Spark Learning with Differentiation for Middle School Advanced Mathematics

Grade 6 Advanced Math
Handout packet

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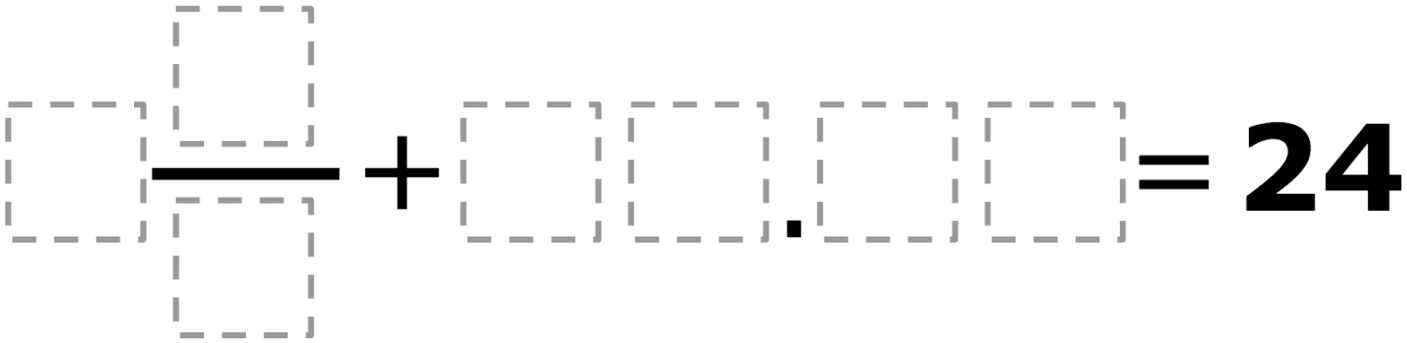
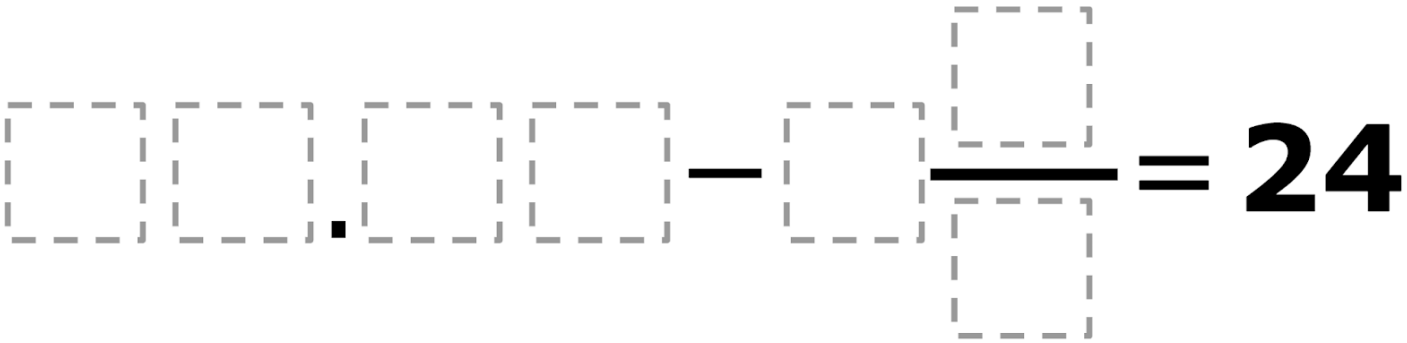
Unit 3, Lesson 4: Adding and Subtracting Rational Numbers

Adding and Subtracting Rational Numbers

Open-middle Independent Practice

Use mental math and the tiles on the last page, using each digit no more than once in any problem, to make true equations. Once you find an answer, see how many other answers you can discover for each problem.





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OPERATIONS WITH RATIONAL NUMBERS

The student is expected to add, subtract, multiply, and divide rational numbers.

TELL ME MORE...

A **rational number** is a number that can be expressed as the ratio of two integers where the denominator is not zero. There are standard algorithms, or commonly used and established procedures, for adding, subtracting, multiplying, and dividing fractions, decimals, and integers.

Standard Algorithms for Operations with Fractions

Addition and Subtraction:

- Generate equivalent fractions with common denominators.
- Add/subtract the numerators.
- Keep the denominator.
- Reduce to lowest terms if necessary.

Multiplication:

- Rewrite whole numbers or fractions as improper fractions.
- Multiply the numerators.
- Multiply the denominators.
- Reduce to lowest terms if necessary.

Division:

- Rewrite whole numbers or fractions as improper fractions.
- Rewrite the division as multiplication by the reciprocal of the divisor.
- Multiply the fractions.
- Reduce to lowest terms if necessary.

Standard Algorithms for Operations with Decimals

Addition and Subtraction:

- Line up the place values of each number.
- Add/subtract as you would with whole numbers.
- Include the decimal point with place value.

Multiplication:

- Multiply as you would with whole numbers.
- Count the digits to the right of the decimal point in both factors.
- Place the decimal point in the product so that there are the same total number of digits to the right of the decimal point as there are in both factors.

Division:

- Multiply the divisor by a power of 10 so that it becomes a whole number.
- Multiply the dividend by the same power of 10.
- Divide the new dividend by the whole number divisor.

Standard Algorithms for Operations with Integers

Addition:

- *Like signs*: Add the number parts of two integers and keep the sign.
- *Unlike signs*: Subtract the number parts of two integers and use the sign of the integer with the greater number part.

Subtraction:

- Keep the sign of the first integer.
- Add the opposite of the second integer using the addition algorithm.

Multiplication:

- *Like signs*: Multiply the number parts of two integers and the product is positive.
- *Unlike signs*: Multiply the number parts of two integers and the product is negative.

Division:

- *Like signs*: Divide the number parts of two integers and the quotient is positive.
- *Unlike signs*: Divide the number parts of two integers and the quotient is negative.

EXAMPLES

EXAMPLE 1: Simplify: $7\frac{1}{2} + 2\frac{3}{4}$.

STEP 1 Generate equivalent fractions with common denominators.

- The least common denominator is 4.
- Rewrite $\frac{1}{2}$ with a denominator of 4.
  - $\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$7\frac{2}{4} + 2\frac{3}{4}$

STEP 2 Add the whole numbers and the fractions.

$(7 + 2) + \left(\frac{2}{4} + \frac{3}{4}\right)$

$9 + \frac{5}{4}$

STEP 3 Reduce to lowest terms.

$\frac{5}{4} = 1\frac{1}{4}$

$9 + 1\frac{1}{4} = (9 + 1) + \frac{1}{4}$

$10\frac{1}{4}$

YOU TRY IT!

Betty is making a batch of cookies for her school's bake sale. The cookies require $1\frac{1}{4}$ cups of white sugar and $2\frac{1}{2}$ cups of brown sugar. How many cups of sugar does Betty need altogether?

- What operation should you use?
- Use the standard algorithm for fractions for that operation to determine the number of cups of sugar.

EXAMPLE 2: Five pounds of potatoes cost \$4.65. What is the cost of one pound of potatoes.

STEP 1 Determine the operation you need to use.

- You can write the rate $\frac{\$4.65}{5 \text{ pounds}}$.
- You are looking for the unit rate, which is the cost of 1 pound of potatoes.

Division

STEP 2 Write the expression needed to solve this problem.

- The dividend, the total cost of the potatoes, is \$4.65.
- The divisor, the number of pounds, is 5 pounds.

4.65 ÷ 5

STEP 3 Divide 4.65 by 5.

- The divisor is already a whole number. So, you do not need to multiply the dividend by a power of 10 in order to move the decimal point.

0.93

$$\begin{array}{r} 0.93 \\ 5\overline{)4.65} \\ \underline{-45} \\ 15 \\ \underline{-15} \\ 0 \end{array}$$

STEP 4 Interpret the quotient in terms of the original problem.

One pound of potatoes costs \$0.93.

YOU TRY IT!

Simplify: 14.02(–3.2).

EXAMPLE 3: A jet ski costs $45 per hour to rent. If Shannon rented the jet ski for $2\frac{1}{2}$ hours, how much did she pay to rent the jet ski?

STEP 1 Determine the operation you need to use.

- You are scaling the cost of renting the jet ski for 1 hour by a factor of $2\frac{1}{2}$ hours.

Multiplication

STEP 2 Write the expression needed to solve this problem.

- One factor, the cost per hour, is $45.
- One factor, the number of hours, is $2\frac{1}{2}$.

$45 \times 2\frac{1}{2}$

STEP 3 Rewrite the mixed number, $2\frac{1}{2}$, as a decimal so that you can use the standard algorithm for multiplying decimals.

- $2\frac{1}{2} = 2\frac{5}{10} = 2.5$

45 × 2.5

STEP 4 Multiply the numbers as whole numbers.

- 45 × 25

1125

STEP 5 Place the decimal in the product equal to the total number of decimal places to the right of the decimal point in both factors.

- There is only one factor that has one decimal place to the right of the decimal point.

112.5

YOU TRY IT!

David has $101\frac{1}{4}$ gallons of water in a large storage tank. He uses $6\frac{3}{4}$ gallons of water each week to water the plants in his greenhouse. How many weeks will it take for David to use all the water in the tank?

- What operation should you use?

- Use the standard algorithm for fractions for that operation to determine the number of weeks.

PRACTICE

For questions 1–6 simpify each expression.

1. $6\frac{1}{6} + 2\frac{2}{3}$

2. $4\frac{1}{2} \times \frac{3}{8}$

3. 8.25 – 11.05

4. 16.8 ÷ 0.04

5. 13.1(-4.2)

6. $-2\frac{1}{4} \div -\frac{1}{8}$

7. Sam hiked for $4\frac{1}{2}$ miles on Monday and then he hiked $3\frac{3}{4}$ miles on Tuesday. How many miles did Sam hike altogether?

8. Kathryn has a $15 gift card from a local restaurant. She spent $11.63 on lunch. How much money is left on the gift card?

9. The change in elevation at a local lake in the summer was −1.2 feet per day. At this rate, what was the change in elevation after 1 week?

10. Julia bought six shirts at a discount store. Each shirt cost $6.05. How much did Julia spend at the discount store?

A $12.05
B $36.30
C $30.05
D $36.95

11. Alan is making hamburger patties for dinner. He has a package of hamburger meat that weighs 3.75 pounds. He wants to make each patty weigh $\frac{3}{4}$ pound. If he uses all of the meat in the package, how many patties can Alan make?

F 3 patties
G 9 patties
H 6 patties
J 5 patties

12. Three friends went to dinner and decided to split the bill and tip evenly. The total bill, including tip, was $109.35. How much did each friend pay?

13. Denise needs $7\frac{1}{4}$ yards of fabric to create a skirt. She has a piece of fabric that is $6\frac{1}{8}$ yards long. How many more yards of fabric does Denise need to make the patterned skirt?

A $5\frac{1}{2}$
B $6\frac{1}{8}$
C $1\frac{1}{8}$
D $2\frac{1}{8}$

14. After a cold front, the temperature in Lubbock, Texas, changed by −3.8 degrees per hour. What was the change in temperature 12 hours after the cold front passed?

Name _____ Date _____

Performance Task: 6AM.3F
Rational Number Operations: Dinner with Friends

Sharick and his two best friends went to their favorite restaurant. The waitress took their order from the menu shown below. Two of the friends ordered the same entrée and two of the friends ordered the same side item.

Entrées	
Cheeseburger	$6.75
Pizza slice	$5.15
Chicken tenders	$8.25
Sides	
Fries	$2.30
Sweet potato fries	$2.99
Onion Rings	$3.75
Beverages	$1.45

With 8.25% tax included, the friends spent a total of $37.29 with each person getting an entrée, a side item, and a soda.

- What was ordered?

Justify your reasoning.

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

Name _____ Date _____

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Chicken tenders	$8.25
Sides	
Fries	$2.30
Sweet potato fries	$2.99
Onion Rings	$3.75
Beverages	$1.45

Not including sales tax, the friends spent a total of $35.85 with each person getting an entrée, a side item, and a soda.

- What was ordered?

Justify your reasoning.

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

Name _____ Date _____

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Sides	
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Sweet potato fries	$2.99
Onion Rings	$3.75
Beverages	$1.45

Each person ordered an entrée, a side item, and a soda. After the 8.25% tax was added to the bill, Sharick paid for the meal with a $50 bill, left a $7 tip, and left with $5.71 after the purchase.

- What was ordered?

Justify your reasoning.

Procedural	0	1	2
Conceptual	0	1	2
Communication	0	1	2

Total points:_____

Name _____ Date _____

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Beverages	$1.45

With 8.25% tax included, the friends spent a total of $37.29 with each person getting an entrée, a side item, and a soda.

1. What equation can be used to determine the subtotal of the food before tax was added? What was the food subtotal before tax?

2. How much of the food subtotal were the beverages?

3. What amount was spent on entrée and side items?

4. Use an appropriate strategy to determine the food items that were ordered to total the correct amount.

5. What did the friends order at the restaurant?