Mr. Ward Answer Key

Factoring Polynomials by Grouping

Another method you'll use to factor polynomials is called grouping. This happens when you break down the polynomial into two different groups and factor each group individually.

Here's how to tell when to use grouping or not. If the polynomial you are trying to factor has 4 or more terms, you want to factor by grouping.

Example #1

$x^3 + 5x^2 - 4x - 20$

How many terms are there? 4

Therefore we're going to want to factor by grouping. To solve this we're going to split those 4 terms into 2 different groups, the 2 terms on the left and the 2 terms on the right. So our two groups will be:

$x^3 + 5x^2$ and $-4x - 20$

(Answer: Left Group = $x^3 + 5x^2$ and Right Group = $-4x - 20$)

Now just factor each of these things individually. Do this just like you did yesterday by finding GMF and factoring it out.

$x^3 = x \cdot x \cdot x$
$5x^2 = 5 \cdot x \cdot x$

What is the greatest monomial factor for the left group? x^2

$-4x = -2 \cdot 2 \cdot x$
$-20 = -2 \cdot 2 \cdot 5$

What is the greatest monomial factor for the right group? -4

Finish factoring below. Be sure to show all your work and steps.

$x^2(x+5) \quad -4(x+5)$

(Answer: $x^2(x+5)$ on the right and $-4(x+5)$ on the left.)

What do you notice about the two things in the parenthesis? they're the same

That's right they are the exact same. This is a good check to make sure you're doing things right. The two things in the parenthesis should always be the same.

Now the last step is to write the two factors out next to each other. One factor is the (x+5) and the other factor are the two individual terms you had factored out. Which in this case is x^2 and -4.

Final answer then is $(x^2 - 4)(x + 5)$.

Practice Problem #1

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

$x^3 = x \cdot x \cdot x$

$-2x^2 = -2 \cdot x \cdot x$

$x^2(x-2)$

$\Rightarrow \quad (x^2-9)(x-2)$

$-9x = -3 \cdot 3 \cdot x$

$18 = 2 \cdot 3 \cdot 3$

$-9(x-2)$

Come show me your answer when you're done so I know you're on the right track!

You should now be able to say:

- I can factor using grouping techniques.

Assignment: pg 535 #15-20, 43-48

Mr. Ward Answer Key

pg 535

15. $x^3 + 4x^2 + 2x + 8$

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

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

16. $6x^3 + 4x^2 + 3x + 2$

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

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

17. $4b^3 - 6b^2 + 10b - 15$

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

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

18. $2m^3 + 4m^2 + 6m + 12$

$2m^2(m+2) + 6(m+2)$

$(2m^2+6)(m+2)$

19. $7r^3 - 35r^2 + 6r - 30$

$7r^2(r-5) + 6(r-5)$

$(7r^2+6)(r-5)$

20. $10a^3 + 4a^2 + 5a + 2$

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

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

43. $2a^3 - 8a^2 + 3a - 12$

$2a^2(a-4) + 3(a-4)$

$(2a^2+3)(a-4)$

44. $x^3 + 3x^2 + 5x + 15$

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

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

45. $6x^3 + 18x^2 + x + 3$

$6x^2(x+3) + 1(x+3)$

$(6x^2+1)(x+3)$

46. $7x^3 + 2x^2 + 28x + 8$

$x^2(7x+2) + 4(7x+2)$

$(x^2+4)(7x+2)$

47. $n^3 - 2n^2 + 5n - 10$

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

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

48. $10b^3 - 16b^2 + 25b - 40$

$2b^2(5b-8) + 5(5b-8)$

$(2b^2+5)(5b-8)$