

## 2 Scale Diagrams

November 1, 2020 2:11 PM

### Math 9 Section 7.1 and 7.2 – Scale Diagrams

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#### Learning Outcomes Covered:

7C: I can determine the **scale factor** of a scale diagram.

7D: I can determine the length of **missing sides** of a scale diagram.



Figures that have the **same shape**, but **different sizes** are found throughout everyday life. Examples include MAPS, BLUEPRINTS, MODELS OF ATOMS, MODEL TRAINS and PICTURES. When you compare the drawing of an atom in your science textbook to the actual atom, the drawing is much larger. This is called an enlargement.

When you compare the model train to the real train, the model is much smaller. This is called a reduction. To determine how much larger or smaller the "model" is to the "real" object we determine the **SCALE FACTOR**. You must measure **corresponding** lengths.

$$\text{SF} = \frac{\text{length of object in model}}{\text{length of object in real life}} = \frac{\text{"fake" "real"}}{\text{model actual}} = \frac{\text{model}}{\text{actual}}$$

*Handwritten notes: "image" < enlargement, reduction. No units!*

How does the scale factor compare to 1?

- **Enlargement**: the "model" is larger than the "real" object so scale factor  $\geq 1$ .
- **Reduction**: the "model" is smaller than the "real" object so scale factor  $< 1$ .
- **No change**: the "model" is the exact same size as the "real" object so scale factor  $= 1$ .

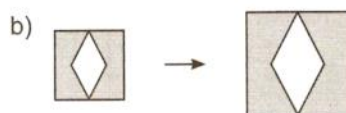
Scale factors can be represented as fractions, ratios or decimals.

$\frac{1}{8}$        $1:8$        $0.125$

**Example 1:** State whether the transformation is an enlargement, a reduction, or neither.



reduction  
 $SF < 1$

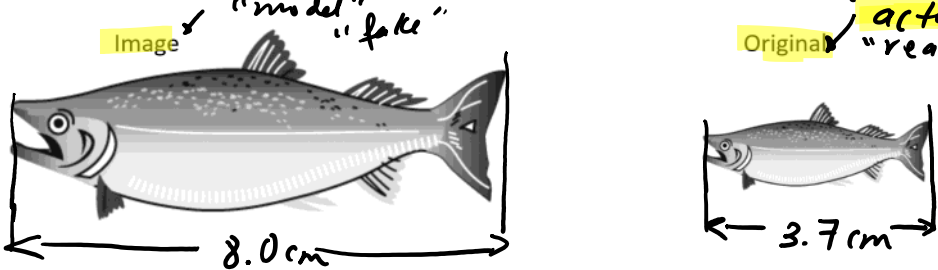


enlargement  
 $SF > 1$



neither  
 $SF = 1$

**Example 2:** Determine the scale factor for each of the following:

(a) 

$$SF = \frac{\text{model}}{\text{actual}} = \frac{8.0 \text{ cm}}{3.7 \text{ cm}} \approx 2.162 \quad \text{"no units!"}$$

- (b) The actual length of a needle is 6 cm. The length of the needle on a scale diagram is 9 cm. What is the scale factor of the diagram?

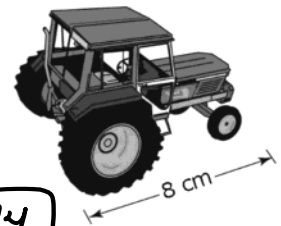
$$SF = \frac{\text{model}}{\text{actual}} = \frac{9}{6} = \boxed{1.5} \text{ enlargement}$$

- (c) A local farm equipment dealership has model tractors. The length of the actual tractor is 5.6 m. What scale factor was used for the reduction?

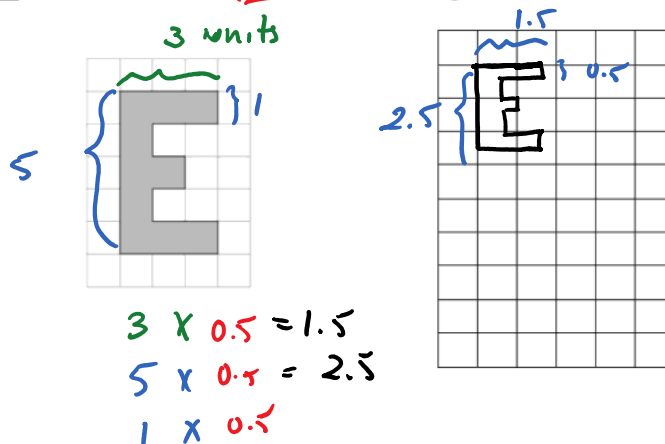
① Need same units!

$$5.6 \text{ m} \\ = 560 \text{ cm}$$

$$\textcircled{2} SF = \frac{\text{model}}{\text{actual}} \\ = \frac{8 \text{ cm}}{560 \text{ cm}} \\ = \frac{1}{70} \approx \boxed{0.014}$$



**Example 3:** Use a scale factor of 0.5 to reduce the figure below



If we are given the scale, we can use a **proportion** to determine the value of either the “**model**” size or the “**real**” size. Note that a proportion is a statement of 2 **equivalent fractions**.

For example:  $\frac{2}{7} = \frac{6}{21}$  since both the numerator and denominators in the 1<sup>st</sup> fraction were multiplied by the same value to get the 2<sup>nd</sup> fraction. You must be able to solve a proportion.

**REVIEW:** Calculate the missing value in each proportion.

(a)  $\frac{2}{5} = \frac{\boxed{8}}{20}$

*Handwritten: x4 (from 2 to 8 and 5 to 20)*

(b)  $\frac{3}{50} = \frac{21}{\boxed{350}}$

*Handwritten: x7 (from 3 to 21 and 50 to 350)*

(c)  $\frac{3}{5} = \frac{8}{\boxed{x}}$

*Handwritten: 3x = (5)(8)  
3x = 40  
x = 40/3 = 13.3*

When the scale is given, you can use a proportion to determine either the actual size of the object or the model size of the object.

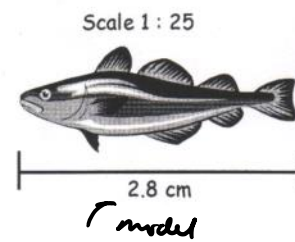
**Example 4:** Find the actual size of the fish.

Scale 1:25 or  $\frac{1}{25} = \frac{\text{model}}{\text{actual}}$

SF =  $\frac{1}{25} = \frac{2.8 \text{ cm}}{x}$

*Handwritten: x = 70 cm*

**The fish is 70 cm long.**



**Example 5:** If a blueprint of a house that is 16 m high is drawn to a scale of 1:100, what would the height of the drawing be in cm?

*Handwritten: convert to cm => 1600 cm*

SF =  $\frac{\text{model}}{\text{actual}} = \frac{1}{100} = \frac{x}{1600}$

$\frac{100x}{100} = \frac{1600}{100}$   $x = 16 \text{ cm}$

**The height of house in drawing is 16 cm.**

**Example 6:** What is the height of the actual fingerprint?

*Handwritten: enlargement*

SF =  $\frac{\text{model}}{\text{actual}} = \frac{3}{1} = \frac{4}{x}$

$\frac{3x}{3} = \frac{4}{3}$   
 $x = \frac{4}{3} = 1.3 \text{ cm}$



**The actual height is 1.3 cm.**