

By now you should be an expert at the X-box method for factoring polynomials. In this lesson, we will learn how to factor polynomials that have four terms. We will use a new method called **factoring by grouping**, but you will see that it is a lot like the X-box method.

Factoring by grouping involves 3 steps:

1. Separate the polynomial into two binomials
2. Factor the GCF out of each of the binomials
3. Factor out the common expression in parentheses

As an example, let's factor $3n^3 - 12n^2 + 2n - 8$.

By grouping:

$$\begin{array}{r} 3n^3 - 12n^2 + 2n - 8 \\ \underline{\quad}(n - 4) + \underline{\quad}(n - 4) \\ (n - 4)(\underline{\quad} + \underline{\quad}) \end{array}$$

By using the box from the X-box method:

First, put the 4 terms into the 4 spots in the box:

_____	$3n^3$	$-12n^2$
_____	$2n$	-8

Now find the common factor of each row and column. As usual, your answer is along the sides of the box!

Now review both of these methods. Do the ones on the left by grouping, and use a box on the right.

1. $8t^3 + 14t^2 + 20t + 35$

2. $2z^3 + 6z^2 + 3z + 9$

3. $10g^3 - 25g^2 + 4g - 10$

4. $6p^3 + 3p^2 + 2p + 1$

Use either method, but be careful with the negatives in these next problems!

5. $2r^3 + 12r^2 - 5r - 30$

6. $8m^3 + 12m^2 - 2m - 3$

7. $20v^3 + 24k^2 - 25v - 30$

8. $12y^3 + 4y^2 - 9y - 3$

Factor completely. Remember to look for common factors first!

9. $8p^3 - 32p^2 + 28p - 112$

10. $3w^4 - 2w^3 + 18w^2 - 12w$

11. $6q^4 + 3q^3 - 24q^2 - 12q$

12. $4d^3 - 6d^2 + 16d - 24$