

Grade 7 · Scale Drawings · Lesson

Common Core 7.G.A.1 · mathovore.fr

A scale drawing is a proportional copy of an actual object in which every length is multiplied by the same scale. To find an actual length, multiply the drawing length by the scale, such as $1 \text{ in} = 20 \text{ mi}$. To find a drawing length, divide. Areas are multiplied by the scale factor squared.

Grade 7 Common Core: 7.G.A.1

Key facts:

- Standard 7.G.A.1: solve problems about actual lengths and areas from a scale drawing.
- A scale such as $1 \text{ in} = 5 \text{ ft}$ is a unit rate: multiply drawing lengths by 5 to get actual feet.
- To change a scale into a scale factor, write both lengths in the same unit.
- Areas change by the square of the scale factor, not by the scale factor itself.
- To redraw at a new scale, find the actual lengths first, then divide by the new scale.

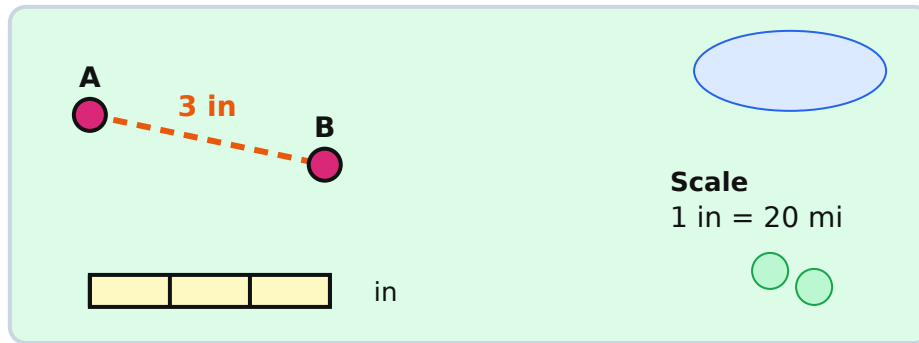
What is a scale drawing?

A **scale drawing** is a smaller or larger copy of a real object, such as a map, a blueprint or a model. Every length is multiplied by the same number, so the shape stays the same and only the size changes.

Vocabulary

Scale: the ratio of a length in the drawing to the matching actual length, such as $1 \text{ in} = 20 \text{ mi}$.

Scale factor: the number you multiply by to go from one figure to a similar figure. When both lengths use the same unit, the scale is a scale factor.



The towns are 3 in apart on the map, so they are $3 \times 20 = 60$ miles apart.

How do you find an actual length?

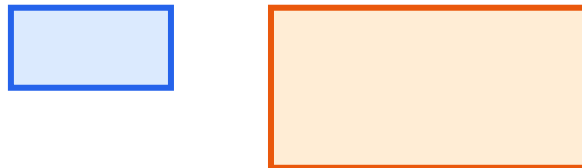
1. Measure the length on the drawing.
2. Write the scale as a unit rate: how many actual units for 1 drawing unit.
3. Multiply the drawing length by that rate.

Worked example. A map uses $1 \text{ in} = 20 \text{ mi}$. Towns A and B are 3 in apart. The actual distance is $3 \times 20 = 60 \text{ mi}$. To go the other way, divide: 100 mi would be $100 \div 20 = 5 \text{ in}$.

What is the scale factor?

Change both lengths to the same unit. Since $5 \text{ ft} = 60 \text{ in}$, the scale $1 \text{ in} = 5 \text{ ft}$ is 1:60, so every actual length is 60 times as long as its drawing. A scale factor greater than 1 makes an enlargement, and one between 0 and 1 makes a reduction.

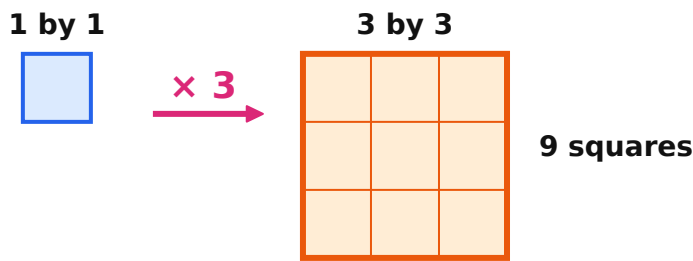
Original: 2 in by 1 in Image: 4 in by 2 in



Every length is multiplied by the same scale factor, here 2.

How do areas change in a scale drawing?

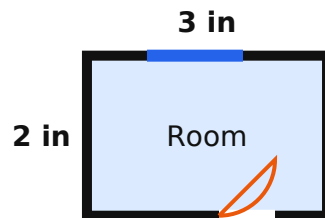
Lengths are multiplied by the scale factor, but areas are multiplied by the **square** of the scale factor. A room that is 3 in by 2 in on a drawing with $1 \text{ in} = 5 \text{ ft}$ is 15 ft by 10 ft. Its drawing area is 6 in^2 and its actual area is 150 ft^2 , which is 6×5^2 .



Lengths are multiplied by 3, but area is multiplied by $3^2 = 9$.

How do you redraw a figure at a different scale?

First find the actual lengths, then divide them by the new scale. The room above is 15 ft by 10 ft. At 1 in = 2.5 ft, it becomes $15 \div 2.5 = 6$ in by $10 \div 2.5 = 4$ in.



At 1 in = 5 ft, this blueprint shows a 15 ft by 10 ft room.

Goal	Operation
Drawing length to actual length	Multiply by the scale
Actual length to drawing length	Divide by the scale
Drawing area to actual area	Multiply by the scale factor squared

Scale Drawings: frequently asked questions

What is a scale drawing?

It is a drawing in which all lengths are in the same proportion to the actual lengths. Maps, blueprints and model cars are scale drawings.

How do you read a scale like 1 in = 20 mi?

It says that every inch on the drawing stands for 20 actual miles. A length of 3.5 in on the map is $3.5 \times 20 = 70$ miles.

What is the difference between a scale and a scale factor?

A scale can have different units, such as 1 in = 4 ft. A scale factor compares lengths in the

same unit, so 1 in = 4 ft is 1:48.

How do you find an actual area from a scale drawing?

Find the actual lengths first, then multiply them, or multiply the drawing area by the square of the scale. Do not just multiply the area by the scale.

How do you draw a figure at a different scale?

Convert each drawing length to the actual length using the old scale, then divide by the new scale to get the new drawing lengths.