

The Distributive Property 1

The **distributive property** states that $a(b + c) = ab + ac$

It may look like a meaningless or difficult equation to you now, but don't worry, it will become clearer!

The equation $a(b + c) = ab + ac$ means that you can *distribute* the multiplication (by a) over the sum ($b + c$) so that you multiply the numbers b and c separately by a , and add last.

You have already used the distributive property! When you separated $3 \cdot 84$ into $3 \cdot (80 + 4)$, you then multiplied 80 and 4 *separately* by 3, and added last: $3 \cdot 80 + 3 \cdot 4 = 240 + 12 = 252$. We called this using "partial products" or "multiplying in parts."

Example 1. Using the distributive property, we can write the product $2(x + 1)$ as $2x + 2 \cdot 1$, which simplifies to $2x + 2$.

Notice what happens: Each term in the sum $(x + 1)$ gets multiplied by the factor 2! Graphically:

$$2(x + 1) = \underline{2x} + \underline{2 \cdot 1}$$

Example 2. To multiply $s \cdot (3 + t)$ using the distributive property, we need to multiply *both* 3 and t by s :

$$s \cdot (3 + t) = s \cdot 3 + s \cdot t, \text{ which simplifies to } 3s + st.$$

1. Multiply using the distributive property.

a. $3(90 + 5) = 3 \cdot \underline{\quad} + 3 \cdot \underline{\quad} =$	b. $7(50 + 6) = 7 \cdot \underline{\quad} + 7 \cdot \underline{\quad} =$
c. $4(a + b) = 4 \cdot \underline{\quad} + 4 \cdot \underline{\quad} =$	d. $2(x + 6) = 2 \cdot \underline{\quad} + 2 \cdot \underline{\quad} =$
e. $7(y + 3) =$	f. $10(s + 4) =$
g. $s(6 + x) =$	h. $x(y + 3) =$
i. $8(5 + b) =$	j. $9(5 + c) =$

Example 3. We can use the distributive property also when the sum has three or more terms. Simply multiply **each term** in the sum by the factor in front of the parentheses:

$$5(x + y + 6) = 5 \cdot x + 5 \cdot y + 5 \cdot 6, \text{ which simplifies to } 5x + 5y + 30$$

2. Multiply using the distributive property.

a. $3(a + b + 5) =$	b. $8(5 + y + r) =$
c. $4(s + 5 + 8) =$	d. $3(10 + c + d + 2) =$

Example 4. Now one of the terms in the sum has a coefficient (the 2 in $2x$):

$$6(2x + 3) = 6 \cdot 2x + 6 \cdot 3 = 12x + 18$$

3. Multiply using the distributive property.

a. $2(3x + 5) =$	b. $7(7a + 6) =$
c. $5(4a + 8b) =$	d. $2(4x + 3y) =$
e. $3(9 + 10z) =$	f. $6(3x + 4 + 2y) =$
g. $11(2c + 7a) =$	h. $8(5 + 2a + 3b) =$

To understand even better why the distributive property works, let's look at an area model (this, too, you have seen before!).

The area of the whole rectangle is 5 times $(b + 12)$.

But if we think of it as *two* rectangles, the area of the first rectangle is $5b$, and of the second, $5 \cdot 12$.

Of course, these two expressions have to be equal:

$$5 \cdot (b + 12) = 5b + 5 \cdot 12 = 5b + 60$$



4. Write an expression for the area in two ways, thinking of one rectangle or two.

<p>a. $9(\underline{\quad} + \underline{\quad})$ and $9 \cdot \underline{\quad} + 9 \cdot \underline{\quad} =$</p>	<p>b. $s(\underline{\quad} + \underline{\quad})$ and $s \cdot \underline{\quad} + s \cdot \underline{\quad} =$</p>
<p>c. $\underline{\quad}(\underline{\quad} + \underline{\quad})$ and</p>	<p>d.</p>
<p>e.</p>	<p>f.</p>