

Expanding and factorising

How to expand brackets involving positive and negative numbers.
 How to simplify the resulting expression where necessary.
 How to identify when the terms of an expression have a common factor.
 How to factorise an expression by extracting a common factor.

Check that you can:

- recognise and group like terms
- remember the rules when performing the four operations (+ − × ÷) upon negative numbers
- identify factors of a number.

Expanding brackets

Example 1

Consider $3(2x + 5)$.
 This means the same as $3 \times (2x + 5)$.

The rules of BIDMAS tell us to calculate the contents of the brackets first. We cannot evaluate the contents of the brackets at this time, but we can **EXPAND** the brackets. This means we need to multiply **every term** inside the brackets, by the number outside the bracket.

We have:
 $3(2x + 5) = 3 \times 2x + 3 \times 5$

This gives a final answer of $6x + 15$.
 $6x$ and 15 are different terms within the expression $6x + 15$.

Remember!

After you have factorised an expression, you can check your answer by expanding the brackets again. If you don't get back to the original expression, check for mistakes.

Expanding brackets involving negative numbers

Care is needed if there is a negative number either inside or outside the brackets.

Example 2

Expand $4(3x - 5)$.

Answer:

$$4(3x - 5) = 4 \times 3x + 4 \times (-5) = 12x - 20$$

Example 3

Expand $-2(x - 6)$.

Answer:

$$-2(x - 6) = (-2) \times x + (-2) \times (-6) = -2x + 12$$

This could also be written as $12 - 2x$.

Example 4

Expand $-(7x - 3)$.

Answer:

Remember that

$-(7x - 3)$ is the same as $-1(7x - 3)$.

$$-(7x - 3) = (-1) \times 7x + (-1) \times (-3) = -7x + 3$$

Factorising: when the common factor is a number

Factorising is the opposite process to expanding brackets.

Factorised expressions always contain at least one set of brackets.

To start factorising, you need to identify the highest common factor of all the terms in the expression.

Example 5

Factorise $10x + 15$.

Answer:

The answer in this case will take the form $\square(\square + \square)$, where the blank spaces need to be filled.

We require the highest common factor of the two original terms.

The highest common factor of $10x$ and of 15 is 5 .

This gives $5(\square + \square)$.

We now need to divide each of the original terms by five in order to complete the factorisation.

This gives an answer of $5(2x + 3)$.

It is always worth checking by expanding the brackets in the final answer.

$$\begin{aligned} 5(2x + 3) &= 5 \times 2x + 5 \times 3 \\ &= 10x + 15 \end{aligned}$$

Example 6

Factorise $16x - 8$.

Answer:

The **highest** common factor of $16x$ and of 8 is 8 .

$$16x - 8 = 8(2x - 1).$$

Note that $16x - 8$ is also equal to $2(8x - 4)$ and $4(4x - 2)$. In neither case has $16x - 8$ been fully factorised as the remaining brackets still contain a factor.