

## 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 monomial 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: Monomial:  $6x, 3y^2, -4$

$$x^3 + 3x^2 - 16x - 48$$

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

$$(x+3)(x^2 - 16) \leftarrow \text{Diff.}$$

$$(x+3)(x-4)(x+4) \text{ of Squares}$$

$$x^3 + 9x^2 + 2x + 18$$

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

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

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

$$\text{GCF: } 5$$

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

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

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

$$10x^4 + 15x^3 - 20x^2 - 30x$$

$$\text{GCF: } 5x$$

$$5x(2x^3 + 3x^2 - 4x - 6)$$

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

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

## Factoring By Grouping

Factor each completely.

1)  $8r^3 - 64r^2 + r - 8$

$$8r^2(r-8) + 1(r-8)$$

$$(r-8)(8r^2+1)$$

2)  $12p^3 - 21p^2 + 28p - 49$

$$3p^2(4p-7) + 7(4p-7)$$

$$(4p-7)(3p^2+7)$$

3)  $12x^3 + 2x^2 - 30x - 5$

$$2x^2(6x+1) - 5(6x+1)$$

$$(6x+1)(2x^2-5)$$

4)  $6v^3 - 16v^2 + 21v - 56$

$$2v^2(3v-8) + 7(3v-8)$$

$$(3v-8)(2v^2+7)$$

5)  $63n^3 + 54n^2 - 105n - 90$

$$9n^2(7n+6) - 15(7n+6)$$

$$(7n+6)(9n^2-15)$$

$$(7n+6) \cdot 3(3n^2-5)$$

7)  $25v^3 + 5v^2 + 30v + 6$

$$5v^2(5v+1) + 6(5v+1)$$

$$(5v+1)(5v^2+6)$$

9)  $96n^3 - 84n^2 + 112n - 98$

$$2(48n^3 - 42n^2 + 56n - 49)$$

$$2(6n^2(8n-7) + 7(8n-7))$$

$$2(8n-7)(6n^2+7)$$

11)  $4v^3 - 12v^2 - 5v + 15$

$$4v^2(v-3) - 5(v-3)$$

$$(v-3)(4v^2-5)$$

13)  $24p^3 + 15p^2 - 56p - 35$

$$3p^2(8p+5) - 7(8p+5)$$

$$(8p+5)(3p^2-7)$$

6)  $21k^3 - 84k^2 + 15k - 60$

$$21k^2(k-4) + 15(k-4)$$

$$(k-4)(21k^2+15)$$

$$(k-4) \cdot 3(7k^2+5)$$

8)  $105n^3 + 175n^2 - 75n - 125$

$$3(7n+6)(3n^2-5)$$

$$35n^2(3n+5) - 25(3n+5)$$

$$(3n+5)(35n^2-25)$$

$$(3n+5) \cdot 5(7n^2-5)$$

$$5(3n+5)(7n^2-5)$$

10)  $28v^3 + 16v^2 - 21v - 12$

$$4v^2(7v+4) - 3(7v+4)$$

$$(7v+4)(7v^2-3)$$

12)  $49x^3 - 35x^2 + 56x - 40$

$$7x^2(7x-5) + 8(7x-5)$$

$$(7x-5)(7x^2+8)$$

14)  $24r^3 - 64r^2 - 21r + 56$

$$8r^2(3r-8) - 7(3r-8)$$

$$(3r-8)(8r^2-7)$$

oops, I did it again!!