Further Factorising

Did you know?

Substitute $x = 9$ into the following two expressions

$$\boldsymbol{x^2 + 3x + 2}$$

What do you notice?

$$(9)^2 + 3(9) + 2 = 81 + 27 + 2 = 110$$

$$\boldsymbol{(x + 2)(x + 1)}$$

$$(9 + 2)(9 + 1) = 11 \times 10 = 110$$

Both give the same answer as the expressions are equivalent

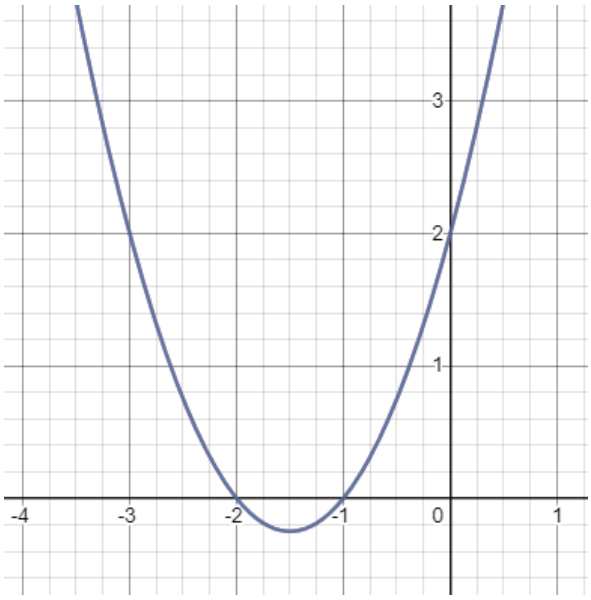
One of the expressions was a lot easier to evaluate! Why?

Which is best?

$x^2 + 3x + 2$ *or* $(x + 2)(x + 1)$

expanded form | factorised form

$y = x^2 + 3x + 2$ $y = (x + 2)(x + 1)$



Factorising is a key skill for both sketching graphs and solving equations, both of which will be covered later.

Sometimes it is more helpful to factorise an expression, other times better to be expand it, depending on the context.

Further Factorising 1

Factorise the following fully:

1. $x^2 + 5x - 6$
2. $x^2 + 13x - 30$
3. $y^2 - 13y + 30$
4. $t^2 + 2t - 15$
5. $k^2 - 2k - 24$
6. $p^2 - 10p + 21$
7. $x^2 - 16x$
8. $3x(2x - 1) + 4(1 - 2x)$

Further Factorising 2

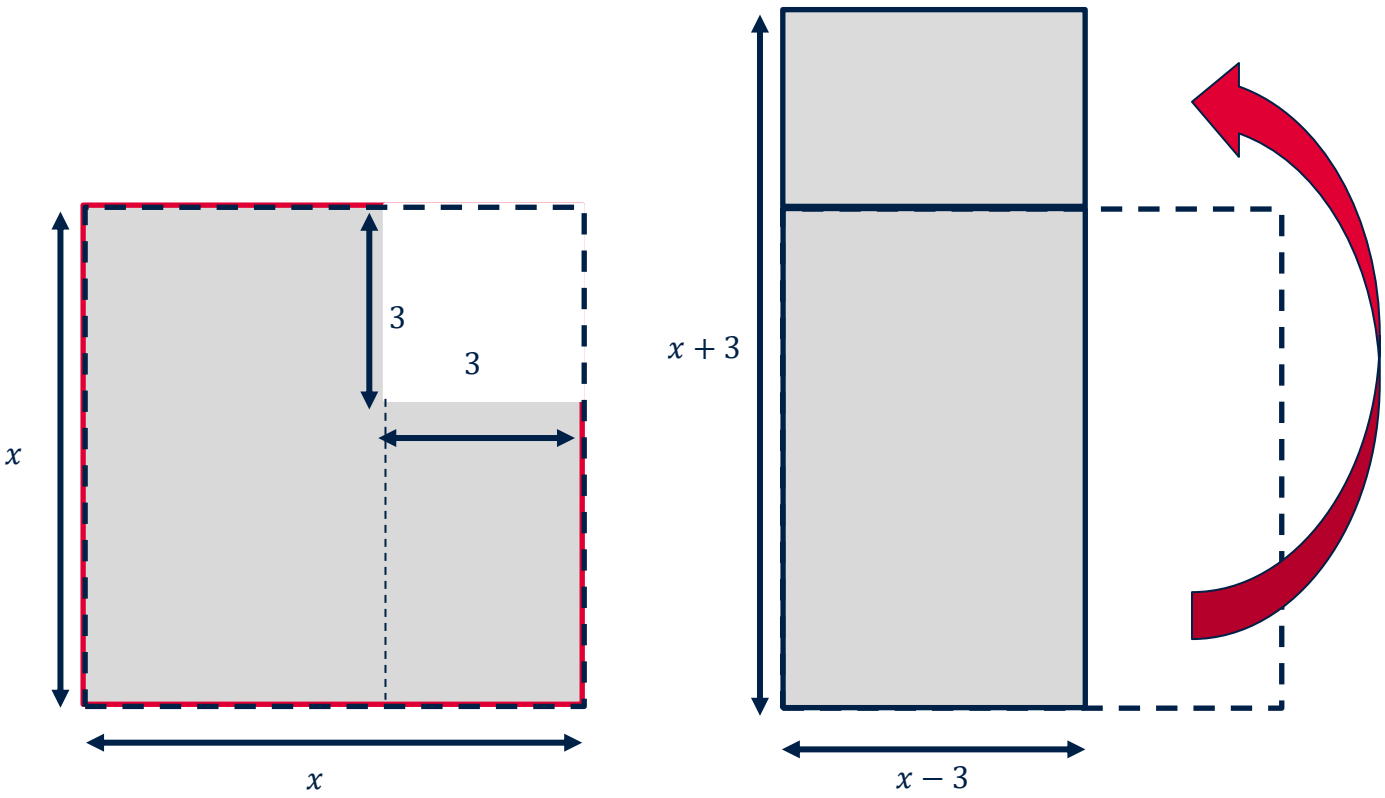
Factorise the following fully:

1. $x^2 + 6x - 7$
2. $y^2 + y - 12$
3. $y^2 - 11y + 28$
4. $t^2 + 7t - 18$
5. $k^2 + 9k + 20$
6. $x^2 + x - 56$
7. $p^2 - 25p$
8. $x^2(3x - 4) + (4 - 3x)$

Difference of Two Squares

A special case for factorising is the difference of two squares.

Expressions such as $x^2 - 3^2$, where the coefficient of x is zero.



$$x^2 - 3^2 \quad = \quad (x-3)(x+3)$$

Try factorising these expressions using the difference of two squares

1. $x^2 - 6^2$
2. $y^2 - 144$
3. $x^2 - y^2$
4. $4t^2 - 81$
5. $x^2 - 5$

$ax^2 + bx + c$

So far we have been factorising quadratic expressions where $a = 1$. For example, $x^2 - 2x - 15$

Time to try some trickier quadratics!

Have a go at this one…

Factorise $\mathbf{6x^2 + 19x + 10}$

If you got $6x^2 + 19x + 10 = (3x + 2)(2x + 5)$ Well done!

Feeling confident? You can try the Trickier Quadratics questions below

There are many methods for factorising quadratics where $a > 1$

You might want to refresh your memory on the method that you learnt at school if you are going to tackle the following questions.

Trickier Quadratics

1. $\mathbf{3x^2 - 10x - 8}$
2. $\mathbf{2x^2 - 7x + 6}$
3. $\mathbf{4y^2 + 20y + 9}$
4. $\mathbf{6x^2 - 13x - 8}$
5. $\mathbf{20x^2 + x - 12}$

Further Factorising Problems

These expressions are slightly different to the previous ones but can still be factorised.

1. $2t^2 - 32$
2. $x^3 - 7x^2 + 12x$
3. $x^4 - x^2 - 2$
4. $y^4 - 625$

Without a calculator

What is the value of each of the following?
calculators not allowed

$$9^2 - 1^2$$

$$99^2 - 1^2$$

$$999^2 - 1^2$$

Still without a calculator

Without using a calculator, find the value of

$$\frac{122 \times (122^2 + 4 \times 123)}{124} - \frac{124 \times (124^2 - 4 \times 123)}{122}$$

Top and Bottom

Simplify

$$\frac{x^2 - 3x - 10}{x^2 + 7x + 10}$$

Some possible hints!

Without a calculator Hint	Still without a calculator Hint	Top and Bottom Hint
■ Can you factorise $9^2 - 1^2$? ■ How does this help?	■ Replace 123 by n and 122 by $n-1$ ■ Now go on to factorise	■ Factorise the numerator then the denominator ■ What do you notice?