

Understanding Proportions and the Constant of Proportionality

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■ Concept Explanation

Proportional relationships can also be represented graphically. A graph of a proportional relationship will always pass through the origin (0,0) and will be a straight line. The constant of proportionality will be the slope of this line. Understanding proportions and how to work with them is crucial in many areas of math and science, and will help you solve problems in a logical and methodical way.

= ■ Worked Examples

Example 1

Problem: A recipe for making lemonade calls for a ratio of 2 cups of water to 1 cup of lemon juice. If you want to make lemonade using 6 cups of water, how many cups of lemon juice will you need?

Solution:

To find out how many cups of lemon juice are needed, we set up a proportion based on the ratio given in the recipe: $2 \text{ cups of water} / 1 \text{ cup of lemon juice} = 6 \text{ cups of water} / x \text{ cups of lemon juice}$. We then cross-multiply: $2x = 6 * 1$. Solving for x , we get $x = 6 / 2 = 3$. Therefore, you will need 3 cups of lemon juice.

Example 2

Problem: A map has a scale of 1:50,000. This means that 1 cm on the map represents 50,000 cm in real life. If a distance on the map is 5 cm, how many meters is this in real life?

Solution:

First, convert the scale to meters: $50,000 \text{ cm} = 500 \text{ meters}$ (since 1 meter = 100 cm). Now, set up the proportion: $1 \text{ cm} / 500 \text{ meters} = 5 \text{ cm} / x \text{ meters}$. Cross-multiply: $1x = 5 * 500$. Solving for x , we get $x = 5 * 500 = 2500 \text{ meters}$.

■ Practice Questions

1. A bicycle travels 25 miles in 2 hours. How many miles will it travel in 5 hours at the same speed? [EASY]
2. A farmer harvests 240 apples from 8 trees. If he has 12 trees in total, how many apples can he expect to harvest from all his trees, assuming each tree produces the same amount of apples? [MEDIUM]
3. A water tank can be filled in 10 minutes with a hose that fills 3 gallons per minute. How long will it take to fill the tank with a hose that fills 2 gallons per minute? [MEDIUM]
4. A recipe for cake calls for a ratio of 3 cups of flour to 2 cups of sugar. If you only have 1 cup of sugar, how much flour will you need to make the cake? [EASY]
5. A car travels 180 miles in 3 hours. If it travels at the same speed, how many hours will it take to travel 270 miles? [EASY]

■ Answer Key

For teacher/tutor reference

- 1.** 62.5 miles
- 2.** 360 apples
- 3.** 15 minutes
- 4.** 1.5 cups of flour
- 5.** 4.5 hours