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Rational Numbers [7th grade]

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Unit Cover Page

Unit Title: Rational Numbers

Grade Level: 7th Grade

Subject/Topic Area(s): Rational Numbers: Fractions, Decimals, Percents
                                  Comparing and Ordering Rational Numbers
                                  Combining Rational Numbers
                                  Percent of a Number
                                  Sales Tax and Discount

Designed By: Courtney Spickelmier

Time Frame: 6-7 Weeks (32 days)

School District: East Central ISD

School: Heritage Middle School

School Address and Phone: 8004 New Sulphur Springs Road
                                        San Antonio, TX 78263
                                        (210) 648-4546

A Brief Summary of Unit:

This 6-7 week unit is designed to provide students with a deep understanding of rational numbers and what they represent: a part out of a whole. The unit encompasses many aspects of working with rational numbers including converting between different forms of rational numbers, comparing and ordering rational numbers, understanding the relationship between improper and mixed number fractions, performing operations with rational numbers, finding percentages, and applying such skills to real world situations. Throughout this unit, students are given the opportunity to discover relationships between numbers, make connections to the real world and other mathematical topics, and reinforce skills through large groups, small groups and independent activities.

Unit: Rational Numbers
Grade: 7th

Stage 1: Desired Results

Understandings

Students will understand that...
- Numbers can be represented in a variety of equivalent forms.
- Rational numbers can be combined and manipulated to solve problems.
- Rational numbers represent a part out of a whole.

Essential Questions

How many ways can a number be represented?
How can I combine different types of numbers?
How does a whole affect a part?

Knowledge	**Skills**
Students will know...	*Students will be able to...*
• Numbers can be represented in a variety of equivalent forms • The difference between a rational and irrational number • The relationship between a part and a whole	• Compare and order rational numbers (fractions, decimals, percents, and whole numbers) • Convert between fractions, decimals, whole numbers and percents mentally and on paper • Write equivalency statements involving rational numbers • Add subtract, multiply, and divide fractions, decimals, and percents • Use models to represents fractions, decimals, and percent operations • Find a fraction or percent of a number in a variety of ways • Use fractions, decimals and percents in real world situations including scientific notation, sales tax, discounts, and commission situations.

Stage 2: Assessment Evidence

Performance Task:

Each student will receive a make believe commissioned job. They will calculate their salary and budget for a shopping spree given a specific scenario. They will calculate the amount of money they can spend on their shopping spree, and will be given a packet of coupons. Students will keep a log as they go on their make-believe shopping spree. They will track the items they purchase, the coupons they use, the amount of money they save through the use of coupons and by purchasing sale items. They will also calculate their subtotal and total costs at each store by calculating discounts and sales tax.

Other evidence:
Class Work
Mini-Tests
Skills Test
Exit Slips
Self-Assessments
Percent of a Number Quiz
Unit Exam

Stage 3: Learning Activities

(Steps taken to get students to answer Stage 1 questions and complete performance task)

Day 1: An Introduction to Rational Numbers:

- The teacher will pose the question "How many way can the number 4 be represented?" and student will brainstorm various ways based on previous knowledge (including absolute value and order of operation expressions)
- The teacher will explain that over the next few weeks they will be looking into answering the question *"How many ways can a number be represented?"* they will be examining how to represent numbers and operations with models, as fractions, decimals, and as percents.
- The teacher will introduce and students will sketch an advance organizer to classify real numbers into rational and irrational numbers, and to classify rational numbers as whole numbers, fractions, decimals, and percents. The teacher will explain that the class is going to begin by talking about fractions.
- The class will review how to write equivalent fractions while reviewing LCM, GCF, and Prime Factorization. Other important vocabulary to review will be prime and composite, numerator, denominator, and common denominator using fill in the blank notes that will be entered into the student folder.
- Students will practice finding GCF and LCM, and finding the prime factorization of composite numbers. In discussing these concepts the teacher will tie back to the different ways of representing a number.
- For homework students will find the LCM, GCF and Prime factorization of numbers

Day 2: Equivalent Fractions, Mixed Numbers, and Improper Fractions

- The class will continue with their introduction to rational numbers by reviewing the relationship between mixed number and improper fractions and by examining models of fractions and how the same value can be written in different forms.
- Students will also build pre-requisite skills of borrowing by examining how to turn whole numbers into fractions through the use of models. ie: 3 and 1/3 = 2 and 4/3. Students will also examine how to simplify fractions and mixed numbers by writing equivalent fractions. They will also discuss different ways to write 1 (ie: 4/4, 7/7, etc)
- Students will work independently writing equivalent fractions, mixed numbers, and improper fractions.

Day 3: Ordering Fractions and Ordering Decimals

- Students will be divided into groups and will be given 3 sets of numbers. The first set will consist of decimals. The second set will consist of fractions, improper fractions and mixed numbers with common denominators and the third set will consist of fractions, improper fractions, and mixed numbers with different denominators. In their groups students will work to put each set of numbers in order from least to greatest.
- After the activity the class will discuss strategies and tools they used for ordering decimals and fractions. The class will be given more practice ordering fractions and decimals.
- At the end of the period, the teacher will put up a set of numbers including fractions, decimals, and percents and will ask the students how they would order a set of rational numbers if they were in different forms. They will

discuss they fact that all these numbers represent a part out of a whole. This will serve as an introduction to the following day's lesson

Day 4: Converting between Fractions, Decimals, and Percent Notes

- Students will begin by discussing what a fraction is: a part out of a whole. They will then discuss what a decimals is, a part out of a whole where the whole is a power of ten, and what a percent is, a part out of 100. They will then examine how 3/5 can be written as 6/10 or 60/100 and 6/10 is the same as .6, 60/100 is the same as 60%. Students will look at several examples where they can write an equivalent fraction as a power of ten and then create a decimals and percents. Other examples include: 23/50, 2/25, 3/125, 375/1000. The tie can be made to dollars and cents to help students better understand.
- Next the students will work backwards and create fractions from decimals and percents
- Finally the teacher will present a problem like 1/3 and will ask. How would we write this as a decimal? Many students will already know how to write it, but the teacher will ask how they know. At this point the teacher will remind students that a fractions represents a division problem. Much like 6/2 is the same as 3 because 6 divided by 2 is three, we can convert fractions into decimals through division. The teacher will work several problems with the class in this manner
- The class will create a foldable on converting between fractions decimals and percents to add to their note.

Day 5: Comparing and ordering Rational Numbers

- The teacher will explain that the students have been building skills to work with all the different types of rational numbers. Now that they know how to go between the numbers they should be able to compare and order fractions, decimals, and percents.
- Several students will be called up to volunteer Each student will be a rational number. The class will have to tell them where to stand to be in order from least to greatest.
- Then in pairs, students will be given a number line and several rational numbers. They will work in pairs to put the numbers in the correct place on the number line.
- Finally, students will work independently converting between fractions, decimals, and percents and ordering rational numbers
- **Ordering Rational Numbers Exit Slip** Students will be permitted to use their notes on this exit slip, but they will not be allowed to use them on the test the next day.

Day 6: Mini-Test and Pre-Test

- After reviewing any questions and completing more independent practice comparing rational numbers, students will take a brief **mini-test** over Chapter 5. The test will include comparing and ordering rational numbers and converting between rational numbers.
- The second half of the test will be a **pre-test** of skills learned the previous year: students will show the teacher what they know about adding and subtracting decimals and fractions. This portion of the exam will not be graded.

Day 7: Go over test and Review Decimals

- The student's graded exams will be passed back. The class will review common mistakes and questions. And will begin to discuss the material from the pre-test.
- The teacher will ask the students how many of them remembered how to add and subtract rational numbers? S/he will explain that just like we need to be able to combine whole numbers to solve problems, we also need to be able to combine rational numbers to solve problems.
- S/he will introduce the question *"How can I combine different types of numbers?"* The teacher will review

  whole number models for addition, subtraction. Multiplication and division.
- The class will then review how to add and subtract decimals. Most students should remember how. They will look at word problems involving adding and subtracting decimals.

Day 8: Review Cont: Fractions

- The teacher will remind students that they are in the process of examining how to combine different types of numbers. S/he will ask students if the rules for adding whole numbers were the same as the rules for adding decimals. S/he will ask if they were the same as adding integers. The teacher will explain that there were different steps and rules for the different types of numbers. There are also different rules for adding and subtracting fractions.
- The teacher will put a fraction addition problem up (where denominators are the same) and will ask the kids what to do. As students recall the steps that they learned in the previous year, the teacher will show a model to go with the problem.
- Then the teacher will put another problem up where the denominators are different and the class will again review how to solve it.

- The teacher will work a few more addition and subtraction problems with the class, and then ask students to practice adding and subtracting on their own.

Day 9: Estimating with fractions and Decimals
- As a warm up students will review adding and subtracting fractions and decimals in word problems.
- The teacher will pose the following questions to students. How many of you have ever gone to the grocery store with your parents and helped them buy produce? How are these things sold?
- This line of questioning will be used to introduce kids to the fact that estimation is necessary- if I have $10 and I want to buy 3.10 pounds of meat at $2.85 a pound, it is much easier to estimate how much it will cost: 3.10 is close to 3 and 2.85 is close to 3, so I will be spending about $9. That means I should have enough money.
- Students will complete the estimation activity: They will be given a number line and a set of rational numbers. They will place the numbers on the number line and examine which whole numbers they are closest to. They will then complete a set of estimation problems that use the same numbers. These problems will serve as an **exit slip**

Days 10-15: Fraction Operations
- The class will be creating a foldable with all of the rules for combining fractions and mixed numbers. They will spend a day on each operation and will practice with all four operations and word problems.
- As they create the foldable they will examine various models used to show each operations. Each day they will go back to the problems they used when estimating and will find the exact solution.

Day 16: **Fractions Mini-Test**
- Students will demonstrate their ability to add. Subtract, multiply, and divide fractions and mixed numbers

Day 17: Multiplying Decimals
- As a warm up the students will be asked to create a model to represent the problem $1/10 \times 7/10 = 7/100$.
- The class will examine the model they have create and will make the tie to decimals by changing the expressions to $.1 \times .7 = .07$
- Then the class will play the game "What's the rule?" In this game the teacher will give students a number of examples of multiplication problems involving decimals. (ie: $0.2 \times 0.4 = .08$ (not $.8$); $0.3 \times 0.3 = 0.09$ (not $.3$); $0.02 \times 0.3 = 0.006$ (not $.06$)) Then the students will be asked to apply the patterns they are seeing to give an example. Finally, the class will discuss the rules for multiplying decimals. And will practice with larger numbers.

Days 18: Dividing Decimals
- Warm Up: Dividing whole number
- The Class will review how to divide whole numbers. They will review the vocabulary: division, dividend, divisor, quotient, remainder, and decimal. They will create a flow chart shoeing all the steps. They will review how to divide and leave remainders, how to write remainders as fractions, and how to find a solution to the nearest decimal.
- Next the teacher will explain that there are only a couple more steps involved when dividing decimals. S/he will work a few examples. Then allow the class to work on dividing decimals. They will complete an assignment where they have to move the decimals appropriately. Once they have demonstrated their ability to do this, they will move on to actually completing the problems.
- **Dividing Decimals Exit Slip**

Day 19: More Dividing and Skills Test
- Warm up: Dividing Decimals
- At this point the class will have covered all the material on the 7th Grade Skills Test. After reviewing division for a bit, the class will complete a **skills test.** Then students will go through their solutions in pairs, making an argument for their solutions if they did not get the same answers.

Day 20: Multiplying and Dividing by Powers of 10 and Scientific Notation
- Warm up: Dividing decimals and review commonly made skills test mistakes
- The class will play "What's the rule?" first with multiplying by 10, then with multiplying by 1,000, then with dividing by 100, then with dividing by 10,000.
- The teacher will use questioning to introduce first rules for multiplying and dividing by powers of ten, then for reviewing how to use powers and exponents, and finally how large and small numbers can be represented through scientific notation
- Students will complete a rally-coach exercise on multiplying and dividing by powers of ten and scientific notation.

Day 21: Fractions and Percents of A Number
- Students will complete a fill in the blank review that emphasizes the concept of a part out of a whole: Fractions define the part and the whole in their numerator and denominator. Decimals are a part out of a power of 10,

and Percents are a part out of 100. The teacher will explain that over the next few days we will be examining what happens when you change the whole. We will be attempting to answer the questions *"How does the whole affect the part?"*

- Students will complete the step by step notes in pairs using their knowledge form the previous weeks. The teacher will then explain that they have been using proportions to find the percent or fraction of a number. The notes will guide their reasoning so that they can discover for them selves the relationship between a part and a whole, and how the part changes when the whole changes as when you are discovering a percent of a number.
- Finally the teacher will introduce the percent proportion and how it is used.

Day 22: Percent Proportion:

- Students will have an opportunity to practice solving problems involving the percent proportion. Each group of students will be given a set of questions, a set of numbers (which are from the questions) and a game board. In their groups, the students will need to set up the numbers from the questions into proportions. Once they have the proportions set up correctly, they will solve the proportions independently and check their work with one another. Finally, they will be asked to create a different proportion with the numbers that would give them the same solution.
- After completing the activity, students will work independently, with pencil and paper, and practice percent and fraction of a number problems using proportions.

Day 23: Percent Equation:

- Warm Up: *Percent Proportions Quiz*
- The statement "There are many ways to solve problems" will be written on the board in Spanish (Hay muchas maneras de resolver un problema), French (il y a beaucoup de façons pour résoudre un problème), and Piglatin (erethay areay, anymay ysway otay olvesay roblemspay.) Given the translations, the students will try to figure out what the statement is or what it is about. The teacher will discuss with them strategies they used to help translate the statement into English (picking out key words and drawing upon previous knowledge or experiences) The teacher will then explain that there are many ways to solve problems and that one way is to translate problems into mathematical sentences or equations.
- The teacher will demonstrate the proper way to create percent equations. Students will then use the same problems and numbers from the previous day to solve the problems using the percent equations.
- Students will work independently practicing the percent equation. They will check their work with their partners and assist one another as needed.

Day 24-26: Estimating and % Mental Math:

- The class will complete the % mental math notes together and will practice using mental math "tricks" to find or estimate percentages.

Day 27: Using Percents to Make Predictions

- Students will use data from their class to make predictions about the entire 7th grade and the whole school. They will look at things like ridding the bus vs. parent pick up, amount of time spent on homework, distance from school, and eye color.
- Students will work independently finding percentages in sets of data and making predictions about that data. They will then pair up and discuss their predictions with another student in the class

Day 28: Sales Tax and Discounts

- Warm Up: Percent of a Number and Fraction of a Number
- Introduction: The class will begin by answering the questions " If I go to Hollister and buy a t-shirt, and the tag says it costs $25, why is it that I pay $27 at the register?" (sales tax) "How much more did I pay?" ($2) "If I buy a pair of pants and the tag says it is $40, does that mean I will pay $42 at the register?" (no, it will be more because the original cost is more) The teacher will explain that sales tax is a percentage of the sub-total on a sale.
- The class will define the words tax, discount, commission, sale price, original price, subtotal, savings/ discount amount in their own words and use these words in a sentence.
- The class will then work problems calculating total costs given tax and discount. The teacher will emphasize the importance of discovering the different pieces of the problem before solving the problem. The class will use the percent proportion to solve these problems.
- Students will then examine commission and see how the same steps are used to determine a person's pay in a commissioned job.
- After students become comfortable with calculating totals given sales tax and discounts commissions, the teacher will ask students what they would do to find a discount given the original price and the sales price. Again, they will identify the missing pieces and set up proportions.

Day 29: More Practice with Sales Tax, Discounts, and Commission

- Warm Up- Students will calculate the total cost of an object that is on sale given the sales tax rate.
- Problems Solving: Students will make their way through various problem solving stations where they will use problem solving steps to solve problems related to 1) Commission, 2) Sales Tax, and 3) Discounts
- ***Exit Slip***

Day 30-31: Performance Assessment
Day 32: Unit Exam

Specific TEKS:
(7.1) Number, operation, and quantitative reasoning. The student represents and uses numbers in a variety of equivalent forms. The student is expected to:
(A) compare and order integers and positive rational numbers;
(B) convert between fractions, decimals, whole numbers, and percents mentally, on paper, or with a calculator
(7.2) Number, operation, and quantitative reasoning. The student adds, subtracts, multiplies, or divides to solve problems and justify solutions.
(7.2) Number, operation, and quantitative reasoning. The student adds, subtracts, multiplies, or divides to solve problems and justify solutions. The student is expected to:
(A) represent multiplication and division situations involving fractions and decimals with models, including concrete objects, pictures, words, and numbers;
(B) use addition, subtraction, multiplication, and division to solve problems involving fractions and decimals;
(F) select and use appropriate operations to solve problems and justify the selections; and
(G) determine the reasonableness of a solution to a problem.
(7.3). The student solves problems involving direct proportional relationships. The student is expected to:
(A) estimate and find solutions to application problems involving percent

A Mathematical Shopping Spree!

Congratulations! Over the past few months, you have been spending your evenings as a cell phone sales man. This month you have sold $2,100 worth of cell phone products, and have earned 12% commission on your sales. Your check is on the way and it is the perfect timing because you need to get some new school clothes. You can spend as much or as little of your check on cloths, but there are a few rules:

1. You cannot spend more money than you have. You have $_____ to spend on you shopping spree.
   Use the space provided bellow to calculate the amount of money you will have to spend on your shopping spree and fill in the above blank.

2. You need to purchase at least 5 items from at least 3 different stores. Stores include Hot Topic, Hollister, Aeropastale, JC Pennys, and Academy.
3. You must take advantage of at least 3 different coupons.
   > You have received the following coupons in the mail:
   > Hot Topic:
   > - Buy 1 t-shirt get another of lesser or equal value for ½ off
   > - 10% off all Jewelry
   > - 15% off all footwear
   > Hollister:
   > - Buy one item get another of lesser or equal value for ½ off
   > - 20% off all pants
   > Aeropostale:
   > - All Tees are 1/3 off!
   > - 10% off all pants
   > Academy:
   > - ¼ off all sportswear
   > - 15% off all Nike Shoes
   > JC Penney:
   > - 15% off your entire purchase

4. You must calculate and consider sales tax in all stores. Assume the sales tax is 8%.
5. Any money that you don't spend on clothing will be put into a savings account at the end of your shopping spree.

Now you are ready to go shopping. Be sure to follow the directions carefully and fill in all the blanks.

Your first stop is…….

Hot Topic

| Coupon 1: | Coupon 2: | Coupon 3: |

Buy 1 t-shirt get another of lesser or equal value for ½ off

10% off
all Jewelry

15% off
footwear

Look at the attached print out of Hot Topic Products

1. How much money do you have when you enter the store? $_____

2. Fill in the table below to show which products you plan to purchase, the original cost of those items, which if any coupons you plan to use, and the discounted price of each item. Show all work in the space next to the table. Then find your subtotal, and your total cost including tax. If you choose not to purchase any items from Hot Topic, move on to question 5.

Item Description	Original Price	Coupon Used	Discount Price

3. Use the space below to calculate your subtotal: $_____

4. There is an 8% sales tax. Use the space below to calculate you total cost: $_____

5. How much money do you have when you leave the store? Show your work below. $ _____

Your next stop is…….

hollister

Coupon 1:

```
Buy 1 item get
another of lesser
or equal value for
½ off
```

Coupon 2:

```
20% off
all pants
```

Look at the attached print out of Hollister Products

6. How much money do you have when you enter the store? $_____

7. Fill in the table below to show which products you plan to purchase, the original cost of those items, which if any coupons you plan to use, and the discounted price of each item. Show all work in the space next to the table. Then find your subtotal, and your total cost including tax. If you choose not to purchase any items from Hollister, move on to question 10.

Item Description	Original Price	Coupon Used	Discount Price

8. Use the space below to calculate your subtotal: $_____

9. There is an 8% sales tax. Use the space below to calculate you total cost: $_____

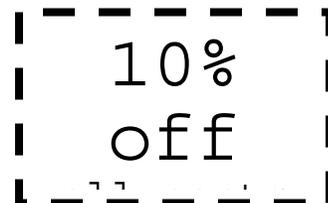10. How much money do you have when you leave the store? Show your work below. $ _____

Your next stop is…….

AÉROPOSTALE

Coupon 1:

```
  All
  Tees
1/3 off
```

Coupon 2:

```
  10%
  off
```

Look at the attached print out of Hollister Products

11. How much money do you have when you enter the store? $_____

12. Fill in the table below to show which products you plan to purchase, the original cost of those items, which if any coupons you plan to use, and the discounted price of each item. Show all work in the space next to the table. Then find your subtotal, and your total cost including tax. If you choose not to purchase any items from Hot Topic, Move on to question 15.

Item Description	Original Price	Coupon Used	Discount Price

13. Use the space below to calculate your subtotal: $_____

14. There is an 8% sales tax. Use the space below to calculate you total cost: $_____

15. How much money do you have when you leave the store? Show your work below. $ _____

Your next stop is…….

Academy
SPORTS+OUTDOORS

Coupon 1:

¼ off all
sportswear
(Coupon may be applied to
only one item)

Coupon 2:

15%
off

Look at the attached print out of Academy Products

16. How much money do you have when you enter the store? $_____

17. Fill in the table below to show which products you plan to purchase, the original cost of those items, which if any coupons you plan to use, and the discounted price of each item. Show all work in the space next to the table. Then find your subtotal, and your total cost including tax. If you choose not to purchase any items from Hot Topic, Move on to questions 20.

Item Description	Original Price	Coupon Used	Discount Price

18. Use the space below to calculate your subtotal: $_____

19. There is an 8% sales tax. Use the space below to calculate you total cost: $_____

20. How much money do you have when you leave the store? Show your work below. $ _____

Your final stop is…….

Coupon:

15% off
your ENTIRE
purchase
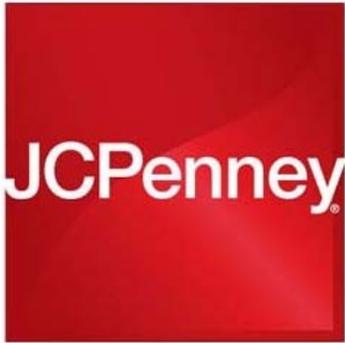
Look at the attached print out of JC Penney Products

21. How much money do you have when you enter the store? $_____

22. How is the JC Penney Coupon different from the other coupons you've used?

23. Make your own table to show which items you are buying, the original cost of those items, how much you would pay without your coupon, and how much you are spending with the coupon. If you choose not to shop at JC Pennys, skip to question 25.

24. What is your subtotal (without tax) and total cost (with an 8% sales tax)?

25. How much money do you have left over at the end of your shopping spree? $ _____

Extra Credit!
How much money did you have to put into a savings account after your shopping spree?
$ _____

Did you know that when you put money into a savings account, the bank will pay you for leaving your money there!

Here's how it works:
You put money into a savings account. The money you put in is called the principle. Every period (usually a year or every 6 months) the bank pays you a percentage of your principle. The money that the bank pays you is called interest.

So, if I were to put $100 into a savings account that earns 4% interest a year, then after one year, the bank will pay me $4 in interest because 4% of $100 is $4. That means that at the end of the year instead of $100, I have $104. A $4 profit may not seem like a lot, but what if I had $10,000 in savings. Then I would earn $400!

 Basically, the more money you save and the longer you leave money in a savings account, the more money you make!

Suppose you put the money you had left from your shopping spree into a savings account that earns 4% interest each year.

How much interest would the money earn after the first year? _$_____

How much money will be in your account after the first year? _$_____