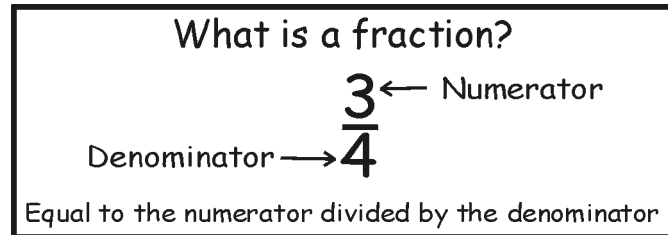


Name: _____

In physical science classes, you will solve problems that involve fractions. Understanding the rules for addition, subtraction, multiplication, and division of fractions helps you solve these problems. The diagram below shows the parts of a fraction. This skill sheet guides you through a review of the rules for working with fractions. You will see how the rules are used in both simple and complex fractions.



1. Addition and subtraction of fractions

To add or subtract fractions you must first have a common denominator. For example, if you wanted to add or subtract $\frac{5}{8}$ and $\frac{6}{4}$, you must first convert both denominators to the same number.

Addition:

$$\frac{5}{8} + \frac{6}{4} = \frac{5}{8} + \left(\frac{2}{2} \times \frac{6}{4}\right) = \frac{5}{8} + \frac{12}{8} = \frac{17}{8}$$

Subtraction:

$$\frac{5}{8} - \frac{6}{4} = \frac{5}{8} - \left(\frac{2}{2} \times \frac{6}{4}\right) = \frac{5}{8} - \frac{12}{8} = \frac{-7}{8}$$

As you can see, the rules for adding and subtracting positive and negative numbers also apply to fractions.

2. Multiplication of fractions

To multiply fractions, first multiply the numerators and then multiply the denominators. For example:

$$\frac{5}{8} \times \frac{6}{4} = \frac{30}{32}$$

Fractions are commonly expressed in their lowest terms so that they are easier to recognize. To find a fraction's lowest terms, you need to divide the numerator and the denominator by any common factors. The fraction in the example above can be rewritten like this:

$$\frac{30}{32} = \frac{3 \times 2 \times 5}{2 \times 2 \times 2 \times 2 \times 2}$$

This form is called the *prime factorization* because all of the factors are prime numbers (this means they can't be divided by any whole number except 1 to get a whole number answer). Notice that there's a 2 in both the numerator and the denominator. Cross out any factor that appears in both places. Multiply out the remaining factors. The simplified fraction is:

$$\frac{3 \times 5}{2 \times 2 \times 2 \times 2} = \frac{15}{16}$$

At other times you may be asked to change the fraction to a decimal. This is very easy! Simply divide the numerator by the denominator. Remember that the divisor line between the numerator and the denominator in a fraction means "divide by" and is the same as a division sign (\div).

$$\frac{30}{32} = 30 \div 32 = 0.9375$$

3. Division of fractions

To divide fractions you first invert (turn upside down) the second fraction and then multiply. Follow the rules for multiplying fractions. When necessary, reduce the fraction to its lowest terms. For example:

$$\begin{aligned} \frac{5}{8} \div \frac{6}{4} &= \frac{5}{8} \times \frac{4}{6} = \frac{20}{48} \\ \frac{20}{48} &= \frac{2 \times 2 \times 5}{2 \times 2 \times 2 \times 2 \times 3} = \frac{5}{2 \times 2 \times 3} = \frac{5}{12} \end{aligned}$$

4. Division of complex fractions

An example of a complex fraction is shown below. A complex fraction is a fraction of fractions. You can divide complex fractions using the rules you already know for dividing fractions. For example:

$$\begin{aligned} &\frac{\frac{5}{8}}{\frac{6}{4}} \\ &= \left(\frac{5}{8} \div \frac{6}{4} \right) = \frac{5}{8} \times \frac{4}{6} = \frac{20}{48} \end{aligned}$$

Reduce:

$$\frac{20}{48} = \frac{2 \times 2 \times 5}{2 \times 2 \times 2 \times 2 \times 3} = \frac{5}{12}$$

As you can see, the last two examples yielded the same answer. Can you see why? The two examples are the same, but written differently. The line between the two fractions, $\frac{5}{8}$ and $\frac{6}{4}$, acts the same as a division (\div) sign.

5. Solving fraction problems

Now it's your turn to solve some problems. Be sure to show your work. Reduce your answers to lowest terms.

Addition of fractions:

1. $\frac{4}{12} + \frac{3}{4}$

2. $\frac{7}{8} + \frac{5}{7}$

3. $\frac{3}{4} + \frac{6}{8} + \frac{5}{3}$

4. Express the above fractions in decimal form.

Subtraction of fractions:

1. $\frac{4}{12} - \frac{3}{4}$

2. $\frac{7}{8} - \frac{5}{7}$

3. $\frac{3}{4} - \frac{6}{8} - \frac{5}{3}$

4. Express the above fractions in decimal form.

Multiplication of fractions:

1. $\frac{4}{12} \times \frac{3}{4}$

2. $\frac{7}{8} \times \frac{5}{7}$

3. $\frac{3}{4} \times \frac{6}{8} \times \frac{5}{3}$

4. Express the above fractions in decimal form.

Division of fractions:

1. $\frac{4}{12} \div \frac{3}{4}$

2. $\frac{7}{8} \div \frac{5}{7}$

3. $\frac{\frac{3}{4}}{\frac{6}{8}}$

4. $\frac{\frac{3}{4}}{\frac{5}{3} \times \frac{7}{6}}$

5. Express the above fractions in decimal form.
