

Factoring

We know three main kinds of factoring:

- Basic
- Multiplication
- Division

The answers for these types look like this (a and b stand for numbers):

- $(x+a)(x+b)$ ← Basic
- $(2x+a)(x+b)$ ← Multiplication
- $2(x+a)(x+b)$ ← Division

Note the stuff underlined in green: they're different! Remember them!

Let's do some examples:

ex

$$\frac{x^2 + 7x + 6}{\begin{matrix} a & b & c \end{matrix}}$$

Check: is $a > 1$?

No. a is equal to 1.

Since $a=1$, we do basic factoring.

$$x^2 + 7x + 6 \quad \swarrow \begin{matrix} 2.3 \end{matrix}$$

$$\begin{matrix} 1 \cdot 6 = 6 \checkmark \\ 1 + 6 = 7 \end{matrix}$$

Factor c .

We need numbers that ADD to b and MULTIPLY to c .

$$(x+1)(x+6)$$

Put your factors in parentheses. You're done.

Basic

What if $a > 1$?

One of two things will happen.

ex/

$$\frac{2x^2 + 8x + 6}{\frac{a}{b} \quad \frac{c}}$$

Check: is $a > 1$?

Yes — so we check if b and c are divisible by a

They are — pull a out:

$$2(x^2 + 4x + 3)$$

This the result of $\frac{2x^2 + 8x + 6}{2}$.

Factor the () like normal:

$$2(x^2 + 4x + 3)$$

$$2(x+1)(x+3)$$

Remember — a stays out front!

We're done.

Division

What if you can't divide b and c by a ?

If $a > 1$ and you can't divide, multiply $a \cdot c$.

ex/ $\frac{3x^2 + 13x + 4}{a \quad b \quad c}$

$$a \cdot c = 3 \cdot 4 = 12$$

Now factor 12

$$\begin{array}{l} 12 = 1 \cdot 12 \\ 13 = 1 + 12 \end{array} \quad \begin{array}{l} 1 \\ 2 \cdot 6 \end{array} \quad 3 \cdot 4$$

a and c drop down, and the factors take the place of $13x$:

$$3x^2 + 12x + 1x + 4$$

Break in half:

$$(3x^2 + 12x) \quad (1x + 4)$$

$$3x \swarrow \quad \downarrow \\ (x + 4) + 1(x + 4)$$

$$\boxed{(3x + 1)(x + 4)}$$

We're done.

Multiplication

• Pull out common factors

• Terms outside get put in their own

()^s
• Terms already in ()_s come down