Unit 8 – Factoring

Section 8-1: LCM/GCF (Day 1)

Review Question
What does LCM mean? **Least Common Multiple**

Discussion
Sometimes we want fractions smaller and sometimes we want them bigger. When we are finding a common denominator we want the fractions to be bigger (**LCM**). When we are reducing fractions we want the fractions to be smaller (**GCF**).

Today, we are going to focus on finding the LCM between monomials.

SWBAT to find the LCM between monomials

Definition
<u>Least Common Multiple (LCM)</u> – least number that is a common multiple of two or more monomials

What does that mean?
I'm not sure. So let's try an easy one together.

Example 1: Find the LCM between the following monomials: 4 and 6.
(**Start to list the multiples of each number until you find a match**.)

4: 4, 8, ***<u>12</u>***
6: 6, ***<u>12</u>***
Therefore, 12 is the LCM between 4 and 6.

Example 2: Find the LCM between the following monomials: 15 and 18.
(**Start to list the multiples of each number until you find a match**.)

15: 15, 30, 45, 60, 75, ***<u>90</u>***
18: 18, 36, 54, 72, ***<u>90</u>***
Therefore, 90 is the LCM between 15 and 18.

Example 3: Find the LCM between the following monomials: x^3yz and x^2y.
(**Use the highest exponent on each variable**.)
Therefore, x^3yz is the LCM between x^3yz and x^2y.

Example 4: Find the LCM between the following monomials: $8x^2y$ and $12x^3$.
(**Start to list the multiples of each number until you find a match. Then use the highest exponent on each variable**.)

8: 8, 16, ***<u>24</u>***
12: 12, ***<u>24</u>***
Therefore, $24x^3y$ is the LCM between $8x^2y$ and $12x^3$.

You Try!

Find the LCM.

1. 4, 10 **20**
2. a^7b^2, a^2b $\mathbf{a^7b^2}$
3. $6a^2b$, $8a^2b^2c$ $\mathbf{24a^2b^2c}$
4. $5y$, $8y^2$ $\mathbf{40y^2}$
5. $7x^2y^3$, $21x^3y^3$ $\mathbf{21x^3y^3}$
6. $2xy$, $4x^2y^2$, $8x^3y^3$ $\mathbf{8x^3y^3}$

What did we learn today?

Section 8-1 Homework (Day 1)

Find the LCM.

1. 4 and 8
2. 8 and 10
3. 10 and 15
4. 9 and 12
5. 2 and 6 and 10
6. 5 and 10 and 12
7. x^2y^3 and x^3y
8. x^3y^4 and x^2
9. x^5y^3 and xyz
10. $a^2b^4c^5$ and a^2
11. x^2y^4 and x^3y and x^5z^2
12. x^9y^4z and x^2 and $x^4y^2z^2$
13. $4x^2y$ and $10x^2y^2$
14. $8x^3y^4$ and 10
15. $3x^4y^2$ and x^2y^5
16. $5x^3y^4$ and $10x$
17. $2x^4y^3$ and $5xyz$
18. $15a^2b^3c^4$ and $20ab^3c^2$
19. x and $2x^2$ and $3x^3$
20. $3x^2y^2$ and $4xy$ and $8x^2y^4$

Section 8-1: LCM/GCF (Day 2)

Review Question
How do you find the LCM between two monomials?
Start listing the multiples of each monomial until you get a match.

Discussion
This unit is called factoring. What do you think factoring means?
Breaking down polynomials. Notice this is the opposite of what we did last chapter.

Last chapter: $(x + 3)(x + 2) = x^2 + 5x + 6$
This chapter: $x^2 + 5x + 6 = (x + 3)(x + 2)$

One method of factoring involves finding the GCF of monomials. So today we will focus on finding the GCF between monomials.

SWBAT find the GCF between monomials

Definitions
Prime – number itself and 1 are the only factors
Can someone give me an example of a prime number? **5**

Composite – more factors than 1 and itself
Can someone give me an example of a composite number? **12**

Greatest Common Factor (GCF) – biggest "thing" that goes into both monomials

Example 1: Find the GCF between the following monomials: 6 and 18.
(**List all of the factors of the smaller number then check them with the bigger number. Start with the biggest factor of the smaller number**.)

6: 1, 2, 3, 6 (**See if 6 is a factor of 18. It is.)**
Therefore, 6 is the GCF between 6 and 18.

Example 2: Find the GCF between the following monomials: x^3y and x^2y.
(**Use the smallest exponent on each variable**)

Therefore, x^2y is the GCF between x^3y and x^2y.

Example 3: Find the GCF between the following monomials: $24x^2y$ and $36x^3$.
(**List all of the factors of the smaller number then check them with the bigger number. Start with the biggest factor of the smaller number. Then use the smallest exponent on each variable**.)

24: 1, 2, 3, 4, 6, 8, 12, 24 (See if 24 is a factor of 36. Then keep trying each smaller factor.)
Therefore, $12x^2$ is the GCF between $24x^2y$ and $36x^3$.

Example 4: Find the GCF between the following monomials: $8x^2y^3$ and $36x^3y$ and $48xy^4$.
(**List all of the factors of the smaller number then check them with the bigger number. Start with the biggest factor of the smaller number. Then use the smallest exponent on each variable**.)

8: 1, 2, 4, 8 (**See if 8 is a factor of 36 and 48. Then keep trying each smaller factor**.)
Therefore, $4xy^2$ is the GCF between $8x^2y^3$ and $36x^3y$ and $48xy^4$.

You Try!

Find the GCF.

1. 54, 63 **9**
2. x^2y^3, x^3y^4 **x^2y^3**
3. $4a^7b$, $28ab$ **4ab**
4. $12a^2b$, $90a^2b^2c$ **$6a^2b$**
5. 5x, 12y **1**
6. $2x^2$, $4x^2y^3$, 10xyz **2x**

What did we learn today?

Section 8-1 Homework (Day 2)

Find the GCF between the monomials.

1. 4 and 8
2. 8 and 10
3. 10 and 15
4. 9 and 12
5. 2 and 6 and 10
6. 5 and 10 and 12
7. x^2y^3 and x^3y
8. x^3y^4 and x^2
9. x^5y^3 and xyz
10. $a^2b^4c^5$ and a^2
11. x^2y^4 and x^3y and x^5z^2
12. x^9y^4z and x^2y and $x^4y^2z^2$
13. $4x^2y$ and $10x^2y^2$
14. $8x^3y^4$ and 10
15. $3x^4y^2$ and x^2y^5
16. $5x^3y^4$ and 10x
17. $2x^4y^3$ and 5xyz
18. $15a^2b^3c^4$ and $20ab^3c^2$
19. 12x and $20x^2$ and $40x^3$
20. $3x^2y^2$ and 4xy and $8x^2y^4$

Section 8-1: LCM/GCF (Day 3)

Review Question

What does greatest common factor mean? **The biggest number that "goes into" different monomials**
What is the GCF between $16x^2y$ and $36x^3y^2$? $\mathbf{4x^2y}$

Discussion

Today we are going to be simplifying expressions. Tomorrow we will be solving equations. Let's make sure we understand the difference.

Expression: $x^2 + 4x$ (**Simplify**)
Equation: $x^2 + 4x = 0$ (**Solve**)

How would you do the following problem using your skills from the last chapter? **Distribute**
$x(x + 4) = \mathbf{x^2 + 4x}$

In this chapter, we are going to do the exact opposite.
They are going to give us $x^2 + 4x$ and ask us to break it down into $x(x + 4)$. We are going to do this by finding the GCF of the two terms first.

SWBAT factor using the GCF

Example 1: Factor: $x^2 + 4x = \mathbf{x(x + 4x)}$
Notice to factor we must find the GCF first.

Example 2: Factor: $2x^2 + 10xy = \mathbf{2x(x + 5y)}$
Notice to factor we must find the GCF first.

Example 3: Factor: $2q^5 + 8q^3 – 12q^2 = \mathbf{2q^2(q^3 + 4q – 6)}$
Notice to factor we must find the GCF first.

Example 4: Factor: $12ac + 8bc + 21ad + 14bd$
What is common to all four terms? **Nothing. Therefore, we will have to factor a different way.**

What if we grouped the 1st two and last two terms together?
$4c(3a + 2b) + 7d(3a + 2b)$
Notice both terms still have a common factor.
$(3a + 2b)(4c + 2b)$

What if we grouped the 1st and 3rd terms together and the 2nd and 4th terms together?
$3a(4c + 7d) + 2b(4c + 7d)$
Notice both terms still have a common factor.
$(4c + 7d)(3a + 2b)$

You Try!

Factor.

1. $9x^3 - 3x^2$ **$3x^2(3x - 1)$**
2. $4x^2y + 10xy^3$ **$2xy(2x + 5y^2)$**
3. $x^2y - x^2$ **$x^2(y - 1)$**
4. $4m + 6n - 8p$ **$2(2m + 3n - 4p)$**
5. $3mn + 6xy + 2mn^2 + 12x^2y^2$ **$3(mn + 2xy) + 2(mn^2 + 6x^2y^2)$**
6. $15x - 3xy - 4y + 20$ **$3x(5 - y) + 4(-y + 5) = (3x + 4)(5 - y)$**

What did we learn today?

Section 8-1 Homework (Day 3)

Factor each polynomial.

1. $5x + 15y$
2. $16x + 4y$
3. $a^4b - a$
4. $x^2y^3 + x^3y^2$
5. $21xy - 3x$
6. $14ab - 18b$
7. $20x^2y^4 - 30x^3y^2$
8. $x^3y^4 + x^2$
9. $8x^5y^3 + 24xyz$
10. $12a^2b^4c^5 + 40a^2$
11. $x^2y^4 + x^3y + x^5z^2$
12. $3x^3y - 9xy^2 + 36xy$
13. $12ax^3 + 20bx^2 + 32cx$
14. $15x^3y^4 + 25xy + x$
15. $x^2 + 5x + 7x + 35$
16. $4x^2 + 14x + 6x + 21$
17. $8ax - 6x - 12a + 9$
18. $10x^2 - 14xy - 15x + 21y$

19. Make up a binomial that you can factor using GCF.

20. Make up a trinomial that you can factor using GCF.

Section 8-1: LCM/GCF (Day 4)

Review Question

What does factoring mean? **Breaking polynomials down**
How would you factor: $x^2 + 4x$? **$x(x + 4)$**

Discussion

Consider the following equation: $x^2 + 4x = 0$.
What issues do we have solving this? **We don't know how to solve an equation with an exponent other than '1'.**

If we have the following equation, what do we know about each quantity?
(stuff)(junk) = 0
Since the equation equals 0, one or the other is equal to 0.

Let's see how this concept can help us. So if we can break $x^2 + 4x$ into two parts, then we can use this previous idea to help us.

$x^2 + 4x = 0$
$x(x + 4) = 0$
Therefore, either $x = 0$ or $x + 4 = 0$.
Notice the key is that the equation is equal to 0.

SWBAT solve a quadratic equation by factoring using the GCF

Example 1: Solve: $(x – 2)(x + 3) = 0$
$x – 2 = 0$ or $x + 3 = 0$
$x = 2$ or $x = 3$

Example 2: Solve: $x^2 + 12x = 0$
$x(x + 12) = 0$
$x = 0$ or $x = -12$

Example 3: Solve: $4x^2 = 8x$
$4x^2 – 8x = 0$
$4x(x – 2) = 0$
$x = 0$ or $x = 2$

You Try!

Solve.

1. $x(x – 32) = 0$ **$x = 0, 32$**
2. $(y – 3)(y + 2) = 0$ **$y = 3, -2$**
3. $8p^2 – 4p = 0$ **$p = 0, 1/2$**
4. $9x^2 = 27x$ **$x = 0, 3$**
5. $10x^2 – 12x = 0$ **$x = 0, 6/5$**
6. $6x^2 = -4x$ **$x = 0, -2/3$**

What did we learn today?

Section 8-1 Homework (Day 4)

Factor each polynomial.

1. $3x + 15y$

2. $10x + 4y$

3. $a^4b - a^2$

4. $4x^3y^2 + 14x^3y^2$

5. $15x^3y^4 - 20x^3y$

6. $9x^5y^3 + 15x^2yz$

Solve each equation.

7. $x(x - 11) = 0$ **$x = 0, 11$**

8. $y(y + 5) = 0$ **$y = 0, -5$**

9. $(x + 4)(x - 2)$ **$x = -4, 2$**

10. $(2x + 4)(x - 6)$ **$x = -2, 6$**

11. $(2y - 5)(3y + 8)$ **$x = 5/2, -8/3$**

12. $(x + 3)/(x + 2)^{-1} = 0$ **$x = -3, -2$**

13. $3x^2 + 12x = 0$ **$x = 0, -4$**

14. $7y^2 - 35y = 0$ **$y = 0, 5$**

15. $2x^2 = 6x$ **$x = 0, 3$**

16. $7x^2 = 6x$ **$x = 0, 6/7$**

17. $5x^2 = -2x$ **$x = 0, -2/5$**

18. $20x^2 = -15x$ **$x = 0, -4/3$**

19. Why do we set the equation equal to 0?

20. How does this help us solve quadratic equations?

Section 8-2: Factor: $x^2 + bx + c$ (Day 1)

Review Question
What does factoring mean? **Breaking polynomials down**
How would you factor: **$2x^2 + 4x$? $2x(x + 2)$**

How would this help us solve the equation:
$2x^2 + 4x = 0$?
We would have two factors equal to zero.

Discussion
What two numbers add up to 12? **8,4 3,9 etc.**
Can you break '12' into two factors? **3,4 2,6 etc.**

Can you break $x^2 + 6x + 8$ into two factors? **(?)(?)**
This would be a bit more difficult. This is what we will be doing today.

Consider the following expression: $x^2 + 6x + 8$.
Why wouldn't our GCF method work to break down this trinomial? **All 3 terms don't have a common factor**
What else could we do? **Break it down into two factors just like we break '12' into '3' and '4'** (**remember our goal; break it down into smaller parts**)

SWBAT factor a trinomial

Example 1: Factor: $x^2 + 7x + 12$
List all of the factors of 12. **(1, 12) (2, 6) (3, 4)**
What two factors can add/subtract to 7? **(3, 4)**
When the last number is positive, what do we know about the signs in each quantity? **They are the same.**
$(x + 3)(x + 4)$

Example 2: Factor: $x^2 – 13 + 36$
List all of the factors of 36. **(1, 36) (2, 18) (3, 12) (4, 9) (6, 6)**
What two factors can add/subtract to -13? **(4, 9)**
When the last number is positive, what do we know about the signs in each quantity? **They are the same.**
$(x – 4)(x – 9)$

Example 3: Factor: $x^2 – x – 6$
List all of the factors of 6. **(1, 6) (2, 3)**
What two factors can add/subtract to -1? **(2, 3)**
When the last number is negative, what do we know about the signs in each quantity? **They are different.**
$(x – 3)(x + 2)$

Example 4: Factor: $x^2 - 7x - 12$
List all of the factors of 12. **(1, 12) (2, 6) (3, 4)**
What two factors can add/subtract to -7? **(3, 4)**
Remember the signs have to be different. Therefore, '3' and '4' will not work.
This trinomial is prime. It can't be broken down into factors other than '1' and itself.

You Try!

Factor.

1. $x^2 + 12x + 32$ **$(x + 4)(x + 8)$**
2. $x^2 - 4x - 21$ **$(x + 3)(x - 7)$**
3. $x^2 - 6x + 8$ **$(x - 4)(x - 2)$**
4. $x^2 + x - 10$ **Prime**
5. $x^2 + 8x - 48$ **$(x + 12)(x - 4)$**
6. $x^2 + 6x - 5$ **Prime**

What did we learn today?

Section 8-2 Homework (Day 1)

Factor each trinomial by breaking it down into two quantities.

1. $x^2 + 8x + 15$
2. $x^2 + 12x + 27$
3. $x^2 + 8x - 20$
4. $x^2 + 3x - 28$
5. $x^2 - 7x + 14$
6. $x^2 - 17x + 72$
7. $x^2 - 19x + 60$
8. $x^2 - 3x - 54$
9. $x^2 - 13x + 36$
10. $x^2 - 4x + 5$

Factor each polynomial by using any of your factoring techniques.

11. $x^2 + 11x + 24$
12. $x^2 - 7x - 18$
13. $2x^2y + 4xy^3$
14. $4x^2y^3 + 10x - 8xz$
15. $x^2 - 13x + 40$
16. $x^2 - x + 15$
17. $x^2 - 32x - 33$
18. $12x^2 + 9x + 8x + 6$
19. $10x^2 - 15x$
20. $x^2 - 7x - 10$

Section 8-2: Factor: $x^2 + bx + c$ (Day 2)

Review Question
What does factoring mean? **Breaking polynomials down**
How would you factor: $x^2 - 4x - 12$? **(x + 2)(x – 6)**

Discussion
How would factoring $x^2 - 4x - 12$ into $(x + 2)(x - 6)$ help us solve $x^2 - 4x - 12 = 0$?
We would have two factors equal to zero.

SWBAT solve an equation by factoring

Example 1: Solve: $x^2 + 6x + 5 = 0$
List all of the factors of 5. What two factors can add/subtract to 6? **1, 5**
When the last number is positive, what do we know about the signs in each quantity? **Same**
$(x + 5)(x + 1) = 0$; $x = -5, -1$

Example 2: Solve: $x^2 - 20x = 44$
List all of the factors of 44. What two factors can add/subtract to -20? **2, 22**
When the last number is negative, what do we know about the signs in each quantity? **Different**
$x^2 - 20x - 44 = 0$
$(x + 2)(x - 22) = 0$; $x = -2, 22$

Example 3: Solve: $x^2 + 8x = 0$
Remember to check for a GCF first.
$x(x + 8) = 0$; $x = 0, -8$

Example 4: Solve: $x^4 + 10x^3 + 16x^2 = 0$
Remember to check for a GCF first. Then factor the trinomial.
$x^2(x^2 + 10x + 16) = 0$
$x^2(x + 8)(x + 2) = 0$; $x = 0, -8, -2$

You Try!
Solve.

1. $x^2 + 10x + 24 = 0$	**$x = -6, -4$**
2. $x^2 - 12x - 28 = 0$	**$x = -2, 14$**
3. $x^2 - 18 = 3x$	**$x = -3, 6$**
4. $(x - 1)(2x + 3) = 0$	**$x = 1, -3/2$**
5. $x^3 + x^2 - 2x = 0$	**$x = 0, -2, 1$**
6. $x^2 - 9x + 18 = 0$	**$x = 6, 3$**

What did we learn today?

Section 8-2 Homework (Day 2)

Solve each equation by using any of your factoring techniques.

1. $x^2 + 9x + 20 = 0$	**x = -4, -5**	2. $x^2 - 11x + 24 = 0$	**x = 3, 8**
3. $x^2 + x - 20 = 0$	**x = -5, 4**	4. $x^2 - 7x - 30 = 0$	**x = -3, 10**
5. $x^2 - 7x = 0$	**x = 0, 7**	6. $x^2 - 22x + 72 = 0$	**x = 18, 4**
7. $(x - 5)(3x + 4) = 0$	**x = 5, -4/3**	8. $x^2 - 36 = 0$	**x = -6, 6**
9. $x^2 - 12x + 32 = 0$	**x = 4, 8**	10. $x^2 - 4x - 5 = 0$	**x = -1, 5**
11. $x^2 + 8x = -12$	**x = -2, 6**	12. $x^2 + 19x + 18 = 0$	**x = -18, -1**
13. $x^5 + 4x^4 + 4x^3 = 0$	**x = -2, -2**	14. $x^2 + 2x - 48 = 0$	**x = -8, 6**
15. $x^2 + 40 = 14x$	**x = 4, 10**	16. $x^2 - 2x + 15 = 0$	**x = 5, -3**
17. $(x + 5)(4x - 3) = 0$	**x = -5, 3/4**	18. $x^3 + 9x^2 + 8x$	**x = 0, -1, -8**
19. $x^2 - 4x + 45$	**x = -5, 9**	20. $x^2 - 7x + 12 = 2$	**x = 2, 5**

Section 8-2: Factor: $x^2 + bx + c$ (Day 3)

Review Question
What does factoring mean? **Breaking polynomials down**
How would you factor: $x^2 - 6x - 16$? **$(x + 2)(x - 8)$**
How would factoring $x^2 - 6x - 16$ into $(x + 2)(x - 8)$ help us solve $x^2 - 6x - 16 = 0$?
We would have two factors equal to zero.

Discussion
How do you get better at something? **Practice**
Today will be a day of practice. Let's make sure we know what we are doing first.

SWBAT solve an equation by factoring

Example 1: Solve: $x^2 - 7x + 24 = 12$
Set the equation equal to 0. List all of the factors of 12. What two factors can add/subtract to -7? **3, 4**
When the last number is positive what do we know about the signs in each quantity? **Same**
$x^2 - 7x + 12 = 0$
$(x - 3)(x - 4) = 0$; $x = 4, 3$

Example 2: Solve: $x^6 + 10x^5 - 24x^4 = 0$
Remember to check for a GCF first. Then factor the polynomial.
$x^4(x^2 + 10x - 24) = 0$
$x^4(x + 12)(x - 2) = 0$; $x = 0, 2, -12$

What did we learn today?

Section 8-2 In-Class Assignment (Day 3)

Factor each polynomial.

1. $x^2 + 10x + 16$
2. $21x^2y - 3xy$
3. $x^2 - 8x - 20$
4. $3x^3y + 15y - 21y^2$
5. $x^2 + 2x - 24$
6. $6xy - 8x + 15y - 20$
7. $x^2 + x + 18$
8. $x^3 + 8x^2 - 20x$
9. $x^2 - 16x + 64$
10. $x^2 - 21x - 100$

Solve each equation.

11. $4x^2 + 12x = 0$ **$x = 0, -3$**

12. $(4x - 3)(2x + 4) = 0$ **$x = 3/4, -2$**

13. $x^2 - 5x - 84 = 0$ **$x = -7, 12$**

14. $x^2 - 7x = -12$ **$x = 3, 4$**

15. $25x^2 = -15x$ **$x = 0, -3/5$**

16. $y^2 + 12y + 20 = 0$ **$x = -10, -2$**

17. $x^3 + x^2 - 2x = 0$ **$x = 0, -2, 1$**

18. $x^2 + 5x - 50 = 0$ **$x = -10, 5$**

19. $(x^2 + 4x + 38) + (15x - 4) = 0$ **$x = -17, -2$**

20. $(2x^2 - 8x + 18) - (x^2 + x - 2) = 0$ **$x = 4, 5$**

Section 8-3: Factor: $ax^2 + bx + c$ (Day 1)

Review Question
What does factoring mean? **Breaking polynomials down**
What methods of factors do we know? **GCF, Factoring a Trinomial**

Discussion
How is $2x^2 + 14x + 20$ different from the other polynomials that we factored?
It has a coefficient in front of the x^2 term.

What would you do first to factor this polynomial? **GCF**
Good! If you can pull out a common factor it will always make the problem easier.

SWBAT factor a trinomial with a coefficient in front of the x^2 term

Example 1: Factor: $2x^2 + 14x + 20$
Is there a common factor? **Yes, 2.**
$2(x^2 + 7x + 10)$
Now factor the trinomial.
$2(x + 5)(x + 2)$

Example 2: Factor: $7x^2 + 22x + 3$
Is there a common factor? **No.**
This will be a bit more difficult. You must use guess and check.
$(7x + 1)(x + 3)$

Example 3: Factor: $9x^2 - 9x - 10$
Is there a common factor? **No.**
This will be a bit more difficult. You must use guess and check.
$(3x - 5)(3x + 2)$

Example 4: Factor: $10x^2 - 43x + 28$
Is there a common factor? **No.**
This will be a bit more difficult.
$(2x - 7)(5x - 4)$

You Try!
Factor.
1. $3x^2 + 13x + 12$ **$(3x + 4)(x + 3)$**
2. $2x^2 + 3x - 20$ **$(2x - 5)(x + 4)$**
3. $6x^2 + 8x - 8$ **$2(3x - 2)(x + 2)$**
4. $10x^2 - 31x + 15$ **$(2x - 5)(5x - 3)$**
5. $4x^2 + 8x - 32$ **$4(x - 2)(x + 4)$**
6. $5x^2 + 6x + 8$ **Prime**

What did we learn today?

Section 8-3 Homework (Day 1)

Factor each trinomial.

1. $2x^2 + 7x + 5$
2. $3x^2 + 5x + 2$
3. $6p^2 + 5p - 6$
4. $30x^2 - 25x - 30$
5. $8k^2 - 19k + 9$
6. $9g^2 - 12g + 4$
7. $6r^2 - 14r - 12$
8. $2x^2 - 3x - 20$
9. $5c^2 - 17c + 14$
10. $3p^2 - 25p + 16$

Factor each polynomial by using any of your factoring techniques.

11. $5d^2 + 6d - 8$
12. $2a^2 - 9a - 18$
13. $15x^2 - 20x$
14. $x^2 - 13x + 22$
15. $8y^2 - 6y - 9$
16. $10n^2 - 11n - 6$
17. $15z^2 + 17z - 18$
18. $14x^2 + 13x - 12$
19. $6x^4yz + 4x^2y^3$
20. $5x^2y^3 + 10x - 25xz$
21. $9x^2 + 30xy + 25y^2$
22. $36a^2 + 9ab - 10b^2$
23. $3x^2 + 18x + 24$
24. $2x^2 - 2x - 24$

Section 8-3: Factor: $ax^2 + bx + c$ (Day 2)

Review Question
What is the first thing that you should check for when you are factoring a polynomial? **GCF**

Discussion
How would factoring $4x^2 - 16x - 48$ into $4(x + 2)(x - 6)$ help us solve $4x^2 - 16x - 48 = 0$?
We would have two factors equal to zero.

SWBAT solve an equation with a trinomial that has a coefficient in front of the x^2 term

Example 1: Solve: $3x^2 + 6x - 24 = 0$
Is there a common factor? **Yes, 3.**
$3(x^2 + 2x - 8) = 0$
Now factor the trinomial.
$3(x - 2)(x + 4) = 0$; $x = -4, 2$

Example 2: Solve: $7x^2 + 19x = 6$
Is there a common factor? **No.**
This will be a bit more difficult. You must use guess and check.
$7x^2 + 19x - 6 = 0$
$(7x - 2)(x + 3) = 0$; $x = 2/7, -3$

You Try!
Solve.
1. $6x^2 + 19x + 10 = 0$ **$x = -2/3, -5/2$**
2. $17x^2 + 10x = 2x^2 + 17x + 4$ **$x = -1/3, 4/5$**
3. $6x^2 + 8x = 0$ **$x = 0, -4/3$**
4. $2x^2 + 18x + 40 = 0$ **$x = -4, -5$**

What did we learn today?

Section 8-3 In-Class Assignment (Day 2)

Solve each equation.

1. $5x^2 + 27x + 10 = 0$ **$x = -5, -2/5$**
2. $3x^2 - 5x - 12 = 0$ **$x = -4/3, 3$**
3. $14n^2 - 25n - 25 = 0$ **$x = -5/7, 5/2$**
4. $12a^2 + 13a - 35 = 0$ **$x = 5/4, -7/3$**
5. $12x^2 - 4x = 0$ **$x = 0, 1/3$**
6. $x^2 + 24x + 80 = 0$ **$x = -20, -4$**
7. $5x^2 + 20x - 25 = 0$ **$x = -5, 1$**
8. $x^3 + 2x^2 + x = 0$ **$x = -1, 0$**
9. $6x^2 - 14x = 12$ **$x = -2/3, 3$**
10. $21x^2 - 6 = 15x$ **$x = -2/7, 1$**

11. $24x^2 - 30x + 8 = -2x$ **$x = 1/2, 2/3$**

12. $24x^2 - 46x = 18$ **$x = -1/3, 9/4$**

13. $24x^2 - 11x - 3 = 3x$ **$x = -1/6, 3/4$**

14. $17x^2 - 11x + 2 = 2x^2$ **$x = 1/3, 2/5$**

15. $4x^2 = 24x$ **$x = 0, 6$**

16. $5x^2 = 20$ **$x = -2, 2$**

Section 8-4: Difference of Two Squares (Day 1)

Review Question

How does factoring polynomials help us solve equations?

It allows us to solve the equation when it is set equal to zero.

$(x + 3)(x + 2) = 0$

Discussion

What is special about the list of the following numbers: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100?

Perfect Squares

What is special about the list of the following terms: x^2, y^6, z^{10}?

Perfect Squares

This means that there exists some number times itself to give you that number. These numbers are going to be important to us today.

SWBAT factor a binomial by using the difference of two squares

Example 1: Factor: $x^2 - 49$

Is there a common factor? **No**

Let's treat it like a trinomial.

$(x - 7)(x + 7)$

This will give us a middle term of zero 'x'.

This method is called the difference of two squares for a reason. You need two perfect squares separated by a subtraction sign.

Example 2: Factor: $4x^2 - 25y^6$

Is there a common factor? **No**

Notice there are two perfect squares separated by a subtraction sign.

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

Example 3: Factor: $3x^4 - 48y^2$

Is there a common factor? **Yes; 3**

$3(x^4 - 16y^2)$

Now there are two perfect squares separated by a subtraction sign.

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

Example 4: Factor: $x^2 + 25$

Suckers! This method is called the difference of two squares not the addition of two squares.

Prime

You Try!

Factor.

1. $x^2 - 64$ **$(x - 8)(x + 8)$**
2. $x^6 - x^4y^4$ **$x^4(x - y^2)(x + y^2)$**
3. $9x^6 - 100y^8$ **$(3x^3 - 10y^4)(3x^3 + 10y^4)$**
4. $x^2 + 13x + 40$ **$(x + 8)(x + 5)$**
5. $6x^{11} - 96xy^2$ **$6x(x^5 - 4y)(x^5 + 4y)$**
6. $2x^2 + 5x - 12$ **$(2x - 3)(x + 4)$**
7. $4x^8 - 16y^2$ **$4(x^4 - 2y)(x^4 + 2y)$**
8. $2x^2 - 4x - 30$ **$2(x + 3)(x - 5)$**

What did we learn today?

Section 8-4 Homework (Day 1)

Factor using the difference of two squares.

1. $x^2 - 49$
2. $n^2 - 36$
3. $81 + 16k^2$
4. $25 - 4p^2$
5. $-16 + 49h^2$
6. $-9r^2 + 121$
7. $100c^2 - d^2$
8. $9x^2 - 10y^2$
9. $3x^2 - 75$
10. $169y^2 - 36z^2$

Factor using any method.

11. $8d^2 - 18$
12. $144a^2 - 49b^2$
13. $3x^2 + 2x - 8$
14. $6x^2 - 3xy^2 + 4xy - 2y^3$
15. $8z^2 - 64$
16. $18a^4 - 72a^2$
17. $48x^2 + 22x - 15$
18. $9x^8 - 4y^2$
19. $2x^3 + 6x^2 - 20x$
20. $x^4 + 100$

Section 8-4: Difference of Two Squares (Day 2)

Review Question
When is the difference of two squares applicable?
When you have two perfect squares separated by a subtraction sign.
$4x^2 - 9y^4$

Discussion
How would factoring $x^2 - 16$ into $(x + 4)(x - 4)$ help us solve $x^2 - 16 = 0$?
We would have two factors equal to zero.

SWBAT solve an equation with a binomial using the difference of two squares

Example 1: Solve: $9x^2 - 4 = 0$
Is there a common factor? **No**
Use the difference of two squares.
$(3x - 2)(3x + 2) = 0$; $x = -2/3, 2/3$

Example 2: Solve: $6x^2 - 13x = 28$
Is there a common factor? **No**
Factor the trinomial.
$6x^2 - 13x - 28 = 0$
$(2x - 7)(3x + 2) = 0$; $x = -2/3, 7/2$

You Try!
Solve.
1. $16x^2 - 25 = 0$ **$x = -5/4, 5/4$**
2. $5x^2 = 75x$ **$x = 0, 15$**
3. $x^2 = 9$ **$x = -3, 3$**
4. $8x^2 + 32x + 14 = 0$ **$x = -7/2, -1/2$**

What did we learn today?

Section 8-4 In-Class Assignment (Day 2)

Solve each equation.

1. $25x^2 - 36 = 0$ **$x = -6/5, 6/5$**
2. $x^2 + 10x + 16 = 0$ **$x = -8, -2$**
3. $9y^2 = 64$ **$y = -8/3, 8/3$**
4. $12 - 27n^2 = 0$ **$n = -2/3, 2/3$**
5. $50 - 8a^2 = 0$ **$a = -5/2, 5/2$**
6. $12d^3 - 147d = 0$ **$d = -7/2, 0, 7/2$**
7. $28x^2 + 60x - 25$ **$x = 5/14, -5/2$**
8. $18n^3 - 50n = 0$ **$n = -5/3, 0, 5/3$**
9. $x^2 - 16x = -64$ **$x = 8$**
10. $6x^2 - 13x - 5 = 0$ **$x = -1/3, 5/2$**

11. $3x^3 - 75x = 0$ **$x = -5, 0, 5$**

12. $16x^2 + 8x = 35$ **$x = -7/4, 5/4$**

13. $16a^2 - 81 = 0$ **$x = -4/9, 4/9$**

14. $6x^3 + 11x - 10x = 0$ **$x = -5/2, 0, 2/3$**

15. $25 - 9y^2 = 0$ **$x = -5/3, 5/3$**

16. $3x^2 + 3x - 60 = 0$ **$x = -5, 4$**

Section 8-5: Perfect Square Factoring (Day 1)

Review Question
When is the difference of two squares applicable?
When you have two perfect squares separated by a subtraction sign.
$4x^2 – 9y^4$

Discussion
What is a perfect square? **A number made by squaring another number.**
1, 4, 16, 25, 36, 49, …

Is '121' a perfect square? **Yes**
How do you know? **11 x 11 = 121**

Is $x^2 + 8x + 16$ a perfect square? **Yes, $(x + 4)(x + 4) = x^2 + 8x + 16$**
Can you tell me another trinomial that is a perfect square? **$x^2 + 10x + 25$**

How can you tell if a trinomial is a perfect square?
1st/3rd terms perfect squares, 2nd term is twice the factors of the 1st and 3rd terms

Today we will be talking about perfect square trinomials.

SWBAT factor a trinomial that is a perfect square

Example 1: Factor: $y^2 + 6x + 9$
Is there a common factor? **No**
$(y + 3)^2$
Notice the 1st/3rd factors are perfect squares.
You could factor it the "normal" way.

Example 2: Factor: $x^2 – 10x + 25$
Is there a common factor? **No**
$(x – 5)^2$
Notice the 1st/3rd factors are perfect squares.
You could factor it the "normal" way.

Example 3: Factor: $9x^2 – 12x + 4$
Is there a common factor? **No**
$(3x – 2)^2$
Notice the 1st/3rd factors are perfect squares.
You could factor it the "normal" way.

Example 4: Factor: $2x^2 + 8x + 8$
Is there a common factor? **Yes, 2**
$2(x^2 + 4x + 4)$
Now the 1st/3rd factors are perfect squares.
$2(x + 2)^2$
You could factor it the "normal" way.

You Try!

Factor.

1. $x^2 + 14x + 49$ **$(x + 7)^2$**
2. $25x^2 - 10x + 1$ **$(5x - 1)^2$**
3. $4x^2 - 100$ **$4(x - 5)(x + 5)$**
4. $16x^2 - 24x + 9$ **$(4x - 3)^2$**
5. $9x^2 - 3x - 20$ **$(3x + 4)(3x - 5)$**
6. $4x^2 - 20x + 25$ **$(2x - 5)^2$**

What did we learn today?

Section 8-5 Homework (Day 1)

Factor using perfect square trinomials.

1. $x^2 + 18x + 81$
2. $x^2 - 24x + 144$
3. $36x^2 - 36x + 9$
4. $4x^2 + 36xy + 81y^2$

Factor using any method.

5. $4x^2 + 20x$
6. $x^2 + 12x + 20$
7. $5x^2 - 125$
8. $x^2 + 6x + 9$
9. $9x^2 + 3k - 20$
10. $8x^2 - 72$
11. $50g^2 + 40g + 8$
12. $x^2 + 10x - 25$
13. $9t^3 + 66t^2 - 48t$
14. $a^2 - 36$
15. $20n^2 + 34n + 6$
16. $5y^2 - 90$
17. $24x^3 - 78x^2 + 45x$
18. $9y^2 - 24y + 16$
19. $27g^2 - 90g + 75$
20. $45c^2 - 32cd$

Section 8-5: Perfect Square Factoring (Day 2)

Review Question
How can you tell if a trinomial is a perfect square?
The 1st/3rd terms are perfect squares and the 2nd term is twice the factors of the 1st and 3rd terms.

Discussion
How do you get better at something? **Practice**

Today will be a day of practice. Specifically, we will be reviewing all of our factoring techniques:
GCF, Factoring Trinomials, Difference of 2 Squares, and Perfect Square Trinomials

SWBAT factor any polynomial

Example 1: Factor: $12ac + 21ad + 8bc + 14bd$
Is there a common factor? **Yes, with the 1st two terms and 2nd two terms.**
$3a(4c + 7d) + 2b(4c + 7d)$
Notice both terms have a common factor of $(4c + 7d)$
$(4c + 7d)(3a + 2b)$

Example 2: Factor: $6x^2 + 7x - 20$
Is there a common factor? **No**
$(3x - 4)(2x + 5)$

Example 3: Factor: $3x^2 - 48$
Is there a common factor? **Yes, 3.**
$3(x^2 - 16)$
Can you factor the next quantity? **Yes, it is the difference of two squares.**
$3(x - 4)(x + 4)$

Example 4: Factor: $4x^2 - 12xy + 9y^2$
Is there a common factor? **No**
Notice the 1st/3rd factors are perfect squares.
$(2x - 3y)^2$
You could factor it the "normal" way.

What did we learn today?

Section 8-5 In-Class Assignment (Day 2)

Factor completely using any method.

1. $x^2 + 12x + 32$
2. $2y^3 - 128y$
3. $3x^2 + 3x - 60$
4. $36c^3 + 6c^2 - 6c$

5. $x^2 + 7x - 12$

6. $2x^2 + 9x + 10$

7. $25 - 9y^2$

8. $x^2 + 8x + 16$

9. $16a^8 - 81b^4$

10. $a^3 - a^2b + ab^2 - b^3$

11. $x^2 - 13x - 30$

12. $x^6 - y^4$

13. $24am - 9an + 40bm - 15bn$

14. $6x^3 + 11x^2 - 10x$

15. $8x^2 + 10x - 25$

16. $6x^2 - 7x + 18$

Solve each equation.

17. $16x^2 + 8x - 35 = 0$ **x = -7/4, 5/4**

18. $12x^2 - 2x = 70$ **x = -7/3, 5/2**

19. $a^2 - 20a + 100 = 0$ **a = 10**

20. $3x^3 = 75x$ **x = -5, 0, 5**

Unit 8 Review

Review Question

What are the different methods of factoring that we have learned?
GCF, Factoring Trinomials, Difference of 2 Squares, Perfect Square Trinomials

Discussion

What is this unit called? **Factoring**
What does that mean? **Breaking down polynomials**
How does breaking down polynomials help us solve equations? **By setting the quantities equal to zero**

SWBAT review for the Unit 8 test

Discussion

1. How do you study for a test? **The students either flip through their notebooks at home or do not study at all. So today we are going to study in class.**

2. How should you study for a test? **The students should start by listing the topics.**

3. What topics are on the test? **List them on the board**
- GCF/LCM
- Factoring Trinomials
- Difference of 2 Squares
- Perfect Square Trinomials

4. How could you study these topics? **Do practice problems**

Practice Problems

You must make up your own questions and answers. Specifically, you will make up 15 questions and answers. The breakdown of the problems is as follows:

2 – Distributive Property	$2x^2 + 8x = 2x(x + 4)$
3 – "Easy" Trinomials	$\underline{\mathbf{1}}x^2 + 6x + 5 = (x + 5)(x + 1)$
3 – "Hard" Trinomials	$\underline{\mathbf{6}}x^2 - 11x - 10 = (2x - 5)(3x + 2)$
2 – Difference of 2 Squares	$4x^2 - 9y^4 = (2x - 3y^2)(2x + 3y^2)$
3 – Perfect Square Trinomials	$9x^2 + 24x + 16 = (3x + 4)(3x + 4) = (3x + 4)^2$
2 – Use Two Methods	$2x^2 - 2x - 40 = 2(x^2 - x - 20) = 2(x + 4)(x - 5)$

The key to making up these problems is to work backwards. You can start with answer first then use your skills from the previous unit to combine the quantities.

What did we learn today?

Unit 8 Cumulative Review

SWBAT do a cumulative review

Discussion

What does cumulative mean?
All of the material up to this point.

Does anyone remember what the first seven chapters were about? Let's figure it out together.

1. **Pre-Algebra**
2. **Solving Linear Equations**
3. **Functions**
4. **Linear Equations**
5. **Inequalities**
6. **Systems**
7. **Polynomials**
8. **Factoring**

Things to Remember:

1. Reinforce test taking strategies: guess/check, eliminate possibilities, work backwards, and estimating.
2. Reinforce the importance of retaining information from previous units.
3. Reinforce connections being made among units.

In-Class Assignment

1. What set of numbers does $\sqrt{6}$ belong?
   a. counting b. whole c. integers d. irrationals

2. (6 + 2) + 3 = 6 + (2 + 3) is an example of what property?
   a. Commutative b. Associative c. Distributive d. Identity

3. -8.2 + 3.6 =
   a. -4.6 b. -11.8 c. -5.4 d. -9.8

4. $1\frac{1}{6} + \frac{2}{4} =$
   a. 20/12 b. 10/12 c. 7/24 d. 2/3

5. (-4.8)(2.6) =
   a. -12.48 b. -7.4 c. -8.8 d. -5.9

6. 15.12 ÷ 6.3 =
   a. 4.8 b. 2.4 c. 1.8 d. -13.8

7. $-2\frac{1}{2} \div \frac{10}{3} =$

a. -2/12 b. -1/4 c. -3/4 d. 8/9

8. Which of the following is equal to 3^3?

a. 9 b. 27 c. 12 d. 128

9. Which of the following is equal to $\sqrt{27}$?

a. $3\sqrt{3}$ b. 13.5 c. $9\sqrt{3}$ d. 27

10. $18 – (2 + 3)^2 + 22$

a. -29 b. 15 c. 17 d. 2

11. -2x + 10 = 24

a. 17 b. -17 c. 7 d. -7

12. 2(x – 3) – 5x = -6 – 3x

a. 5 b. 6 c. Empty Set d. Reals

13. Which of the following is a solution to y = 2x + 5 given a domain of {-3, 0, 6}

a. (0, 5) b. (6, 2) c. (-3, -10) d. (-3, 7)

14. Which equation is not a linear equation?

a. $y = 2x + 2$ b. $\frac{x}{4} = y$ c. $x = 2$ d. $y = x^2 + 3$

15. Which equation is not a function?

a. $y = 3x + 7$ b. $y = 2$ c. $x = -2$ d. $y = \frac{1}{2}x + 2$

16. If f(x) = 4x + 3, find f(4).

a. 4 b. 7 c. 10 d. 19

17. Write an equation of a line that passes through the points (3, 6) and (4, 10).

a. y = 4x b. y = -4x c. y = 4x + 12 d. y = 4x – 6

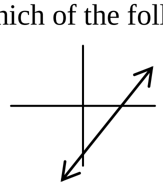
18. Write an equation of a line that is perpendicular to $y = \frac{1}{3}x - 2$ and passes thru (-2, 4).

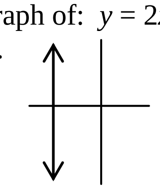
a. y = -3x b. y = -3x + 10 c. y = -3x – 2 d. y = -3x – 10

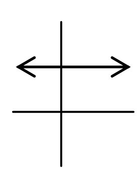
19. Write an equation of a line that is parallel to y + 4x = -2 and passes thru (5, -2).

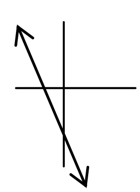
a. y = -4x – 4 b. y = -4x c. y = -4x + 8 d. y = 4x

20. Which of the following is a graph of: $y = 2x – 2$.

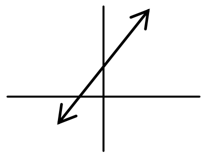
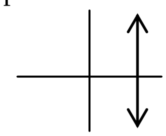
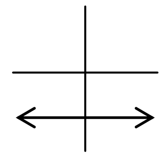
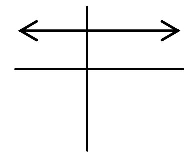
a.


b.


c.


d.


21. Which of the following is a graph of: x = 5

a. 
b. 
c. 
d. 

22. $\frac{x}{-2} + 3 > 12$

a. x < -18   b. x < -18   c. x < 30   d. x < -10

23. |3x – 12| < 12

a. 0 < x< 8   b. x < 0 and x > 8   c. x < 0   d. x< 8

24. |3x – 12| < -2

a. x > -3/4   b. x < 1/2   c. Empty Set   d. Reals

25. Solve the following system of equations.

y = x + 4
<u>2x + 3y = 22</u>

a. (0, 4)   b. (4/5, 14/5)   c. (2, 6)   d. (-2, 1)

26. Solve the following system of equations.

3x – y = 8
<u>5x – 2y = 13</u>

a. (0, -8)   b. (6, 2)   c. (3, 1)   d. (-3, 7)

27. Solve the following system of equations.

x – 6y = 8
<u>2x – 12y = 10</u>

a. Empty Set   b. Infinite   c. (1, 1)   d. (-3, 5)

28. Simplify: $(2y^3)^2(x^4y)^3$

a. $4x^{12}y^9$ b. $6x^{12}y^9$ c. $8x^{12}y^{18}$ d. $x^{12}y^9$

29. Simplify: (5x – 6) – (3x + 4)

a. 2x – 2   b. 2x – 10   c. –x – 1   d. $6x^2 + 7x + 20$

30. Simplify: (4x – 2)(3x + 4)

a. $12x^2 + 7x + 8$ b. $7x^2 – 7x – 8$ c. $12x^2 + 23x + 20$ d. $12x^2 + 10x – 8$

31. $(2x-4y)(2x+4y)$

a. $4x^2 + 8x + 16y^2$ b. $4x^2 – 8x – 16y^2$ c. $4x^2 + 16y^2$ d. $4x^2 – 16y^2$

32. $(4y^2 + 3)^2$

a. $16y^4 + 24y^2 + 9$ b. $16y^4 + 9$ c. $8x^2y^4 + 9$ d. $6x^2 – 7x – 20$

33. $5x(x^2 + 3y^3)$

a. $5x^3 + 8xy^3$ b. $5x^3 + 15xy^3$ c. $5x^3 + 8xy^3$ d. $6x^2 – 7x – 20$

34. Factor: $x^2 – 5x – 36$

a. $(x – 9)(x + 4)$ b. $(x + 9)(x – 4)$ c. $(x + 9)(x + 4)$ d. $(x – 4)(x – 9)$

35. Factor: $4x^2 – 22x – 36$

a. $2(2x^2 – 11x – 18)$ b. $2(x + 9x – 4)$ c. $2x(x + 11x + 18)$ d. $(2x – 4)(2x – 9)$

36. Solve: $9x^2 – 36 = 0$

a. $x = 2$ b. $x = -2, 2$ c. $x = -2$ d. $x = -4, 4$

Standardized Test Review

1. When the expression $4y^2 - 36$ is factored completely, what are its factors?

a. $(2y - 6) + (2y - 6)$ b. $(2y^2 - 6)(2y - 6)$ c. $(2y - 6)(2y + 6)$ d. $4(y - 3)(y + 3)$

2. When the expression $x^2 + 3x - 18$ is factored completely, which is one of its factors?

a. $(x - 2)$ b. $(x + 3)$ c. $(x + 6)$ d. $(x - 9)$

3. When factored completely, what are the factors of $4x^2 + 8x - 12$?

a. $4(x + 2)(x - 2)$ b. $4(x - 3)(x + 1)$ c. $4(x + 1)(3x + 4)$ d. $4(x - 1)(x + 3)$

4. What are the factors of $x^2 - 11x + 24$?

a. $(x + 2)(x + 12)$ b. $(x - 8)(x - 3)$ c. $(x + 6)(x - 4)$ d. $(x - 6)(x + 4)$

5. Which represents the expression $\frac{x^2 + x - 20}{x^2 - 7x + 12}$ written in simplest form?

a. -20/12 b. $-x - 8$ c. $\frac{x+5}{x-3}$ d. $\frac{x+5}{x+3}$

6. The following problems require a detailed explanation of the solution. This should include all calculations and explanations.

Factoring is the process of breaking a polynomial down into its factors.

a. Factor: $x^2 + 7x - 18$.

b. Why isn't $2(4x - 8)(x + 2)$ factored completely?

c. Factor $2(4x - 8)(x + 2)$ completely.

d. Why is $x^2 + 5x + 12$ prime?