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Learning Outcomes

- Write a rate as a fraction
- Find unit rates
- Find unit price

Write a Rate as a Fraction

Frequently we want to compare two different types of measurements, such as miles to gallons. To make this comparison, we use a rate. Examples of rates are 120 miles in 2 hours, 160 words in 4 minutes, and $\text{\$5}$ dollars per 64 ounces.

Rate

A rate compares two quantities of different units. A rate is usually written as a fraction.

When writing a fraction as a rate, we put the first given amount with its units in the numerator and the second amount with its units in the denominator. When rates are simplified, the units remain in the numerator and denominator.

example

Bob drove his car 525 miles in 9 hours. Write this rate as a fraction.

Solution

	$\text{525 miles in 9 hours}$
Write as a fraction, with 525 miles in the numerator and 9 hours in the denominator.	$\frac{\text{525 miles}}{\text{9 hours}}$
	$\frac{\text{175 miles}}{\text{3}}$

	hours}}]/[latex]
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So $\frac{525}{9}$ miles in 9 hours is equivalent to $\frac{175}{3}$ miles per hour.

try it



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Find Unit Rates

In the last example, we calculated that Bob was driving at a rate of $\frac{175}{3}$ miles per hour. This tells us that every three hours, Bob will travel 175 miles. This is correct, but not very useful. We usually want the rate to reflect the number of miles in one hour. A rate that has a denominator of 1 unit is referred to as a unit rate.

Unit Rate

A unit rate is a rate with denominator of 1 unit.

Unit rates are very common in our lives. For example, when we say that we are driving at a speed of 68 miles per hour we mean that we travel 68 miles in 1 hour. We would write this rate as 68 miles/hour (read 68 miles per hour). The common abbreviation for this is 68 mph. Note that when no number is written before a unit, it is assumed to be 1.

So 68 miles/hour really means 68 miles/1 hour.

Two rates we often use when driving can be written in different forms, as shown:

Example	Rate	Write	Abbreviate	Read
68 miles in 1 hour	$\frac{68 \text{ miles}}{1 \text{ hour}}$	68 miles/hour	68 mph	68 miles per hour
36 miles to 1 gallon	$\frac{36 \text{ miles}}{1 \text{ gallon}}$	36 miles/gallon	36 mpg	$\text{36 miles per gallon}$

Another example of unit rate that you may already know about is hourly pay rate. It is usually expressed as the amount of money earned for one hour of work. For example, if you are paid $\text{\$12.50}$ for each hour you work, you could write that your hourly (unit) pay rate is $\text{\$12.50/hour}$ (read $\text{\$12.50}$ per hour.)

To convert a rate to a unit rate, we divide the numerator by the denominator. This gives us a denominator of 1 .

example

Anita was paid $\text{\$384}$ last week for working 32 hours. What is Anita's hourly pay rate?

Show Solution

Solution

Start with a rate of dollars to hours. Then divide.	$\text{\$384}$ last week for 32 hours.
Write as a rate.	$\frac{\$384}{32 \text{ hours}}$

Divide the numerator by the denominator.	$\frac{12}{1 \text{ hour}}$
Rewrite as a rate.	$12/\text{hour}$

Anita's hourly pay rate is $\text{\$12}$ per hour.

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example

Sven drives his car 455 miles, using 14 gallons of gasoline. How many miles per gallon does his car get?

Show Solution

Solution

Start with a rate of miles to gallons. Then divide.

	$\text{455 miles to 14 gallons of gas}$
Write as a rate.	$\frac{\text{455 miles}}{\text{14 gallons}}$
Divide 455 by 14 to get the unit rate.	$\frac{\text{32.5 miles}}{\text{1 gallon}}$

Sven's car gets 32.5 miles/gallon, or 32.5 mpg.

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The next video shows more examples of how to find rates and unit rates.



[Video Link](#)

Calculating Unit Price

Sometimes we buy common household items ‘in bulk’, where several items are packaged together and sold for one price. To compare the prices of different sized packages, we need to find the unit price. To find the unit price, divide the total price by the number of items. A unit price is a unit rate for one item.

Unit price

A unit price is a unit rate that gives the price of one item.

example

The grocery store charges $\text{\$3.99}$ for a case of 24 bottles of water. What is the unit price?

Solution

What are we asked to find? We are asked to find the unit price, which is the price per bottle.

Write as a rate.	$\frac{\text{\$3.99}}{\text{24 bottles}}$
Divide to find the unit price.	$\frac{\text{\$0.16625}}{\text{1 bottle}}$
Round the result to the nearest penny.	$\frac{\text{\$0.17}}{\text{1 bottle}}$

The unit price is approximately $\text{\$0.17}$ per bottle. Each bottle costs about $\text{\$0.17}$.

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Unit prices are very useful if you comparison shop. The *better buy* is the item with the lower unit price. Most grocery stores list the unit price of each item on the shelves.

example

Paul is shopping for laundry detergent. At the grocery store, the liquid detergent is priced at $\text{\$14.99}$ for 64 loads of laundry and the same brand of powder detergent is priced at $\text{\$15.99}$ for 80 loads.

Which is the better buy, the liquid or the powder detergent?

Show Solution

Solution

To compare the prices, we first find the unit price for each type of detergent.

	Liquid	Powder
Write as a rate.	$\frac{\text{\$14.99}}{\text{64 loads}}$	$\frac{\text{\$15.99}}{\text{80 loads}}$
Find the unit price.	$\frac{\text{\$0.234}}{\text{1 load}}$	$\frac{\text{\$0.199}}{\text{1 load}}$
Round to the nearest cent.	$\begin{array}{c} \text{\$0.23/load} \\ \hfill \text{(23 cents per load.)} \end{array}$	$\begin{array}{c} \text{\$0.20/load} \\ \hfill \text{(20 cents per load)} \end{array}$

Now we compare the unit prices. The unit price of the liquid detergent is about $\text{\$}0.23$ per load and the unit price of the powder detergent is about $\text{\$}0.20$ per load. The powder is the better buy.

Notice in the example above that we rounded the unit price to the nearest cent. Sometimes we may need to carry the division to one more place to see the difference between the unit prices.

Example

Find each unit price and then determine the better buy. Round to the nearest cent if necessary.

Brand A Storage Bags, $\text{\$}4.59$ for 40 count, or Brand B Storage Bags, $\text{\$}3.99$ for 30 count

Show Solution

Brand A costs $\text{\$}0.12$ per bag. Brand B costs $\text{\$}0.13$ per bag. Brand A is the better buy.

Find each unit price and then determine the better buy. Round to the nearest cent if necessary.

Brand C Chicken Noodle Soup, $\text{\$}1.89$ for 26 ounces, or Brand D Chicken Noodle Soup, $\text{\$}0.95$ for 10.75 ounces

Show Solution

Brand C costs $\text{\$}0.07$ per ounce. Brand D costs $\text{\$}0.09$ per ounce. Brand C is the better buy.

The following video shows another example of how you can use unit price to compare the value

of two products.



[Video Link](#)

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