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LESSON 10

CCSS: 7.RP.3

# Solving Problems with Proportional Relationships

## PART 1 Introduction

A proportion is an equation that shows that two ratios are equal. You can use proportions to solve problems involving proportional relationships. Some types of proportional relationships involve percents. A **percent** is a ratio that compares a number to 100.

A percent compares a number to 100. For example, 12% is 12 out of 100, or $\frac{12}{100}$; and 47% is 47 out of 100, or $\frac{47}{100}$.

Dina's grade on the last math test was 80%. There were 20 problems on the test. How many problems did she answer correctly?

The ratio that describes Dina's score is 80 out of 100, or $\frac{80}{100}$. The ratio of the number of correct problems to total problems is $\frac{n}{20}$. These ratios must be equal to each other.

$$\frac{80}{100} = \frac{n}{20}$$

Solve for $n$ by cross multiplying. Multiply the numerator of each ratio by the denominator of the other. Then solve the resulting equation.

$\frac{80}{100} \times \frac{n}{20}$

$$\begin{aligned} 100n &= 80(20) \\ 100n &= 1{,}600 \\ n &= 16 \end{aligned}$$

Dina got 16 problems correct on the math test.

Suppose on her science test Dina got 22 out of 25 questions correct and she wants to know what percent this is. She can set up a similar proportion, and solve it in much the same way.

$$\begin{aligned} \frac{22}{25} &= \frac{n}{100} \\ 25n &= 22(100) \\ 25n &= 2{,}200 \\ n &= 88 \end{aligned}$$

Dina scored 88% on the science test.

Both ratios in a proportion should be set up the same way.

$\frac{22}{25} = \frac{n}{100}$ ←Part ←Total

SAMPLE



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## Think About It

Explain how you would find the amount of discount on a cellphone if it is 40% off and the original cost is $160.

_____

_____

## PART 2 Focused Instruction

**You can use a proportion to find the whole when a percent is known.**

➤ Pam pays 25% of her income as income tax. If she pays $15,000 in income tax, what is her income?

Remember that a percent is a fraction with a denominator of 100.

What ratio represents her tax, in dollars, to what she earns?

_____

What ratio represents her tax rate as a percent? _____

What proportion shows that these ratios are equal? _____

What procedure do you use to solve for the variable in the proportion?

_____

What equation is the result of using this procedure on the proportion?

_____

How do you solve this equation for the variable?

_____

What is Pam's income? _____

**You can use a proportion to find a discount when the percentage is known.**

➤ Ahmet bought a car just before the new models came out. His car was originally priced at $24,000, but the dealer offered an 8% discount. What is the amount of the discount?

What ratio represents the discount, in dollars, to the price of the car? _____

What ratio represents the discount rate as a percent? _____

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What proportion shows that these ratios are equal?

_____

What is the result of using cross multiplication on the proportion?

_____

How do you solve this equation for the variable?

_____

What is the amount of the discount? _____

Use inverse operations to isolate the variable.

**Use what you know about proportions and percents to answer these questions.**

**1** Ulrich works in an appliance store. He makes a commission of 12% on all his sales. If his commission today is $240, what is the total amount of his appliance sales for the day?

_____

**2** Sandra makes baskets to sell. Each basket costs her $13 in materials. She increases that price by $6.50 to get her selling price. What percent markup does she use?

_____

SAMPLE



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**Solve the following problems.**

**1** Eight new teachers were hired at Plainville Middle School. This represents 16% of the total number of teachers at the school. How many teachers work at Plainville Middle School? Show your work.

Remember that a percent is out of 100.

**Answer** _____ teachers

**2** Caitlyn made $300 last week and donated 20% of it to a charity. How much money did she donate? Show your work.

Set up a proportion using the percent.

**Answer** $_____

**3** Brock bought a baseball bat that originally cost $28. It was on sale for 40% off. What was the amount of the discount? Show your work.

A percent can be written as a ratio to 100.

**Answer** $_____

SAMPLE



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**Solve the following problems.**

**1** This table shows the original price and discount amount for items at a gift store.

| Original Price ($) | 5 | 15 | 25 |
|---|---|---|---|
| Discount Amount ($) | 1.25 | 3.75 | 6.25 |

Each price in the table is discounted the same percent. What percent is the discount?

**A** 12.5%

**B** 25%

**C** 50%

**D** 62.5%

**2** During a concert, 150 seats in a theater were filled. This represents 75% of the total seats in the theater.

**Part A** Write a proportion you could use to find the total number of seats.

**Answer** _____

**Part B** How many total seats are there? Show your work.

**Answer** _____ seats

SAMPLE



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**3** A realtor gets a 4% commission on the sale of a house. How much commission does the realtor get on the sale of a $180,000 house?

**A** $4,500

**B** $7,200

**C** $45,000

**D** $72,000

**4** Christian made a model of his favorite type of car. The length of the model was 6 inches long, which is 5% of the length of the actual car. How long is the actual car, in feet?

**Answer** _____ feet

**5** Edwin paid $16.25 tax on a new television that cost $250.

**Part A** What percent tax did Edwin pay?

**Answer** _____%

**Part B** Explain the steps you took to solve this problem.

_____

_____

_____

_____

SAMPLE



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**6** Harrison takes out a loan for $18,000. He will pay 6.25% simple interest annually on it.

**Part A** Write a proportion you could use to find the amount of interest per year.

**Answer** _____

**Part B** Find the amount of simple interest Harrison will pay annually. Show your work.

**Answer** $_____

SAMPLE



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