Factoring

What is it, and how do I use it?

	In Factored Form	Not in Factored Form
Example 1	$2x(x + y)$	$2x + 3y + z$
Example 2	$(x + y)(3x - 2y)$	$2(x + y) + z$
Example 3	$(x + 4)(x^2 + 3x - 1)$	$(x + y)(2x - y) + 5$

When we want to factor something it is to remove the plus and minus so that we have everything in one term. This lets us see the behaviour of the polynomial and allows for some nice simplification tricks.

Today we will be working on 2 things. The Greatest Common Factor, and Grouping.

The Greatest Common Factor:

This part should look familiar to you (from grade 9):

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

All we are doing today is starting from $2x^2 + 2x$ and making it $2x(x + 1)$.

We want to take out the Greatest Common Factor.

$$5 + 10 = 5(1 + 2)$$

We know they are the same thing, we just want to be able to start with 2 terms and make 1 term.

- ➔ Identify the Greatest Common Factor
- ➔ Multiply and divide everything by that
  - ◆ Cancel what you can and you're left with the answer.
  - ◆ Ie:

multiply by 1

$$\begin{aligned} &\frac{2x^2+2x}{1} \\ &= \frac{2x}{2x}(2x^2+2x) \\ &= 2x\left(\frac{2x^2+2x}{2x}\right) \\ &= 2x\left(\frac{2x^2+2x}{2x}\right) \\ &= 2x(x+1) \end{aligned}$$

$2x$

$2x^2+2x$

$2x(x+1)$

You Try:

$2x-14$ $2(x-7)$ ✓	$15x^3+9x^2$ $3x^2(5x+3)$
$3x+6x^2$ $3x(1+2x)$	$-6x^4y^2+18x^2y-24$ $-6(x^4y^2-3x^2y+4)$

A tricky version of this type of factoring is called "Grouping". Sometimes you can factor from some of the terms - but not all of the terms. Then we factor what we can, where we can.

For example:

$$3xy + 6xy + 4x + 8y$$

There are no common factors between all 4 terms. But, the first 2 terms have a $3xy$ and the last 2 terms have a 4.

So, we deal with this as 2 seperate Greatest Common Factor problems.

$$3xy + 6xy \qquad +4x + 8y$$

$3xy(1+2) + 4(x+2y)$

$3xy(3) + 4(x+2y)$

$9xy + 4(x+2y)$

Another Example:

$$2xy + 4xz - 5y - 10z$$

$2x(y+2z) - 5(y+2z)$

$(y+2z)(2x-5)$

You Try:

$3x^2+6x+4x+8$ $3x(x+2)+4(x+2)$ $(x+2)(3x+4)$	$2x^3-10x^2+3x-15$ $2x^2(x-5)+3(x-5)$ $(x-5)(2x^2+3)$
$x^3-6x^2+10x-60$ $x^2(x-6)+10(x-6)$ $(x-6)(x^2+10)$	$2x^3-x^2-10x+5$ $x^2(2x-1)-5(+2x-1)$ $(2x-1)(x^2-5)$

Homework:

1) $4x^3+8x^2+x+2$

2) $3a^3-6a^2+2a-4$

3) $5p^3+10p^2-16p-32$

4) $56m^3-7m^2-8m+1$

5) $2mx-7x-2m+7$

6) $3pz-9p+5z-15$

7) $2u^2+4uv+u+2v$

8) $6xy+2y-3x-1$