + 6).*

**Answer:** $5x(x + 6)$

**15.** The area of a rectangle is 2x^2 + 14x square units. Factor the expression to find possible dimensions.

$2x^2 + 14x$

→ *Factor out the GCF of 2x^2 and 14x: GCF = 2x.*
→ *Dimensions: 2x(x + 7).*

**Answer:** $2x(x + 7)$

## Adding and subtracting polynomials

**16.** Add: (3x^2 + 2x + 4) + (5x^2 + 8x + 5)

$$(3x^2 + 2x + 4) + (5x^2 + 8x + 5)$$

→ *Combine like terms: (3+5)x^2 = 8x^2, (2+8)x = 10x, (4+5) = 9.*
→ *Result: 8x^2 + 10x + 9.*

**Answer:** $8x^2 + 10x + 9$

**17.** Subtract: (7x^2 + 8x + 4) - (3x^2 + 5x + 2)

$$(7x^2 + 8x + 4) - (3x^2 + 5x + 2)$$

→ *Distribute the minus sign to the second polynomial.*
→ *Combine like terms: (7-3)x^2, (8-5)x, (4-2).*
→ *Result: 4x^2 + 3x + 2.*

**Answer:** $4x^2 + 3x + 2$

**18.** Add: (1x^2 + 6x + 5) + (5x^2 + 1x + 2)

$$(1x^2 + 6x + 5) + (5x^2 + 1x + 2)$$

→ *Combine like terms: (1+5)x^2 = 6x^2, (6+1)x = 7x, (5+2) = 7.*
→ *Result: 6x^2 + 7x + 7.*

**Answer:** $6x^2 + 7x + 7$

**19.** Subtract: (7x^2 + 6x + 4) - (2x^2 + 1x + 2)

$$(7x^2 + 6x + 4) - (2x^2 + 1x + 2)$$

→ *Distribute the minus sign to the second polynomial.*
→ *Combine like terms: (7-2)x^2, (6-1)x, (4-2).*
→ *Result: 5x^2 + 5x + 2.*

**Answer:** $5x^2 + 5x + 2$

**20.** Add: (1x^2 + 2x + 4) + (4x^2 + 7x + 3)

$$(1x^2 + 2x + 4) + (4x^2 + 7x + 3)$$

→ *Combine like terms: (1+4)x^2 = 5x^2, (2+7)x = 9x, (4+3) = 7.*
→ *Result: 5x^2 + 9x + 7.*

**Answer:** $5x^2 + 9x + 7$

**21.** Subtract: (8x^2 + 10x + 8) - (1x^2 + 5x + 2)

$$(8x^2 + 10x + 8) - (1x^2 + 5x + 2)$$

→ *Distribute the minus sign to the second polynomial.*
→ *Combine like terms: (8-1)x^2, (10-5)x, (8-2).*
→ *Result: 7x^2 + 5x + 6.*

**Answer:** $7x^2 + 5x + 6$

## Multiplying polynomials (FOIL)

**22.** Multiply using FOIL: (1x + 3)(2x + 1).

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

→ *F: 2x^2. O: 1x. I: 6x. L: 3.*
→ *Combine: 2x^2 + 7x + 3.*

**Answer:** $2x^2 + 7x + 3$

**23.** Multiply using FOIL: (4x + 5)(3x + 4)

$$(4x + 5)(3x + 4)$$

→ *First: 4x * 3x = 12x^2.*
→ *Outer: 4x * 4 = 16x. Inner: 5 * 3x = 15x.*
→ *Last: 5 * 4 = 20. Sum the middle terms: 31x.*
→ *Result: 12x^2 + 31x + 20.*

**Answer:** $12x^2 + 31x + 20$

**24.** Expand: (x + 2)(x - 7).

$$(x + 2)(x - 7)$$

→ *FOIL: x^2 - 7x + 2x - 2*7 = x^2 + -5x + -14.*

**Answer:** $x^2 - 5x - 14$

**25.** Multiply using FOIL: (1x + 1)(3x + 4).

$$(1x + 1)(3x + 4)$$

→ *F: 3x^2. O: 4x. I: 3x. L: 4.*
→ *Combine: 3x^2 + 7x + 4.*

**Answer:** $3x^2 + 7x + 4$

**26.** Multiply using FOIL: (3x + 5)(2x + 5)

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

→ *First: 3x * 2x = 6x^2.*
→ *Outer: 3x * 5 = 15x. Inner: 5 * 2x = 10x.*
→ *Last: 5 * 5 = 25. Sum the middle terms: 25x.*
→ *Result: 6x^2 + 25x + 25.*

**Answer:** $6x^2 + 25x + 25$

**27.** Expand: (x + 4)(x - 2).

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

→ *FOIL: x^2 - 2x + 4x - 4*2 = x^2 + 2x + -8.*

**Answer:** $x^2 + 2x - 8$

**28.** Multiply using FOIL: (3x + 1)(1x + 2).

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

→ *F: 3x^2. O: 6x. I: 1x. L: 2.*
→ *Combine: 3x^2 + 7x + 2.*

**Answer:** $3x^2 + 7x + 2$

---

**29.** Multiply using FOIL: (1x + 5)(4x + 8)

$$(1x + 5)(4x + 8)$$

→ *First: 1x * 4x = 4x^2.*
→ *Outer: 1x * 8 = 8x. Inner: 5 * 4x = 20x.*
→ *Last: 5 * 8 = 40. Sum the middle terms: 28x.*
→ *Result: 4x^2 + 28x + 40.*

**Answer:** $4x^2 + 28x + 40$

---

**30.** Expand: (x + 3)(x - 5).

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

→ *FOIL: x^2 - 5x + 3x - 3*5 = x^2 + -2x + -15.*

**Answer:** $x^2 - 2x - 15$

---