Equivalent Ratios Have the Same Unit Rates

Let's revisit equivalent ratios.

19.1 Which Three Go Together: Distance and Time

Which three go together? Why do they go together?

A. 5 miles in 15 minutes

B. 3 minutes per mile

C. 20 miles per hour

D. 3 kilometers per minute

19.2 Binders and Notebooks

1. Two binders cost $14, and 5 binders cost $35.

   a. Complete the table to show the cost for 4 binders and 10 binders at that rate. Next, find the cost for a single binder in each case, and record those values in the third column.



number of binders	cost (dollars)	unit price (dollars per binder)
2	14	
4		
5	35	
10		

   b. What do you notice about the values in this table?

2. This table shows the cost of notebooks. Complete the table. Be prepared to explain your reasoning.

number of notebooks	cost (dollars)	unit price (dollars per notebook)
20		3
50		3
	21	3
	84	3
n		3

19.3 Making Bracelets



1. Clare makes bracelets at a constant speed.
   Complete the table. Be prepared to explain your reasoning.

time spent (hours)	number of bracelets	speed (bracelets per hour)
2		6
5		6
	42	6
	66	6
	90	6
h		6

2. Noah and Lin each bought some bracelets that Clare made.

   a. Noah bought 5 bracelets for d dollars. How much did he pay per bracelet? Record it in the table.

	number of bracelets	cost (dollars)	unit price (dollars per bracelet)
Noah	5	d	
Lin			

   b. Lin bought twice as many bracelets as Noah bought and paid twice the amount Noah paid. Complete the table to show her purchase.

   c. Did Lin pay twice the unit price that Noah paid?

Pause here for a class discussion before moving on.

3. Mai bought b bracelets for c dollars. Diego bought 3 times as many bracelets and paid 3 times as much as Mai did. Complete the table.

	number of bracelets	cost (dollars)	unit price (dollars per bracelet)
Mai	b	c	
Diego			

19.4 How Much Applesauce?

It takes 4 pounds of apples to make 6 cups of applesauce.

1. At this rate, how much applesauce can you make with:
   a. 7 pounds of apples?
   b. 10 pounds of apples?
2. How many pounds of apples would you need to make:
   a. 9 cups of applesauce?
   b. 20 cups of applesauce?
3. In general, how would you:
   a. Find the number of cups of applesauce that can be made from a given number of pounds of apples?
   b. Find the number of pounds of apples needed to make a given number of cups of applesauce?

pounds of apples	cups of applesauce
4	6
7	
10	
	9
	20

Are you ready for more?

Andre and his neighbor are using their garden hoses to fill a 750-gallon pool. Andre's hose can fill a 5-gallon bucket in 2 minutes. His neighbor's hose can fill a 10-gallon bucket in 8 minutes.

The hoses start filling the pool at the same time and work at the same rate as when filling a bucket. How long will they take to fill the pool?

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Lesson 19 Summary

The table shows different amounts of apples selling at the same rate. This means that all of the ratios of weight (in pounds) to price (in dollars) are equivalent.

We can find the *unit price* in dollars per pound by dividing the price (in dollars) by the weight of apples (in pounds).

In each case, the unit price is always the same. Whether we buy 4 pounds of apples for 10 dollars or 8 pounds of apples for 20 dollars, the apples cost 2.50 dollars per pound.

weight of apples (pounds)	price (dollars)	unit price (dollars per pound)
4	10	$10 \div 4 = 2.50$
8	20	$20 \div 8 = 2.50$
20	50	$50 \div 20 = 2.50$

We can also find the number of pounds of apples we can buy per dollar by dividing the weight of apples (in pounds) by the price (in dollars).

weight of apples (pounds)	price (dollars)	pounds per dollar
4	10	$4 \div 10 = 0.4$
8	20	$8 \div 20 = 0.4$
20	50	$20 \div 50 = 0.4$

The number of pounds we can buy for a dollar is the same as well! Whether we buy 4 pounds of apples for 10 dollars or 8 pounds of apples for 20 dollars, we are getting 0.4 pound per dollar.

This is true in all situations: When two ratios are equivalent, their unit rates will be equal.

quantity x	quantity y	unit rate 1	unit rate 2
a	b	$\frac{a}{b}$	$\frac{b}{a}$
$5 \cdot a$	$5 \cdot b$	$\frac{5 \cdot a}{5 \cdot b} = \frac{a}{b}$	$\frac{5 \cdot b}{5 \cdot a} = \frac{b}{a}$
$s \cdot a$	$s \cdot b$	$\frac{s \cdot a}{s \cdot b} = \frac{a}{b}$	$\frac{s \cdot b}{s \cdot a} = \frac{b}{a}$