How do I Factor a Polynomial with 4 Terms?

When a polynomial has 4 terms, try factoring by *grouping*.

Steps: (Apply these steps after factoring out the GCF, if applicable)

1. Pair the first two terms and factor out the GCF. This creates a binomial factor.
2. Factor the same binomial factor from the second pair of terms. This is like using reverse distributive property. You now have a common binomial factor.
3. Factor the binomial out of each of the two terms. Combine the remaining two terms into a binomial factor.
4. Check to see if you can factor further.

Examples:

$x^3 + 3x^2 - 16x - 48$ you must factor (x+3) from 2nd pair of terms! $x^2(x+3) - 16(x+3)$ the sign matters! $(x+3)(x^2-16)$ the common binomial factor Lonely Hearts Club ♡ BE ALERT! We can still factor $((x+3)(x+4)(x-4))$	$x^3 + 9x^2 + 2x + 18$ $x^2(x+9) + 2(x+9)$ $((x+9)(x^2+2))$
$5x^3 + 10x^2 + 5x + 10$ $5(x^2 + 2x + x + 2)$ $5(x^2(x+2) + 1(x+2))$ $(5(x+2)(x^2+1))$	$10x^4 + 15x^3 - 20x^2 - 30x$ GOLDEN RULE! FACTOR OUT 5x from all 4 terms! $5x(2x^3 + 3x^2 - 4x - 6)$ $x^2(2x+3) - 2(2x+3)$ $(5x(2x+3)(x^2-2))$

Factoring by Grouping

When factoring polynomials with four terms, try the grouping method. **Always** look for a GCF first. You can always check your answer by multiplying the factors. The first two problems have been started for you.

1. $5(a-3)-2a(a-3)$

$(a-3)(5-2a)$

2. $4(x+7)+3y(x+7)$

$(x+7)(4+3y)$

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3. $2x^3-3x^2-8x+12$

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

$(2x-3)(x^2-4)$ ← LOOK!

$(2x-3)(x-2)(x+2)$

4. $3x^3-3x^2+4x-4$

$3x^2(x-1)+4(x-1)$

$(x-1)(3x^2+4)$

5. $5x^3+10x^2-5x-10$

$5(x^3+2x^2-x-2)$

$5(x^2(x+2)-1(x+2))$

$5(x+2)(x^2-1)$ ← LOOK!

$5(x+2)(x-1)(x+1)$

6. $3ax^3+3ax^2-48ax-48a$

$3a(x^3+x^2-16x-16)$

$3a(x^2(x+1)-16(x+1))$

$3a(x+1)(x^2-16)$

$3a(x+1)(x+4)(x-4)$

7. $4x^3+8x^2-9x-18$

$4x^2(x+2)-9(x+2)$

$(x+2)(4x^2-9)$

$(x+2)(2x-3)(2x+3)$

8. $AB+A+BC+C$

$A(B+1)+C(B+1)$

$(B+1)(A+C)$

9. $3ab-b-4+12a$

need to Rearrange

$b(3a-1)$

$3ab+12a-b-4$

$3a(b+4)-1(b+4)$

$(b+4)(3a-1)$

10. $3a^4+a^3+6a^2+2a$

$a^3(3a+1)+2a(3a+1)$

$(3a+1)(a^3+2a)$

↗ oops! this means I forgot GCF at beginning

$(3a+1)a(a^2+2)$

OR $a(3a+1)(a^2+2)$