Multiplying Rational Numbers (Part 1)

Let's use signed numbers to represent movement.

8.1 Distance, Rate, Time

1. A car is traveling at a constant speed of 60 miles per hour. How far does the car travel in:
   a. 2 hours?

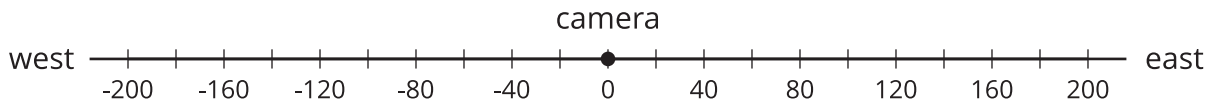
   b. 5 hours?

   c. x hours?

2. Create a representation that shows the relationship between the elapsed time and the distance traveled for this car.

8.2 Velocity

A traffic safety engineer was studying traffic patterns. She set up a camera to record the speed and direction of cars and trucks that passed by. She decided to represent positions to the east of the camera with positive numbers and positions to the west of the camera with negative numbers.



1. A car is traveling east at 12 meters per second. Where will it be 10 seconds after it passes the camera?

2. A car is traveling west at -14 meters per second. Where will it be 10 seconds after it passes the camera?

3. Complete the table to show the position of each vehicle after traveling at a constant velocity for the given amount of time.

	velocity (meters per second)	time after passing the camera (seconds)	position (meters)	equation
car A	+12	+10	+120	$12 \cdot 10 = 120$
car B	-14	+10		
car C	+9	+5		
car D	-11	+8		
car E	-15	+20		
car F	+8	0		

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4. Complete the sentences. Be prepared to explain your reasoning.
    - A positive number times a positive number equals a _____.
    - A negative number times a positive number equals a _____.

Are you ready for more?

In many contexts we can interpret negative rates as "rates in the opposite direction." For example, a car that is traveling -35 miles per hour is traveling in the opposite direction of a car that is traveling 40 miles per hour.

1. What could it mean if we say that water is flowing at a rate of -5 gallons per minute?

2. Make up another situation with a negative rate, and explain what it could mean.

8.3 Carbon Dioxide

The table shows how much carbon dioxide, on average, is released by each of these things in one year.

object	average amount of carbon dioxide released in a year (kilograms)
campfire	9
car	4,500
semi-truck	200,000
oak tree	-22
pine tree	-10
oyster	-0.004
clam	-0.003

1. If there are 400,000 cars in a city, about how much carbon dioxide is released by these cars in one year?

2. If there are 10,000 clams in a clam bed, about how much carbon is released by this clam bed in one year?

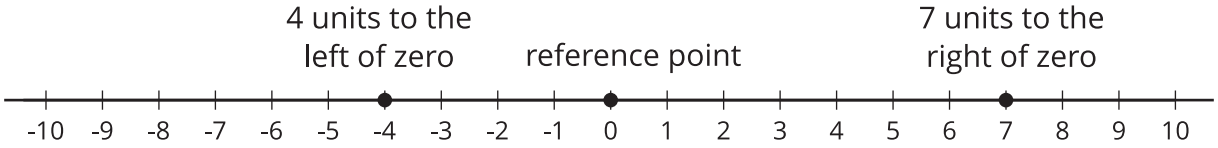
3. If a park has 25 pine trees and 10 oak trees, about how much carbon dioxide is released by these trees in one year?

4. If the city with 400,000 cars wanted to absorb as much carbon dioxide as was released by all these cars each year, how many parks and clam beds of these sizes would they need?

5. College students in the Netherlands developed a car that releases -2 kilograms of carbon dioxide per year. If half of the cars in the city were this new type of car, how much carbon dioxide would be released by all the cars in the city in one year?

Lesson 8 Summary

We can use signed numbers to represent the position of an object along a line. We pick a point to be the reference point and call it zero. Positions to the right of zero are positive. Positions to the left of zero are negative.



When we combine speed with direction indicated by the sign of the number, it is called *velocity*. For example, if you are moving 5 meters per second to the right, then your velocity is +5 meters per second. If you are moving 5 meters per second to the left, then your velocity is -5 meters per second.

If you start at zero and move 5 meters per second for 10 seconds, you will be 50 meters to the *right* of zero. In other words,

$$5 \cdot 10 = 50$$

If you start at zero and move -5 meters per second for 10 seconds, you will be 50 meters to the *left* of zero. In other words,

$$-5 \cdot 10 = -50$$

In general, a negative number times a positive number is a negative number.

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