Unit 3
Dividing
Fractions

Lesson 1

Dividing Fractions by Whole Numbers

CCSS: 6.NS.A.1

UNIT 3: ESSENTIAL QUESTIONS

01. What methods can I use to divide fractions?

02. What models can I use to divide fractions?

03. In what ways does division of fractions apply to real-world problems?

LEARNING OBJECTIVES

- Fluently divide a fraction by a whole number.
- Define the term “reciprocal”.

Warm-Up: Fraction multiplication

Find the product of the following:

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

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

3. $\frac{6}{5} \times 7$

4. $\frac{5}{8} \times 2$

Warm-Up: Fraction Multiplication

Find the product of the following:

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

2. $\frac{3}{4} \times 3 = \frac{9}{4}$

3. $\frac{6}{5} \times 7 = \frac{42}{5}$

4. $\frac{5}{8} \times 2 = \frac{10}{8} = \frac{5}{4}$

I Do: Dividing Fractions by Wholes

Before we can get into fraction division, we need to look at what some meanings of fractions.

$$\frac{3}{4}$$

This is a common fraction. We can rewrite this several ways to look at its meaning.

I Do: Dividing Fractions by Wholes

All fractions are essentially division problems, they are just written in a different form.

$\frac{3}{4} = 3 \div 4$ or $\frac{3}{4}$ is the same as $4\sqrt{3}$

So, when we are writing fractions, we are just writing a division problem in a different way.

I Do: Dividing Fractions by Wholes

Now let's look at a fraction division problem.

$$\frac{3}{4} \div \frac{1}{2} = \frac{\frac{3}{4}}{\frac{1}{2}}$$

This looks complicated, but we are using the same properties that we used before, just now with fractions.

I Do: Dividing Fractions by Wholes

$$\frac{3}{4} \div \frac{1}{2} = \frac{\frac{3}{4}}{\frac{1}{2}}$$

Before we can tackle this problem, we need to use some other information that we have learned in the past.

You Do: Dividing Fractions by Wholes

Before we can tackle this problem, we need to use some other information that we have learned in the past.

Find the quotient of the following.

1. $2 \div 1$
2. $3 \div 1$
3. $4000 \div 1$
4. $1234.5689 \div 1$
5. $\frac{3}{4} \div 1$

You Do: Dividing Fractions by Wholes

We have already learned that if you divide anything by one, you get the number you started with. This will help us with fraction division.

Find the quotient of the following.

1. $2 \div 1 = 2$
2. $3 \div 1 = 3$
3. $4000 \div 1 = 4000$
4. $1234.5689 \div 1 = 1234.56789$
5. $\frac{3}{4} \div 1 = \frac{3}{4}$

I Do: Dividing Fractions by Wholes

$$\frac{3}{4} \div \frac{1}{2} = \frac{\frac{3}{4}}{\frac{1}{2}}$$

We just saw that if we can change the $\frac{1}{2}$ in the problem to a 1, we will only be left with what is in the numerator.

I Do: Dividing Fractions by Wholes

$$\frac{\frac{3}{4}}{\frac{1}{2}}$$

$$\frac{1}{2} \times ? = \frac{2}{2} = 1$$

We just saw that if we can change the $\frac{1}{2}$ in the problem to a 1, we will only be left with what is in the numerator. What can we multiply $\frac{1}{2}$ by to get a product of 1?

We Do: Dividing Fractions by Wholes

$$\frac{1}{2} \times ? = \frac{2}{2} = 1$$

What can we multiply $\frac{1}{2}$ by to get a product of 1?

Take 1 minute to think, and then be prepared to share your answer.

We Do: Dividing Fractions by Wholes

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

What can we multiply $\frac{1}{2}$ by to get a product of 1?

If we multiply $\frac{1}{2} \times \frac{2}{1}$, we get an answer of 1!

$\frac{1}{2}$ and $\frac{2}{1}$ have a special relationship. They are called *reciprocals* of each other.

We Do: Dividing Fractions by Wholes

What do you think the term reciprocal means in mathematics?

Take 1 minute to think, then be prepared to share.

We Do: Dividing Fractions by Wholes

What do you think the term reciprocal means in mathematics?

Take 1 minute to think, then be prepared to share.

Oxford dictionary defines reciprocal as, “A number related to another number in that their product is 1.”

I Do: Dividing Fractions by Wholes

$$\frac{3}{4} \div \frac{1}{2} = \frac{\frac{3}{4}}{\frac{1}{2}}$$

So now we know that we can use the fact that anything divided by 1 is itself, and the properties of a reciprocal to create a 1 in the denominator.

I Do: Dividing Fractions by Wholes

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

We can multiply $\frac{1}{2} \times \frac{2}{1}$ to get our 1 in the divisor or denominator in the case of our fraction.

I Do: Dividing Fractions by Wholes

$$\frac{\frac{3}{4}}{\frac{1}{2}\times\frac{2}{1}}=\frac{\frac{3}{4}}{\frac{2}{2}}=\frac{3}{4}$$

$$\frac{3}{4}\div\frac{1}{2}\neq\frac{3}{4}\div 1$$

$$\frac{1}{2}\neq 1$$

Fantastic! We have solved the problem of the denominator in our problem. However, we have changed the value of our original expression. We need to do one more thing to make sure we keep the expression equivalent.

I Do: Dividing Fractions by Wholes

$$\frac{\frac{3}{4}}{\frac{1}{2}\times\frac{2}{1}}=\frac{\frac{3}{4}}{\frac{2}{2}}=\frac{3}{4}$$

We can use the multiplicative identity to fix this problem though. Remember that any number multiplied by 1 is always that number. So, we will use this property.

I Do: Dividing Fractions by Wholes

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

$$\frac{\frac{2}{1}}{\frac{2}{1}} = 1$$

If we multiply the top (numerator) by the same value as we did the bottom, we are essentially multiplying by 1 and do not change the value of our expression.

I Do: Dividing Fractions by Wholes

$$\frac{\frac{3}{4}\times\frac{2}{1}}{\frac{1}{2}\times\frac{2}{1}}=\frac{\frac{6}{4}}{\frac{2}{2}}=\frac{\frac{3}{2}}{1}=\frac{3}{2}$$

$$\frac{3}{4}\div\frac{1}{2}=\frac{3}{2}$$

Now we understand why we are doing each step and can put this all together. On the next slide we will try a new problem together.

We Do: Dividing Fractions by Wholes

$$\frac{2}{3} \div \frac{2}{1}$$

Let's work together to solve this problem. First, we need to rewrite as a fraction over a fraction.

$$\frac{\frac{2}{3}}{\frac{2}{1}}$$

We Do: Dividing Fractions by Wholes

$$\frac{\frac{2}{3} \times \frac{1}{2}}{\frac{2}{1} \times \frac{1}{2}}$$

Next, we need to use the reciprocal of the denominator to multiply both the top and the bottom of the fraction.

We Do: Dividing Fractions by Wholes

$$\frac{\frac{2}{3} \times \frac{1}{2}}{\frac{2}{1} \times \frac{1}{2}} = \frac{\frac{2}{6}}{\frac{2}{2}}$$

Next, we use the properties of fraction multiplication we used during the last unit.

We Do: Dividing Fractions by Wholes

$$\frac{\frac{2}{3}\times\frac{1}{2}}{\frac{2}{1}\times\frac{1}{2}}=\frac{\frac{2}{6}}{\frac{2}{2}}=\frac{\frac{1}{3}}{1}=\frac{1}{3}$$

Now we can simply and get our final answer.

What are the questions you have at this point?

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{4}{5} \div \frac{3}{1}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{4}{5} \div \frac{3}{1} \qquad \frac{\frac{4}{5} \times \frac{1}{3}}{\frac{3}{1} \times \frac{1}{3}} = \frac{\frac{4}{15}}{\frac{3}{3}} = \frac{\frac{4}{15}}{1} = \frac{4}{15}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{5}{6} \div \frac{10}{1}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{5}{6} \div \frac{10}{1} \qquad \frac{\frac{5}{6} \times \frac{1}{10}}{\frac{10}{1} \times \frac{1}{10}} = \frac{\frac{5}{60}}{\frac{10}{10}} = \frac{\frac{1}{12}}{1} = \frac{1}{12}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{2}{5} \div \frac{6}{1}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{2}{5} \div \frac{6}{1} \qquad \frac{\frac{2}{5} \times \frac{1}{6}}{\frac{6}{1} \times \frac{1}{6}} = \frac{\frac{2}{30}}{\frac{6}{6}} = \frac{\frac{1}{30}}{1} = \frac{1}{30}$$

I Do: Dividing Fractions by Wholes

$$\frac{\frac{4}{5}\times\frac{1}{3}}{\frac{3}{1}\times\frac{1}{3}}=\frac{\frac{4}{15}}{\frac{3}{3}}=\frac{\frac{4}{15}}{1}=\frac{4}{15}$$

$$\frac{\frac{5}{6}\times\frac{1}{10}}{\frac{10}{1}\times\frac{1}{10}}=\frac{\frac{5}{60}}{\frac{10}{10}}=\frac{\frac{1}{12}}{1}=\frac{1}{12}$$

$$\frac{\frac{2}{5}\times\frac{1}{6}}{\frac{6}{1}\times\frac{1}{6}}=\frac{\frac{2}{30}}{\frac{6}{6}}=\frac{\frac{1}{30}}{1}=\frac{1}{30}$$

Looking at these 3 problems. Does anyone have suggestions on how we can make this simpler?

I Do: Dividing Fractions by Wholes

$$\frac{\frac{4}{5}\times\frac{1}{3}}{\frac{3}{1}\times\frac{1}{3}}=\frac{\frac{4}{15}}{\frac{3}{3}}=\frac{\frac{4}{15}}{1}=\frac{4}{15}$$

$$\frac{\frac{5}{6}\times\frac{1}{10}}{\frac{10}{1}\times\frac{1}{10}}=\frac{\frac{5}{60}}{\frac{10}{10}}=\frac{\frac{1}{12}}{1}=\frac{1}{12}$$

$$\frac{\frac{2}{5}\times\frac{1}{6}}{\frac{6}{1}\times\frac{1}{6}}=\frac{\frac{2}{30}}{\frac{6}{6}}=\frac{\frac{1}{30}}{1}=\frac{1}{30}$$

In every problem we have done, the bottom portion always goes to 1 and is not included in the final answer! Do we need to keep writing it?

I Do: Dividing Fractions by Wholes

$$\frac{4}{5} \div \frac{3}{1} = \frac{4}{5} \times \frac{1}{3} = \frac{4}{15}$$

We do not need to keep writing all the steps, but it is important to understand why the original divisor disappears, and a new value is multiplied. This is not magic; we are using mathematical properties.

I Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{4}{5} \div \frac{3}{1}$$

I Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{8}{3} \div \frac{2}{1}$$

I Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{8}{3} \div \frac{2}{1} = \frac{8}{3} \times \frac{1}{2} = \frac{8}{6} = \frac{4}{3}$$

We Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{2}{5} \div \frac{8}{1}$$

We Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{2}{5} \div \frac{8}{1} = \frac{2}{5} \times \frac{1}{8} = \frac{2}{40} = \frac{1}{20}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{9}{10} \div \frac{5}{1}$$

You Do: Dividing Fractions by Wholes

Find the quotient of the following:

$$\frac{9}{10} \div \frac{5}{1} = \frac{9}{10} \times \frac{1}{5} = \frac{9}{50}$$

Let’s Summarize

We covered a lot today. Fraction division is made easier though use of reciprocals. If you had to explain to a friend what a reciprocal was, what would you tell them?

Let's Summarize

We covered a lot today. Fraction division is made easier though use of reciprocals. If you had to explain to a friend what a reciprocal was, what would you tell them?

Hopefully, you told them something about how a reciprocal is a set of numbers that have a relationship where when you multiply them, they equal 1.

QZ/EXIT TICKET

It is now time for a QZ! Take your time and do your best!