Rate	Unit rate
75 miles in 3 hrs.	25 miles per 1 hr
3 lbs for $9	$3 per 1 lb.

Lesson 7: Unit Rate as the Constant of Proportionality

Classwork

Example 1: National Forest Deer Population in Danger?

Wildlife conservationists are concerned that the deer population might not be constant across the National Forest. The scientists found that there were 144 deer in a 16 square mile area of the forest. In another part of the forest, conservationists counted 117 deer in a 13 square mile area. Yet a third conservationist counted 216 deer in a 24 square mile plot of the forest. Do conservationists need to be worried?

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S

a. Why does it matter if the deer population is not constant in a certain area of the National Forest?

- Throw off the balance of the ecosystem.

b. What is the population density of deer per square mile?

$\frac{y}{x}$

Sq. miles (x)	# of deer (y)	$k=\frac{y}{x}$
16	144	$\frac{144}{16}=9$
13	117	$\frac{117}{13}=9$
24	216	$\frac{216}{24}=9$
207	1,863	

The unit rate of deer per 1 square mile is 9.

Constant of Proportionality: $k=9$

Explain the meaning of the constant of proportionality in this problem:

There are 9 deer for every 1 square mile.

c. Use the unit rate of deer per square mile (or $\frac{y}{x}$) to determine how many deer are there for every 207 square miles.

$y=kx$

$k=\frac{y}{x}$

$9(207)=1{,}863$ deer

d. Use the unit rate to determine the number of square miles in which you would find 486 deer?

$\frac{486}{9}=54$ sq. miles

CoP

$x + 3$

Variable Costant

$y = 3x$

x	y
1	3
4	12

Vocabulary:

A **constant** specifies a unique number.

A **variable** is a letter that represents a number.

If a proportional relationship is described by the set of ordered pairs that satisfies the equation $y = kx$, where k is a positive constant, then k is called the **constant of proportionality**. It is the value that describes the multiplicative relationship between two quantities, x and y. The (x, y) pairs represent all the pairs of values that make the equation true.

Note: In a given situation, it would be reasonable to assign any variable as a placeholder for the given quantities. For example, a set of ordered pairs (t, d) would be all the points that satisfy the equation $d = rt$, where r is the positive constant, or the constant of proportionality. This value for r specifies a unique number for the given situation.

Example 2: You Need WHAT???

Brandon came home from school and informed his mother that he had volunteered to make cookies for his entire grade level. He needs 3 cookies for each of the 96 students in 7th grade. Unfortunately, he needs the cookies the very next day! Brandon and his mother determined that they can fit 36 cookies on two cookie sheets.

total cookies $3 \times 96 = 288$

a. Is the number of cookies proportional to the number of cookie sheets used in baking? Create a table that shows data for the number of sheets needed for the total number of cookies baked.

Table:

# of cookie sheets	# of cookies	$k = \frac{y}{x}$
2	36	$\frac{36}{2} = 18$
4	72	$\frac{72}{4} = 18$
10	180	$\frac{180}{10} = 18$
16	288	$\frac{288}{16} = 18$
1	18	$\frac{18}{1} = 18$

$k = 18$

$y = 18x$

The unit rate of $\frac{y}{x}$ is 18.

Constant of Proportionality: $k = 18$

Explain the meaning of the constant of proportionality in this problem: There are 18 cookies per 1 cookie sheet.

b. It takes 2 hours to bake 8 sheets of cookies. If Brandon and his mother begin baking at 4:00 p.m., when will they finish baking the cookies?

96 students × 3 per student = 288 total cookies

$\frac{288 \text{ cookies}}{18 \text{ cookies per sheet}}$ = 16 sheets of cookies

It will take 4 hrs to bake the cookies. They will finish at 8 pm