

Multiplying and dividing like terms

Remember that, when adding and subtracting, **like terms** are terms with the same base and same exponent. For instance, $-4x^2$ and $3x^2$ are like terms because they have the same base, x , and the same exponent, 2. The coefficients are different, -4 and 3 , but the coefficients can be different and the terms are still alike.

On the other hand, $3x^2$ and $-4x^5$ are not like terms for addition and subtraction because, while they have the same base, the exponents 2 and 5 are different.

Like terms for multiplication and division

When we're multiplying and dividing, the base still has to be the same (just like when we were adding and subtracting), but the exponents can be different.

So while $3x^2$ and $-4x^5$ *can't* be added or subtracted, the sum is just $3x^2 - 4x^5$ and the sum can't be simplified any further. But they *can* be multiplied or divided. When we multiply terms with the same base, the base stays the same and the exponents get added. The coefficients get multiplied together to become the new coefficient.

$$4x^2 \cdot 3x^5$$

$$(4 \cdot 3)x^{2+5}$$



$$12x^7$$

Similarly, when we divide terms with the same base, the base stays the same and the exponents get subtracted (we subtract the exponent in the denominator from the exponent in the numerator). The coefficients get divided to become the new coefficient.

$$\frac{4x^3}{2x}$$

$$\frac{4}{2}x^{3-1}$$

$$2x^2$$

We won't be able to multiply or divide terms when the bases aren't the same. For example, the bases of x^2 and y^3 are different, so we can multiply the terms, we just can't combine or simplify the product in any way.

$$x^2 \cdot y^3 = x^2y^3$$

We can also divide these terms, we just can't combine or simplify the quotient in any way.

$$x^2 \div y^3 = \frac{x^2}{y^3}$$

Let's work through an example to see this in action.

Example

Simplify the expression.



$$\frac{x^3}{x} - (2x)(3x)$$

In the fraction, the terms in the numerator and denominator are alike, because they have the same base, x . So to simplify the fraction, the base will stay the same and we'll subtract the exponents.

$$x^{3-1} - (2x)(3x)$$

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

To simplify the product of the terms $(2x)(3x)$, we can see that the terms are alike because they have the same base, x . To simplify the product, the coefficients will be multiplied to get the new coefficient, the base will stay the same, and the exponents will get added.

$$x^2 - (2 \cdot 3)x^{1+1}$$

$$x^2 - 6x^2$$

Now we realize that we're left with subtraction. Terms are only alike for the purpose of addition and subtraction when the base and exponent are both equivalent. For both of these terms, the base is x and the exponent is 2. So we have like terms for subtraction, and we're subtracting six x^2 terms from one x^2 terms, so the result will be

$$(1 - 6)x^2$$

$$-5x^2$$

