6.1 Factoring by Grouping DAY TWO

OBJECTIVE 4: Factoring by Grouping

Once the GCF is factored out, we can often continue to factor the polynomial using a variety of techniques. We discuss here a technique for factoring polynomials called factoring by grouping.

Factoring by Grouping is most often used when there are four terms. The nice thing is it has a self built in checking system if done correctly.

Here are a few examples of the self built-in checking with factoring by grouping.

Example 1: Factor: $5(x + 3) + y(x + 3)$

$(5+y)(x+3)$

Practice 1: $8(y - 2) + x(y - 2)$

$(8+x)(y-2)$

another example

Example 2: Factor: $3m^2n(a + b) - 1(a + b)$

$(3m^2n - 1)(a + b)$

Practice 2: $7xy^3(p + q) - 1(p + q)$

$(7xy^3 - 1)(p + q)$

Whole process of factoring by grouping:

Example 3: Factor $xy + 2x + 3y + 6$

$(x+3)(y+2)$

$xy + 2x + 3y + 6$

$x(y + 2) + 3(y + 2)$

$(x + 3)(y + 2)$

Helpful Hint

Notice that this form, $x(y + 2) + 3(y + 2)$, is *not* a factored form of the original polynomial. It is a sum, not a product.

Check by multiplying or FOILing!!

Practice 3: $xy + 3y + 4x + 12$

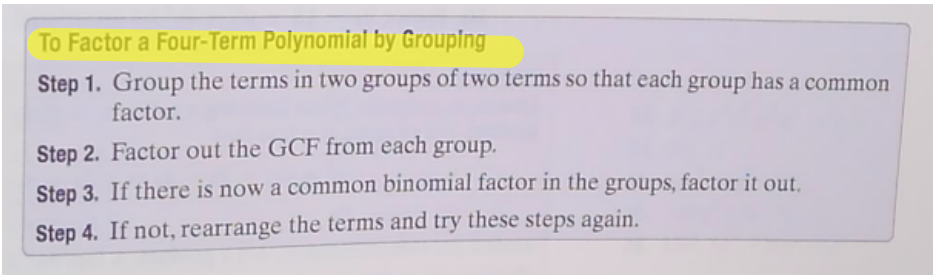
$(y+4)(x+3)$

$xy + 3y + 4x + 12$

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

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

$2^2 = 4$



To Factor a Four-Term Polynomial by Grouping

Step 1. Group the terms in two groups of two terms so that each group has a common factor.

Step 2. Factor out the GCF from each group.

Step 3. If there is now a common binomial factor in the groups, factor it out.

Step 4. If not, rearrange the terms and try these steps again.

Examples 4 - 6: Factor by Grouping

4) $15x^3 - 10x^2 + 6x - 4$

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

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

5) $3x^2 + 4xy - 3x - 4y$

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

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

6) $2a^2 + 5ab + 2a + 5b$

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

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

Practices 4 - 6: Factor by Grouping

4) $40x^3 - 24x^2 + 15x - 9$

$8x^2(5x-3)+3(5x-3)$

$(8x^2+3)(5x-3)$

5) $3y^2 + 2xy - 2x - 3y$

$y(3y+2x)-1(2x+3y)$

$(y-1)(3y+2x)$

6) $7a^3 + 5a^2 + 7a + 5$

$a^2(7a+5)+1(7a+5)$

$(a^2+1)(7a+5)$

Examples 7 & 8: Factor by grouping.

Sometimes we may need to change the order.

7) $3xy + 2 - 3x - 2y$

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

$3x(y-1) - 2(-1+y)$

$(3x-2)(y-1)$

8) $5x - 10 + x^3 - x^2$

$(x^3 + 5x) + (-x^2 - 10)$

$x(x^2+5) - 1(x^2+10)$

not factorable

Practice 7 & 8:

7) $4xy + 15 - 12x - 5y$

$(4xy - 12x) + (15 - 5y)$

$4x(y-3) - 5(-3+y)$

$(y-3)(4x-5)$

8) $9y - 18 + y^3 - 4y^2$

$9(y-2) y^2 (y-4)$

not factorable

Remember if you can first GCF, you should!

Example 9: Factor: $4ax - 4ab - 2bx + 2b^2$

$2(2ax - 2ab)(-bx + b^2)$

$2[2a(x-b) - b(x-b)]$

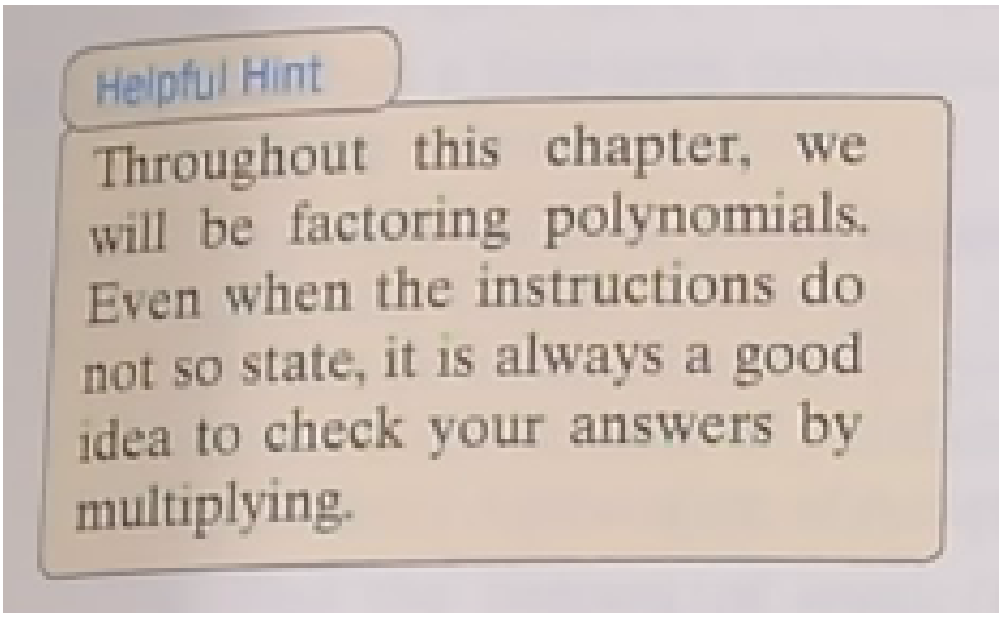
$2(2a-b)(x-b)$

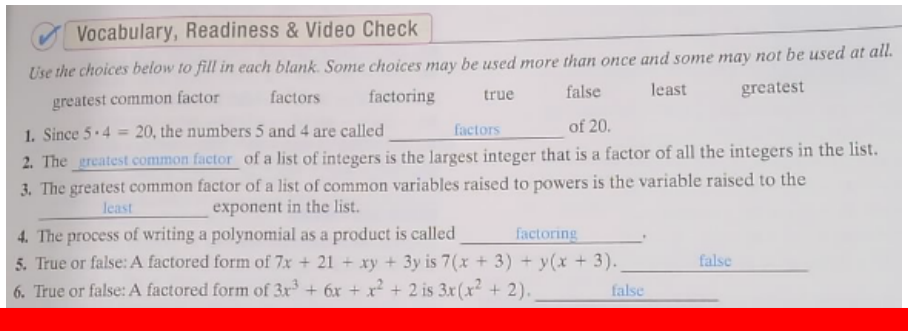
Practice 9: $3xy - 3ay - 6ax + 6a^2$

$3(xy - ay - 2ax + 2a^2)$

$3[y(x-a) - 2a(x-a)]$

$3(y-2a)(x-a)$





Vocabulary, Readiness & Video Check

Use the choices below to fill in each blank. Some choices may be used more than once and some may not be used at all.

greatest common factor factors factoring true false least greatest

1. Since $5 \cdot 4 = 20$, the numbers 5 and 4 are called factors of 20.
2. The greatest common factor of a list of integers is the largest integer that is a factor of all the integers in the list.
3. The greatest common factor of a list of common variables raised to powers is the variable raised to the least exponent in the list.
4. The process of writing a polynomial as a product is called factoring.
5. True or false: A factored form of $7x + 21 + xy + 3y$ is $7(x + 3) + y(x + 3)$. false
6. True or false: A factored form of $3x^3 + 6x + x^2 + 2$ is $3x(x^2 + 2)$. false

6.1 DAY TWO Assignment:

pg. 386: 55 - 98 (o), 111, 113