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# What Are Rational Numbers? [8th grade]

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*Education Department*

*Understanding by Design Curriculum Units*

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*Trinity University*

*Year 2005*

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What Are Rational Numbers?

Catherine Risinger  
Trinity University,

# UNDERSTANDING BY DESIGN

## Unit Cover Page

**Unit Title: What Are Rational Numbers?**

**Grade Level: 8**

**Subject/Topic Area(s): Pre-Algebra**

**Designed By: Catherine Risinger**

**Time Frame: 4 weeks**

**School District (One Designer): North East ISD**

**School: Tejada Middle School**

**School Address and Phone: 2909 East Evans Road  
San Antonio, TX 78259  
(210)482-2260**

### Brief Summary of Unit (Including curricular context and unit goals):

In this pre-algebra unit of rational numbers, students will further their understanding of rational numbers and its application to everyday experiences. Pre-algebra is the stepping stone to high school mathematics. Therefore, it is imperative for students to recognize and demonstrate that there are appropriate situations in which rational numbers should be used and their usefulness to us.

In the culminating performance task, students are asked to develop and present a plan for the BBQ that they will be hosting for a specified number of people. The BBQ scenario allows students to apply their knowledge of rational numbers in order to do comparison shopping at 3 different grocery stores. The unit concludes with why students shopped the way that they did and a self-evaluation of what they have learned.

## STAGE 1 – DESIRED RESULTS

### Content Standard(s)

- 8.1b selects and uses appropriate forms of rational numbers to solve real-life problems including those involving proportional relationships**
- 8.3b estimate and find solutions to application problems involving percents (& proportional relationships such as similarity rates)**
- 8.14a identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics**

### *Understanding(s)* Students will understand that...

- Rational numbers can be represented as decimals, fractions, and percents
  - Strategies can be used to simplify expressions and to compare and order rational numbers
  - There are advantages and disadvantages to each type of representation (fractions, decimals, and percents)
- Sometimes the “correct” unit rate (i.e., fractions, decimals, and percents) is not the best solution to real-world problems

### Essential Question(s)

**Q**

#### Overarching Question

- Why do we need numbers? (Year Overview)
  - What couldn't we do if we didn't have numbers?
  - What is a number?

#### Topical Question(s)

- What is a rational number?
- When is it best to use a fraction? When is it best to use a decimal? When is it best to use a percent?

#### *Students will know:*

- **Key Terms** – unit rate, ratio, percent, decimal, fraction, rational number
- The properties of rational numbers expressed in a variety of forms

#### *Students will be able to:*

**K**

- Compute with rational numbers being expressed in a variety of forms
- Determine if a solution is appropriate and moving beyond a particular problem by thinking of other situations

## STAGE 2 – ASSESSMENT EVIDENCE

### Performance Task:

T

You are planning a BBQ for a specified number of people. Your task is to utilize your knowledge of rational numbers in order to buy the correct amount of food for your BBQ. Keep in mind what you don't want to buy too much or too little food. It is your job to spend the least amount of money necessary for everyone to eat.

You will be provided with the following:

- The names of 3 grocery stores in which you will be allowed to shop at.
- A shopping list in which you will have to buy everything that is there (\*\*Keep in mind you get to choose from where you purchase your items)
- A pricing list for each identical item from each store
- You will draw a card out of a box, which will specify the number that will be attending your BBQ, what they will eat at your BBQ, and what they will drink.

### Requirements:

- Include a paragraph explaining why you planned your BBQ the way in which you did and what you learned from completing this project.
- Make sure that you showed all of your work and that it is neatly organized on a spreadsheet or table.
- Keep in mind you will have to plan appropriately since there will be a discount given at 1 of the stores and some of your items will require you to think through what is cost effective.

**WAIT!!** As you were going through your wallet you realized that you have \$15.00 left over for dessert. With your remaining money choose a dessert that you would like to serve at your BBQ and show how you spent the money.

### BBQ Planning

- 1  $\frac{3}{4}$  lbs Hamburger Meat for every 2.5 people
- 1.5 Hot Dogs for every 1 person
- 1 Hot Dog bun for every hot dog
- 1 Hamburger bun for every hamburger
- 8.0 oz of ketchup for every 5 people
- 3.0 oz of mustard for every 2 people
- 4.5 oz of relish for every 3 people
- 1 dinner plate enough for every 1 person
- 3 napkins for every 2 people
- 1 fork & knife for every 1 person
- 1 serving of tea for every 2.5 people
- 2 drinks for every one person
- Soda
- Bottled water

## STAGE 2 – ASSESSMENT EVIDENCE (cont.)

### Key Criteria:

CATEGORY	4	3	2	1
Mathematical Concepts	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Strategy/Procedures	Uses an efficient and effective strategy to solve the problem(s).	Uses an effective strategy to solve the problem(s).	Sometimes uses an effective strategy to solve problems, but does not do it consistently.	Rarely uses an effective strategy to solve problems.
Mathematical Errors	90-100% of the steps and solutions have no mathematical errors.	Almost all (85-89%) of the steps and solutions have no mathematical errors.	Most (75-84%) of the steps and solutions have no mathematical errors.	More than 75% of the steps and solutions have mathematical errors.
Completion	All problems are completed.	All but 1 of the problems are completed.	All but 2 of the problems are completed.	Several of the problems are not completed.
Neatness and Organization	The work is presented in a neat, clear, organized fashion that is easy to read.	The work is presented in a neat and organized fashion that is usually easy to read.	The work is presented in an organized fashion but may be hard to read at times.	The work appears sloppy and unorganized. It is hard to know what information goes together.

### Other Evidence:

- Skill Check: Daily warm-ups
- Prompt: In what kind of situations would it be beneficial and not beneficial to use fractions, percents, and decimals & does it really matter what kind of rational number we use?
- Homework (sometimes daily)
- Quizzes: Percents, Decimals, and Fractions
- Test: Percents, decimals, and fractions

## Stage 3 – Learning Plan

1. Have students respond to: What do I already know about rational numbers, fractions, decimals, and percents?
2. Discuss student responses and revisit “What is a number?”
3. Introduce the essential questions, key terms, and the performance task
4. Present lesson on unit rates and its application to rational numbers
5. Discuss the various types of unit rates found in the real world
6. Present lesson on ratios and types of representation
7. Present lesson on using proportions to solve real-world problems
8. Assess students by having them take a quiz
9. Return and discuss quiz, clarify any misunderstandings
10. Academic Prompt: In what kind of situations would it be beneficial and not beneficial to use fractions, percents, and decimals?
11. Have students use research material that has already been gathered to begin working on performance task & answer any further questions
12. Present lesson on using percent proportions
13. Present lesson on converting fractions, decimals, and percents
14. Discuss the appropriate use of fractions, decimals, and percents.
15. Academic Prompt: Does it really matter what kind of rational number we use?
16. Present lesson on fractions of a percent & its use
17. Students take a brief quiz
18. Observe and watch students as they work on finishing their performance assessment
19. Return & discuss quiz with students, clarify any misunderstandings
20. Review with students concepts for upcoming test
21. Students take test on fractions, decimals, and percents
22. Conclude the unit with project presentations and completion of a self-evaluation

## *Unit Calendar*

Period Length: 45 minutes

<u><b>Monday</b></u>	<u><b>Tuesday</b></u>	<u><b>Wednesday</b></u>	<u><b>Thursday</b></u>	<u><b>Friday</b></u>
1 1. Have students respond to prompt 2. Discuss student responses 3. Introduce essential questions	2 4. Present lesson on unit rates and its applications 5. Discuss various unit rates	3 Cont. Day 2	4 6. Present lesson on ratios and types of representation	5 Cont. Day 4
6 7. Present lesson on using proportions for real-world problems	7 Cont. Day 6	8 8. Assess students by giving quiz	9 9. Return and discuss quiz & clarify any misunderstandings 10. Academic Prompt	10 11. Students work on performance assessment
11 12. Present lesson on using percent proportions	12 Cont. Day 11	13 Cont. Day 11	14 13. Present lesson on converting fractions, decimals, & percents 14. Discuss appropriate use	15 Cont. Day 14
16 Cont. Day 14	17 15. Academic Prompt 16. Present lesson on fractions of a percent	18 17. Take brief quiz 18. Observe & watch students on performance task	19 19. Return & discuss quiz clarify any misunderstandings 20. Review for test	20 21. Take test on fractions, decimals, percents
21 22. Students present projects & complete self-evaluation				