

Rewriting Linear Expressions in Equivalent Forms

Grade 7 math · Lesson · Standards: 7.EE.A.1, 7.EE.A.2

Quick answer: Equivalent expressions have the same value for every value of the variable. You can create them with the distributive property, such as $3(x + 4) = 3x + 12$, by combining like terms, and by factoring out a greatest common factor. Rewriting an expression can also reveal meaning, like $p + 0.05p = 1.05p$.

Standards: 7.EE.A.1, 7.EE.A.2 · **Level:** Grade 7

What makes two expressions equivalent?

Two expressions are equivalent when they give the same value for every number that replaces the variable. For example, $3(x + 4)$ and $3x + 12$ both equal 18 when $x = 2$, and they match for every other value too.

Equivalent expressions

Expressions that name the same quantity for all values of the variable. One test value can prove two expressions different, but it can never prove them equal.



The area of $3(x + 4)$ equals $3x + 12$.

How do you expand and combine like terms?

Distributive property

$$a(b + c) = ab + ac \quad \text{and} \quad a(b - c) = ab - ac$$

Like terms have the same variable part, so their coefficients can be added or subtracted. The terms $8x$ and $3x$ combine, but $8x$ and 3 do not.

Expression	Expanded form
$-2(3x - 5)$	$-6x + 10$
$\frac{1}{2}(8x + 6)$	$4x + 3$
$0.4(5x - 2.5)$	$2x - 1$

$$-2 \cdot 3x = -6x \qquad -2 \cdot (-5) = +10$$

Distributing -2 to both terms: $-2(3x - 5) = -6x + 10$.

Two common slips

Distribute to every term: $4(x + 3)$ is $4x + 12$, not $4x + 3$. A minus sign in front of parentheses flips every sign inside: $-(x - 4) = -x + 4$.

How do you factor a linear expression?

Factoring runs the distributive property backward. Find the greatest common factor (GCF) of the coefficients, write it outside the parentheses, and put what remains inside. For $12x + 18$, the GCF is 6, so the result is $6(2x + 3)$. Expand to check.

How can rewriting an expression show its meaning?

A price p plus 5% tax is $p + 0.05p$. Combining like terms gives $1.05p$, which says "multiply the price by 1.05" in one step.

$$\text{total price} = p + 0.05p = 1.05p$$

A 5% increase adds a small piece of $0.05p$ to the price p .

Method for simplifying

1. Distribute every factor, keeping each sign.
2. Group like terms.
3. Combine the coefficients.
4. Check with a test value.

Worked example

Simplify $4(2x - 3) - (x - 5)$.

$$8x - 12 - x + 5 = \mathbf{7x - 7}$$

Check with $x = 2$: $4(1) - (-3) = 7$ and $7(2) - 7 = 7$.

Mathbot's tip

Circle every sign before you move a term. Most errors in this chapter are lost minus signs, not hard arithmetic.

Key points to remember

- The distributive property multiplies a factor by every term inside the parentheses.
- Like terms share the same variable part, so only their coefficients are added or subtracted.
- Factoring out the greatest common factor reverses expanding, and expanding checks it.
- A percent change can be written as one multiplier: a 5% increase is 1.05 times the original.

Rewriting Linear Expressions in Equivalent Forms: frequently asked questions

How can I prove two expressions are not equivalent?

Find one value of the variable that gives different results. A single mismatch is enough, but matching values for a few numbers does not prove equivalence.

What happens when a negative number is outside the parentheses?

Multiply it by every term inside, changing signs as the sign rules require. For example, $-3(x - 2) = -3x + 6$ because -3 times -2 is positive.

Can I combine $5x$ and 5 ?

No. They are not like terms, because one has the variable x and the other does not. The sum $5x + 5$ can only be factored as $5(x + 1)$.

What is the greatest common factor of $18x$ and 24 ?

It is 6, the largest number dividing both coefficients evenly. Then $18x + 24 = 6(3x + 4)$.

Why write $p + 0.05p$ as $1.05p$?

Because p is $1p$, and $1p + 0.05p = 1.05p$. One multiplication then gives the total price, with no separate tax step.