8.3 Scale Diagrams

Learning targets:

1. Demonstrate understanding of new terminology pertaining to scale diagrams.
2. Calculating a scale factor.
3. Using scale factors to solve problems.
4. Using scale factors to draw scale diagrams.

Terminology

Scale diagram:

A drawing in which measurements are proportionally reduced or enlarged from actual measurements; a scale diagram is similar to the original.

Scale:

The ratio of a measurement on a diagram to the corresponding distance measured on the shape or object represented by the diagram. The scale is normally given in the a : b ratio format.

Terminology

Scale factor:

A **number** created from the ratio of any two corresponding measurements (using the same units) of two similar shapes or objects, written as a **fraction**, a **decimal**, or a **percent**.

Ex: $\frac{4\ cm}{100\ cm} = \frac{4}{100} = \frac{1}{25} = 0.04 = 4\%$

Scale Factor Formula

- The letter k is used for scale factor.
- Scale factors are related to the scale used to create the scale diagram.
- Scale factors can also be calculated if you know one set of corresponding measurements from the diagram and the actual object:

$$k = \frac{diagram\ measurement}{actual\ measurement}$$

The value of k may be expressed as a fraction, decimal or percent.

Example #1:

Finding a scale factor from a given scale

A floor plan of a house was created using a scale of

2 cm : 1 m

a) Interpret what this scale is telling us:

→The scale **2 cm : 1 m** means that every **2 cm of length in the drawing** corresponds to **1 m of actual length.**

Example #1: continued...

b) What scale factor was used?

2 cm = 1 m

diagram → actual measurement

$$k = \frac{d}{a} = \frac{2\text{ cm}}{100\text{ cm}} = \frac{1}{50}$$

$$= 0.02$$

$$= 2\%$$

Example #2:

Finding a scale factor from measurements

A desk that is 150 cm long is drawn in a scale diagram as 15 cm long. What scale factor was used in the diagram?

$k = \frac{d}{a} = \frac{15\text{cm}}{150\text{cm}} = \frac{1}{10}$

$= 0.1$

$= 10\%$

$2\frac{1}{4} = \frac{1}{2}$

$2\frac{1}{3} = \frac{2}{3}$

$20 = 2$

Example #2:

Finding a scale factor from measurements

A desk that is 150 cm long is drawn in a scale diagram as 15 cm long. What scale factor was used in the diagram?

$$k = \frac{diagram\ measure}{actual\ measure} = \frac{15\ cm}{150\ cm} = \frac{1}{10} \text{ or } 0.1 \text{ or } 10\%$$

Reduction vs. Enlargement

→ When a scale factor **between 0 and 1** is used, the new shape will be a **reduction** of the original shape.

→ When a scale factor **greater than 1** is used, the new shape will be an **enlargement** of the original shape.

You Try:

A scale diagram of an animal cell has a diameter of 3.5 cm. The actual cell has a diameter of 0.25 mm.

(Note: 1 cm = 10 mm)

What scale factor was used to create the diagram?

Is this a reduction or enlargement?

$$k = \frac{d}{a} = \frac{35\ \text{mm}}{0.25\ \text{mm}} = 140$$

$$= 14\,000\%$$

Example #3:

Using a scale factor to determine actual measurements

A scale drawing uses a scale factor of $\frac{1}{25}$

- Is the drawing a reduction of an enlargement?
- If the length of the object in the drawing is 5 cm, what is the length of the actual object?

$$k = \frac{d}{a}$$

$$\frac{1}{25} = \frac{5\text{cm}}{a}$$

$$a = (25)(5\text{cm})$$

$$a = 125\text{cm}$$

Example #3:

Using a scale factor to determine actual measurements

A scale drawing uses a scale factor of $\frac{1}{25}$

- Is the drawing a reduction of an enlargement?
- If the length of the object in the drawing is 5 cm, what is the length of the actual object?

→ The drawing is a reduction because the scale factor is between 0 and 1.

$$k = \frac{diagram}{actual}$$

Let x represent the length of the actual object.

$$\frac{1}{25} = \frac{5\ cm}{x}$$

$$\frac{25}{1} = \frac{x}{5cm}$$

$$x = (5\ cm)(25) = 125\ cm\ or\ 1.25\ m$$

You Try:

A scale drawing uses a **scale factor of 4.**

- Is the drawing a reduction or an enlargement?
- If the length of the object in the drawing is 10 cm, what is the length of the actual object?

You Try:

A scale drawing uses a **scale factor of 4**.

- Is the drawing a reduction or an enlargement?
- If the length of the object in the drawing is 10 cm, what is the length of the actual object?

→ The drawing is an enlargement because **the scale factor is greater than 1.**

$$k = \frac{diagram}{actual}$$ Let x represent the length of the actual object

Example #4:

Using a scale factor to make a scale drawing

To make a scale drawing of a rectangular park, a scale factor of $\frac{1}{1000}$ or 0.001 is to be used.

If the length and width of the park are 100 m and 75 m, how long would the length and width be in the scale drawing? cm

Length

$k = \frac{d}{a}$ $ka = d$

$\frac{1}{1000} = \frac{d}{100\,m}$

$d(1000) = \frac{100\,m}{1000} = 0.1\,m = 10\,cm$

Width

$d = ka$

$d = (0.001)(75\,m)$

$d = 0.075\,m$

$d = 7.5\,cm$

Example #4:

Using a scale factor to make a scale drawing

To make a scale drawing of a rectangular park, a scale factor of $\frac{1}{1000}$ or 0.001 is to be used.

If the length and width of the park are 100 m and 75 m, how long would the length and width be in the scale drawing?

Multiply the actual lengths by the scale factor:

Length in diagram: (100 m)(0.001) = 0.1 m or 10 cm

Width in diagram: (75 m)(0.001) = 0.075 m 7.5 cm

Assignment

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#1, 2, 3, 4, 6, 7, 11, 12, 13, 14, 15