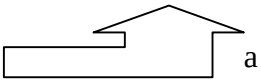
Chapter 6: FACTORING & APPLICATIONS

6.1 The Greatest Common Factor; Factor by Grouping

FACTORING
(to express as a multiplication)

Step 1: Factor out GCF (greatest common factor)
Step 2: Count the terms
4-terms $\Longrightarrow$ grouping (2-steps)
3-terms $\Longrightarrow$ trial & error or master product
2-terms $\Longrightarrow$ difference of squares

1. $\underbrace{a^2}_{a} - \underbrace{b^2}_{b}$ *then factor as* $(a+b)(a-b)$

a & b are the roots used in  a sum & difference

difference of cubes

2. $\underbrace{a^3}_{a} - \underbrace{b^3}_{b}$ *then factor as* $(a-b)(a^2+ab+b^2)$

sum of cubes

3. $\underbrace{a^3}_{a} + \underbrace{b^3}_{b}$ *then factor as* $(a+b)(a^2-ab+b^2)$

FACTOR (verb): express as a multiplication

example: Factor 12

$12 = 1(12)$ note: $12 = (1) + (11)$
$12 = 2(6)$  Not factored
$12 = 3(4)$ note: factors of a number divide it evenly, 1,2,3,4,12 divide 12 evenly

$12 = 2(2)(3) = 2^2(3)$ this is called the Prime Factorization of 12
because all the factors are prime numbers

Greatest Common Factor (GCF)

example: Find the GCF of 12 and 16……..do you know the answer??

If not…step 1: prime factor each number (tree method or division)

$12 = 2^2 (3)$

$16 = 2^4$

step 2: multiply the factors they have in common

GCF $= 2^2$ or 4 note: since 4 is a factor (GCF) it will divide 12 & 16 evenly

example: Find the GCF of $21m^7,\ -18m^6,\ 45m^8$

step 1: $21m^7 = 3 \cdot 7 \cdot m^7$

$-18m^6 = (-1) \cdot 2 \cdot 3^2 \cdot m^6$

$45m^8 = 3^2 \cdot 5 \cdot m^8$

step 2: GCF = $3m^6$

FACTORING

Step 1: Factor out GCF or Divide out GCF

example: $21m^7 - 18m^6 + 45m^8$ *remember GCF* $= 3m^6$ *(see above)*

$(3m^6)(7m - 6 + 15m^2)$ check this answer by multiplying out and seeing if you get the original problem

FACTORING

Step 1: Factor out GCF
Step 2: Count the terms
4-terms: grouping (2-steps)

example 1:

$$\underbrace{2x+6}_{2(x+3)} + \underbrace{ax+3a}_{+a(x+3)}$$

four terms, no GCF, we try groups of 2

factor out GCF of each group
notice there is now a GCF of (x + 3)

$$(x+3)(2+a)$$

SO factor out (x + 3), now the expression is completely factored

Look at the original addition problem, it has now been rewritten as a multiplication problem…factored!!

example 2:

$$\underbrace{6xy-21x}_{3x(2y-y)} - \underbrace{8y+28}_{-4(2y-7)}$$

note sign change because you are factoring out a **negative** number (-4)

$$(2y-7)(3x-4)$$

The sign change in example 2 is often overlooked on the exam. Also remember when factoring by grouping you are done until you've completed 2 steps.