Math 9

2.2 Enlargements and Reductions

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Learning Goals: *I will learn to*

- analyze to determine the scale factor by which an item was reduced or enlarged
- solve for actual measurements using a given scale

An enlargement is a diagram or model that is larger than the object it represents.

actual length of housefly is 1cm (3cm ÷ 3)

3cm diagram length

scale: 3 : 1

drawing is 3 times bigger than actual housefly

scale factor: 3

A reduction is a diagram or model that is smaller than the object it represents.

actual length of scooter is 70cm (3.5cm × 20)

3.5cm diagram length

scale: 1 : 20

actual scooter is 20 times bigger than drawing.

scale factor: $\frac{1}{20}$

Scale is the relationship between a distance on a diagram (or model) and the actual distance.
It is usually expressed as a ratio.

diagram length : actual length

If the bigger number is first, the model is an enlargement.

If the smaller number is first, the model is a reduction.

The scale factor is the number used as a multiplier in scaling. It describes how the size of the diagram (or model) compares to the actual distance.

actual length × scale factor = diagram length

A scale factor greater than 1 indicates an enlargement.

A scale factor ~~less than 1~~ indicates a reduction.

between 0 and 1

Example: Determine the Scale of a Photo or Diagram

The Sopwith Camel was a British World War I plane. The photo on p. 47 shows a scale model of the Sopwith Camel. In a scale model every dimension of the actual object has been reduced by the same factor.

The actual wingspan of the Sopwith Camel is 8.53 metres. Measure the wingspan of the photo on p. 47 in centimetres and determine the scale of the photo. Express the scale factor as a fraction.

reduction

actual plane → photo

measure 11.7cm

wingspan: 8.53m
853cm

* need measurements in the same units. ⇒ change m → cm (×100)

8.53m × 100 = 853cm

SCALE

* same units
* smaller number should be 1

diagram : actual

11.7 : 853 ÷11.7

÷11.7 → 1 : 72.905...

1 : 73

SCALE FACTOR

1 : 73 → $\frac{1}{73}$

ratio → fraction

actual lengths × $\frac{1}{73}$ = model lengths

Example 2: Determine the Actual Size of an Object

A common scale for collectable toy cars is 1:64

a) What does the ratio mean?

→ the toy car is $\frac{1}{64}$ the size of the real car

→ the real car is 64 times bigger than the toy car.

b) Use the measurements on the photo on p. 48 of the scale model to determine the actual measurements of a 1959 Volkswagen Beetle. Express your answer in the most appropriate SI units. Round your answers as necessary.

toy car → 6.4 cm long
→ 5.6 mm wheel diameter.

Length

6.4 cm (toy) × 64 = 409.6 cm (actual)

metres is a better unit!

cm → m
÷ 100

409.6 cm ÷ 100 = 4.096

= 4.1 m

Wheel Diameter

5.6 mm × 64 = 358.4 mm

cm is a better unit!

mm → cm
÷ 10

358.4 mm ÷ 10 = 35.84

= 35.8 cm

Example: Create Scale Drawings drawing : actual "original"

Create a scale drawing of the letter 'E' below at each of the following scales:

a) 2 : 1 $SF = \frac{2}{1} = 2 \longrightarrow$ twice as big

b) 1 : 1 $SF = \frac{1}{1} = 1 \longrightarrow$ same size

c) 1 : 2 $SF = \frac{1}{2} \longrightarrow$ half the size