

Dividing expressions



This objective develops the quotient law for powers with the same non-zero base.

Vocabulary

A **quotient** is the result of division. To **simplify** is to write an equivalent expression clearly. A **coefficient** is the numerical factor; a **power/index** shows repeated multiplication.

Key idea

For $a \neq 0$, $a^m \div a^n = a^{m-n}$. Keep the base and subtract the exponents.

Why factors cancel



Write short products to see what remains.

Repeated factors

$$x^5 \div x^2 = \frac{\overset{\text{XXXXX}}{x^5}}{\underset{\text{XX}}{x^2}} = \text{xxx} = x^3. \text{ Two common factors make } x \div x = 1.$$

Identity and inverse

$a \div a = 1$ for $a \neq 0$. This is the multiplicative inverse/identity idea behind cancellation.

Zero exponent

$$a^4 \div a^4 = a^{4-4} = a^0 = 1, \text{ provided } a \neq 0.$$

A reliable process



Separate coefficients and each variable.

Worked example

$$24x^3y \div 6xy = (24 \div 6)(x^{3-1})(y^{1-1}) = 4x^2.$$

Two variables

$$30a^2b^3 \div 5ab = 6a^{2-1}b^{3-1} = 6ab^2.$$

Check

$(-24x^4) \div (6x) = -4x^3$: divide the signed coefficients first, then subtract exponents.

Representations and applications



A fraction bar means division.

Fraction form

$\frac{63c^3d^5}{7cd^2} = 9c^2d^3$. A factor in the numerator and denominator can cancel.

Area model

If area is $24a^3b^2$ and width is $6ab$, length is $\frac{24a^3b^2}{6ab} = 4a^2b$.

Negative result

If the denominator has the higher power, $a^3 \div a^5 = a^{-2} = 1/a^2$.

Checks and boundaries



Cancel factors, never pieces of sums.

Common mistake

$\frac{8x^5}{2x^3} = 4x^2$, not $4x^{15}$: exponents subtract in a quotient.

Do not cancel a sum

$\frac{x+2}{x}$ cannot simplify by cancelling x , because $x+2$ is not a product with factor x .

Connection

LO9 multiplication uses $a^m a^n = a^{m+n}$. Division is its inverse: it removes matching factors and subtracts exponents.