GRADE 7 - MODULE 3 - APPLICATION OF RATIONAL NUMBERS

Big Ideas
Rational numbers can be used to solve mathematical and real-world problems.
Vocabulary
terminating decimals, repeating decimals, rational numbers, percent, rounding
Prior Learning
In Grades 4 – 6 students have applied operations with fractions, decimals and percents to solve mathematical and real-world problems.
Essential Questions
• How can we use rational numbers to solve real world application problems? • How are fractions, decimals and percents connected to one another? • How are fractions, decimals and percents connected to one another? • When given a fraction, how do you determine if the equivalent decimal will be terminating? • When given a fraction, how do you determine if the equivalent decimal will be repeating? • How can operation calculations with fractions, decimals and percents be applied to integers?
Competencies
• Students will use fractions, decimals, percents and integers in mathematical and real-world problems. • Students will use properties to simplify expressions and solve mathematical and real-world problems. • Students will apply properties of operation to calculate with numbers in any form. • Students will apply estimation strategies and mental computation to solve multi-step real-world and mathematical problems
Misconceptions
• Students may add or subtract denominators when adding or subtracting fractions. • Students may have finding common denominators. • Students may not correctly apply the rules of integers operations when solving mathematical and real-world problems. • Students may not recognize the value of the 100 when converting decimals to percents. • Students may incorrectly convert fractions to decimals. • Students sometimes have trouble rounding when converting fractions to decimals.
Resources from The Key Elements to Mathematics Success - KEMS Grade 7 for Building the Conceptual Understanding of this Module
KEMS LESSON 15 - REAL WORLD APPLICATION WITH RATIONAL NUMBERS Additional Activities: Quiz – T359-T360, Scavenger Hunt T963-T966

Mathematics Content Standards	Examples
7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*	Students solve contextual problems and mathematical problems using rational numbers. Students convert between fractions, decimals, and percents as needed to solve the problem. Students use estimation to justify the reasonableness of answers. Example 1: Three students conduct the same survey about the number of hours people sleep at night. The results of the number of people who sleep 8 hours a nights are shown below. In which person's survey did the most people sleep 8 hours? • Susan reported that 18 of the 48 people she surveyed get 8 hours sleep a night • Kenneth reported that 36% of the people he surveyed get 8 hours sleep a night • Jamal reported that 0.365 of the people he surveyed get 8 hours sleep a night Solution: In Susan's survey, the number is 37.5%, which is the greatest percentage.

Questions for 7.EE.3

1. It is 27°F outside. If the temperature drops by 35°F overnight, what will the temperature be in the morning?

A. $^{-}$35°F B. $^{-}$8°F C. 0°F D. 8°F

2. The temperatures in Boston for a week in December are in the chart below.

Day	Temperature (°F)
Sunday	$^{-}$8
Monday	4
Tuesday	$^{-}$1
Wednesday	$^{-}$3
Thursday	2
Friday	5
Saturday	8

What was the difference in the temperature between Wednesday and Thursday?

3. Chandler works as a waiter at a local restaurant. He makes $7.25 per hour plus tips. He worked 8 hours on Friday and made $65.14 in tips. He worked 5.6 hours on Saturday and made $95.50 in tips. What was his gross pay for the two days? Use order of operations to solve.

A. Chandler made $160.64 in the 2 days he worked.

B. Chandler made $259.24 in the 2 days he worked.

C. Chandler made $260.64 in the 2 days he worked.

D. Chandler made $359.24 in the 2 days he worked.

4. The waiters at a local restaurant make $8.25 an hour plus tips. Tianna worked 16 hours on the weekend and made a total of $352. How much did Tianna earn in tips?

5. The William James Science Club was measuring heights of evergreen trees for a project. The tallest evergreen they measured was $13\frac{2}{15}$ feet tall and had a circumference of $3\frac{3}{8}$ feet, while the smallest tree they measured was $5\frac{1}{5}$ feet tall and had a circumference of $1\frac{1}{6}$ feet. What is the difference in the height of the two trees? Show your work or explain how you know.

A. The difference in the heights is $6\frac{14}{15}$ feet.

B. The difference in the heights is $7\frac{14}{15}$ feet.

C. The difference in the heights is $7\frac{4}{15}$ feet.

D. The difference in the heights is $8\frac{14}{15}$ feet.

Answer Key for Questions for 7.EE.3

1. B. ⁻8ºF

2. The difference in temperatures was 5 degrees.

3. 7.25 x (8 + 5. 6) + 65.14 + 95.50 = 259.24
B. Chandler made $259.24 in the 2 days he worked.

4. 16 × 8.25 = 132

352 – 132 = $220 in tips

5. B. $13\frac{2}{15} - 5\frac{1}{5} = 13\frac{2}{15} - 5\frac{3}{15} = 12\frac{17}{15} - 5\frac{3}{15} = 7\frac{14}{15}$

The difference of the heights is $7\frac{14}{15}$ feet.

Tasks for 7.EE.3

*Teacher Note: Please read the Commentary section for the Illustrative Math Tasks. Some tasks will be instructional requiring more teacher modeling and direction. Others will provide the opportunity for students to demonstrate their knowledge of a concept.

Illustrative Math Task: Gotham City Taxis
https://tasks.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/884
Illustrative Math Task: Discounted Books
https://tasks.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/478
Illustrative Math Task: Who is the Better Batter:
https://tasks.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/1588

Illustrative Math Task: Shrinking
https://tasks.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/108
Illustrative Math Task: Guess My Number
https://www.illustrativemathematics.org/content-standards/7/EE/B/tasks/712
Illustrative Math Task: Anna in D.C.
https://www.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/997
Illustrative Math Task: Stained Glass
https://www.illustrativemathematics.org/content-standards/7/EE/B/3/tasks/1513

Extra Questions for Warm-ups and Homework for 7.EE.3

1. Joann bought $15\frac{1}{3}$ yards of yellow fabric. If she cuts the fabric into 6 equal pieces, how much fabric will there be in each piece? Show your work and explain your answer.

Mathematics Content Standards	**Examples**
7.NS.2d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.	Using long division, students understand the difference between terminating and repeating decimals. This understanding is foundational for the work with rational and irrational numbers in 8th grade. Example: Using long division, express the following fractions as decimals. Which of the following fractions will result in terminating decimals; which will result in repeating decimals? $\left\{\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}\right\}$ Identify which fractions will terminate (the denominator of the fraction in reduced form only has factors of 2 and/or 5)

Questions for 7.NS.2d

1. Identify the fractions that convert to a terminating decimal and give the decimal equivalent.

A. $\frac{1}{5}$ B. $\frac{4}{9}$ C. $\frac{8}{10}$

Write the definition of a terminating decimal.

_____

2. Complete the chart below.

Fraction	Decimal	Repeating or Terminating	Prime Factorization of the Denominator
$\frac{1}{4}$			
$\frac{2}{6}$			
$\frac{75}{8}$			
$\frac{4}{5}$			

The fraction $\frac{2}{8}$ is converted to a decimal. Is the decimal repeating or terminating? Explain how you know.

3. Convert the following fraction to a decimal using long division. $\frac{5}{6}$

A. 0.56 B. $0.8\overline{3}$ C. 0.65 D. $0.3\overline{8}$

4. Convert the following fraction to a decimal using long division.

$\frac{7}{8}$

A. 0.78 B. 0.87 C. 0.875 D. 0.975

5. The fraction $\frac{4}{5}$ is converted to a decimal. Is the decimal repeating or terminating? Explain how you know.

Answer Key for Questions for 7.NS.2d

1. A. $\frac{1}{5} = 0.2$

C. $\frac{8}{10} = 0.8$

Definitions may vary.
Ex: A terminating decimal is one that has digits that do not go on forever.

2.

Fraction	Decimal	Repeating or Terminating	Prime Factorization of the Denominator
$\frac{1}{4}$	0.25	Terminating	2×2
$\frac{2}{6}$	$0.\overline{3}$	Repeating	2×3
$\frac{75}{8}$	9.375	Terminating	$2 \times 2 \times 2$
$\frac{4}{5}$	0.8	Terminating	5

3. B. $0.8\overline{3}$

4. 0.875

5. 0.8 is a terminating decimal because when you divide 4 by 5, t goes into 4 evenly with a quotient of 0.8

Tasks for 7.NS.2d

*Teacher Note: Please read the Commentary section for the Illustrative Math Tasks. Some tasks will be instructional requiring more teacher modeling and direction. Others will provide the opportunity for students to demonstrate their knowledge of a concept.

Illustrative Math Task: Equivalent fractions approach to non-repeating decimals
https://tasks.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/604
Illustrative Math Task: Repeating decimal as approximation
https://tasks.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/593
Illustrative Math Task: Decimal Expansions of Fractions

https://tasks.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/1542

Illustrative Math Task: Repeating or Terminating

https://tasks.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/1541

Illustrative Math Task:

https://www.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/1602

Extra Questions for Warm-ups and Homework for 7.NS.2d

1. Determine the decimal equivalent of each of the fractions: $\frac{2}{8}, \frac{1}{10}, \frac{4}{5}$

2. Identify the fractions as terminating or repeating. Be prepared to model and explain your answer. $\frac{3}{4}, \frac{4}{9}, \frac{6}{10}$

3. Laura was working on her math homework. She had to create a chart and identify fractions that would convert to terminating or repeating decimals. Which of the following is a repeating decimal? $\frac{4}{9}, \frac{3}{6}, \frac{8}{10}$.

4. Using the following fractions create a three column table. List the fraction, the decimal equivalent and whether it is terminating or repeating. $\frac{1}{5}, \frac{3}{4}, \frac{5}{8}, \frac{4}{9}$

5. Identify the fractions that convert to a terminating decimal and give the decimal equivalent.

$\frac{3}{4}$ $\frac{3}{6}$ $\frac{8}{9}$

Mathematics Content Standards	**Examples**
7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.	Students use order of operations from 6th grade to write and solve problem with all rational numbers. Example 1: Calculate: $[-10(-0.9)] - [(-10) \bullet 0.11]$ Solution: 10.1 Example 2: Jim's cell phone bill is automatically deducting $32 from his bank account every month. How much will the deductions total for the year? Solution: $-32 + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) + (-32) = 12\ (-32)$ Example 3: It took a submarine 20 seconds to drop to 100 feet below sea level from the surface. What was the rate of the descent? Solution: $\frac{-100 feet}{20\ seconds} = \frac{-5\ feet}{1\ second} = -5\ feet/second$ Example 4: A newspaper reports these changes in the price of a stock over four days: $\frac{-1}{8}, \frac{-5}{8}, \frac{3}{8}, \frac{-9}{8}$. What is the average daily change? Solution:

	The sum is $\frac{-12}{8}$; dividing by 4 will give a daily average of $\frac{-3}{8}$

Questions for 7.NS.3

1. Zoë traveled $12\frac{7}{10}$ miles to get to her aunt's house, while Arthur only traveled $9\frac{4}{5}$ miles to get to the same destination. How much farther did Zoë travel than Arthur?

2. Mary Ellen was writing an essay for her English class. She wrote $3\frac{1}{3}$ pages Monday and $4\frac{5}{6}$ pages on Tuesday. On Wednesday, she was tired and only wrote $\frac{3}{4}$ of a page. What is the total number of pages Mary Ellen completed? Show your work, and explain your answer.

3. Joann bought $15\frac{1}{3}$ yards of yellow fabric. If she cuts the fabric into 6 equal pieces, how much fabric will there be in each piece? Show your work and explain your answer.

4. Tanisha and her sister are going bike riding at the local park. They have a choice of four different trails to ride. If they choose to take the Lake Trail and the Moss Tree Trail, how many total miles will they ride?

Trail Name	Lake Trail	Raccoon Trail	Moss Tree Trail	Fernwood Trail
Length (miles)	$2\frac{1}{3}$	$3\frac{2}{5}$	$1\frac{1}{2}$	$1\frac{5}{6}$

Answer Key for Questions for 7.NS.3

1. $2\frac{9}{10}$ **miles**

2.
$$3\frac{1}{3} + 4\frac{5}{6} + \frac{3}{4} =$$
$$3\frac{4}{12} + 4\frac{10}{12} + \frac{9}{12} =$$
$$7\frac{23}{12} = 8\frac{11}{12}$$

3.
$$15\frac{1}{3} \div 6 = \frac{46}{3} \bullet \frac{1}{6} = \frac{46}{18} = \frac{23}{9} = 2\frac{5}{9}$$

4. $3\frac{2}{5}$ **miles**

Tasks for 7.NS.3

*Teacher Note: Please read the Commentary section for the Illustrative Math Tasks. Some tasks will be instructional requiring more teacher modeling and direction. Others will provide the opportunity for students to demonstrate their knowledge of a concept.

Illustrative Math Task: Sharing Prize Money
https://tasks.illustrativemathematics.org/content-standards/7/NS/A/3/tasks/298
Illustrative Math Task:
https://www.illustrativemathematics.org/content-standards/7/NS/A/2/tasks/1602

Extra Questions for Warm-ups and Homework for 7.NS.3

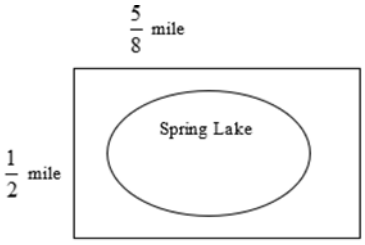
1. At lunch time, Bryce often borrows money from his friends to buy snacks in the school cafeteria. Bryce borrowed $1.25 from his friend Carl five days last week to buy ice cream bars. Represent the amount Bryce borrowed as the product of two rational numbers; then, determine how much Benjamin owed his friend last week.

2. Fill in the blanks with two rational numbers (other than 1 and –1). ___ × $(-\frac{1}{2})$ × ___ = −20

3. Fill in the blanks with two rational numbers. ___ × ___ = −0.75
What must be true about the relationship between the two numbers you chose?

4. Trey bought $5\frac{1}{2}$ feet of lumber. He wants to cut it into pieces that are each $\frac{1}{2}$ foot long. How many pieces will he be able to cut?

5. There is a walking path around Spring Lake.



Jason's family is camping at the lake. He and his brothers walk the rectangle shaped walking trail. If they walk the perimeter of the rectangle one time, what distance will they walk?

6. A cookie recipe needs $3\frac{1}{4}$ cups of flour per batch of cookies. Once all of the dough is prepared, an additional $\frac{7}{8}$ cup is sprinkled on the table for the cookies to be rolled and cut. If a total of $8\frac{3}{4}$ cups of flour were used, how many batches of cookies were made?

7. Sonya worked on her homework for $1\frac{5}{6}$ hours, and Javier worked on his homework for $3\frac{1}{4}$ hours. How many more hours did Javier spend on his homework?

Works Referenced in the Development of the Module	
Common Core State Standards Initiative www.corestandards.org	Ohio Department of Education http://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics
Illustrative Mathematics Project https://illustrativemathematics.org/	North Carolina Math Tools for Teachers https://tools4ncteachers.com/
Mathematics Assessment Project https://www.map.mathshell.org/index.php	Smarter Balanced Assessment Consortium https://smarterbalanced.org/
PARCC http://parcconline.org/	Utah Education Network https://www.uen.org/core/math/
NOYCE Foundation: https://www.insidemathematics.org/	