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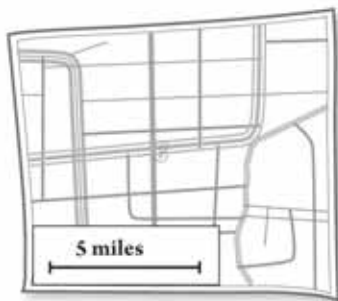
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# Solving Proportions

## Proportions

One way to find the value of equivalent ratios is to write a proportion.

$$\frac{1}{5} = \frac{4}{20}$$



THE PURPOSE OF THIS SECTION IS TO:

- Use different strategies to solve problems using proportions
- Understand the mathematical meaning of a "proportion"

## Proportions

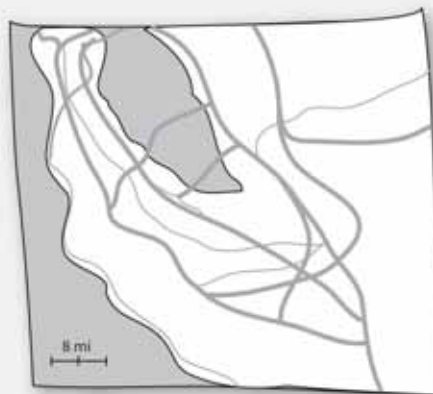
A **proportion** is a statement of equality between two ratios: that is, two ratios that are equal in value are said to form a **proportion**.

Consider the map to the right.

The ratio of actual miles to centimeters is  $\frac{8}{2}$ .

This ratio is equivalent to the ratio  $\frac{4}{1}$  because each ratio has the same value, 4.

The ratio  $\frac{4}{1}$  means that 4 miles is represented by 1 cm on the map.



When we write this as a statement of equality,  $\frac{8}{2} = \frac{4}{1}$ , it is called a **proportion**.

To find how many miles,  $x$ , is represented by 6 cm on the map, you can **solve the proportion**:

$$\frac{8}{2} = \frac{x}{6}$$

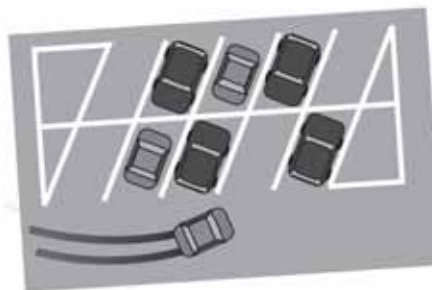
That is, solve the equation for the unknown value of  $x$ .

## Strategies for Solving Proportions



The ratio of hybrids to SUVs  
in a downtown parking lot is 3:4.

One day Alex counts 28 SUVs in the parking lot.



1. Are there more hybrids or more SUVs? \_\_\_\_\_
2. What is the ratio of hybrids to SUVs? \_\_\_\_\_
3. Let  $h$  be the number of hybrids in the parking lot.

What does the ratio of 3 hybrids to 4 SUVs tell us about the relationship of  $h$  and 28?

There are several strategies that can be used to solve for  $h$ :

- Find equivalent ratios
- Generate a ratio table
- Solve a proportion algebraically

We will use these strategies to solve the proportion  $\frac{3}{4} = \frac{h}{28}$  for  $h$ , the number of hybrids.

# Practice Solving Proportions



## STRATEGY 1: Find equivalent ratios

The ratio of hybrids to SUVs in the parking lot is 3:4.

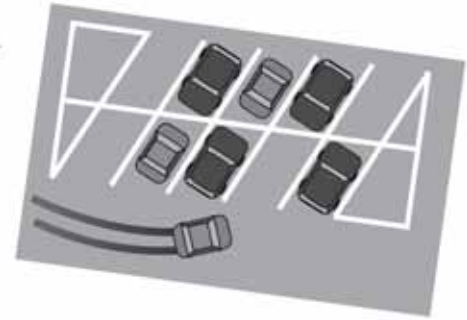


Fill in the blanks to find the number of hybrids,  $h$ , in the proportion  $\frac{3}{4} = \frac{h}{28}$ .

1. By what factor do you multiply 4 to get 28? \_\_\_\_\_

2. Complete the following:  $\frac{3}{4} \cdot \frac{\quad}{\quad} = \frac{h}{28}$

3. How many hybrids were there? \_\_\_\_\_



## STRATEGY 2: Generate a ratio table

Use the fact that for every 3 hybrids there are 4 SUVs to complete the table:

Number of groups	Number of hybrids	Number of SUVs
1	3	4
2		
3		
5		
6		
10		

4. If there are 6 hybrids, how many SUVs are there? \_\_\_\_\_

5. If there are 15 hybrids, how many SUVs are there? \_\_\_\_\_

6. Would you use this strategy if you knew you had 840 SUVs?

Why or why not?

## Practice Solving Proportions, continued



### STRATEGY 3: Solve the proportion algebraically

Fill in the blanks below to find the number of hybrids,  $h$ , in the proportion  $\frac{3}{4} = \frac{h}{28}$ .



7. By what factor would you multiply both sides of the equation  $\frac{3}{4} = \frac{h}{28}$  to solve for  $h$ ?

Multiply both sides of the equation by the **least common denominator**: \_\_\_\_\_.

8. Solve the equation for the value of  $h$ .

Here's one way to solve this proportion:

Show your steps  
Given proportion

$$\frac{3}{4} = \frac{h}{28}$$

Multiply both sides of the equation by 28

$$(28) \frac{3}{4} = \frac{h}{28} (28)$$

$$\frac{28}{28} = 1$$

$$\frac{(28)3}{4} = \frac{\cancel{28}h}{\cancel{28}}$$

Factoring

$$\frac{(4 \cdot 7)3}{4} = h$$

$$\frac{4}{4} = 1$$

$$\frac{\cancel{4}}{\cancel{4}} \cdot 7(3) = h$$

$$21 = h$$

You could also use the ratio SUVs/hybrids, creating the proportion  $\frac{4}{3} = \frac{28}{h}$ .

There were \_\_\_\_\_ hybrids and 28 SUVs.



At day camp there are 2 counselors for every 12 students.

There are a total of 60 students.

Let  $c$  be the total number of counselors.

1. What is the **ratio** of counselors to students? \_\_\_\_\_
2. Write the **proportion** you would use to find the value of  $c$ . \_\_\_\_\_

Use all three strategies to find how many counselors are needed for 60 students.

## FIND EQUIVALENT RATIOS

3. Use equivalent ratios to solve the proportion:  $\frac{2}{12} = \frac{c}{60}$ .

a. Complete the following:

$$\frac{2}{12} \cdot \frac{\square}{\square} = \frac{c}{60}$$

By what factor  
do you multiply  
12 to get 60?

b. If there are 60 students, how many counselors are needed? \_\_\_\_\_



## GENERATE A RATIO TABLE

4. Find the number of counselors:  
a. Complete the table:

Number of groups	Number of counselors	Number of students
1	2	12
2		
3		
4		
5		
6		
7		

Remember, there are 2 counselors for every 12 students.

- b. If there are 60 students, how many counselors are needed? \_\_\_\_\_

## SOLVE THE PROPORTION ALGEBRAICALLY

5. Solve the proportion  $\frac{2}{12} = \frac{c}{60}$  for  $c$ , the number of counselors.  
a. By what factor would you multiply both sides of this equation to solve for  $c$ ?
- b. Solve the equation for the value of  $c$ . Show your work.

# Comic Books



The local store sells 4 comic books for \$3.  
Jamie has \$54 and wants to buy as many comic books as possible.



Let  $n$  be the number of comic books Jamie can buy.

1. What is the ratio of number of comic books to cost? \_\_\_\_\_
2. Write the proportion you would use to solve for  $n$ .

Using the ratio  $\frac{\text{comic books}}{\text{cost}}$   
you could write the proportion:  
 $\frac{4}{3} = \frac{n}{54}$

Remember that you can use either  $\frac{\text{comic books}}{\text{cost}}$  or  $\frac{\text{cost}}{\text{comic books}}$ .

It is usually easier to solve the equation if the unknown is in the numerator.

## FIND EQUIVALENT RATIOS

3. Complete the following:  $\frac{4}{3} \cdot \frac{\square}{\square} = \frac{n}{54}$

4. If Jamie has \$54, how many comic books can he buy? \_\_\_\_\_

Finding **equivalent ratios** is a useful method if the numbers in the ratios are multiples of one another.



## GENERATE A RATIO TABLE

5. Find the number of comic books Jamie can buy for \$54:

a. Complete the ratio table: for every \$3 Jamie spends, he gets 4 comic books.

Number of groups	Cost \$	Number of comic books
1	3	4
2		

b. How many comic books can Jamie buy for \$54? \_\_\_\_\_

## SOLVE THE PROPORTION ALGEBRAICALLY

6. Solve the proportion  $\frac{4}{3} = \frac{n}{54}$  for the value of  $n$ .

How many comic books can Jamie buy for \$54? \_\_\_\_\_

## Choose Your Method



1. A drink has 4 parts milk to 1 part chocolate syrup.

a. What is the ratio of chocolate syrup to milk?

b. Suppose you have 24 cups of milk.

Let  $s$  be the amount of chocolate syrup you need.

Write the proportion you would use to solve for  $s$ .

Here, 1 cup = 1 part.

c. Solve the proportion to find the value of  $s$ .

d. Which strategy did you use to solve this proportion?

2. Suppose you have 10 cups of chocolate syrup.

Using the same recipe (4 parts milk to 1 part chocolate syrup),  
how much milk would you need to use to make the drink?

## Choose Your Method, continued



3. A movie has a giant dinosaur that appears to be 50 feet tall on the screen. The actual model filmed was 20 inches tall. The filmmakers have a model of a building that is 30 inches tall. How tall will the building appear in the movie?

- a. What do you want to find out?
- b. Let  $b$  be the height the building appears to be on screen. Write the proportion you would use to solve for  $b$ .



- c. Solve the proportion to find the value of  $b$ .

4. DaeAhna weighs 120 pounds on Earth.

The table below gives DaeAhna's weight on other planets.

	<b>Earth (lb)</b>	<b>Mercury (lb)</b>	<b>Venus (lb)</b>	<b>Moon (lb)</b>	<b>Jupiter (lb)</b>	<b>Pluto (lb)</b>	<b>Sun (lb)</b>
DaeAhna	120	45.3	108.8	19.9	303.9	8	3248.6
Sam	150						

If Sam weighs 150 pounds on Earth, how much will he weigh on each of the planets? Find the answers and show your work.

## More Practice Solving Proportions



Solve the following proportions for the missing values and show your work:

1.  $\frac{3}{5} = \frac{x}{40}$

3.  $\frac{h}{2.6} = \frac{3}{2}$

2.  $\frac{8}{p} = \frac{32}{20}$

4.  $\frac{15}{x} = \frac{0.05}{3.1}$

Can you rewrite this proportion to make it easier to find the value of  $p$ ?

## More Practice Solving Proportions, continued



Solve the following proportions for the missing values and show your work:



5.  $\frac{35}{7} = \frac{5}{t}$

8.  $\frac{75}{7} = \frac{100}{a}$

6.  $\frac{72}{12} = \frac{x}{18}$

9.  $\frac{4}{6} = \frac{2.4}{x}$

7.  $\frac{z}{25} = \frac{4}{20}$

10.  $\frac{400}{3} = \frac{y}{10.5}$