Unit 4 Operations & Algebraic Thinking

Content Area: **Math**
Course(s): **Math Essentials**
Time Period: **DecJan**
Length: **20 days**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

MATH ESSENTIALS GRADES 11-12

UNIT 4 OPERATIONS AND ALGEBRAIC THINKING

Belleville Board of Education

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Unit Overview

Unit 4: Operations and Algebraic Thinking

In this unit, students should learn to use the correct order of operations to evaluate an arithmetic expression, write and interpret algebraic expressions, write and evaluate expressions with exponents and roots, and use the Distributive Property & combine like terms to simplify expressions.

Enduring Understanding

Unit Enduring Understandings: Students will understand that..

- The order in which operations are performed can affect the value of an expression.
- Expressions are powerful tools for exploring, reasoning about, and representing situations.
- Variables have many different meanings, depending on context and purpose.
- Variables permit writing expressions whose values are unknown or vary under different circumstances.
- The idea of exponents can be extended to include zero and negative exponents.
- Properties of exponents make it easier to simplify products or quotients of powers with the same base or powers raised to a power or products raised to a power.

- Numbers can be expressed in scientific notation to compare very large and very small quantities and to perform computations with those numbers.
- Perfect square roots and perfect cube roots can be written as rational numbers.
- Properties can be used to simplify algebraic expressions.
- An algebraic expression can be simplified by combining the parts of the expression that are alike.

Essential Questions

Unit Essential Questions: Students will keep considering..

- What is the correct order for performing mathematical operations?
- How does changing the order of operations affect the outcome when simplifying an expression?
- How can we create expressions for given situations by using real numbers?
- When writing an algebraic expression to represent a situation, how will I know which operation(s) to use?
- When are radicals and integer exponents used in expressions and equations to tell a story or represent an authentic situation in life?
- What is the difference between a square/cube and a square root/cube root?
- When is it convenient to use scientific notation?
- How do you use the Distributive Property to evaluate and simplify expressions?
- How can combining like terms help solve an algebraic equation?

Exit Skills

By the end of Unit 4 Students will be able to:

- Perform the correct order of operations on a given arithmetic expression.
- Write an algebraic expression to represent a given situation.
- Interpret the meaning of a given algebraic expression.
- Understand the difference between using squares/cubes and square roots/cube roots.
- Write a standard number in scientific notation and vice versa.
- Use the Distributive Property to multiply a monomial by a polynomial.
- Combine like terms when simplifying algebraic expressions and equations.

New Jersey Student Learning Standards (NJSLS-S)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.N-RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.K-12.4	Model with mathematics.
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Interdisciplinary Connections

LA.RL.11-12.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (e.g., Shakespeare as well as other authors.)
LA.W.11-12.2.D	Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

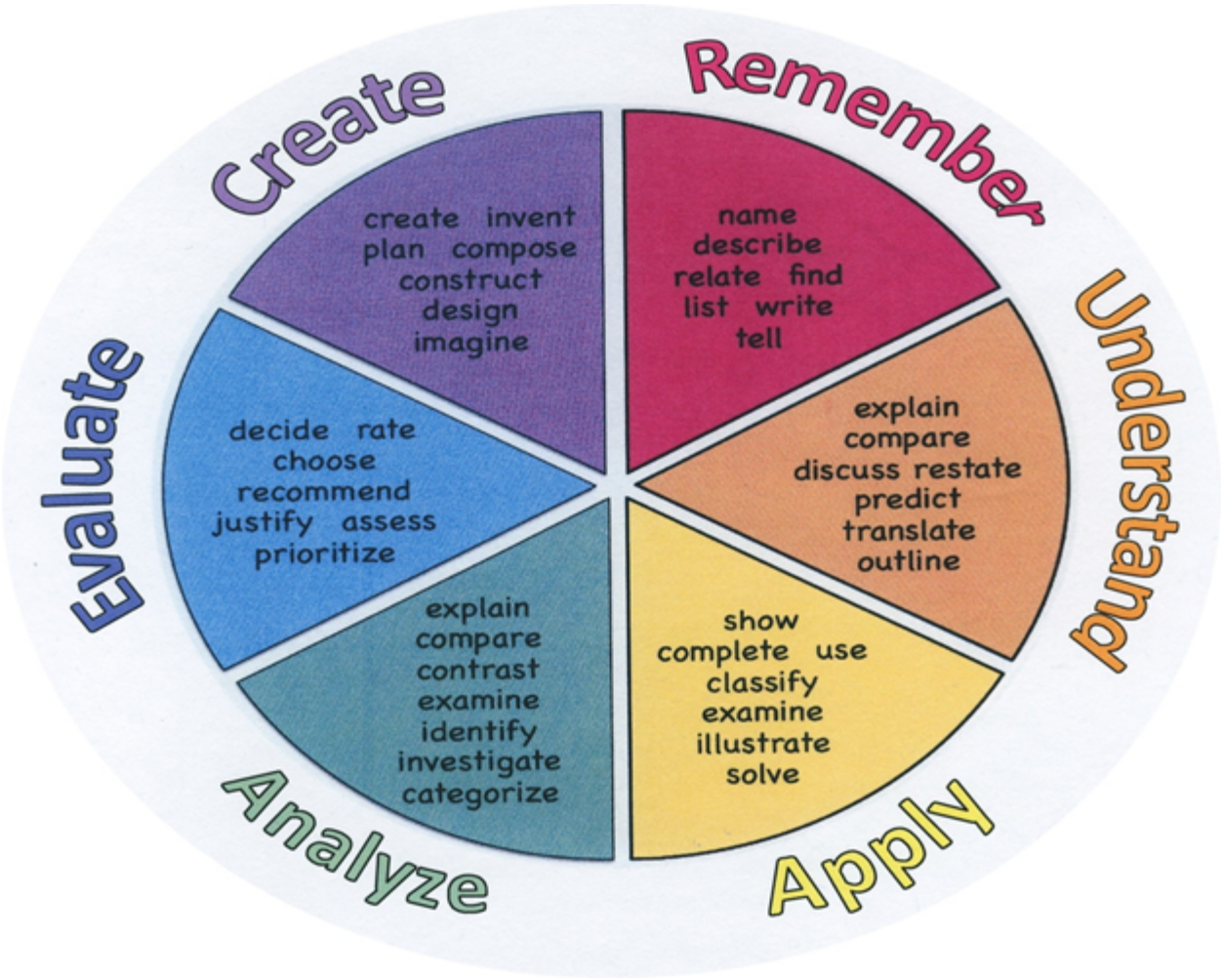
Learning Objectives

Students will be able to...

- Determine the correct order of operations for a given arithmetic expression.
- Produce an algebraic expression to represent a given situation.
- Interpret the meaning of a given algebraic expression.
- Contrast the process of finding squares and cubes with finding the process of square roots and cube roots.
- Rewrite a standard number in scientific notation and vice versa.
- Justify each step in simplifying an algebraic expression by using properties of numbers.

Remember	Understand	Apply	Analyze	Evaluate	Create

Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Supplemental Materials:

- khanacademy.com
- njctl.org
- coolmath.com
- mathbitsnotebook.com/
- https://parcc-assessment.org/released-items/
- https://accuplacer.collegeboard.org/student/practice

Assessment and Learning:

- aleks.com
- Google Forms
- edulastic.com

- Google Classroom
- https://kahoot.com/explore/collections/math-kahoot-algebra/ (has all levels of math in the collections)

Strategies:

- https://mashupmath.com
- virtualnerd.com
- https://ies.ed.gov/ncee/wwc/docs/practiceguide/wwc_algebra_040715.pdf

Assessment Evidence - Checking for Understanding (CFU)

Edulastic Formative Assessment (Formative)

Kahoots - Various Topics (Formative)

Glencoe McGraw-Hill EAssessment Test Generator (Summative)

Common benchmarks on OnCourse (Benchmark)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments

- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments

Primary Resources & Materials

- https://www.nj.gov/education/cccs/2016/math/standards.pdf
- aleks.com
- edulastic.com
- njctl.org
- Glencoe McGraw-Hill Algebra 1 2014
- https://accuplacer.collegeboard.org/student/practice

Ancillary Resources

- teacher-prepared worksheets, notes and slides
- ASVAB for Dummies
- CliffsTestPrep ASVAB
- collegeboard.org
- homeschoolmath.net
- Glencoe Math Accelerated 2017

Technology Infusion

Create and assign exit tickets using Google Forms

Create and display slide presentations using Google Slides

Practice order of operations, identifying like terms, and finding square roots on Geogebra

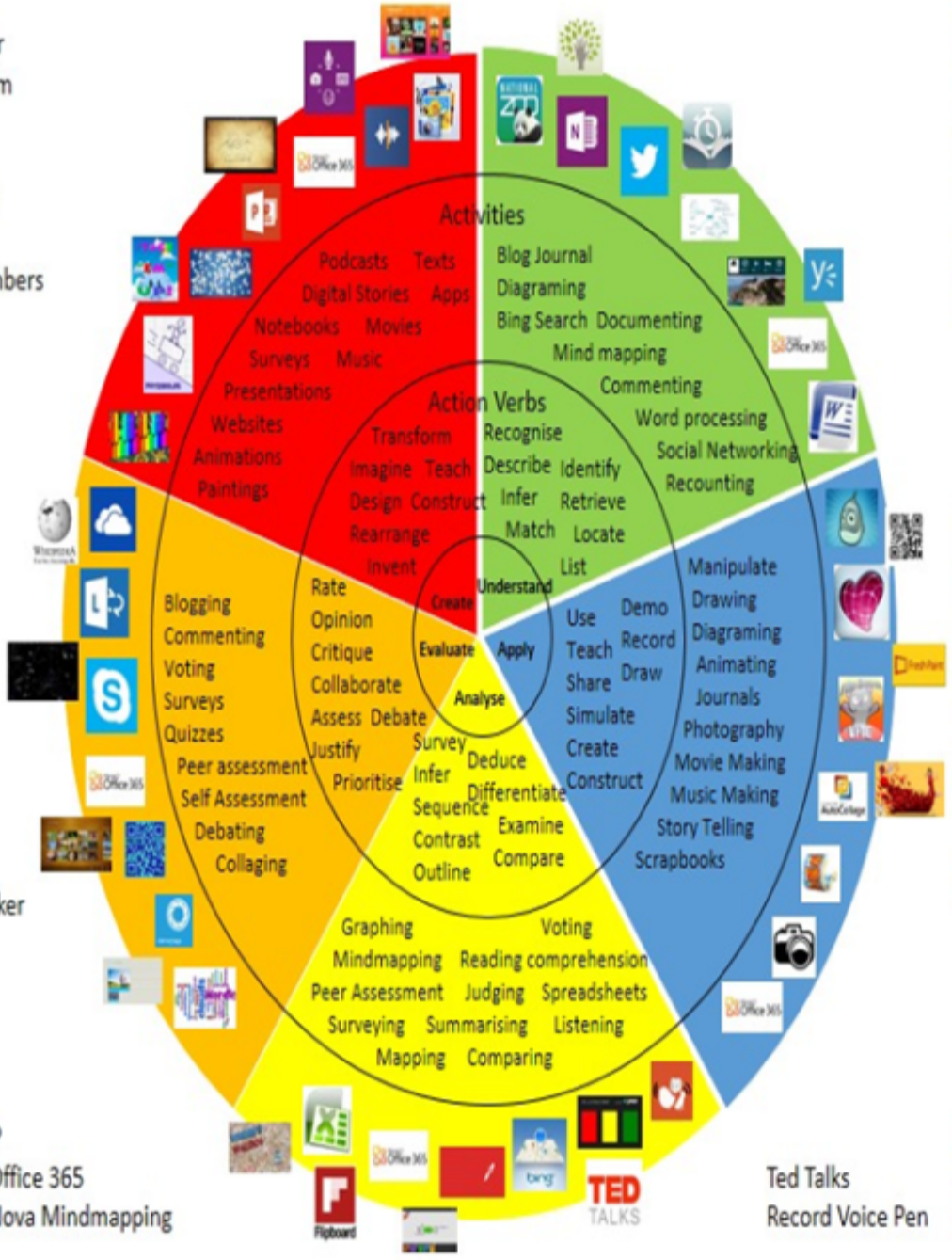
- Youtube
- Khan academy
- MS Word
- Google Slides
- Google Classroom
- Google Forms

- Edulastic
- ALEKS
- Desmos.com
- Geogebra.org
- Smart Exchange
- McGraw-Hill Education

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness

Differentiation

GENERAL EXAMPLES INCLUDE:

Use of Glencoe virtual manipulatives: http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html
Study Guides provided prior to tests and quizzes
Use of ALEKS for differentiated practice or extension of skills

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction

- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies

- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Flash cards for vocabulary and new concepts
One-on-one questioning during testing to elicit responses
Use of Glencoe personal tutor or The Video Math Tutor for additional instruction

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Use of multilingual mathematics glossary including definitions in English and its translations to other languages:
https://my.hrw.com/math06_07/nsmedia/tools/glossary/msm/glossary.html
Use of Spanish instructional videos of concepts:
https://www.youtube.com/user/KhanAcademyEspanol/videos
https://www.mathtv.com/
Peer partners for assignments with students that can verbally translate material and meanings of concepts

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Glencoe Enrichment Activities and Chapter Projects

Complete higher level learning problems in textbook

Complete math league sample contest problems:

https://www.mathleague.com/index.php/annualcontestinformation/samplecontests

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a plan to solve an issue presented in the class or in a text
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Writing Algebraic Expressions

NJSLS: MA.9-12.A-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

Interdisciplinary Connection: Science Connection: Interpret the parts of a scientific formula.

Statement of Objective: SWDT Write and interpret algebraic expressions.

Anticipatory Set/Do Now: Perform the correct order of operations.

Learning Activity: Notes: Writing Algebraic Expressions. Practice: Students write algebraic expressions and place the solutions on the board; Oral Discussion for Summary; Exit Card to check for understanding.

Student Assessment/CFU's: questioning, observation, exit cards, explaining

Materials: Smart TV, WS: Writing Algebraic Expressions - Notes & Practice, use of whiteboard, Google Forms, Google Slides

21st Century Themes and Skills: critical thinking, communication

Differentiation: note-taking, study guides, team work with peer tutoring, highlight text

Integration of Technology: use of Smart TV, Google Forms, Google Slides