# Common Factoring and Factoring by Grouping

**Learning Target:** We are learning to… factor using the techniques of common factoring, and grouping.

**Success Criteria:** I can… factor using the techniques of common factoring, and grouping.

Let's talk English. What do the words, "common" and "factor" mean?

"Common"
- similar
- share something
the same

"Factor"
- write as a product
- multiples of other
numbers

In other words, we are re-writing an expression in terms of its factors. This would be the OPPOSITE of expanding.

EXPANDING →

$$2x(x + 4y - 5) = 2x^2 + 8xy - 10x$$

← FACTORING.

Common factoring should always be the first type of factoring you do (yes, there are more types). A polynomial is completely factored when no more variable factors can be removed and no more integer factors other than 1 or −1 can be removed.

Let's take a look at some examples.

**Ex. 1 Find the greatest common factor (GCF) of $3x^5$, $9x^4y^6$, $12x^2y$.**

Greatest common factor of coefficients: 3
Greatest common factor of variable parts: $x^2$
Therefore, the greatest common factor of the polynomials is: $3x^2$

**Ex. 2 Monomial Common Factor**
Factor fully.

a) $2x + 6x^2$ b) $6x^2 + 12x$ c) $8x^3 - 6x^2y^2 + 4x^2y$ d) $-15x^2y^2 + 10x^3y^2 - 5xy$

a) $= 2x(1+3x)$
GCF

b) $= 6x(x+2)$
GCF

c) $= 2x^2(4x - 3y^2 + 2y)$
GCF

d) $= -5xy(3xy - 2x^2 + 1)$
GCF.

**Ex. 3: Binomial Common Factor**

Factor fully.

a) $3x(2y+1)+4m(2y+1)$

$= (2y+1)(3x+4m)$

GCF

b) $8y(3z-4)-(3z-4)$

$= (3z-4)(8y-1)$

GCF

c) $(3y-1)^2+y(3y-1)$

$= (3y-1)(3y-1+y)$

$= (3y-1)(4y-1)$

GCF

**Ex. 4: Factoring by Grouping**

Factor fully.

a) $ac+bc+ad+bd$

$= (ac+bc)+(ad+bd)$

$= c(a+b)+d(a+b)$

$= (a+b)(c+d)$

GCF

Another approach:

$= (ac+ad)+(bc+bd)$

$= a(c+d)+b(c+d)$

$= (c+d)(a+b)$

GCF

b) $2m^2+6n+4m+3mn$

$= (2m^2+4m)+(6n+3mn)$

$= 2m(m+2)+3n(2+m)$

$= (m+2)(2m+3n)$.

GCF $\longrightarrow (m+2)=(2+m)$

c) $(x+1)^2-x+1$

= NOT FACTORABLE $\longrightarrow$ If $(x+1)^2-x-1$

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

$= (x+1)((x+1)-1)$

$= (x+1)(x)$

or $x(x+1)$

Homework: CP p. 74-75