Unit 4, Lesson 2

Ratios and Rates with Fractions

Let's calculate some rates with fractions.

2.1 Math Talk: Division

Find each answer mentally.

- How many $\frac{1}{3}$s are there in 5?
- What is $2 \div \frac{1}{3}$?
- What is $\frac{1}{2} \div \frac{1}{3}$?
- What is $2\frac{1}{2} \div \frac{1}{3}$?

2.2 A Train Is Traveling at . . .

A train is traveling at a constant speed and goes $7\frac{1}{2}$ kilometers in 6 minutes. At that rate:



1. How far does the train go in 1 minute?

2. How far does the train go in 100 minutes?

3. How long does it take the train to travel 100 kilometers?

4. Create a representation of your choice that shows the relationship between the elapsed time and distance traveled for this train.

2.3 Comparing Running Speeds

Lin ran $2\frac{3}{4}$ miles in $\frac{2}{5}$ of an hour. Noah ran $8\frac{2}{3}$ miles in $\frac{4}{3}$ of an hour.

Who ran faster, Noah or Lin? Explain or show your reasoning.

Are you ready for more?

Nothing can go faster than the speed of light, which is 299,792,458 meters per second. Which of these are possible?

1. Traveling a billion meters in 5 seconds.

2. Traveling a meter in 2.5 nanoseconds. (A nanosecond is a billionth of a second.)

3. Traveling 1 parsec in 1 year. (A parsec is about 3.26 light years, and a light year is the distance light can travel in a year.)

2.4 Scaling the Mona Lisa

In real life, the Mona Lisa measures $2\frac{1}{2}$ feet by $1\frac{3}{4}$ feet. A company that makes office supplies wants to print a scaled copy of the Mona Lisa on the cover of a notebook that measures 11 inches by 9 inches.

1. What size should they use for the scaled copy of the Mona Lisa on the notebook cover?

2. What is the scale factor from the real painting to its copy on the notebook cover?

3. Discuss your thinking with your partner. Did you use the same scale factor? If not, is one more reasonable than the other?

Lesson 2 Summary

There are 12 inches in 1 foot, so we can say that for every 1 foot, there are 12 inches, or the ratio of feet to inches is $1 : 12$. We can find the **unit rates** by dividing the numbers in the ratio:

$1 \div 12 = \frac{1}{12}$,
so there is $\frac{1}{12}$ foot per inch.

$12 \div 1 = 12$,
so there are 12 inches per foot.

When the numbers in a ratio are fractions, we calculate the unit rates the same way: by dividing the numbers. For example, if someone runs $\frac{3}{4}$ mile in $\frac{11}{2}$ minutes, the ratio of minutes to miles is $\frac{11}{2} : \frac{3}{4}$.

$\frac{11}{2} \div \frac{3}{4} = \frac{22}{3}$, so the person's pace is $\frac{22}{3}$ minutes per mile.

$\frac{3}{4} \div \frac{11}{2} = \frac{3}{22}$, so the person's speed is $\frac{3}{22}$ mile per minute.