Unit 4: Develop Understanding of Fractions as Numbers

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Unit 4: Develop Understanding of Fractions as Numbers

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Mathematics: Grade 3

Develop Understanding of Fractions as Numbers

Belleville Board of Education

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Unit Overview

Unit 4 will cover five topics including (T11) Use Operations with Whole Numbers to Solve Problems, (T12) Understand Fractions as Numbers, (T13) Fraction Equivalences and Comparison, and (T14) Solve Time, Capacity, and Mass Problems.

Enduring Understandings

Topic 11 focuses on:

- Bar diagrams show relationships in a two-step word problem and help identify the operation or operations needed to solve the problem.
- The way quantities in a two-step problem are related determines the operations used to solve the problem. Equations show these relationships.
- Good math thinkers use math to explain why they are right. They can talk about the math that others do, too.

Topic 12 focuses on:

- A unit fraction represents one part of a whole that has been divided into equal parts. A fraction can represent multiple copies of a unit fraction.
- The whole can be found given a fractional part.
- Points on a number line can represent fractions. The denominator represents the number of equal parts between 0 and 1, and the numerator represents the number of parts between 0 and the point.
- A number line can be used to represent fractions greater than 1.
- A line plot is a way to organize data on a number line.
- Good math thinkers make sense of problems and think of ways to solve them. If they get stuck, they don't give up.

Topic 13 focuses on:

- The same fractional amount can be represented by an infinite set of different but equivalent fractions.
- There are a limitless number of fraction names for each point on a number line. These points can be used to name equivalent fractions.
- If two fractions have the same denominator, the fraction with the greater numerator is the greater fraction.
- If two fractions have the same numerator, the fraction with the greater denominator is less than the other fraction.
- Benchmark numbers such as 0, 1/2, and 1 can be used to compare fractions.
- You can use a number line to compare fractions.
- Whole numbers can be represented by many different fraction names.
- Good math thinkers use math to explain why they are right. They can talk about the math that others do, too.

Topic 14 focuses on:

- Clocks can be used to tell time to the nearest minute.
- Elapsed time can be found by finding the total amount of time that passes between a starting time and an ending time.
- Time intervals can be added or subtracted to solve problems.
- Benchmarks can be used to estimate capacity (liquid volume).
- Capacity (liquid volume) is a measure of the amount of liquid a container can hold.
- Mass is a measure of the quantity of matter in an object.
- Problems involving mass and volume can often be solved with a picture or a diagram.
- Good math thinkers know how to think about words and numbers to solve problems.

Essential Questions

(T11): Use Operations with Whole Numbers to Solve Problems

- What are ways to solve two-step problems?

(T12): Understand Fractions as Numbers

- What are different interpretations of a fraction?

(T13): Fraction Equivalences and Comparison

- What are different ways to compare fractions?

(T14): Solve Time, Capacity, and Mass Problems

- How can time, capacity, and mass be measured and found?

Exit Skills

Topic 11: Solve problems involving the four operations, and identify and explain patterns in arithmetic.

Topics 12 and 13 Cluster: Develop understanding of fractions as numbers that can represent a portion of a whole or a point on the number line.

Topic 14: Solve problems involving measurement and estimation.

New Jersey Student Learning Standards (NJSLS)

The Math Practices, as put forth by the National Council of Teachers of Mathematics (NCTM), are connected within all lessons:

MP.1 - Make sense of problems and persevere in solving them.

MP.2 - Reason abstractly and quantitatively.

MP.3 - Construct viable arguments and critique the reasoning of others.

MP.4 - Model with mathematics.

MP.5 - Use appropriate tools strategically.

MP.6 - Attend to precision.

MP.7 - Look for and make use of structure.

MP.8 - Look for and express regularity in repeated reasoning.

MA.3.OA.D.8	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
MA.3.NF.A	Develop understanding of fractions as numbers.
MA.3.NF.A.1	Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

MA.3.NF.A.2	Understand a fraction as a number on the number line; represent fractions on a number line diagram.
MA.3.NF.A.2a	Represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $1/b$ and that the endpoint of the part based at 0 locates the number $1/b$ on the number line.
MA.3.NF.A.3	Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
MA.3.NF.A.3c	Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.
MA.3.MD.B.4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.
MA.3.G.A.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

Interdisciplinary Connections

Math and Science Projects / STEM Connections embedded within TE, EnVision Math e.g. Topic 11-1, pg. 571

Topic 11: Use Operations with Whole Numbers to Solve Problems

The science theme for this topic is engineering design.

- Ask students to tal about different designs for kites.
- Discuss the different materials that kites can be made from.
- Talk about how the size of the kite and the different materials wouidl change the cost of making the kite.
- Have students research kite designs.
- Have students write a report/journal entry detailing the information they found.

Topic 12: Understand Fractions as Numbers

The science theme for this topic is fossils and environment.

- Discuss fossils.
- Have students select a fossil to study.
- Have students draw posters of their chosen fossil or to create a diorama depicting the fossil in its original environment.
- Have the students write a report/journal entry comparing and contrasting that environment to today's environment.

Topic 13: Fraction Equivalence adn Comparison

The science theme for this topic is life cycles.

- Have students discuss the image on page 669.
- Have the student write a journal entry explaining the life cycle that all animals have in common.

Topic 14: Solve Time, Capacity, and Mass Problems

The science theme for this topic is forces and interaction.

- Explain to students that a magnetic field is invisible to the human eye. Magnetism can attract magnetic objects.
- Explain that magnets have a north pole and a south pole. Objects of the same pole will push away from each other. While objects from opposite poles will attract each other.
- Have students experiment with magnets.
- Have the students research the types of magnets and write a report/journal entry on the information gathered.

LA.W.3.8	Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
LA.SL.3.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
LA.SL.3.1.A	Explicitly draw on previously read text or material and other information known about the topic to explore ideas under discussion.
LA.SL.3.1.B	Follow agreed-upon norms for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
LA.SL.3.1.C	Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
LA.SL.3.1.D	Explain their own ideas and understanding in light of the discussion.

Learning Objectives

After completing Unit 4, students will be able to:

Topic 11:

- Draw diagrams and write equations to solve two-step problems involving addition and subtraction of whole numbers.
- Draw diagrams and write equations to solve two-step problems involving multiplication and division of whole numbers.
- Examine relationships between quantities in a two-step word problem by writing equations. Choose and apply the operations needed to find the answer.
- Critique the reasoning of others by asking questions, identifying mistakes, and providing suggestions for improvement.

Topic 12:

- Understand how to read and write unit fractions for equal-size parts of a region.
- Use a fraction to represent multiple copies of a unit fraction.
- Determine and draw the whole (unit) given one part (unit fraction).
- Represent fractions on a number line.

- Represent fractions greater than 1 on a number line.
- Measure length to the nearest fourth inch and show the data on a line plot.
- Measure length to the nearest half inch and show the data on a line plot.
- Determine when a problem has either extra or missing information.

Topic 13:

- Find equivalent fractions that name the same part of the whole.
- Represent equivalent fractions on a number line.
- Use models such as fraction strips to compare fractions that refer to the same whole and have the same denominator.
- Use models such as fraction strips to compare fractions that refer to the same whole and have the same numerator.
- Use benchmark numbers to compare fractions.
- Use a number line to compare fractions.
- Use fraction names to represent whole numbers.
- Construct math arguments using fractions.

Topic 14:

- Show and tell time to the nearest minute using analog and digital clocks.
- Tell and write time to the nearest minute and measure time intervals in minutes.
- Solve word problems involving addition and subtraction to measure quantities of time.
- Use standard units to estimate liquid volume.
- Use standard units to estimate the masses of solid objects.
- Use a pan balance with metric weights to measure the mass of objects in grams and kilograms.
- Use pictures to help solve problems about mass and volume.
- Make sense of quantities and relationships in problems.

Suggested Activities & Best Practices

- Consider Extension Activity e.g. Topic 11-1, pg. 571

- Further suggested activities embedded within each Topic

Assessment Evidence - Checking for Understanding (CFU)

- Common Formative Assessments (Formative)
- Common Summative Assessments (Summative)

- District Benchmark (Benchmark)
- Do Now
- EnVision Performance Task (Alternative)
- Exit Tickets
- Higher-order Questioning / Rich Discussion
- Journals
- KWL Chart
- Learning Center Activities
- Quick Check (enVisionmath)
- Quick Write
- Quizzes (Formative)
- Rubrics
- Surveys
- Teacher Observation Checklist
- Think-Pair-Share
- Turn-and-Talk / Share-out
- Unit Assessments (Summative)
- WIK / WINK

Primary Resources & Materials

EnVision Math Teacher Edition

PearsonRealize.com

Ancillary Resources

New Jersey Student Learning Standards for Mathematics

NJSLS Mathematics Crosswalk

IXL Learning

NCTM Illuminations

Prodigy Game

Technology Infusion



Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;

- Visual and Performing Arts.

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CAEP.9.2.4.A.4	Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.
TECH.8.1.5.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
TECH.8.1.5.A.CS1	Understand and use technology systems
TECH.8.1.5.A.CS2	Select and use applications effectively and productively.

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

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

- Use the "Quick Check" feature on Pearson Realize (embedded in each Unit) to help determine the strategy for differentiating instruction; the "Assess and Differentiate" page will prescribe the differentiated instructional activity

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments aloud
- 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

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
- Literature circles
- 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 journal prompts
- Varied supplemental materials

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

- Consider Intervention Activity and/or Reteach e.g. Topic 11-1, pg. 577A

- Use suggestions under Technology Center section in Pearson Realize to target students with disabilities

- Use the Pacer Center Action Information Sheet for research-based ideas on accommodations and modifications

- Allow for open-note/open-book assessments
- Check classwork frequently for understanding
- Conduct preview of content, concepts, and vocabulary
- Consider behavior management plan
- Implement accommodations/modifications as dictated in the student's IEP/504 plan
- Modified test content/format
- Modified written assignments
- Multi-sensory presentation
- Pre-annotate text
- Preferential seating
- Promote pair work
- Provide extended time on various assignments
- Provide printed/online copies of lesson notes
- Secure attention before providing instruction/directions
- Use assistive technology

English Language Learning (ELL)

- Use Teaching Tool 48 as a graphic organizer to help students connect a visual to the vocabulary term

- Use Teaching Tool 49 to connect students' understanding of vocabulary terms with actual meanings

- Use suggestions under English Language Learners section in Pearson Realize to target beginning, intermediate, and advanced learners e.g. Topic 11-1, pg. 573A

- Use suggestions under Technology Center section in Pearson Realize to target ELLs

- Allow for multiple student revisions
- Allow for open-note / open-book assessments
- Allow multiple forms of student products (projects, models, slide-shows, etc.) to demonstrate student learning
- Ask and give information using key words
- Demonstrate listening comprehension by responding to questions
- Develop basic sight vocabulary
- Differentiate assessments to reflect selected objectives
- Express ideas in single words

- Leverage computer spell checker
- Modify reading assignments to correlate with lexile level
- Peer tutoring / Peer note-taking
- Speak using content area vocabulary in context
- Teacher-created Study Guide
- Use prior experiences to understanding meanings
- Use videos, illustrations, pictures, and drawings to explain or clarify

At Risk

- Decrease the amount of work represented or required by assigning the "Do You Understand?" and the "Do You Know How?" sections of each lesson

- Use suggestions under Technology Center section in Pearson Realize to target at-risk students

- Use suggestions under Intervention Activity e.g. Topic 11-1, Error Intervention, pg. 575-576

- Allow for multiple student revisions
- Allow for open-note / open-book assessments
- Allow multiple forms of student products (projects, models, slide-shows, etc.) to demonstrate student learning
- Allow students to select from given assignment choices
- Differentiate assessments to reflect selected objectives
- Mark students' correct and acceptable work, not the mistakes
- Peer tutoring / Peer note-taking
- Promote student collaboration on in-class / outside class assignments
- Reduce lengthy outside reading assignments
- Teach key aspects of a topic - eliminate non-essential information
- Teacher-created Study Guide
- Use authentic assessments with real-life problem-solving
- Use videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

- Use suggestions under Extension for Early Finishers section in Pearson Realize to target advanced learners
- Use suggestions under Advanced Activity Centers to target advanced learners e.g. Topic 11-1, pg. 577A

- Administer Unit Assessment to determine level of proficiency
- Allow gifted children to create and publish a class newspaper to distribute
- Allow students to work at a faster pace
- Complete activities aligned with above grade-level text using Benchmark results
- Consider parental input about the education of their gifted children

- Create a blog or social media page about a topic of interest
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Involve students in academic contests
- Promote advanced problem-solving
- Remember that gifted children may not excel in all areas
- Set individual goals
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge