

Maps

Just like floor plans, maps also include a scale. A scale on a map may show how units on the map correspond to units in reality (for example $1 \text{ cm} = 50 \text{ km}$). It can also be given as a ratio such as $1:120,000$.

A scale of 1:120,000 means that 1 unit on the map corresponds to 120,000 units in reality. This holds true—whether you use centimeters, millimeters, or inches—because the scale $1:120,000$ is a ratio without any particular unit. So 1 cm on the map corresponds to $120,000 \text{ cm}$ in reality, and 1 inch on the map corresponds to $120,000 \text{ inches}$ in reality.

Example 1. A map has a scale $1:150,000$. How long in reality is a distance of 7.1 cm on the map?

Below you can read two solutions to this problem. Both are actually very similar!

Multiply, then change the units.

If 1 cm corresponds to $150,000 \text{ cm}$, then 7.1 cm corresponds to $7.1 \cdot 150,000 \text{ cm} = 1,065,000 \text{ cm}$.

To be useful, this figure needs to be converted into kilometers. You can do this in two steps:

1. From centimeters to meters: Since $1 \text{ m} = 100 \text{ cm}$, we remove two zeros from $1,065,000 \text{ cm}$ to get $10,650 \text{ meters}$ (or you can think of it as dividing by 100).
2. From meters to kilometers: Since $1 \text{ km} = 1,000 \text{ m}$, the $10,650 \text{ meters}$ corresponds to $10.65 \text{ km} \approx 11 \text{ km}$.

Change the units, then multiply.

In this solution, we will first rewrite the scale and then use multiplication to calculate the distance in reality.

Since 1 cm corresponds to $150,000 \text{ cm}$, and $150,000 \text{ cm} = 1,500 \text{ m} = 1.5 \text{ km}$, we can rewrite the scale of this map as $1 \text{ cm} = 1.5 \text{ km}$.

Then, 7.1 cm corresponds to $7.1 \cdot 1.5 \text{ km} = 10.65 \text{ km} \approx 11 \text{ km}$.

You can use a calculator for all the problems in this lesson.

1. A map has a scale ratio of $1:20,000$. Fill in the table.

on map (cm)	in reality (cm)	in reality (m)	in reality (km)
1 cm	20,000 cm		
3 cm			
5.2 cm			
0.8 cm			
17.1 cm			

2. A map has a scale of $1:100,000$.

- a. The scale says that 1 cm on the map corresponds to $100,000 \text{ cm}$ in reality. How many kilometers is that?

Thus, we can rewrite this scale in the format $1 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

- b. A ski trail measures 5.2 cm on this map. In reality, how long is the trail in kilometers?