**Scale Factor**

This HO gauge model train is a **scale model** of a historic train. A **scale drawing** is a proportional drawing of an object.

**A scale factor is the ratio between two sets of measurements.**

The scale factor of an HO gauge model train is \( \frac{1}{87} \).

This means that each dimension of the model is \( \frac{1}{87} \) of the corresponding dimension of the actual train.

**Additional Example 1: Finding a Scale Factor**

Identify the scale factor.

<table>
<thead>
<tr>
<th></th>
<th>Room</th>
<th>Blueprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (in.)</td>
<td>144</td>
<td>18</td>
</tr>
<tr>
<td>Width (in.)</td>
<td>108</td>
<td>13.5</td>
</tr>
</tbody>
</table>

\[
\text{blueprint length} : \text{room length} = \frac{18}{144} = \frac{1}{8}
\]

Write a ratio using one of the dimensions. Simplify.

The scale factor is \( \frac{1}{8} \).

**Try This: Example 1**

Identify the scale factor.

<table>
<thead>
<tr>
<th></th>
<th>Model Aircraft</th>
<th>Blueprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (in.)</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Wing span (in.)</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

\[
\text{blueprint length} : \text{aircraft length} = \frac{2}{12} = \frac{1}{6}
\]

Write a ratio using one of the dimensions. Simplify.

The scale factor is \( \frac{1}{6} \).
A photograph was enlarged and made into a poster. The poster is 20.5 inches by 36 inches. The scale factor is $\frac{5}{1}$. Find the size of the photograph.

**Think:**

\[
\frac{\text{poster}}{\text{photo}} = \frac{5}{1}
\]

Write a proportion to find the length $l$.\[
\frac{36}{l} = \frac{5}{1}
\]

Find the cross products.\[
5l = 36
\]

Divide.\[
l = 7.2
\]

The photo is 7.2 in. long and 4.1 in. wide.

Mary's father made her a dollhouse which was modeled after the blueprint of their home. The blueprint is 24 inches by 45 inches. The scale factor is $\frac{1.5}{1}$. Find the size of the dollhouse.

**Think:**

\[
\frac{\text{dollhouse}}{\text{blueprint}} = \frac{1.5}{1}
\]

Write a proportion to find the length $l$.\[
\frac{l}{45} = \frac{1.5}{1}
\]

Find the cross products.\[
l = 45 \cdot 1.5
\]

Multiply.\[
l = 67.5
\]

The dollhouse is 67.5 inches long and 36 inches wide.

On a road map, the distance between Pittsburgh and Philadelphia is 7.5 inches. What is the actual distance between the cities if the map scale is 1 inch = 60 miles?

Let $d$ be the actual distance between the cities.

\[
\frac{1.5}{60} = \frac{d}{7.5}
\]

Write a proportion.\[
1.5 \cdot d = 60 \cdot 7.5
\]

Find the cross products.\[
1.5d = 450
\]

Multiply.\[
\frac{1.5d}{1.5} = \frac{450}{1.5}
\]

Divide.\[
d = 300
\]

The distance between the cities is 300 miles.