Overview

Lesson Plan #1 Title: Ace it! Lesson Thirty-three

Attached Supporting Documents for Plan #1:

Teacher's Manual and reproductions of student worksheets to support the following lesson objective:

- Simplify polynomials using addition and subtraction.

Lesson Plan #2 Title: Ace it! Lesson Forty-one

Attached Supporting Documents for Plan #2:

Teacher's Manual and reproductions of student worksheets to support the following lesson objective:

- Solve quadratic equations by completing the square.

Lesson Plan #3 Title: Ace it! Lesson Fifty-seven

Attached Supporting Documents for Plan #3:

Teacher's Manual and reproductions of student worksheets to support the following lesson objective:

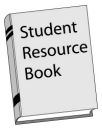
- Add and subtract rational expressions.

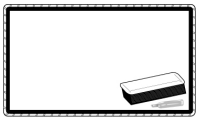
lesson thirty-three

LESSON OBJECTIVE:
Simplify polynomials using addition and subtraction.

Introduction	Direct Skill Instruction and Guided Practice	Summary/Closure	Fact Practice
5 mins.	25 mins.	10 mins.	7 mins.

Lesson:





- ❑ Student Resource Books: Student Resource Sheets (Lesson 33)
- ❑ Dry-erase boards and dry-erase markers

Fact Practice:
(Select one of these sets of materials for the Math Facts Games.)

- ❑ Individual Student Flashcards
- ❑ Buzz
- ❑ Math War or Salute!
  - Playing cards
- ❑ Soccer Ball Facts
  - Soccer ball
- ❑ Math Scramble
  - Index cards, each with a number 0–9; cards with the operations
- ❑ BINGO
  - Flashcards
  - BINGO boards, and tokens or colored squares
- ❑ Around the World
  - Triangle or regular flashcards

Vocabulary Definitions:
This lesson assumes that students know the following vocabulary words:

- constant
- variable
- exponent
- combining like terms

coefficient – A constant that multiplies a variable. Example: the 4 in $4x$.

polynomial – An algebraic expression consisting of two or more rational and integral terms. Example: $x^3 + 4x^2 - 7x + 1$.

Welcome:


3 mins.

Greet students by name and take attendance.

Introduction:


5 mins.

A. Access Prior Knowledge

On your dry-erase board, write the expression 5x + 7y + 3 – 8x – 2 + y.

- ***Raise a hand to tell us what method we will use to simplify this expression.*** (Combining like terms.)
- ***On your dry-erase board, simplify this expression:*** (–3x + 8y + 1).
- ***Raise a hand to tell us why 7y plus y equals 8y.*** (Because y = 1y.)
- ***Raise a hand to tell us why we can't simplify –3x + 8y + 1 any further.*** (The remaining terms are not like terms.)
- ***The terms –3x and 8y are sometimes called "variable terms" because they include variables. Raise a hand to remind us what we call the term*** 1. (A constant or a constant term.)

B. Explain Connection to New Skill

You already know how to simplify expressions by combining like terms.

- ***On your dry-erase board, simplify the expression –5a – 9b – 14 + 2a – 6.*** (–3a – 9b – 20)

C. State Lesson Objective

During today's lesson, we will simplify **polynomials**, ***using addition and subtraction.***

Direct Skill Instruction and Guided Practice:


25 mins.

In your Student Resource Book, below the Lesson Objective, you will see a Vocabulary Box that lists two vocabulary words and their definitions. Let's look at these words together.

We already know that a number, such as 7, is called a constant because its value never changes. When we take a constant and multiply it by a variable, we get a term such as 7x. In this expression, the constant, 7, is called the **coefficient** ***of the term.***

- ***Raise a hand to tell us what the*** **coefficient** ***is in the term –6y^2.*** (–6)

lesson thirty-three

An expression consisting of two or more terms like $-6y^2$ is called a* polynomial. *An example of a* polynomial *is $-6y^2 + 7y - 3$.

We can add* polynomials *by combining like terms. We will need to expand our definition of* like terms *to state that like terms have to include exactly the same variables and exponents.

On your dry-erase board, write this expression:
$(-6y^2 + 7y - 3) + (3y^2 + 5y + 8)$.

NOTE: It will be more efficient to write this expression, and further expressions in this lesson, on a dry-erase board for students to copy.

We will first add these* polynomials *by the horizontal method.

- ***On your dry-erase board, draw one line under each of the two terms that have y^2 in them.*** ($-6y^2$ and $3y^2$.)
- ***Draw two lines under each of the two terms that have* y *in them.*** (7y and 5y.)
- ***Draw three lines under the two constant terms.*** (–3 and 8.)

Now that we have identified the like terms, we can add them by adding their* coefficients. *Be sure to always look to the left of each* coefficient *for its sign. We can also add the two constant terms together.

- ***On your dry-erase board, finish combining like terms to add these* polynomials.** ($-3y^2 + 12y + 5$)

***Now, on your dry-erase board, work with a partner to add these* polynomials.**

- ***$(4x^3 + 8x^2 - x - 9) + (6x^3 - 5x^2 + 6x - 2)$*** $(10x^3 + 3x^2 + 5x - 11)$
- ***$(5a^3 - 7x + 4) + (a^3 + 2x^2 - 4)$*** $(6a^3 + 2x^2 - 7x)$
- ***$(4c + 7c^3 - 12c^2 + 1) + (13 - c - 4c^2 - c^3)$*** $(6c^3 - 16c^2 + 3c + 14)$

Notice that in the last example, the terms were not in order. We generally express* polynomial *answers in descending order of power. You can see that in $6c^3 - 16c^2 + 3c + 14$, the powers descend from 3 to 2 to 1 to 0.

Sometimes it is easier to add* polynomials *with a vertical method. Let's take another look at the first problem you did with your partner:
$(4x^3 + 8x^2 - x - 9) + (6x^3 - 5x^2 + 6x - 2)$.

Write the first* polynomial *on your dry-erase board. Underneath it, write the second* polynomial*. Be sure that the 6x^3 is written directly beneath the 4x^3, that the –5x^2 is directly beneath the 8x^2, and so on. Continue to always look to the left of each term for its sign.

- ***Draw a line underneath the second* polynomial*, and add like terms vertically.*** $(10x^3 + 3x^2 + 5x - 11)$

In problems with unordered terms, like the third one you did with your partner, the vertical method is often helpful.

- ***On your dry-erase board, rewrite 4*c + *7*c^3 *– 12*c^2 *+ 1 in descending order of power.*** $(7c^3 - 12c^2 + 4c + 1)$

- ***Beneath that expression, rewrite 13 –* c *– 4*c^2 *–* c^3*, making sure to write each term beneath its like term.*** $(-c^3 - 4c^2 - c + 13)$

- ***Add like terms vertically to find the sum.*** $(6c^3 - 16c^2 + 3c + 14)$

Now, on your dry-erase board, with your partner, add the following* polynomials*, using the vertical method.

- ***(5***n^2 *– 7*n *– 8) + (2*n^2 *–* n *+ 14)*** $(7n^2 - 8n + 6)$

- ***(4***w^3 *– 3*w *+ 1) + (4 + 3*w *–* $2w^2$ *–* w^3*) Hint: Rewrite 4*w^3 *– 3*w *+ 1 as 4*w^3 *+ 0*w^2 *– 3*w *+ 1.*** $(3w^3 - 2w^2 + 5)$

When you learned how to subtract integers, you learned that subtraction can be performed by adding the opposite of the subtracted number. Likewise, you can subtract* polynomials *by adding the opposite of the subtracted* polynomial*.

On your dry-erase board, write the following expression:
(y^2 *+ 7*y *– 8) – (4*y^2 *– 16*y *+ 12).***

- ***Now copy the first* polynomial*. Change the subtraction sign between the two* polynomials *to an addition sign. Then change the signs of all three terms in the second* polynomials *to their opposites.***
  $((y^2 + 7y - 8) + (-4y^2 + 16y - 12))$

- ***Now add the resulting* polynomials *by your choice of horizontal or vertical method.*** $(-3y^2 + 23y - 20)$

Now, on your dry-erase board, with a partner, subtract the following* polynomials*. After changing each subtraction correctly into an addition, use your choice of horizontal or vertical method, but use each method at least once.

- $(6z^3 - 4z^2 + 3z - 9) - (z^3 - 6z^2 - 5z + 2)$ $(5z^3 + 2z^2 + 8z - 11)$
- $(p^2 - 7p + 8) - (p^2 - 7p - 8)$ (16)
- $(m - 7m^2 - 4m^3) - (m^4 + 2m^2 - 8m - 12)$ $(-m^4 - 4m^3 - 9m^2 + 9m + 12)$

Now complete the Guided Practice problems in your Student Resource Book.

Summary/Closure:

10 mins.

A. Define Vocabulary Words

In your Student Resource Book, Lesson Thirty-Three, in the Summary/Closure section, there are exercises dealing with today's vocabulary terms. Take a few minutes to carefully complete these exercises.

B. Summarize What We Learned Today

Let's summarize the skill that we have been working on today. In your Student Resource Book, in the Summary/Closure section, write two problems requiring addition of **polynomials**. ***Simplify one using the horizontal method and one using the vertical method. Then, write and simplify a problem involving subtraction of*** **polynomials**. ***These examples will be your reference sheet when you need to remember how to do these types of problems in the future.***

Raise a hand to share your sample problems with the class. NOTE: Be alert to correct all student errors and to encourage students to show complete work so that they have accurate reference sheets.

C. Apply Skill

Add or subtract as indicated.

- $(6u^3 - 5u^2 - 9u) + (u^3 - 4u^2 - u)$***, by the horizontal method***
  $(7u^3 - 9u^2 - 10u)$
- $(x^4 - 14x^2 - 49) + (12 + 8x - 4x^2 - x^3)$***, by the vertical method***
  $(x^4 - x^3 - 18x^2 + 8x - 37)$
- $(k^3 - k^2 + k - 1) - (k^3 + k^2 - 5k - 8)$***, by your choice of method, after correctly changing the subtraction problem into an addition problem***
  $(-2k^2 + 6k + 7)$

Fact Practice:

Operation: Addition

Fact Activity: _____

Count/Record Tokens:

Count and record tokens in the Student Resource Book.

lesson thirty-three – teacher resource sheet

Lesson Objective: Simplify polynomials using addition and subtraction.

Vocabulary Box

coefficient – A constant that multiplies a variable. Example: the 4 in 4x.

polynomial – An algebraic expression consisting of two or more rational and integral terms. Example: $x^3 + 4x^2 - 7x + 1$.

Guided Practice

You will complete the following practice problems with your partner. Then your teacher will review the answers. Make sure that you show all important work.

Directions: Add or subtract as indicated. Use the horizontal and vertical method at least once each.

1. $(a^3 + 4a^2 + 6a + 7) + (4a^3 + 6a^2 - 3a - 4)$ *$(5a^3 + 10a^2 + 3a + 3)$*

2. $(c^2 - 6c + 9 - c^4) + (18 - 9c + 3c^2 - c^3)$ *$(-c^4 - c^3 + 4c^2 - 15c + 27)$*

3. $(d^3 - 5d^2 + 4d - 40) - (3d^2 - 5d - 30)$ *$(d^3 - 8d^2 + 9d - 10)$*

4. $(f^2 - f + 6) - (4f - 3f^2 + 6f^3 - f^4)$ *$(f^4 - 6f^3 + 4f^2 - 5f + 6)$*

Summary/Closure

A. Vocabulary Words

Directions: In the polynomials below, list the coefficients and the constant term of each.

1. $5v^2 + 7v - 8$

   coefficients: *(5, 7)* constant term: *(–8)*

2. $8y^3 - 6y^2 - y$

   coefficients: (*8, –6, –1)* constant term: *(none; 0 is also acceptable.*)

3. $48 - 16p + p^2 - p^3$

   coefficients: *(–1, 1, –16)* constant term: *(48)*

B. Summarize What We Learned Today

Directions: Write two problems requiring addition of polynomials. Simplify one using the horizontal method and one using the vertical method. Then, write and simplify a problem involving subtraction of polynomials. Write a few sentences to explain how to add and subtract polynomials. You will use this explanation as a personal reference sheet.

lesson thirty-three – student resource sheet

Lesson Objective: Simplify polynomials using addition and subtraction.

Vocabulary Box

coefficient – A constant that multiplies a variable. Example: the 4 in $4x$.

polynomial – An algebraic expression consisting of two or more rational and integral terms. Example: $x^3 + 4x^2 - 7x + 1$.

Guided Practice

You will complete the following practice problems with your partner. Then your teacher will review the answers. Make sure that you show all important work.

Directions: Add or subtract as indicated. Use the horizontal and vertical method at least once each.

1. $(a^3 + 4a^2 + 6a + 7) + (4a^3 + 6a^2 - 3a - 4)$

2. $(c^2 - 6c + 9 - c^4) + (18 - 9c + 3c^2 - c^3)$

3. $(d^3 - 5d^2 + 4d - 40) - (3d^2 - 5d - 30)$

4. $(f^2 - f + 6) - (4f - 3f^2 + 6f^3 - f^4)$

Summary/Closure

A. Vocabulary Words

Directions: In the polynomials below, list the coefficients and the constant term of each.

1. $5v^2 + 7v - 8$

   coefficients: constant term:

2. $8y^3 - 6y^2 - y$

   coefficients: constant term:

3. $48 - 16p + p^2 - p^3$

   coefficients: constant term:

B. Summarize What We Learned Today

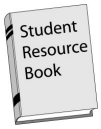
Directions: Write two problems requiring addition of polynomials. Simplify one using the horizontal method and one using the vertical method. Then, write and simplify a problem involving subtraction of polynomials. Write a few sentences to explain how to add and subtract polynomials. You will use this explanation as a personal reference sheet.

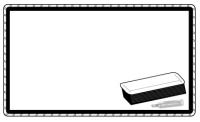
lesson forty-one – new for TX

LESSON OBJECTIVE:
Solve quadratic equations by completing the square.

Introduction	Direct Skill Instruction and Guided Practice	Summary/Closure	Fact Practice
5 mins.	25 mins.	10 mins.	7 mins.

Lesson:





- ❑ Student Resource Books: Student Resource Sheets (Lesson 41)
- ❑ Calculators with Square Root Keys
- ❑ Dry-erase boards and dry-erase markers

Fact Practice:

(Select one of the sets of materials for the Math Facts Games):

- ❑ Individual Student Flashcards
- ❑ Buzz
- ❑ Math War or Salute!
  - Playing cards
- ❑ Soccer Ball Facts
  - Soccer ball
- ❑ Math Scramble
  - Index cards each with a number 0-9; cards with the operations
- ❑ Bingo
  - Flashcards
  - BINGO boards, and tokens or colored squares
- ❑ Around the World
  - Triangle or regular flashcards

Vocabulary Definitions:

This lesson assumes that students know the following vocabulary words:

- quadratic equation
- inverse operation
- square root
- factor
- perfect square trinomial
- greatest common factor

completing the square – The process of finding values for a, b, and c, such that $ax^2 + bx + c$ is a perfect square trinomial.

Welcome:

3 mins.

Greet students by name and take attendance.

Introduction:

5 mins.

A. Access Prior Knowledge

When I say equals***, everyone tell me the product to complete this chart of perfect squares.*** NOTE: Build the chart of perfect squares on your dry-erase board while asking the questions.

- 2^2= (4)
- 3^2= (9)
- 4^2= (16)
- 5^2= (25)
- 6^2= (36)
- 7^2= (49)
- 8^2= (64)
- 9^2= (81)
- 10^2= (100)
- 11^2= (121)
- 12^2= (144)

On your dry-erase board:

- ***Find*** $\sqrt{36}$**.** (6)

- ***Use your calculator to approximate*** $\sqrt{60}$ ***to the nearest tenth.*** (7.7)
  NOTE: Students learned in a previous lesson how to approximate square roots. If calculators are not available, have students use the methods learned in lessons 3 and 4.

- ***Factor*** $x^2 + 14x + 49$***. Express your answer as a square of a binomial.*** $((x + 7)^2)$

- ***Factor*** $2x^2 - 10x + 6$**.** $(2(x^2 - 5x + 3))$

B. Explain Connection to New Skill

You already know how to find square roots of perfect squares and how to approximate the square roots of non-perfect squares. You can also factor a perfect square trinomial into the square of a binomial, as well as factor a greatest common factor out of a polynomial.

lesson forty-one – new for TX

On your dry-erase board:

- ***Find*** $\sqrt{121}$**.** (11)
- ***Use your calculator to approximate*** $\sqrt{15}$ ***to the nearest tenth.*** (3.9)
- ***Factor*** $x^2 - 20x + 100$***. Express your answer as a square of a binomial.*** $((x - 10)^2)$
- ***Factor*** $-5x^2 - 45x + 30$**.** $(-5(x^2 + 9x - 6))$

C. State Lesson Objective

During today's lesson, we will learn how to solve quadratic equations by **completing the square.**

Direct Skill Instruction and Guided Practice:

25 mins.

On your Student Resource Sheets, below the lesson objective, you will see a Vocabulary Box that lists a vocabulary term and its definition. Let's look at this term together.

Raise a hand to answer the following questions.

- ***What is the general form of a quadratic trinomial?*** $(ax^2 + bx + c)$
- ***What does*** **completing the square**, ***with regard to a quadratic trinomial, mean?*** (Finding values of a, b, and c, such that $ax^2 + bx + c$ is a perfect square trinomial.)

Let us start by solving equations where the quadratic expression is already a perfect square.

On your dry-erase board, write the equation $x^2 = 64$**.**

When I pause, everyone complete the following sentence.

- ***Whatever we do to one side of an equation. . .*** (we must do to the other.)

To solve $x^2 = 64$***, we must use the correct inverse operation to get*** x ***by itself.***

Raise a hand to answer the following question.

- ***What is the inverse operation of squaring a number?*** (Taking its square root.)

- ***What is the square root of*** x^2***?*** (x) NOTE: The more correct answer is |x|, but this concept is beyond the scope of this lesson.

- ***What is the square root of 64?*** (8)

- ***A solution to the equation is therefore 8, because*** $8^2 = 64$***. Is there another number, however, whose square is 64? What is it?*** (Yes; –8.)

So the solutions to $x^2 = 64$ ***are 8 and –8. This is the work that we would show to solve this equation.*** NOTE: Write the diagram below on a dry-erase board and show to all students.

$$x^2 = 64$$
$$\sqrt{x^2} = \pm\sqrt{64}$$
$$x = \pm 8$$

Notice that we insert the plus-or-minus symbol in the same step that we take the square root of both sides. This allows us to find solutions using both the positive square root and the negative square root.

In more complicated equations, we will want to isolate the x^2 ***term, similar to solving two-step equations. On your dry-erase board, write the equation*** $5x^2 + 9 = 89$***.***

Raise a hand to answer the following questions.

- ***What is the first step in solving this equation?*** (Subtract 9 from both sides.)

- ***What is the second step?*** (Divide both sides by 5.)

Good! Now we can take the square root of both sides to finish solving this equation.

On your dry-erase board:

- ***Finish solving the equation*** $5x^2 + 9 = 89$***.*** ($x = \pm 4$)

Now, with a partner, on your dry-erase board, solve these equations. Round your answers to the nearest tenth, if necessary.

- $7x^2 = 567$ ($x = \pm 9$)

- $x^2 - 24 = 25$ ($x = \pm 7$)

- $12x^2 + 99 = 207$ ($x = \pm 3$)

- $2x^2 - 5 = 7$ ($x \approx \pm 2.4$)

Now, on your dry-erase board, write the equation $(x - 3)^2 = 25$.

Raise a hand to answer the following question.

- ***Is the left side of this equation a perfect square?*** (Yes.)

- ***Yes, it is! Therefore, we can solve this equation by taking the square root of both sides. What is the square root of*** $(x - 3)^2$***?*** ($x - 3$)

Correct! The square root of any quantity squared is itself.

On your dry-erase board:

- ***Finish solving this equation. I will be checking all of your work closely and will help you with each step, if necessary.*** ($(x - 3)^2 = 25 \Rightarrow \sqrt{(x-3)^2} = \pm\sqrt{25} \Rightarrow x - 3 = \pm 5 \Rightarrow x = 3 \pm 5 \Rightarrow x = 8$ or $x = -2$)
  NOTE: Be sure to that students show and understand each step.

Now, with your partner, solve these equations on your dry-erase board. Round your answers to the nearest tenth, if necessary.

- $(x + 5)^2 = 16$ ($x = -9$ or $x = -1$)

- $(x - 1)^2 = 20$ ($x \approx -3.5$ or $x \approx 5.5$)

Now, on your dry-erase board, write the equation $x^2 + 10x + 25 = 49$***. The left side of the equation is a perfect square trinomial.***

- ***Raise a hand to tell us how to rewrite*** $x^2 + 10x + 25$ ***as the square of a binomial.*** ($(x + 5)^2$)

- ***Raise a hand to tell us if you notice any easy ways when looking at problems like*** $x^2 + 10x + 25$ ***to tell if they are perfect square trinomials.*** (Half of ten is five and five squared is twenty-five.)

- ***On your dry-erase board, use this square of a binomial to finish solving the equation*** $x^2 + 10x + 25 = 49$. ($x = -12$ or $x = 2$)

Now, on your dry-erase board, write the equation $x^2 + 8x = 65$***. Notice that the left side is not a perfect square trinomial.***

- ***Raise a hand if you have an idea what to add to*** $x^2 + 8x$ ***to make it a perfect square trinomial.*** (Half of eight is four and four squared is sixteen.)

To make it a perfect square trinomial, we will add $\left(\frac{b}{2}\right)^2$ ***to both sides.***

NOTE: Write the expression $\left(\frac{b}{2}\right)^2$ on a dry-erase board to show students.

Remember that b ***is the coefficient of the*** x ***term, so in*** $x^2 + 8x = 65$, b ***is equal to 8.***

- ***Raise a hand to tell us what*** $\left(\frac{b}{2}\right)^2$ ***equals, when*** $b = 8$. (16)

Correct! So we will add 16 to the left side of the equation, which will make it a perfect square trinomial. Of course, we will remember to also add 16 to the right side of the equation to keep the equation balanced.

- ***On your dry-erase board, add 16 to both sides of*** $x^2 + 8x = 65$.
  ($x^2 + 8x + 16 = 81$)

- ***Now, on your dry-erase board, finish solving this equation.***
  ($x = -13$ or $x = 5$)

Now, on your dry-erase board, write the equation $x^2 - 10x + 6 = 8$. ***Notice that*** $x^2 - 10x + 6$ ***is not a perfect square trinomial.***

On your dry-erase board:

- ***First, subtract 6 from both sides, since the 6 is not helping us find a perfect square trinomial.*** ($x^2 - 10x = 2$)

- ***Next, find the term to add to both sides by taking half of –10 and squaring the result.*** (25)

- ***Add 25 to both sides of*** $x^2 - 10x = 2$. ($x^2 - 10x + 25 = 27$)

- ***Finish solving this equation.*** ($x \approx -0.2$ or $x \approx 10.2$)

Now, with your partner, on your dry-erase board, solve the following quadratic equations by **completing the square.**

- $x^2 - 14x = -5$ ($x \approx 0.4$ or $x \approx 13.6$)
- $x^2 + 18x + 50 = 69$ ($x = -19$ or $x = 1$)

When "a" does not equal 1, we will first have to divide both sides of the equation by a.

On your dry-erase board:

- ***Write the equation*** $3x^2 + 48x = 15$. ***Then divide both sides by 3. Don't forget that the distributive property tells us that we must divide all terms by 3.*** ($x^2 + 16x = 5$)
- ***Now, finish solving this equation by*** **completing the square.** ($x \approx -16.3$ or $x \approx 0.3$)

Now, on your dry-erase board, write the equation $2x^2 - 10x - 17 = 35$. ***You will work with your partner to solve this equation.***

It is easier to add 17 to both sides before dividing both sides by 2.

- ***On your dry-erase board, use this fact to solve*** $2x^2 - 10x - 17 = 35$ ***by*** **completing the square.** ($x \approx -3.2$ or $x \approx 8.2$)

Now complete the problems in the Guided Practice section of your Student Resource Sheets.

Summary/Closure:

A. Define Vocabulary Words

On your Student Resource Sheets (Lesson 41), in the Summary/Closure section, there is an exercise dealing with today's vocabulary term. Take a few minutes to carefully complete this exercise.

B. Summarize What We Learned Today

Let's summarize the skill that we have been working on today. On your Student Resource Sheets, in the Summary/Closure section, write an example of a quadratic equation that will need to be solved by using all of the steps of the process of **completing the square.** ***Then solve the equation by*** **completing the square.** ***These examples will be your reference sheet when you need to remember how to do these types of problems in the future.***

Raise a hand to share your sample problems with the class. NOTE: Be alert to correct all student errors and to encourage students to show complete work so that they have accurate reference sheets.

C. Apply Skill

On your dry-erase board, solve the following equations.

- $(x + 5)^2 = 50$ ($x \approx -12.1$ or $x \approx 2.1$)
- $x^2 - 20x = 44$ ($x = -2$ or $x = 22$)
- $5x^2 - 20x + 17 = 2$ ($x = 1$ or $x = 3$)

Fact Practice:

7 mins.

Operation: Subtraction

Fact Activity: _____

Count/Record Tokens:

5 mins.

Count and record tokens in the Student Resource Book.

lesson 41 – new for TX – teacher resource sheet

Lesson Objective: Solve quadratic equations by completing the square.

Vocabulary Box

completing the square – The process of finding values for a, b, and c, such that $ax^2 + bx + c$ is a perfect square trinomial.

Guided Practice

You will complete the following practice problems with your partner. Then your teacher will review the answers.

Directions: Solve each equation.

1. $-7x^2 + 80 = 17$ *(x = –3 or x = 3)*

2. $(x - 11)^2 = 64$ *(x = 3 or x = 19)*

3. $x^2 + 12x = 25$ *($x \approx -13.8$ or $x \approx 1.8$)*

4. $x^2 - 8x - 14 = 6$ *(x = –2 or x = 10)*

5. $7x^2 - 42x = 21$ *($x \approx -0.5$ or $x \approx 6.5$)*

6. $-2x^2 - 6x + 7 = 11$ *(x = –2 or x = –1)*

Summary/Closure

A. Vocabulary Words

Directions: Unscramble the words and symbols to make a correct definition.

Completing the trinomial is a perfect process for finding square values called a and b, such that, $ax^2 + bx + c$, is the square of c.

(The process of finding values of a, b, and c, such that $ax^2 + bx + c$ is a perfect square trinomial is called completing the square.)

B. Summarize What We Learned Today

Directions: Write an example of a quadratic equation that will need to be solved by using all of the steps of the process of completing the square. Then solve the equation by completing the square. Then explain how to solve a quadratic equation by completing the square. You will use this explanation as a personal reference sheet. *(Answers will vary.)*

lesson 41- new for TX – student resource sheet

Lesson Objective: Solve quadratic equations by completing the square.

Vocabulary Box

completing the square – The process of finding values for a, b, and c, such that $ax^2 + bx + c$ is a perfect square trinomial.

Guided Practice

You will complete the following practice problems with your partner. Then your teacher will review the answers.

Directions: Solve each equation.

1. $-7x^2 + 80 = 17$

2. $(x - 11)^2 = 64$

3. $x^2 + 12x = 25$

4. $x^2 - 8x - 14 = 6$

5. $7x^2 - 42x = 21$

6. $-2x^2 - 6x + 7 = 11$

Summary/Closure

A. Vocabulary Words

Directions: Unscramble the words and symbols to make a correct definition.

Completing the trinomial is a perfect process for finding square values called a and b, such that, $ax^2 + bx + c$, is the square of c.

B. Summarize What We Learned Today

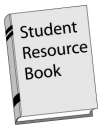
Directions: Write an example of a quadratic equation that will need to be solved by using all of the steps of the process of completing the square. Then solve the equation by completing the square. Then explain how to solve a quadratic equation by completing the square. You will use this explanation as a personal reference sheet.

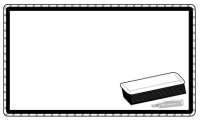
lesson fifty-seven

LESSON OBJECTIVE:
Add and subtract rational expressions.

Introduction	Direct Skill Instruction and Guided Practice	Summary/Closure	Fact Practice
5 mins.	25 mins.	10 mins.	7 mins.

Lesson:





- ❑ Student Resource Books: Student Resource Sheets (Lesson 57)
- ❑ Dry-erase boards and dry-erase markers

Fact Practice:
(Select one of these sets of materials for the Math Facts Games.)

- ❑ Individual Student Flashcards
- ❑ Buzz
- ❑ Math War or Salute!
  - Playing cards
- ❑ Soccer Ball Facts
  - Soccer ball
- ❑ Math Scramble
  - Index cards, each with a number 0–9; cards with the operations
- ❑ BINGO
  - Flashcards
  - BINGO boards, and tokens or colored squares
- ❑ Around the World
  - Triangle or regular flashcards

Vocabulary Definitions:
This lesson assumes that students know the following vocabulary words:

- least common denominator
- simplify
- greatest common factor
- difference of squares
- perfect square trinomial

rational expression – An expression that can be written as the ratio of two polynomials.

Example: $\frac{3x^2 - 21x}{x^2 - 14x + 49}$.

Welcome:

3 mins. Greet students by name and take attendance.

Introduction:

5 mins.

A. Access Prior Knowledge

On your dry-erase board, simplify the following expressions.

- $\frac{45}{75}$ $(\frac{3}{5})$
- $\frac{12\text{m}+42}{14\text{m}+49}$ $(\frac{6}{7})$
- $\frac{\text{n}^2-22\text{n}+121}{\text{n}^2-121}$ $(\frac{\text{n}-11}{\text{n}+11})$
- $\frac{5}{13}+\frac{3}{13}$ $(\frac{8}{13})$
- $\frac{9}{14}-\frac{5}{14}$ $(\frac{2}{7})$
- $\frac{5}{6}+\frac{3}{4}$ $(\frac{19}{12})$

B. Explain Connection to New Skill

You already know how to simplify many types of expressions. These include expressions used in addition and subtraction of fractions, including those without common denominators. You also know how to simplify fractions and **rational expressions.**

On your dry-erase board, simplify the following expressions.

- $\frac{\text{b}^2-36}{12\text{b}+72}$ $(\frac{\text{b}-6}{12})$
- $\frac{17}{8}-\frac{5}{8}$ $(\frac{3}{2})$
- $\frac{4}{7}+\frac{2}{9}$ $(\frac{50}{63})$

Alg 57

lesson fifty-seven

C. State Lesson Objective

During today's lesson, we will add and subtract **rational expressions.**

Direct Skill Instruction and Guided Practice:

In your Student Resource Book, below the Lesson Objective, you will see a Vocabulary Box that lists today's vocabulary term and its definition. Let's look at this term together.

In the last lesson, we multiplied and divided **rational expressions**, ***and we found that the process was similar to that of multiplying and dividing fractions.***

Today we will look at adding and subtracting **rational expressions**. ***This process is similar to that of adding and subtracting fractions.***

First, let's consider adding and subtracting **rational expressions** ***that have a common denominator. On your dry-erase board, write the expression*** $\frac{7}{v}+\frac{4}{v}$.

- ***The denominators are the same. Raise a hand to tell me how we'll add these fractions.*** (Add the numerators.)
- ***On your dry-erase board, simplify this expression.*** $(\frac{11}{v})$

In the last example, we could add the 7 and the 4 because they were both constants. Sometimes the numerators will not be like terms, so we will simply use them to write an expression for the numerator.

- ***On your dry-erase board, simplify the expression*** $\frac{c}{x}-\frac{z}{x}$. $(\frac{c-z}{x})$
- ***On your dry-erase board, simplify the expression*** $\frac{k^2+5k}{12}+\frac{7k+24}{12}$. $(\frac{k^2+12k+24}{12})$

In the last example, the second **rational expression** ***had a numerator that was a polynomial. When this is the case, and the operation is subtraction, we must be careful to use the distributive property to subtract all the terms of the numerator.***

On your dry-erase board, write the expression $\frac{j-5}{9}-\frac{3j-4}{9}$.

- ***Recall that we subtract polynomials by adding the opposite of each term. On your dry-erase board, change the main subtraction sign to addition, and change the sign of each term in 3*j *– 4.*** $(\frac{j-5}{9}+\frac{-3j+4}{9})$

- ***Now, on your dry-erase board, finish simplifying this expression.*** $(\frac{-2j-1}{9})$

Just as when adding or subtracting fractions, we will sometimes end up with an answer that is a **rational expression** ***that can be simplified further.***

- ***On your dry-erase board, add*** $\frac{3h+1}{8}+\frac{h-13}{8}$. $(\frac{4h-12}{8})$

Notice that the numerator of your answer has a common factor.

- ***On your dry-erase board, factor the numerator.*** $(\frac{4(h-3)}{8})$

- ***Finish simplifying by canceling the common factor, 4.*** $(\frac{h-3}{2})$

Now work on your dry-erase board with a partner to simplify the following expressions.

- $\frac{8}{g}-\frac{3}{g}$ $(\frac{5}{g})$
- $\frac{5f}{d}+\frac{f-8}{d}$ $(\frac{6f-8}{d})$
- $\frac{3a-10}{4}-\frac{5a+7}{4}$ $(\frac{-2a-17}{4})$
- $\frac{6p}{25}-\frac{21p-10}{25}$ $(\frac{-3p+2}{5})$

Now let's look at finding common denominators for adding **rational expressions.**

If the denominators don't share any common factors, we can just multiply them to find the least common denominator. Then we can multiply each numerator and denominator by the missing factor to find equivalent fractions.

- ***On your dry-erase board simplify*** $\frac{6}{7}+\frac{2}{5}$.

  (LCD = 35; $\frac{6\bullet5}{7\bullet5}=\frac{30}{35}$; $\frac{2\bullet7}{5\bullet7}=\frac{14}{35}$; $\frac{30}{35}+\frac{14}{35}=\frac{44}{35}$)

- ***On your dry-erase board, simplify*** $\frac{5}{\mathrm{u}}-\frac{\mathrm{u}}{3\mathrm{y}}$. (LCD = 3uy;

  $\frac{5\bullet3\mathrm{y}}{\mathrm{u}\bullet3\mathrm{y}}=\frac{15\mathrm{y}}{3\mathrm{uy}}$; $\frac{u\bullet u}{3y\bullet u}=\frac{u^2}{3uy}$; $\frac{15\mathrm{y}}{3\mathrm{uy}}-\frac{\mathrm{u}^2}{3\mathrm{uy}}=\frac{15\mathrm{y}-\mathrm{u}^2}{3\mathrm{uy}}$)

Now work on your dry-erase board with a partner to simplify the following expressions.

- $\frac{7}{2\mathrm{r}}-\frac{8}{3\mathrm{w}}$ $(\frac{21\mathrm{w}-16\mathrm{r}}{6\mathrm{rw}})$

- $\frac{5}{\mathrm{q}-4}+\frac{12}{\mathrm{q}-7}$ ***HINT:*** ***(*** q ***– 4) and (*** q ***– 7) are binomial factors and do not share any common factors.*** $(\frac{17\mathrm{q}-83}{(\mathrm{q}-4)(\mathrm{q}-7)})$

Now, on your dry-erase board, write the expression $\frac{3}{8}+\frac{5}{12}$.

- ***Raise a hand to tell me the least common denominator for these two fractions.*** (24)

- ***8 times 12 is 96. Raise a hand to tell me why we shouldn't use 96.*** (It's too large a number. It will make computation more difficult, and then we will have to simplify the answer.)

Good! Likewise, we want to find the least ***common denominator for rational expressions. On your dry-erase board, write the expression*** $\frac{6}{4\mathrm{m}^3}-\frac{1}{6\mathrm{m}^5}$.

- ***Raise a hand to tell me the least common denominator.*** ($12\mathrm{m}^5$)
  NOTE: If students are having difficulty with this, tell them to first find the LCM of the coefficients, 12, then put that with the highest power of each variable that appears in the expression.

- ***On your dry-erase board, simplify this expression.*** $(\frac{18m^2-2}{12m^5})$

Now work on your dry-erase board with a partner to simplify the following expressions.

- $\frac{4}{b^5n^3}+\frac{6b}{n}$ $(\frac{4+6b^6n^2}{b^5n^3})$
- $\frac{2}{v^2-9}+\frac{5}{v^2+6v+9}$

HINT: Factor the numerators. The least common denominator has three binomial factors, two of which are the same.

$$(\frac{2(v+3)}{(v-3)(v+3)(v+3)}+\frac{5(v-3)}{(v-3)(v+3)(v+3)}=\frac{7v-9}{(v-3)(v+3)(v+3)})$$

Now complete the problems in the Guided Practice Section of your Student Resource Book.

Summary/Closure:

10 mins.

A. Define Vocabulary Words

In your Student Resource Book, Lesson Fifty-Seven, in the Summary/Closure section, there is an exercise dealing with today's vocabulary term. Take a few minutes to carefully complete this exercise.

B. Summarize What We Learned Today

Let's summarize the skill that we have been working on today. In your Student Resource Book, in the Summary/Closure section, write two examples of adding **rational expressions** ***and one example of subtracting*** **rational expressions**. ***These examples will be your reference sheet when you need to remember how to do these types of problems in the future.***

Raise a hand to share your sample problems with the class. NOTE: Be alert to correct all student errors and to encourage students to show complete work so that they have accurate reference sheets.

lesson fifty-seven

C. Apply Skill

Simplify the following expressions.

- $\frac{6}{7c} - \frac{c-4}{7c}$ $\left(\frac{10-c}{7c}\right)$
- $\frac{9}{4x^4} + \frac{3}{10x^{10}}$ $\left(\frac{45x^6+6}{20x^{10}}\right)$
- $\frac{z}{5z+15} + \frac{4}{7z+21}$ $\left(\frac{7z+20}{35(z+3)}\right)$

Fact Practice:

7 mins.

Operation: Addition

Fact Activity: _____

Count/Record Tokens:

5 mins.

Count and record tokens in the Student Resource Book.

lesson fifty-seven – teacher resource sheet

Lesson Objective: Add and subtract rational expressions.

Vocabulary Box

rational expression – An expression that can be written as the ratio of two polynomials.

Example: $\frac{3x^2 - 21x}{x^2 - 14x + 49}$.

Guided Practice

Complete the following practice problems with your partner. Your teacher will review the answers. Make sure that you show all important work.

Directions: Simplify each expression.

1. $\frac{7}{4k^2} + \frac{8}{3k^5}$ $\left(\frac{21k^3 + 32}{12k^5}\right)$

2. $\frac{8j - 4}{15} + \frac{12j - 26}{15}$ $\left(\frac{4j - 6}{3}\right)$

3. $\frac{4}{h + 6} - \frac{3}{h - 2}$

   HINTS: Remember to change to an equivalent addition problem. Remember to use the distributive property, as appropriate. $\left(\frac{h - 26}{(h + 6)(h - 2)}\right)$

Summary/Closure

A. Vocabulary Words

1. Write a brief explanation of how to add two fractions, including how to find a least common denominator. *(Possible answer: find the LCD; find equivalent fractions; add the numerators; simplify, if possible.)*

2. Write a brief explanation of how to add two rational expressions, including how to find a least common denominator. *(Possible answer: find the LCD; find equivalent fractions; add the numerators; simplify, if possible.)*

B. Summarize What We Learned Today

Directions: Write two examples of adding rational expressions and one example of subtracting rational expressions. Then write a few sentences about adding and subtracting rational expressions. You will use this explanation as a personal reference sheet. *(Answers will vary.)*

lesson fifty-seven – student resource sheet

Lesson Objective: Add and subtract rational expressions.

Vocabulary Box

rational expression – An expression that can be written as the ratio of two polynomials.

Example: $\frac{3x^2 - 21x}{x^2 - 14x + 49}$.

Guided Practice

Complete the following practice problems with your partner. Your teacher will review the answers. Make sure that you show all important work.

Directions: Simplify each expression.

1. $\frac{7}{4k^2} + \frac{8}{3k^5}$

2. $\frac{8j-4}{15} + \frac{12j-26}{15}$

3. $\frac{4}{h+6} - \frac{3}{h-2}$

   HINTS: Remember to change to an equivalent addition problem. Remember to use the distributive property, as appropriate.

Summary/Closure

A. Vocabulary Words

1. Write a brief explanation of how to add two fractions, including how to find a least common denominator.

2. Write a brief explanation of how to add two rational expressions, including how to find a least common denominator.

B. Summarize What We Learned Today

Directions: Write two examples of adding rational expressions and one example of subtracting rational expressions. Then write a few sentences about adding and subtracting rational expressions. You will use this explanation as a personal reference sheet.