Factorising Expressions

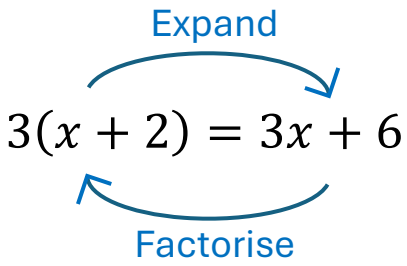
Starter

1) Expand $3x(2x-4)$
2) Simplify $a+9a-8a$
3) Simplify $4x \times 3x + 4x^2$
4) Solve $3x-4=8$
5) Solve $6x+3x-2-4=10$

Starter Answers

1) $6x^2-12x$ 2) $2a$ 3) $16x^2$ 4) $x=4$ 5) $x=\frac{16}{9}$

A few lessons ago, we looked at expanding brackets.
For example, we saw that $3(x+2)=3x+6$.
Factorising an expression changes an algebraic **addition** back into a **multiplication** by finding a common factor.



Example 1

Fill in the gaps

1) $3(\square + 4) = 6x + 12$

2) $4(\square - 2) = 4x - \square$

3) $\square(\square + \square) = 8x + 12$

4) For question 3, can you think of any different answers?

Answers

1) $3(\boxed{2x} + 4) = 6x + 12$

2) $4(\boxed{x} - 2) = 4x - \boxed{8}$

3) $\boxed{4}(\boxed{2x} + \boxed{3}) = 8x + 12$

4) We could have $2(4x+6)$

Which answer do we choose if there is more than one?

Notice how question 3 had more than one answer. This is because 8 and 12 have more than one common factor (2 and 4 are both common factors of 8 and 12). $2(4x+6)$ and $4(2x+3)$ are both correct factorisations of $8x+12$ but we would say that $4(2x+3)$ is **fully factorised**.

When we factorise, we tend to choose the **highest common factor** (the highest times table both numbers are in) so we would choose $4(2x+3)$ as our answer.

Example 2

Factorise these expressions

a) $10x+20$

Look at both terms ($10x$ and 20 are the terms) and find the highest common factor of 10 and 20.

The highest common factor of these numbers is 10. So, 10 goes on the outside of the bracket.

$$10(\square+\square)$$

Next, use a grid to find the terms that go inside of the bracket.

$\times$		
10	$10x$	20

Then find the missing numbers in the grid. Think about what we would need to times 10 by to get $10x$ and 20.

$\times$	x	2
10	$10x$	20

So, the answer is $10(x+2)$.

b) $12a-16$

The highest common factor of 12 and 16 is 4. So, 4 goes on the outside of the bracket, $4(\quad)$

Now draw a grid:

$\times$		
4	$12a$	-16

→

$\times$	$3a$	-4
4	$12a$	-16

So, $12a-16=4(3a-4)$

c) $9 - 6b$

Find the highest common factor of 9 and 6. This is 3, so 3 goes on the outside of the bracket.

This would be $3(\quad)$

Now draw a grid:

×		
3	9	$-6b$

→

×	3	$-2b$
3	9	$-6b$

So, $9 - 6b = 3(3 - 2b)$

d) $21a + 14b - 35c$

Find the highest common factor of 21, 14 and 35. This is 7, so 7 goes on the outside of the bracket.

Now draw a grid:

×			
7	$21a$	$14b$	$-35c$

→

×	$3a$	$2b$	$-5c$
7	$21a$	$14b$	$-35c$

So, $21a + 14b - 35c = 7(3a + 2b - 5c)$

Your go

Factorise

a) $8a + 10$ b) $24b - 12$ c) $21 + 56c$ d) $16d + 24b - 32c$

Answers

a) $2(4a + 5)$ b) $12(2b - 1)$ c) $7(3 + 8c)$ d) $8(2d + 3b - 4c)$

Example 3

Factorise these expressions:

a) $4x^2 + 6x$

The highest common factor of 4 and 6 is 2. So, 2 can go on the outside of the bracket.

But, this time, there is another common factor of $4x^2$ and $6x$. Both terms are multiplied by x, so x can go on the outside of the bracket too.

So, we have $2x(\quad)$

Now draw a grid:

×		
$2x$	$4x^2$	$6x$

→

×	$2x$	3
$2x$	$4x^2$	$6x$

So, the answer is $2x(2x + 3)$

b) $12x^3 - 8x^2$

Find the highest common factor of 12 and 8. This is 4.
Find the highest common factor of x^3 and x^2 (what is the highest amount of x both terms are multiplied by?). This is x^2.
So, we have $4x^2($ $)$

Next, draw a grid:

×		
$4x^2$	$12x^3$	$-8x^2$

→

×	$3x$	-2
$4x^2$	$12x^3$	$-8x^2$

So, the answer is $4x^2(3x - 2)$.

c) $3eg + 7gh$

The highest common factor of 3 and 7 is 1. We do not need to put a 1 on the outside of the bracket.
The highest common factor of eg and gh is g (since there is a g in both terms).
So, we have $g($ $)$
Next, draw a grid:

×		
g	$3eg$	$7gh$

→

×	$3e$	$7h$
g	$3eg$	$7gh$

So, the answer is $g(3e + 7h)$.

Your go

Factorise

a) $16x^2 + 24x$ b) $4a^3 - 28a^2$ c) $12c^3 + 4c$ d) $15abc - 12bcd$

Answers

a) $8x(2x + 3)$ b) $4a^2(a - 7)$ c) $4c(3c^2 + 1)$ d) $3bc(5a - 4d)$