Family Support Materials

Rational Number Arithmetic

Here are the video lesson summaries for Grade 7, Unit 5: Rational Number Arithmetic. Each video highlights key concepts and vocabulary that students learn across one or more lessons in the unit. The content of these video lesson summaries is based on the written Lesson Summaries found at the end of lessons in the curriculum. The goal of these videos is to support students in reviewing and checking their understanding of important concepts and vocabulary. Here are some possible ways families can use these videos:

- Keep informed on concepts and vocabulary students are learning about in class.
- Watch with their student and pause at key points to predict what comes next or think up other examples of vocabulary terms (the bolded words).
- Consider following the Connecting to Other Units links to review the math concepts that led up to this unit or to preview where the concepts in this unit lead to in future units.

Grade 7, Unit 5: Rational Number Arithmetic	Vimeo	YouTube
Video 1: Adding Rational Numbers (Lessons 1–4)	Link	Link
Video 2: Subtracting Rational Numbers (Lessons 5–7)	Link	Link
Video 3: Multiplying and Dividing Rational Numbers (Lessons 8–11)	Link	Link
Video 4: Solving With Rational Numbers (Lessons 12–16)	Link	Link

Video 1

Video 'VLS G7U5V1 Adding Rational Numbers (Lessons 1–4)' available here: https://player.vimeo.com/video/494808053.

Video 2

Video 'VLS G7U5V2 Subtracting Rational Numbers (Lessons 5–7)' available here: https://player.vimeo.com/video/495520145.

Video 3

Video 'VLS G7U5V3 Multiplying and Dividing Rational Numbers (Lessons 8–11)' available here: https://player.vimeo.com/video/503252065.

Video 4

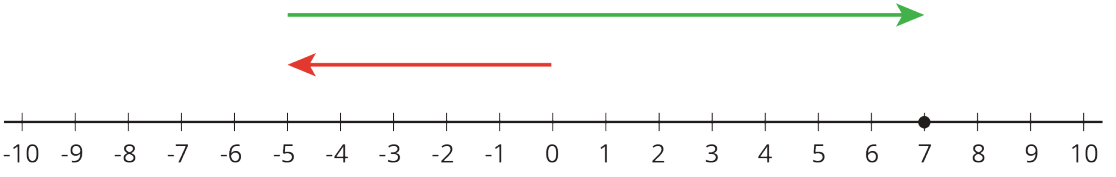
Video 'VLS G7U5V4 Solving With Rational Numbers (Lessons 12–16)' available here: https://player.vimeo.com/video/503606703.

Adding and Subtracting Rational Numbers

Family Support Materials 1

This week your student will be adding and subtracting with negative numbers. We can represent this on a number line using arrows. The arrow for a positive number points right, and the arrow for a negative number points left. We add numbers by putting the arrows tail to tip.

For example, here is a number line that shows $-5 + 12 = 7$.



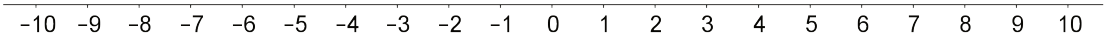
The first number is represented by an arrow that starts at 0 and points 5 units to the left. The next number is represented by an arrow that starts directly above the tip of the first arrow and points 12 units to the right. The answer is 7 because the tip of this arrow ends above the 7 on the number line.

In elementary school, students learned that every addition equation has two related subtraction equations. For example, if we know $3 + 5 = 8$, then we also know $8 - 5 = 3$ and $8 - 3 = 5$.

The same thing works when there are negative numbers in the equation. From the previous example, $-5 + 12 = 7$, we also know $7 - 12 = -5$ and $7 - -5 = 12$.

Here is a task to try with your student:

1. Use the number line to show $3 + -5$.

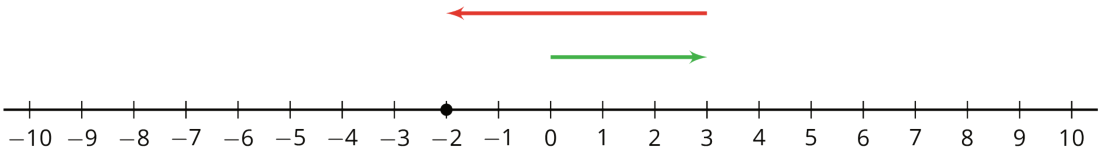


2. What does your answer tell you about the value of:
   a. $-2 - 3$?

   b. $-2 - -5$?

Solution:

1. The first arrow starts at 0 and points 3 units to the right. The next arrow starts at the tip of the first arrow and points 5 units to the left. This arrow ends above the -2, so $3 + -5 = -2$.



2. From the addition equation $3 + -5 = -2$, we get the related subtraction equations:

   a. $-2 - 3 = -5$

   b. $-2 - -5 = 3$

Multiplying and Dividing Rational Numbers

Family Support Materials 2

This week your student will be multiplying and dividing with negative numbers. The rules for multiplying positive and negative numbers are designed to make sure that addition and multiplication work the same way they always have.

For example, in elementary school students learned to think of "4 times 3" as 4 groups of 3, like $4 \cdot 3 = 3 + 3 + 3 = 12$. We can think of "4 times -3" the same way: $4 \cdot \text{-}3 = (\text{-}3) + (\text{-}3) + (\text{-}3) + (\text{-}3) = \text{-}12$. Also, an important property of multiplication is that we can multiply numbers in either order. This means that $\text{-}3 \cdot 4 = 4 \cdot \text{-}3 = \text{-}12$.

What about $\text{-}3 \cdot \text{-}4$? It may seem strange, but the answer is 12. To understand why this is, we can think of -4 as $(0 - 4)$.

$$(\text{-}3) \cdot (\text{-}4)$$

$$(\text{-}3) \cdot (0 - 4)$$

$$(\text{-}3 \cdot 0) - (\text{-}3 \cdot 4)$$

$$0 - \text{-}12$$

$$12$$

After more practice, your student will be able to remember this without needing to think through examples:

- A positive times a negative is a negative.
- A negative times a positive is a negative.
- A negative times a negative is a positive.

Here is a task to try with your student:

1. Calculate $5 \cdot \text{-}2$.
2. Use your answer to the previous question to calculate:
   a. $\text{-}2 \cdot 5$
   b. $\text{-}2 \cdot \text{-}5$
   c. $\text{-}5 \cdot \text{-}2$

Solution:

1. The answer is -10. We can think of $5 \cdot -2$ as 5 groups of -2, so
   $5 \cdot -2 = (-2) + (-2) + (-2) + (-2) + (-2) = -10$

2.
   a. The answer is -10. We can multiply numbers in either order, so
      $-2 \cdot 5 = 5 \cdot -2 = -10$

   b. The answer is 10. We can think of -5 as $(0 - 5)$, and $-2 \cdot (0 - 5) = 0 - -10 = 10$.

   c. The answer is 10. Possible Strategies:
      - We can think of -2 as $(0 - 2)$, and $-5 \cdot (0 - 2) = 0 - -10 = 10$.
      - We can multiply numbers in either order, so $-5 \cdot -2 = -2 \cdot -5 = 10$.

Four Operations with Rational Numbers

Family Support Materials 3

This week your student will use what they know about negative numbers to solve equations.

- The *opposite* of 5 is -5, because $5 + \text{-}5 = 0$. This is also called the additive inverse.
- The *reciprocal* of 5 is $\frac{1}{5}$, because $5 \cdot \frac{1}{5} = 1$. This is also called the multiplicative inverse.

Thinking about opposites and reciprocals can help us solve equations. For example, what value of x makes the equation $x + 11 = \text{-}4$ true?

$$\begin{aligned} x + 11 &= \text{-}4 \\ x + 11 + \text{-}11 &= \text{-}4 + \text{-}11 \\ x &= \text{-}15 \end{aligned}$$

11 and -11 are opposites.

The solution is -15.

What value of y makes the equation $\frac{\text{-}1}{3}y = 6$ true?

$$\begin{aligned} \frac{\text{-}1}{3}y &= 6 \\ \text{-}3 \cdot \frac{\text{-}1}{3}y &= \text{-}3 \cdot 6 \\ y &= \text{-}18 \end{aligned}$$

$\frac{\text{-}1}{3}$ and -3 are reciprocals.

The solution is -18.

Here is a task to try with your student:

Solve each equation:

$25 + a = 17$ $\quad$ $\text{-}4b = \text{-}30$ $\quad$ $\frac{\text{-}3}{4}c = 12$

Solution:

1. -8, because $17 + \text{-}25 = \text{-}8$.
2. 7.5 or equivalent, because $\frac{\text{-}1}{4} \cdot \text{-}30 = 7.5$.
3. -16, because $\frac{\text{-}4}{3} \cdot 12 = \text{-}16$.